Mineral and Energy Resource Assessment of the Nellis Air Force Range

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Mineral and Energy Resource Assessment of the Nellis Air Force Range U.S. Air Force Air Combat Command

Clark, Lincoln, and Nye Counties,
Nevada

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This information should be considered preliminary.
It has not been edited or checked for completeness or accuracy.

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LIST OF ABBREVIATIONS

AA	atomic absorption analysis
AFB	Air Force Base, in this report refers specifically to the Nellis Air Force Base at Las Vegas Nevada
Ag	silver
Ar	argon
As	arsenic
Au	gold
Ba	barium
Be	beryllium
Bi	bismuth
BLM	Bureau of Land Management
Br	bromine
°C	degrees Celsius
CAI	conodont coloration alteration index
Cd	cadmium
Ce	cerium
cm	centimeter
Co	cobalt
Cr	chromium
Cs	cesium
Cu	copper
CVAA	cold vapor atomic absorption analysis
DRI	Desert Research Institute
Eu	europium
F	fluorine
fob	free on board, delivered to the point of sale including freight charge
g	gram
Ga	gallium
GFAA	graphite furnace atomic absorption analysis
GSC	geochemical and lithologic characterization sample
Hf	hafnium
Hg	mercury
HSSR	Hydrogeochemical and Stream Sediment Reconnaissance program
ICP	inductively-coupled plasma-emission spectroscopy analysis
INAA	instrumental neutron activation analysis
K	potassium
kg	kilogram
km	kilometer
La	lanthanum
Li	lithium
Lu	lutetium
m	meter
mm	millimeter
M S	mineral survey
Ma	million years before present
MAI	TRC Mariah Associates Inc
mW/m^2	milliwats per square meter
mg	milligram
MILS	mineral property location database compiled by the U.S. Bureau of Mines
Mno	manganese oxide
Mo	moybdenum
MRDS	mineral resource dataset compiled by the U.S. Geological Survey
MSS	multispectral scanner
mW	milliwatt
Na	sodium
NAFR	Nellis Air Force Range
NASA	National Aeronautics and Space Administration
Nb	niobium
NBMG	Nevada Bureau of Mines and Geology
Nd	neodymium
Ni	nickel
NOAA	National Oceanographic and Atmospheric Administration
NURE	National Uranium Resource Evaluation
oz	ounce, specifically troy ounce in this report
P	phosphorous
Pb	lead
pH	used to indicate the relative acidity of a solution (low pH, acidic; high pH, basic)
ppb	parts per billion
ppm	parts per million
Pu	plutonium
R E	Range East
Rb	rubidium
REE	rare earth elements
Sb	antimony
Sc	scandium
Se	selenium
SEM/EDX	scanning electron microscope/energy dispersive x-ray
Sm	samarium
Sn	tin
Sr	strontium
T N	Township North
T S	Township South
Ta	tantalum
Tb	terbium
Te	tellurium
Th	thorium
Tl	thallium
TM	thematic mapper
TOC	total organic carbon
U	uranium
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USBM	U.S. Bureau of Mines
USGS	U.S. Geological Survey
V	vanadium
W	tungsten
wt%	weight percent
XRF	X-ray fluorescence analysis
Y	yttrium
Yb	ytterbium
Zn	zinc
Zr	zirconium

EXECUTIVE SUMMARY

1.0 INTRODUCTION

The purpose of the investigation summarized in this report was to conduct a survey and provide an assessment of all energy and mineral resources on the Nellis Air Force Range [NAFR], consisting of approximately 3.1 million acres of public land in Clark, Lincoln, and Nye Counties, Nevada. The energy and mineral assessment project began in late 1993 and was completed in 1996. The three-year project required the combined efforts of personnel at Air Force Air Combat Command, Nellis Air Force Base, U.S. Army Corps of Engineers, TRC Mariah Associates Inc., the Nevada Bureau of Mines and Geology, and the Desert Research Institute.

The assessment program consisted of a review of available data on geologic setting, metallic and industrial minerals, gemstones, uranium, geothermal resources, and oil and gas resources of the NAFR. Remote sensing studies were carried out to provide an overview of lineation patterns and to outline areas of spectral response indicative of rock alteration and possible mineralization. A total of 220 geochemical characterization samples were collected and analyzed to determine background chemical characteristics of unaltered rocks. Mines and prospects within the area were examined and 800 samples of mineralized material were collected and analyzed. Using data generated from the literature review, photo interpretation, and mineral-site examination stages, a stream sediment sampling program was designed to investigate various areas of interest outlined as well as to provide background geochemical data for regional evaluation purposes. Stream sediment samples were collected from 380 sites selected to evaluate areas outlined by the geologic, remote sensing, and mine, prospect, and outcrop sampling programs. The stream sediment samples were also analyzed for 48 elements.

From these data, areas of mineral potential were defined and estimates of the types of known and undiscovered mineral resources that may be present within the project area and of the favorability for their occurrence were made. Levels of mineral resource potential and certainty of assessment (table ES-1) were assigned using the system described in Goudarzi (1984, p. 23-24). This information has been assembled in a mineral potential report which generally follows, with some modification, formats outlined in Goudarzi (1984) and in Section 3060.13 of the BLM Manual.

Table ES-1. Definition of mineral resource potential and certainty of assessment.*

Definitions of Mineral Resource Potential

LOW (L) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is unlikely. This broad category embraces areas with dispersed but insignificantly mineralized rock as well as areas with few or no indications of having been mineralized.

MODERATE (M) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a reasonable likelihood of resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

HIGH (H) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data support mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.

UNKNOWN (U) mineral resource potential is assigned to areas where information is inadequate to assign low. moderate, or high levels of resource potential.

NO (N) mineral resource potential is a category reserved for a specific type of resource in a well-defined area.

Definitions of Level of Certainty

A Available information is not adequate for determination of the level of mineral resource potential.

B Available information suggests the level of mineral resource potential.

C Available information gives a good indication of the level of mineral resource potential.

D Available information clearly defines the level of mineral resource potential.

*Modified from Goudarzi 1984.

Relationships between levels of resource potential and certainty.

INCREASING LEVEL OF POTENTIAL

U/A UNKNOWN POTENTIAL	H/B HIGH POTENTIAL	H/C HIGH POTENTIAL	H/D HIGH POTENTIAL
	M/B MODERATE POTENTIAL	M/C MODERATE POTENTIAL	M/D MODERATE POTENTIAL
	L/B LOW POTENTIAL	L/C LOW POTENTIAL	L/D LOW POTENTIAL
			N/D NO POTENTIAL

INCREASING LEVEL OF CERTAINTY

2.0 LOCATION AND LAND STATUS

The NAFR is located in Nye, Lincoln, and Clark Counties, south-central Nevada (fig. ES-1). The NAFR lies northwest of Las Vegas and southeast of Tonopah in a largely remote area bordered by U.S. Highway 95 on the south and west, U.S. Highway 6 on the north, State Route 375 on the northeast, and U.S. Highway 93 on the east. The NAFR, when established in 1940 as the Las Vegas Bombing and Gunnery Range, reserved 3,560,000 acres of public land for military use. During the years since its creation, portions of the original reservation have been transferred to the U.S. Department of Energy to establish the Nevada Test Site and related facilities and subsequent land withdrawals have added other areas. Presently, the NAFR includes approximately 3.1 million acres.

3.0 PHYSIOGRAPHIC SETTING

The NAFR is situated in the southern part of the Great Basin region of the Basin and Range physiographic province, a region characterized by a series of generally north-trending mountain ranges separated by wide, alluviated valleys.

Pahute Mesa, a volcanic plateau lying on the southwestern border of the northern portion of the NAFR, separates typical north-trending mountain ranges on the east from small ranges with more random orientation along the California border area to the west (fig. ES-2). Northeast of Pahute Mesa are the Kawich, Belted, and Groom Ranges. To the southeast, in the segment of NAFR east of the Nevada Test Site, are the Spotted, Pintwater, and Desert Ranges.

The only notable ranges within the NAFR north of Pahute Mesa are the Cactus Range and Stonewall Mountain. Stonewall Mountain marks the northwestern boundary of Pahute Mesa, separating it from Stonewall Flat to the north. Drainages from the Stonewall Mountain and Pahute Mesa areas flow west and southwest into Sarcobatus Flat and the Amaragosa Desert. Drainages from the higher mountains in the central and eastern parts of NAFR flow into closed desert valleys such as Cactus Flat, Gold Flat, Kawich Valley, Indian Springs Valley, and Three Lakes Valley.

4.0 GEOLOGIC SETTING

In general, the geologic terrain of the NAFR can be divided into a southeastern area of largely Paleozoic sedimentary rocks, and a northwestern area of mainly volcanic rocks of late Cenozoic age (fig. ES-3).

Granitic plutons are not abundant in the NAFR, although they may be concealed by younger rocks. A Cretaceous granitic pluton is present in the Oak Springs area of the southern Belted Range, just south of the NAFR-Nevada Test Site boundary. Mesozoic(?) granitic plutons crop out in a small area in the southern Kawich Range and in a small area about 3 km south-southwest of Urania Peak in the Cactus Range, and weakly foliated, coarse grained granite of unknown age is exposed in the Trappman Hills.

The pre-Cenozoic rocks of the NAFR are unconformably overlain and intruded by volcanic rocks erupted during two periods of magmatic and volcanic activity that swept through the Great Basin from north to south from Oligocene to early Miocene time (from 43 to 17 million years before present (Ma), and from 17 to 6 Ma).

Rocks of the southwestern Nevada volcanic field (volcanic centers and related flow rocks in the area extending from Stonewall Mountain to south and east of Yucca Mountain) overlie the Oligocene-early Miocene units. Major units of this volcanic series were erupted largely between 15.2 and 10 Ma from vent areas of overlapping and nested volcanic centers in the Timber Mountain area. Between 9.5 and 7.5 Ma, major volcanism shifted to the outlying Black Mountain and Stonewall Mountain volcanic centers with the eruptions of the Thirsty Canyon Group and the Stonewall Flat Tuff.

Lacustrine and fluvial sedimentary units, deposited in shallow basins in middle to late Tertiary time, crop out in several areas within the NAFR, particularly in the southern Spotted Range, Pintwater Range, and the Desert Range. Quaternary alluvial units, in large part consisting of alluvial fan, pediment, valley fill, and playa deposits, are the most recent sedimentary formations within the NAFR and make up nearly one-half of the surface exposures.

5.0 REGIONAL REMOTE SENSING

The application of remote sensing and various geophysical studies to the detection and mapping of potential mineral resources is based on a limited number of intrinsic bulk physical and chemical properties of the rocks. The imagery and other digital datasets used are designed to detect only a limited range (spectral and spatial relationships) of information that is useful in producing small-scale maps and potential mineral resource (exploration) targets. The delineation of these potential mineral resource targets is then used to plan field studies such as geochemical sampling and regional and district geologic mapping.

Landsat Thematic Mapper (TM) data was chosen for use in the NAFR project. The TM scene used for most of the project was TM scene Path 40 Row 34 Quarters 1-4. As this scene has about 10 percent cloud cover, a second scene for the same path/row that had no cloud cover was later

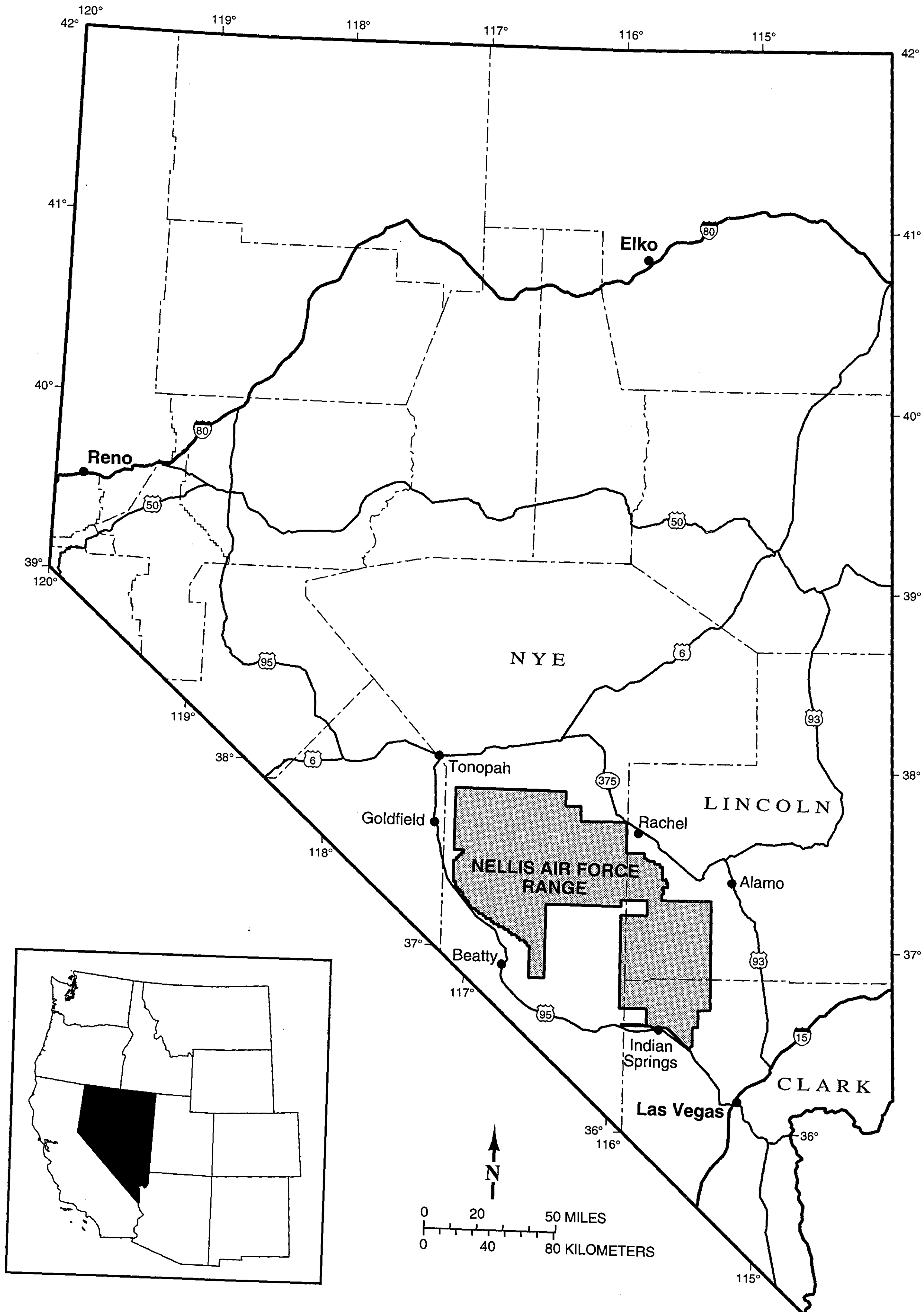


Figure ES-1 Location map, Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

acquired and used. An additional scene to the west TM scene Path 41 Row 34 Quarter 2 was used to view the Tonopah, Goldfield, and Cuprite mining districts that lie just outside the NAFR boundaries.

Regional magnetic data were obtained from the USGS Digital Data Series DDS-9, National Geophysical Data Grids: Gamma-Ray, Gravity, Magnetic, and Topographic Data for the Conterminous United States. Regional gravity data for the NAFR were obtained from the NOAA 1994 GRAVITY CD-ROM compiled for North America. A subset of the State of Nevada data was used in combination with the georeferenced Landsat TM data. These data were used as background information for the mineral assessment project.

6.0 REGIONAL GEOCHEMISTRY

6.1 NATIONAL URANIUM RESOURCE EVALUATION (NURE) PROGRAM

Geochemical data that were collected in the conterminous United States as part of the National Uranium Resource Evaluation (NURE) program were examined. Data for this program were collected 1976-80 and consist of analyses of stream sediment, soil, surface water, and groundwater samples. Each sample was analyzed for uranium and for as many as 58 other elements. Since the focus of the NURE program was to assess uranium resources in the United States, samples were not routinely analyzed for precious metals, base metals, or for some of the important elements associated with precious and base metal deposits. The NURE data were, therefore, of little value in the NAFR mineral assessment program.

6.2 NELLIS AIR FORCE RANGE GEOCHEMICAL SAMPLING PROGRAM

Geochemical sampling and lithologic characterization (GSC sampling) of major lithologic and stratigraphic units was carried out in the NAFR to determine baseline trace element contents for use in evaluation of stream sediment and mineralized area samples.

Stream sediment sample sites were selected following study of the regional geology, study of alteration and structural patterns on satellite imagery, and investigation of the known mineral deposits of the region. At each selected sample site, two separate samples were collected from the stream drainage; a silt sample collected by scooping material from the most active portions of the drainage channel, and a float chip sample collected by chipping fragments from altered or mineralized boulders found in the stream channel. Anomalous values in the stream sediment samples are defined by contrasting sediment sample values to threshold values derived from the GSC sample set.

As part of the mine evaluation program, composite rock samples were collected at mines, prospects, and mineralized outcrops within the project area. These samples were collected to provide trace-element information on mineralization present at each site. Individual samples were high-graded from material found on old mine dumps or collected from altered, discolored, or mineralized outcrops.

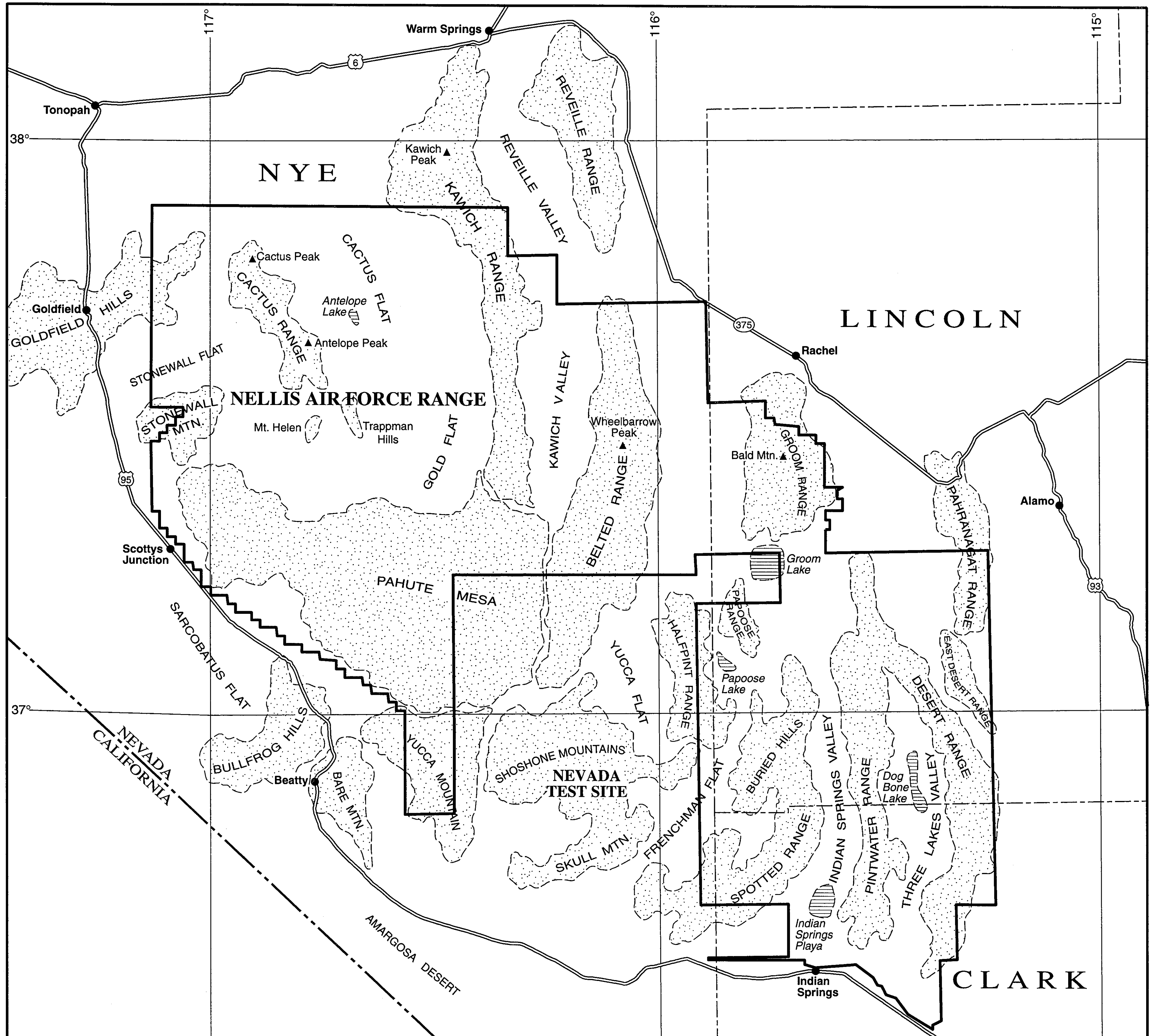
7.0 DESCRIPTION OF KNOWN MINERAL AND ENERGY RESOURCES

7.1 MINING AND PROSPECTING HISTORY

Prospecting and mining within the area now included within the NAFR began in the late 1860s and continued unrestricted to 1942. Evidence of this activity can be seen throughout the NAFR, but most mining took place in the northern part. All or parts of some 25 major mining districts and areas are within the NAFR, and 13 additional smaller areas of prospecting activity were defined during this investigation (fig. ES-4).

The discovery of the Comstock Lode in 1859 prompted waves of prospecting activity across the state of Nevada, resulting in mineral discoveries at several mining camps around the eastern periphery of the present-day NAFR: Pahranagat in 1865, Tem Piute in 1865, and Reveille in 1866. Within the study area during this time period, discoveries were made in the Groom district in 1864 and in the Southeastern district in about 1870.

Prospecting activity on the west side of the NAFR study area exploded following the discovery of the rich silver deposits at Tonopah in 1900 and gold at Goldfield in 1902. Some of the mines and prospects in the eastern Goldfield district now inside the NAFR boundary were first located in 1902-03 and claims were staked on turquoise and gold discoveries near Cactus Peak, in the Cactus Springs district, and in the Antelope Springs district from 1901 through 1903. Precious metal discoveries were made at Silverbow, Wellington, Trappmans, and Wilsons camps in 1904; at Gold Reed, Tolicha (Quartz Mountain) and Gold Crater in 1905; at Transvaal in 1906; and at Jamestown in 1907-08. The Silverbow district was somewhat anomalous in producing ore steadily over most of the years from its discovery until closure of the range in 1942. The Cactus Range districts did not have a "boom" period, but rather the same workers who made the initial discoveries continued to prospect and develop for several decades. In the southeastern part of the NAFR, the Groom district produced lead-silver-copper ore from 1869 to 1874, lapsed until 1915, then produced ore steadily through 1956. Of the mining districts within the NAFR the greatest production, both in tons ore produced and in value of ore, was from the Groom district.



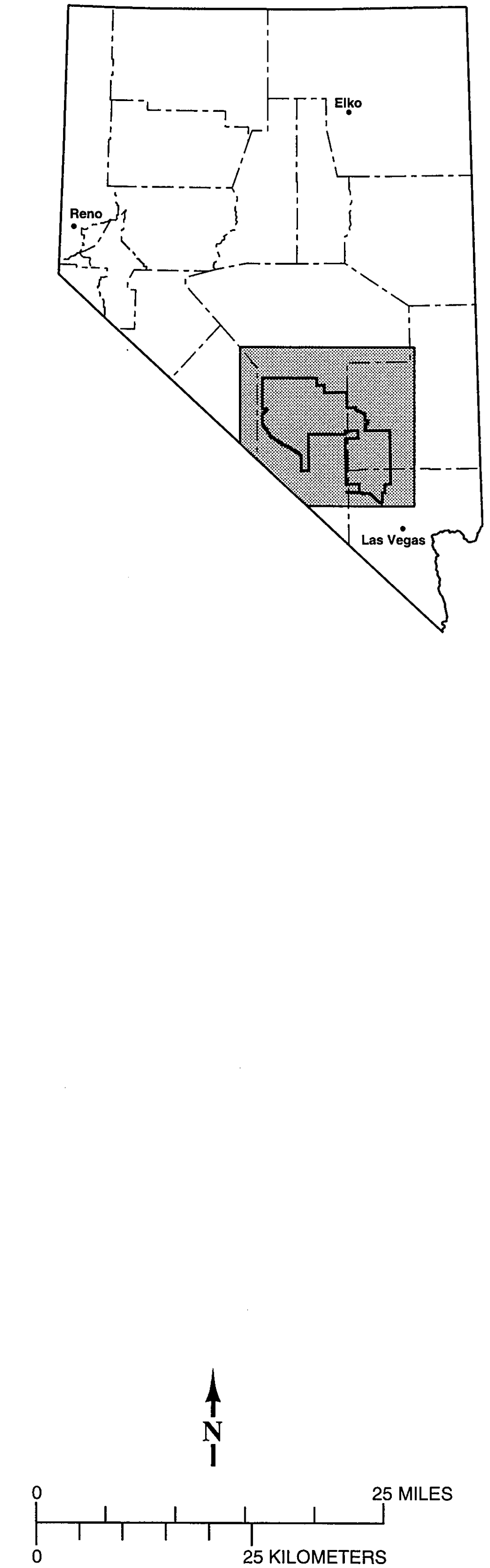


Figure ES-2 Physiographic map of the Nellis Air Force Range and surrounding portions of southern Nevada

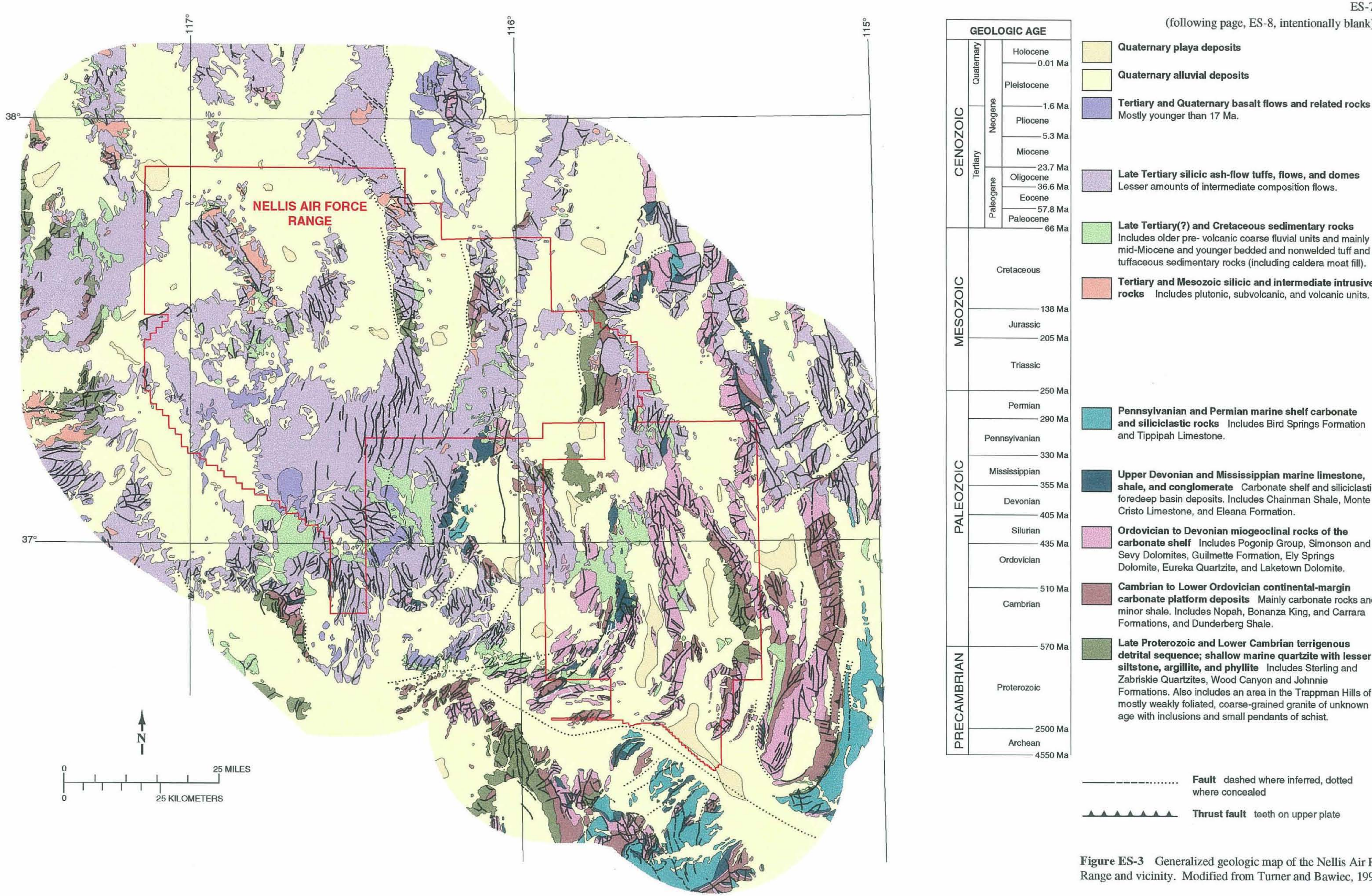


Figure ES-3 Generalized geologic map of the Nellis Air Force Range and vicinity. Modified from Turner and Bawiec, 1991.

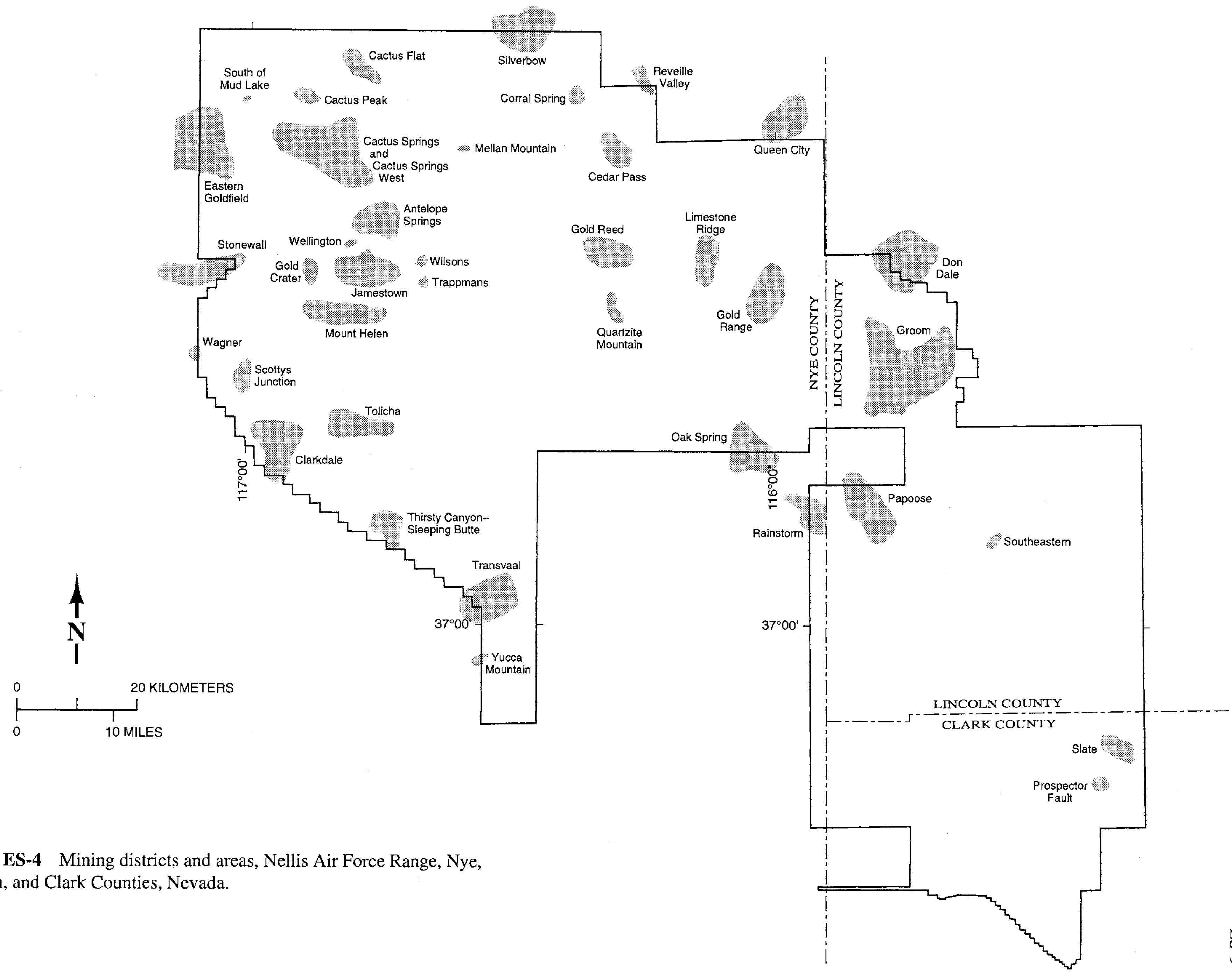


Figure ES-4 Mining districts and areas, Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

There was a brief surge in small-scale prospecting activity throughout the study area in the early 1930s when the mining camps of Mellan Mountain, Clarkdale, and Gold Range came into being, and there was also minor production from older mining claims at Gold Crater, Tolicha, and Wilsons.

Production for mining districts within the NAFR study area is summarized in table ES-2. Most production figures have been compiled from USBM records for the years 1902-69 augmented by production data from unpublished reports in NBMG files and from newspaper articles.

7.2 TYPES OF MINERAL DEPOSITS

Hydrothermal ore deposits and prospects in areas on and adjacent to NAFR belong to several general deposit classes: (1) Epithermal precious metal deposits in the Goldfield (eastern part), Antelope Springs, Cactus Springs, Gold Reed, Mellan Mountain, Jamestown, Silverbow, Stonewall, Gold Crater, Clarkdale, Tolicha, Gold Range, Wellington, and Wilsons districts; (2) Sediment-hosted gold prospects in the Belted and Groom Ranges; (3) Epithermal manganese prospects in the South of Mud Lake area; (4) Hot-spring mercury deposits in the Transvaal district and the Kawich Range; (5) Polymetallic vein deposits in the Southeastern, Papoose, and Rainstorm districts; (6) Polymetallic replacement deposits in the Groom district; (7) Porphyry-related copper-molybdenum prospects, essentially confined to the Cactus Range; and (8) Skarn tungsten deposits in the Oak Spring district.

8.0 ASSESSMENT OF MINERAL AND ENERGY RESOURCE POTENTIAL

8.1 METALLIC MINERALS

On a regional level, geochemical data from the reconnaissance stream sediment sampling program were used to define areas of mineral resource potential for precious and base metals. These areas of mineral resource potential are shown in figures ES-5 through ES-8.

At a district level, mine sampling and examination data were used to define specific areas of metallic resource potential. The areas of mineral resource potential generated from the mine sampling and examination program are shown in figures ES-9 and ES-11, and are listed in tables ES-3 and ES-4. Figure ES-10 is a composite of the areas of medium and high potential shown on figures ES-5 and ES-9. Figure ES-12 is a composite of the areas of medium and high potential shown on figures ES-6, 7, 8, and 11.

<u>8.1.1 Gold and Silver</u>

Areas of gold and silver potential defined by stream sediment sampling (fig. ES-5) are concentrated in the northern portion of NAFR. Large areas of high resource potential were defined in the Cactus Range, southeast of the Cactus Springs district; in the Mount Helen area; near Cedar Pass and north and south of the Gold Reed district in the Kawich Range; and north of Limestone Ridge in the Belted Range.

With the exception of the Slate district, and possibly the Prospector Fault area in the southern part of the NAFR, gold and/or silver have been sought in every mining district within NAFR. Specific areas of gold-silver potential and their ratings within and near these districts are shown on figure ES-9.

<u>8.1.2 Copper and Molybdenum</u>

Stream sediment sampling outlined several areas of copper-molybdenum potential within NAFR (fig. ES-6). The three largest of these encompass the west slope of the northern Cactus Range, the area extending from Gold Crater through Mount Helen to the Trappman Hills, and the area surrounding Gold Reed in the southern Kawich Range.

There is mineral resource potential for three types of copper deposits within the NAFR. In the Cactus Springs West district, rock alteration and surface trace element associations indicate potential porphyry-type copper-molybdenum mineralization. High-sulfidation epithermal systems such as those present at Jamestown, Gold Crater, and part of the Cactus Springs West districts could contain disseminated copper mineralization. There is potential for polymetallic replacement deposits of copper in the Wagner, Southeastern, Groom, Papoose, and Rainstorm districts. The specific areas of copper-molybdenum potential are shown on figure ES-11.

<u>8.1.3 Lead and Zinc</u>

Stream sediment sampling defined only two areas of high potential for lead and zinc (fig. ES-7). One of these is centered on the Groom district, the largest known lead-producing district within NAFR. The second is focused on the Southeastern Mine in the northern Pintwater Range. Moderate resource potential for lead and zinc was defined in the Gold Crater-Jamestown-Mount Helen area.

Lead production is reported from seven districts within NAFR; zinc production is documented from only one. The Groom district, the largest has produced both lead and zinc. Papoose, the second largest, has produced only lead.

There is potential for development of polymetallic vein or polymetallic replacement deposits of lead and/or zinc in four districts within the NAFR: the Groom, Papoose, Rainstorm, and Southeastern. The specific areas of lead-zinc potential are shown on figure ES-11.

Table ES-2. Total production by district, Nellis Air Force Range.

District	Ore (tons)	Gold (oz)	Silver (oz)	Copper (pounds)	Lead (pounds)	Zinc (pouuds)	Years Produced	Comments
Antelope Springs	328	157	54,024	275	454		1912-1917, 1926, 1939	
Cactus Springs	200	15	3,147				1909-1910, 1915-1916, 1920,1927, 1940-1941	
Clarkdale	316	160	398				1932-1933, 1936-1938, 1940	Under Bullfrog 1930s; Beatty,1940)
Gold Crater	188	82	2,722		4,500		1913, 1916, 1939, 1949, 1953	
Gold Reed	335	217	475				1910-1912, 1921, 1927, 1941	
Groom	34,484	45	145,279	72,421	10,425,430	39,100	1915-1918, 1922-1931, 1933-1938, 1942-1956	
Jamestown	1	4					1908	$78 per ton
Mellan	20	3	2				1936	Under Tonopah, 1935; Kawich, 1936
Oak Springs	26	10	667	3,832			1917, 1951	
Papoose	458	1	3,029	400	301,673			
Rainstorm	39	5	918	128	42,741		1933, 1951	Under Groom
Silverbow*	3,524	1,346	95,976				1906-1914, 1920-1923, 1929-1936, 1940-1947, 1955	
Southeastern	31		352	1,400	2,700		1940, 1947	Under Groom, 1947
Stonewall*	38	16	1,165				1910, 1915-1916	
Tolicha	991	1,345	2,409				1923, 1929-1936, 1940	
Trappmans	1	1	130				1908	
Wilsons	15		527	105	993		1933	
TOTAL	**40,995**	**3,407**	**311,220**	**78,561**	**10,778,491**	**39,100**		

*Some production for Silverbow and Stonewall districts may have come from mines outside NAFR. Production for all other districts came entirely from mines within NAFR.

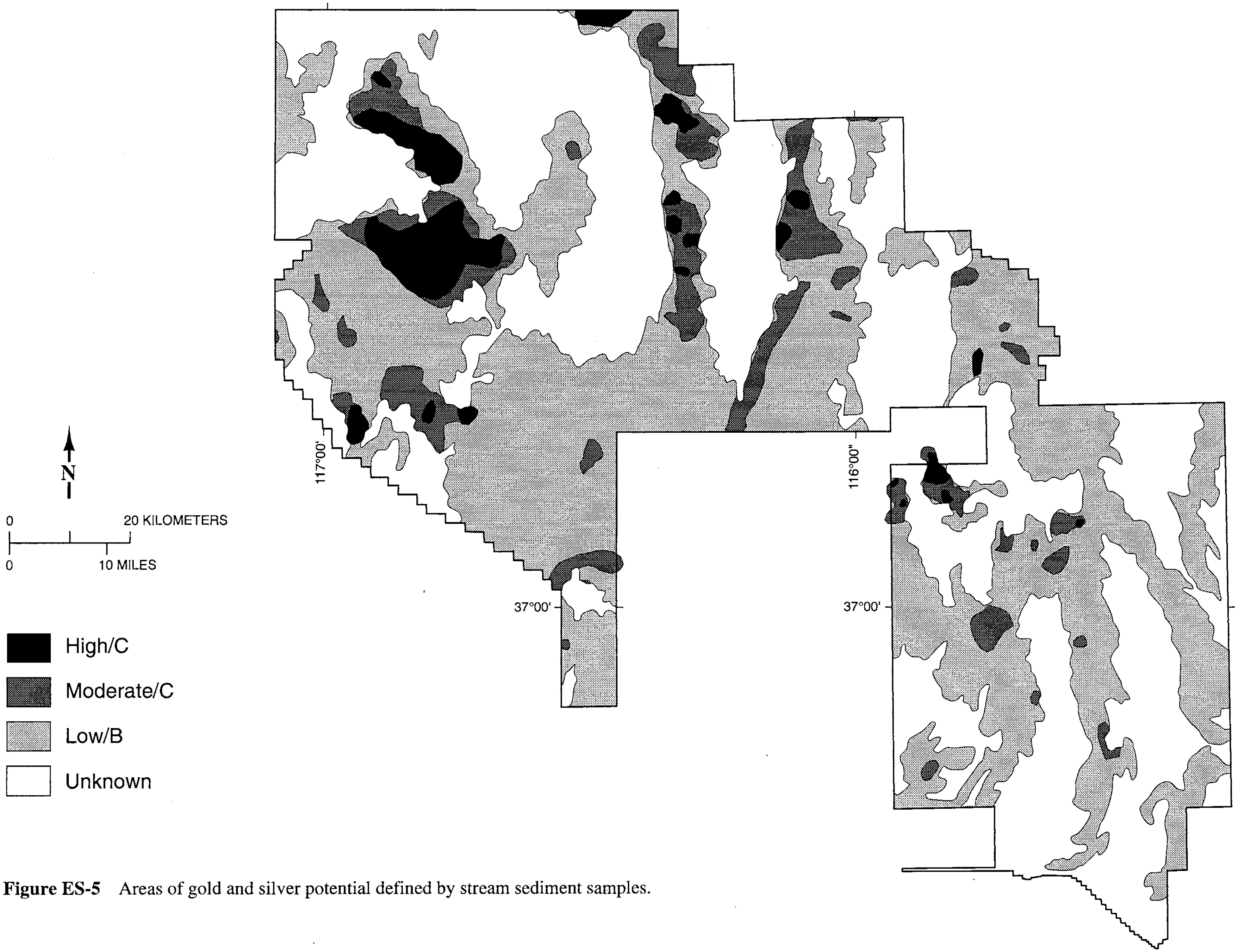


Figure ES-5 Areas of gold and silver potential defined by stream sediment samples.

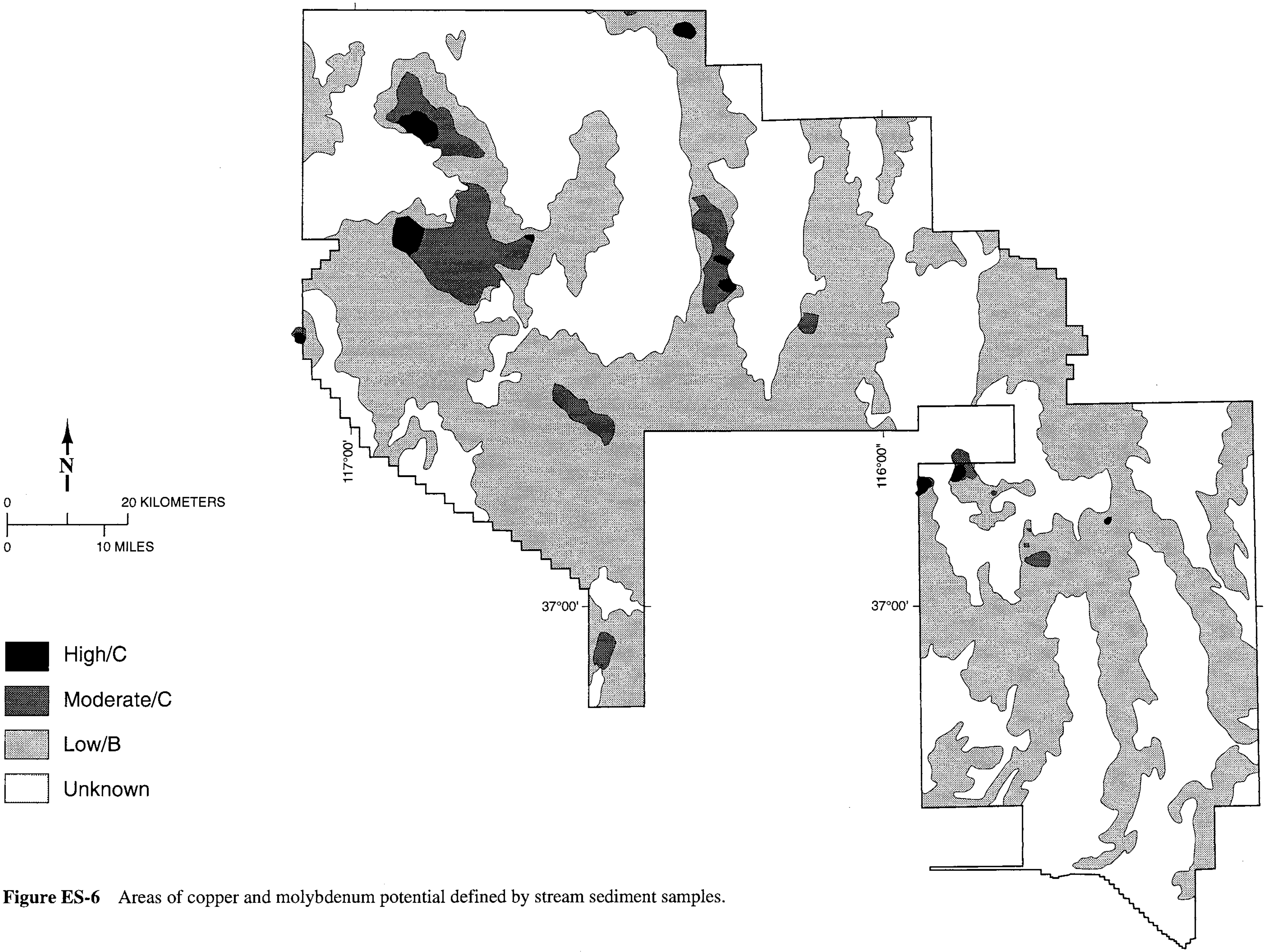


Figure ES-6 Areas of copper and molybdenum potential defined by stream sediment samples.

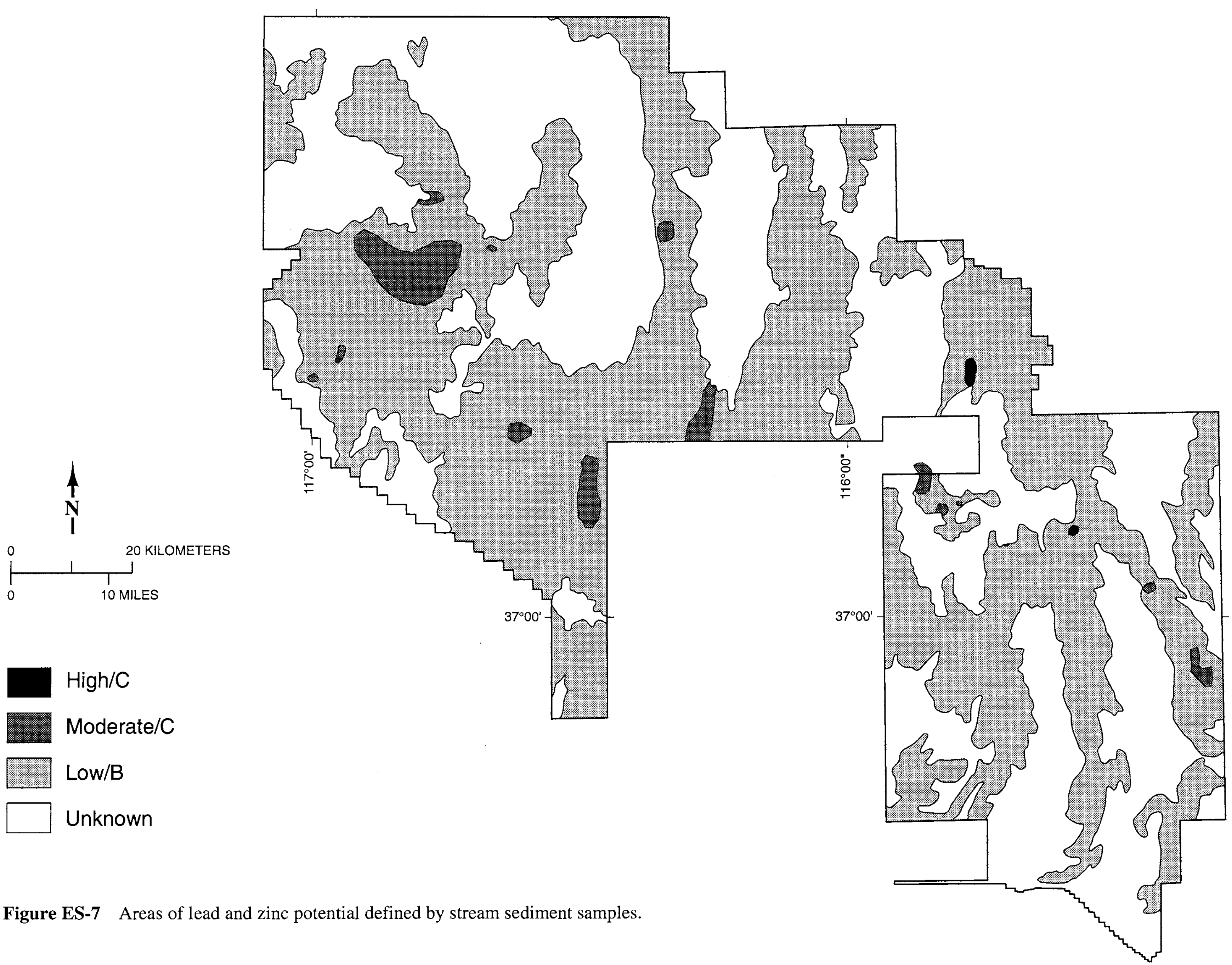


Figure ES-7 Areas of lead and zinc potential defined by stream sediment samples.

Figure ES-8 Areas of mercury potential defined by stream sediment samples.

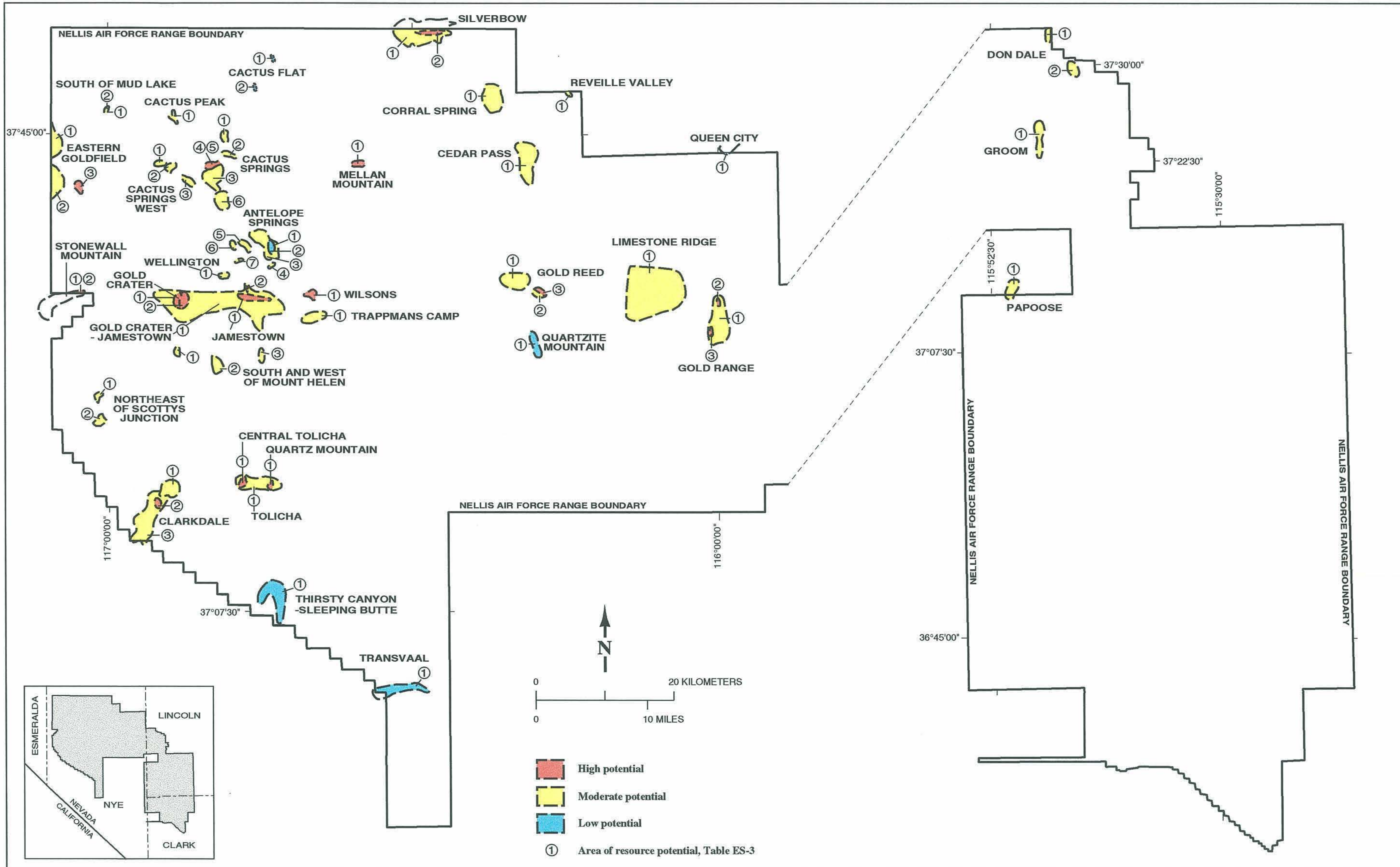


Figure ES-9 Precious metals potential within known mining districts.

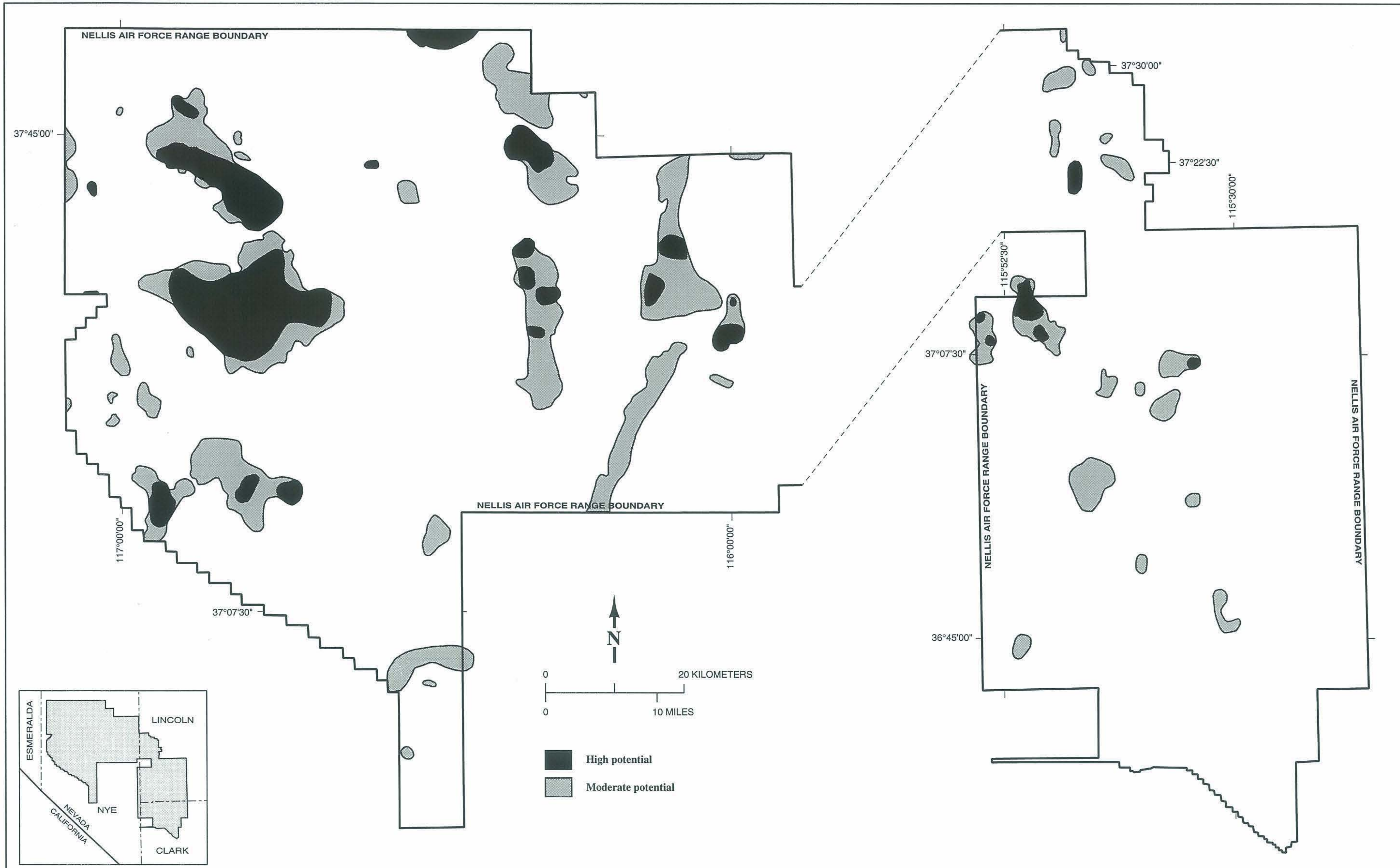


Figure ES-10 Areas of moderate and high potential for precious metals, NAFR (composite of figs. ES-5 and ES-9).

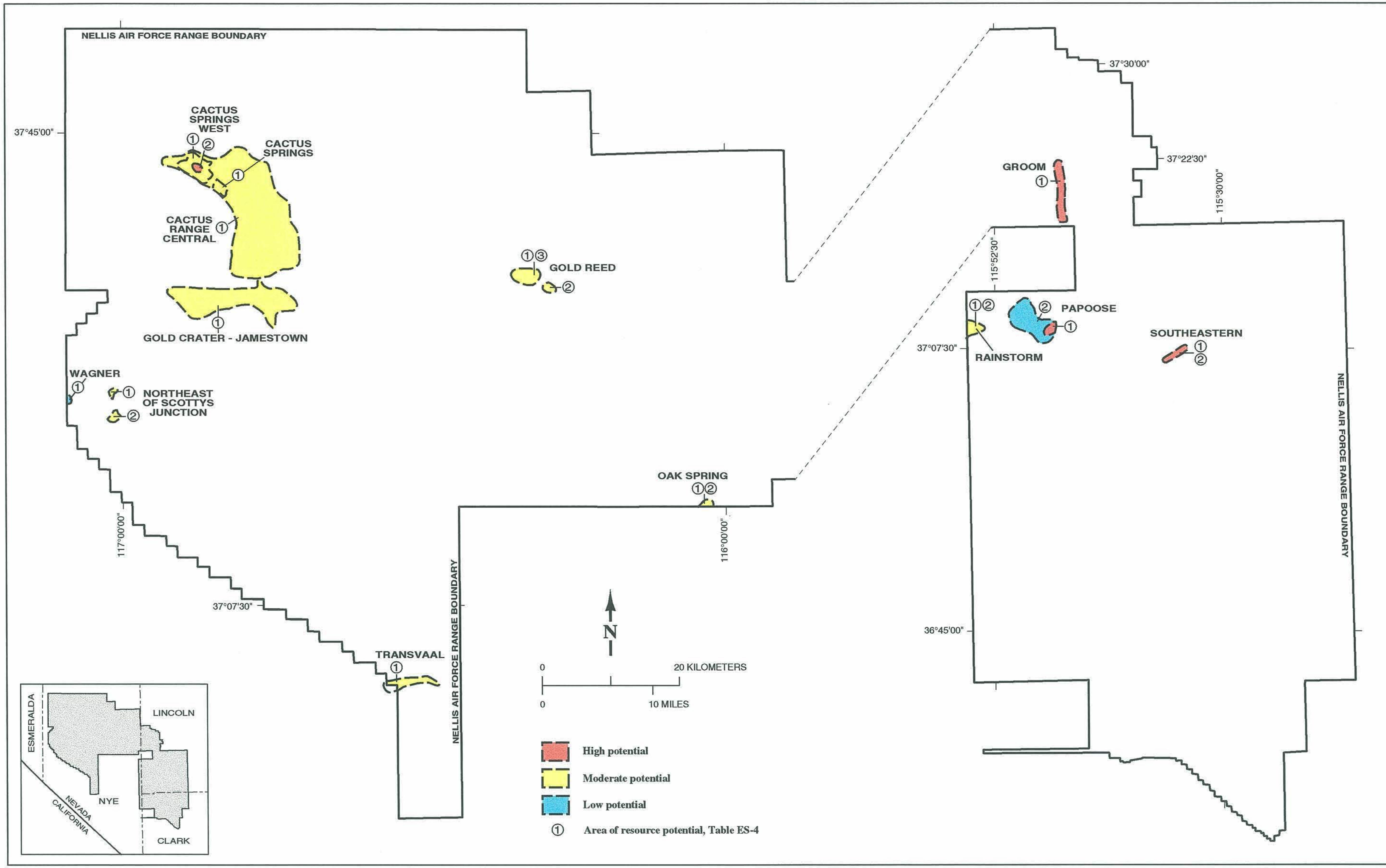


Figure ES-11 Base metals potential within known mining districts.

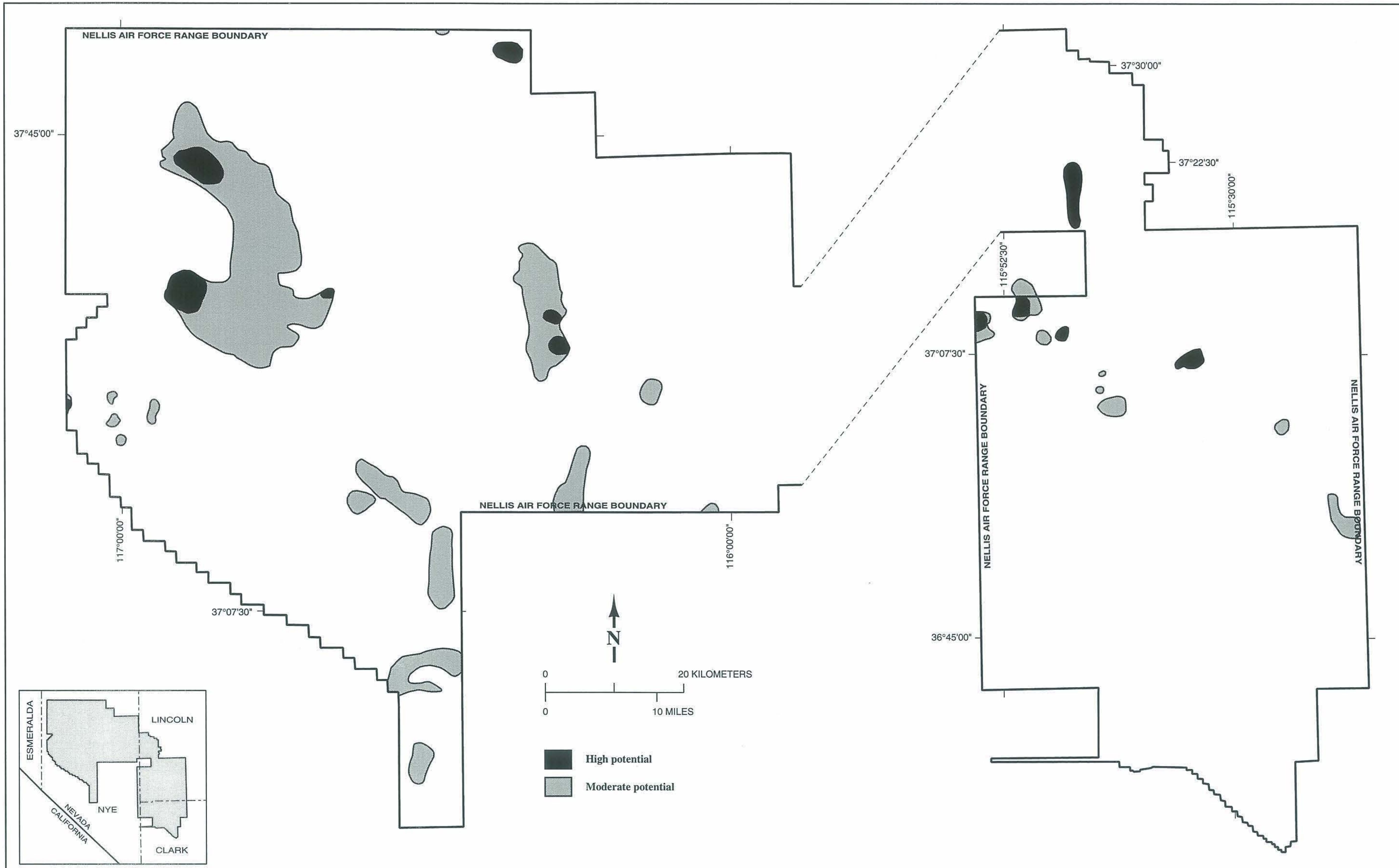


Figure ES-12 Areas of moderate and high potential for base metals, NAFR (composite of figs. ES-6, 7, 8, and 11).

Table ES-3. Precious metals potential within known mining districts .

District	Area**	Mineral Resource	Resource* Potential	Certainty* Level	Figure	Comments
Antelope Springs	1	Ag, Au dissem	Low	B	8-21	Defined by alteration, rock chemistry
	2	Ag, Au vein	Moderate	D	8-21	Defined by mine and surface sampling
	3	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration
	4	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration
	5	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration
	6	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration
	7	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration
Cactus Flat	1	Ag, Au	Low	C	8-21	Defined by prospects, alteration, rock chemistry
	2	Ag, Au	Low	C	8-21	Defined by prospects, alteration, rock chemistry
Cactus Peak	1	Au, Ag	Moderate	B	8-21	Defined by color anomaly, rock alteration
Cactus Springs	1	Au, Ag	Moderate	B	8-21	Defined by color anomaly, rock alteration
	2	Au, Ag	Moderate	B	8-21	Defined by color anomaly, rock alteration
	3	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration, rock chemistry
	4	Ag, Au veins	High	C	8-21	Defined by mines, prospects, alteration, rock chemistry
	5	Ag, Au	Moderate	C	8-21	Defined by mines, prospects, alteration, rock chemistry
	6	Ag, Au	Moderate	B	8-21	Defined by prospects, alteration, rock chemistry
Cactus Springs West	1	Au, Ag	Moderate	B	8-21	Defined by rock alteration, rock chemistry
	2	Au, Ag	Moderate	B	8-21	Defined by mines, prospects, alteration, rock chemistry
	3	Au, Ag	Moderate	B	8-21	Defined by mines, prospects, alteration, rock chemistry
Cedar Pass	1	Ag, Au	Moderate	B	8-24	Defined by prospects, color anomaly, alteration, rock chemistry
Central Tolicha	1	Au, Ag	High	C	8-23	Defined by mines, prospects, alteration, rock chemistry
Clarkdale	1	Au, Ag	Moderate	B	8-23	Defined by alteration, rock chemistry
	2	Au, Ag	High	C	8-23	Defined by mines, prospects, alteration, rock chemistry
	3	Au, Ag	Moderate	C	8-23	Defined by mines, prospects, alteration, rock chemistry
Corral Spring	1	Au, Ag	Moderate	B	8-24	Defined by prospects, alteration, rock chemistry
Don Dale	1	Ag, Au	Moderate	C	8-26	Defined by prospects, rock chemistry
	2	Au	Moderate	B	8-26	Defined by stratigraphy, rock chemistry
Eastern Goldfield	1	Au, Ag	Moderate	B	8-21	Defined by mines prospects, alteration, rock chemistry
	2	Au, Ag	Moderate	B	8-21	Defined by mines prospects, alteration, rock chemistry
	3	Au, Ag	High	C	8-21	Defined by mines prospects, alteration, rock chemistry
Gold Crater	1	Au, Ag	High	B	8-22	Defined by alteration, rock alteration
	2	Au, Ag	High	C	8-22	Defined by mines, prospects, alteration, rock chemistry
Gold Crater-Jamestown	1	Au, Ag	Moderate	B	8-22	Defined by color anomaly, alteration
Gold Reed	1	Au, Ag	Moderate	C	8-24	Defined by prospects, color anomaly, alteration, rock chemistry
	2	Au, Ag	Moderate	B	8-24	Defined by prospects, color anomaly, alteration, rock chemistry
	3	Au, Ag	High	C	8-24	Defined by prospects, color anomaly, alteration, rock chemistry

*Refer to table ES-1 for definition.
**Areas shown on Fig. ES-9.

continued

Table ES-3. Precious metals potential within known mining districts (continued).

District	Area**	Mineral Resource	Resource* Potential	Certainty* Level	Figure	Comments
Gold Range	1	Au, Ag	Moderate	B	8-25	Defined by prospects, alteration, rock chemistry
	2	Au, Ag	Moderate	C	8-25	Defined by prospects, alteration, rock chemistry
	3	Au, Ag	Moderate	C	8-25	Defined by prospects, alteration, rock chemistry
Groom	1	Ag, Au	Moderate	C	8-26	Defined by mines, prospects, structure, rock chemistry
Jamestown	1	Au, Ag	High	C	8-22	Defined by mines, prospects, alteration, rock chemistry
	2	Au, Ag	High	C	8-22	Defined by mines, prospects, alteration, rock chemistry
Limestone Ridge	1	Au	Moderate	B	8-25	Defined by stratigraphy, alteration, rock chemistry
Mellan Mountain	1	Au, Ag	High	C	8-21	Defined by mines, prospects, rock alteration, rock chemistry
Northeast of Scottys Junction	1	Au, Ag	Moderate	B	8-22	Defined by prospects, color anomaly, rock chemistry
	2	Au, Ag	Moderate	B	8-22	Defined by prospects, color anomaly, rock chemistry
Papoose	1	Au	Moderate	B	8-27	Defined by prospects, stratigraphy, alteration, rock chemistry
Quartz Mountain	1	Au, Ag	High	C	8-23	Defined by mines, prospects, alteration, rock chemistry
Quartzite Mountain	1	Ag, Au	Low	C	8-24	Defined by prospects, alteration, rock chemistry
Queen City	1	Ag, Au	Low	C	8-25	Defined by color anomaly, alteration, rock chemistry
Reveille Valley	1	Au, Ag	Moderate	B	8-24	Defined by color anomaly, alteration
South and west of Mount Helen	1	Au, Ag	Moderate	B	8-22	Defined by color anomaly, alteration, rock chemistry
	2	Au, Ag	Moderate	B	8-22	Defined by color anomaly, alteration, rock chemistry
	3	Au, Ag	Moderate	B	8-22	Defined by color anomaly, alteration, rock chemistry
Silverbow	1	Ag, Au	Moderate	C	8-24	Defined by mines, prospects, alteration, rock chemistry
	2	Ag, Au	High	C	8-24	Defined by structure, alteration, rock chemistry
South of Mud Lake	1	Ag	Low	C	8-21	Defined by mines prospects, alteration, rock chemistry
	2	Ag	Moderate	B	8-21	Defined by mines prospects, alteration, rock chemistry
Stonewall Mountain	1	Ag, Au	High	C	8-22	Defined by prospects, alteration, rock chemistry
	2	Ag, Au	Moderate	B	8-22	Defined by geology, mines, prospects
Thirsty Canyon	1	Au, Ag	Low	B	8-27	Defined, alteration, rock chemistry
Tolicha	1	Au, Ag	Moderate	B	8-23	Defined color anomaly, alteration, rock chemistry
Transvaal	1	Au, Ag	Low	B	8-27	Defined, alteration, rock chemistry
Trappmans Camp	1	Ag, Au	Moderate	C	8-22	Defined by mines, prospects, alteration
Wellington	1	Au, Ag	Moderate	C	8-21	Defined by prospects, alteration, rock chemistry
Wilsons	1	Au, Ag	High	C	8-22	Defined by rock structure, color anomaly, alteration, rock chemistry

*Refer to table ES-1 for definition.
**Areas shown on Fig. ES-9.

Table ES-4. Base metals potential within known mining districts .

District	Area**	Mineral Resource	Resource * Potential	Certainty * Level	Figure	Comments
Cactus Range, Central	1	Cu, Mo, Au	Moderate	B	8-29	Multiple porphyritic intrusions; propylitic, argillic, acid-sulfate alteration
Cactus Springs	1	Zn, Pb, Ag	Moderate	B	8-29	Defined by stratigraphy, alteration, rock chemistry
Cactus Springs West	1	Cu, Mo,	Moderate	C	8-29	Defined by mines, prospects, alteration, rock chemistry
	2	turquoise	High	C	8-29	Defined by mines, prospects, alteration, rock chemistry
Cedar Pass	1	Mo	Moderate	B	8-32	Defined by prospects, color anomaly, alteration, rock chemistry
Gold Crater-Jamestown	1	Cu, Mo	Moderate	B	8-30	Defined by alteration, mineral zoning
Gold Reed	1	Cu	Moderate	B	8-32	Defined by prospects, color anomaly, alteration, rock chemistry
	2	Cu	Moderate	B	8-32	Defined by prospects, color anomaly, alteration, rock chemistry
	3	Hg	Low	C	8-32	Defined by prospects, color anomaly, alteration, rock chemistry
Groom	1	Pb, Ag, Zn	High	C	8-34	Defined by mines, prospects, structure, rock chemistry
Northeast of Scottys Junction	1	Cu, Mo	Moderate	B	8-30	Defined by alteration, rock chemistry
	2	Cu, Mo	Moderate	B	8-30	Defined by alteration, rock chemistry
Oak Spring	1	W	Moderate	B	8-33	Defined by stratigraphy, rock chemistry
	2	Pb, Ag	Moderate	B	8-33	Defined by prospects, rock chemistry
Papoose	1	Pb, Ag	High	C	8-35	Defined by mines, prospects, rock chemistry
	2	Pb, Ag	Low	B	8-35	Defined by mines, prospects, rock chemistry
Prospector Fault	1	Cu, Pb, Ag, Zn	Moderate	B	8-36	Defined by prospects, rock structure, rock chemistry
Rainstorm	1	Pb, Ag (replacement)	Moderate	B	8-35	Defined by mines, prospects, stratigraphy, rock chemistry
	2	Pb, Ag (vein)	Moderate	C	8-35	Defined by mines, prospects, stratigraphy, rock chemistry
Southeastern	1	Pb, Cu, Ag (replacement)	High	B	8-35	Defined by mines, prospects, stratigraphy, rock chemistry
	2	Pb, Cu, Ag (vein)	High	C	8-35	Defined by mines, prospects, stratigraphy, rock chemistry
Transvaal	1	Hg	Moderate	C	8-31	Defined by prospects, alteration, rock chemistry
Wagner	1	Cu	Low	C	8-30	Defined by geologic relationships

*Refer to table ES-1 for definition.
**Areas shown on Fig. ES-11.

8.1.4 Mercury

Stream sediment sampling outlined two areas within NAFR with moderate resource potential for mercury (fig. ES-8). Both of these areas, the Gold Reed district in the southern Kawich Range and the Transvaal Hills south of Pahute Mesa, coincide with areas of known mercury prospects. There are no large mercury-producing districts near the NAFR. Prospecting for mercury is evident in only two districts within the NAFR. The Bristol group claims in the Gold Reed district were evaluated for mercury in the early 1930s, and a small area of shallow hot-spring alteration and possible mercury mineralization is present in the eastern part of the Transvaal district. The specific areas of mercury potential are shown on figure ES-11.

8.1.5 Tungsten

No areas of tungsten resource potential were defined by the stream sediment sampling program, and there are no known tungsten mines or prospects within the NAFR. There is, however, limited potential for skarn tungsten deposits in the northern part of the Oak Spring district (fig. ES-11).

8.2 NONMETALLIC (INDUSTRIAL) MINERALS

For most nonmetallic commodities, ore deposit models do not have the same importance as for the metallic commodities, and value is determined by demand and/or proximity to consumers. Many commodities are specific to certain rock types or depositional environments; potential is mapped by rock stratigraphy and drilling/sampling programs covering large areas. This type of program is beyond the scope of the present study. Assessments, therefore, are based on the limited information available from the few nonmetallic occurrences documented within NAFR combined with regional knowledge of favorable geologic settings. The areas of nonmetallic mineral resource potential are summarized in table ES-5.

8.2.1 Barite

Barite has been mined from five deposits in the region around the NAFR, including three deposits of bedded barite in Paleozoic rock that are north of the northern NAFR, and two vein barite deposits west of the northern NAFR. There are no barite deposits within 50 km of the southern NAFR, and no barite deposits are known within the NAFR.

8.2.2 Borate Minerals

Bedded borate deposits occur in the Tertiary Horse Spring Formation in the Muddy Mountains about 70 km southeast of the NAFR. During sampling and reconnaissance of Tertiary sedimentary exposures in the NAFR, neither borate minerals nor rock types that accompany borate minerals were noted.

8.2.3 Building Stone

The only active building stone producer in the Nellis region is Nevada Neanderthal Stone located northeast of Beatty. This company quarries and cuts 12 varieties of Miocene-age ash-flow tuff from localities adjacent to the NAFR to produce floor tiles, wall panels, and other stone products. The same ash-flow tuff units that are the source of production here are widespread within the southwestern portion of the NAFR and it is possible that they could be utilized for similar products.

Slate quarries in the Desert Range are the only known mining sites for building stone on the southern NAFR. Little is known about the mining history of these quarries, but "greenstone-flagstone" is said to have been produced from the Hancock Stone Quarry in this area, possibly in the 1920s. The material that has been quarried at these sites the NAFR may have potential for use as structural slate in such products as floor tiles or steps, and has potential for use as decorative paving stone or flagstone.

Areas underlain by pre-Tertiary bedrock and Tertiary volcanic bedrock in the NAFR (fig. ES-13) are considered to have moderate potential, certainty level B, for building stone. However, due to local features such as hydrothermal alteration and moderate to intense fracturing, not all bedrock areas contain rock of sufficient quality for building stone. In addition, it is difficult to predict public preferences for color and textural features that will make certain lithologies marketable. Therefore, delineation of specific bedrock areas with known potential for building stone is beyond the scope of this study.

8.2.4 Clay

Clay is currently mined at two sites in the region around the NAFR. The largest clay producer in Nevada, the IMV Division of Floridin Co., mines sepiolite, montmorillonite, saponite, and hectorite from deposits in the Ash Meadows area about 45 km south of the NAFR and, at the New Discovery Mine, 20 km west of the NAFR, the Vanderbilt Minerals Co. mines high-grade montmorillonite clay.

Within the NAFR, two areas of clay deposits are present along the western, lower slope of Pahute Mesa. Other deposits of clay minerals are probably present in the northern NAFR because hydrothermally altered volcanic rocks are common. However, no unique sources of high-grade clay have been identified. Potential for clay deposits in some Tertiary sedimentary rocks and in altered Tertiary rocks in the NAFR (fig. ES-14) is considered to be moderate, certainty level B.

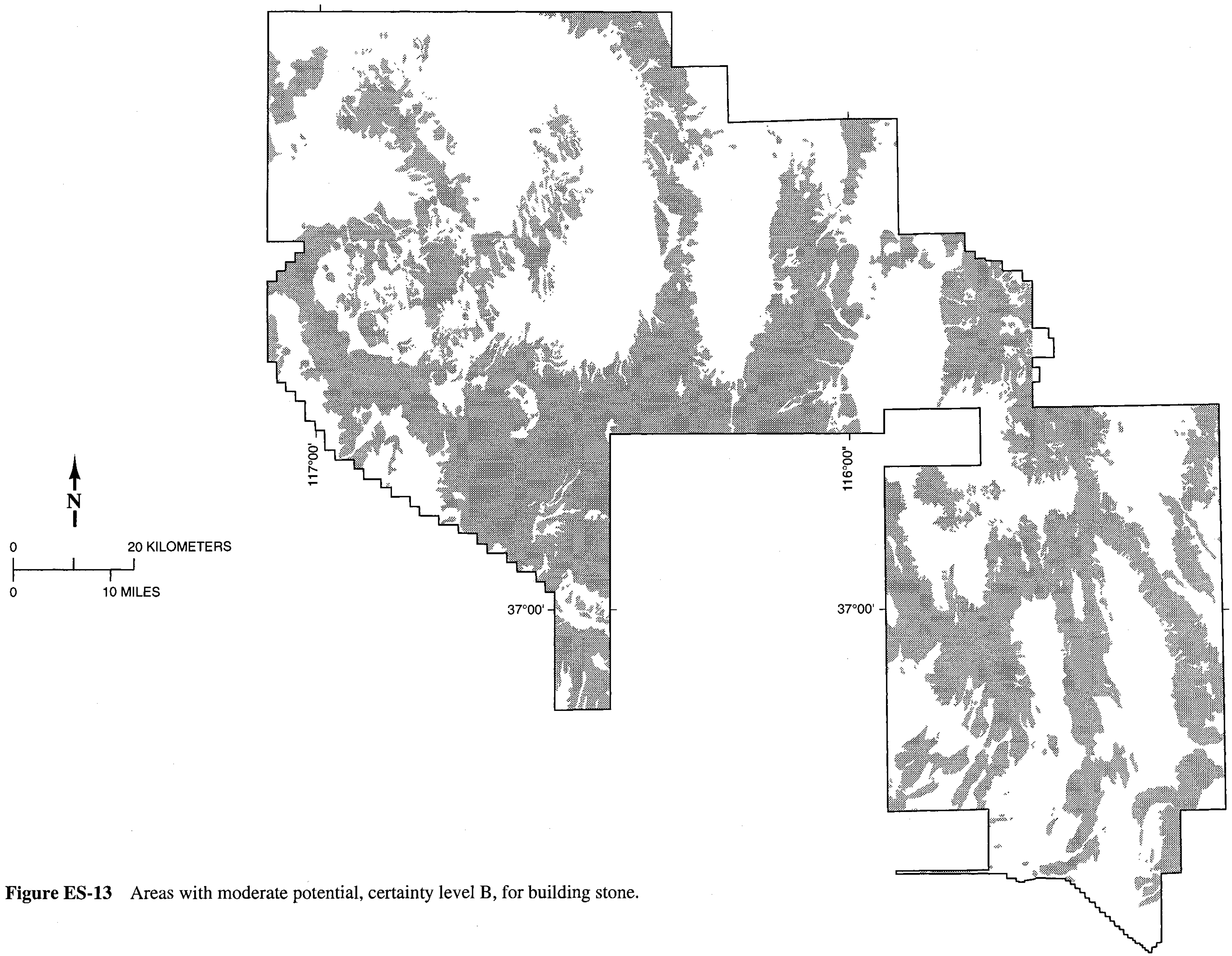


Figure ES-13 Areas with moderate potential, certainty level B, for building stone.

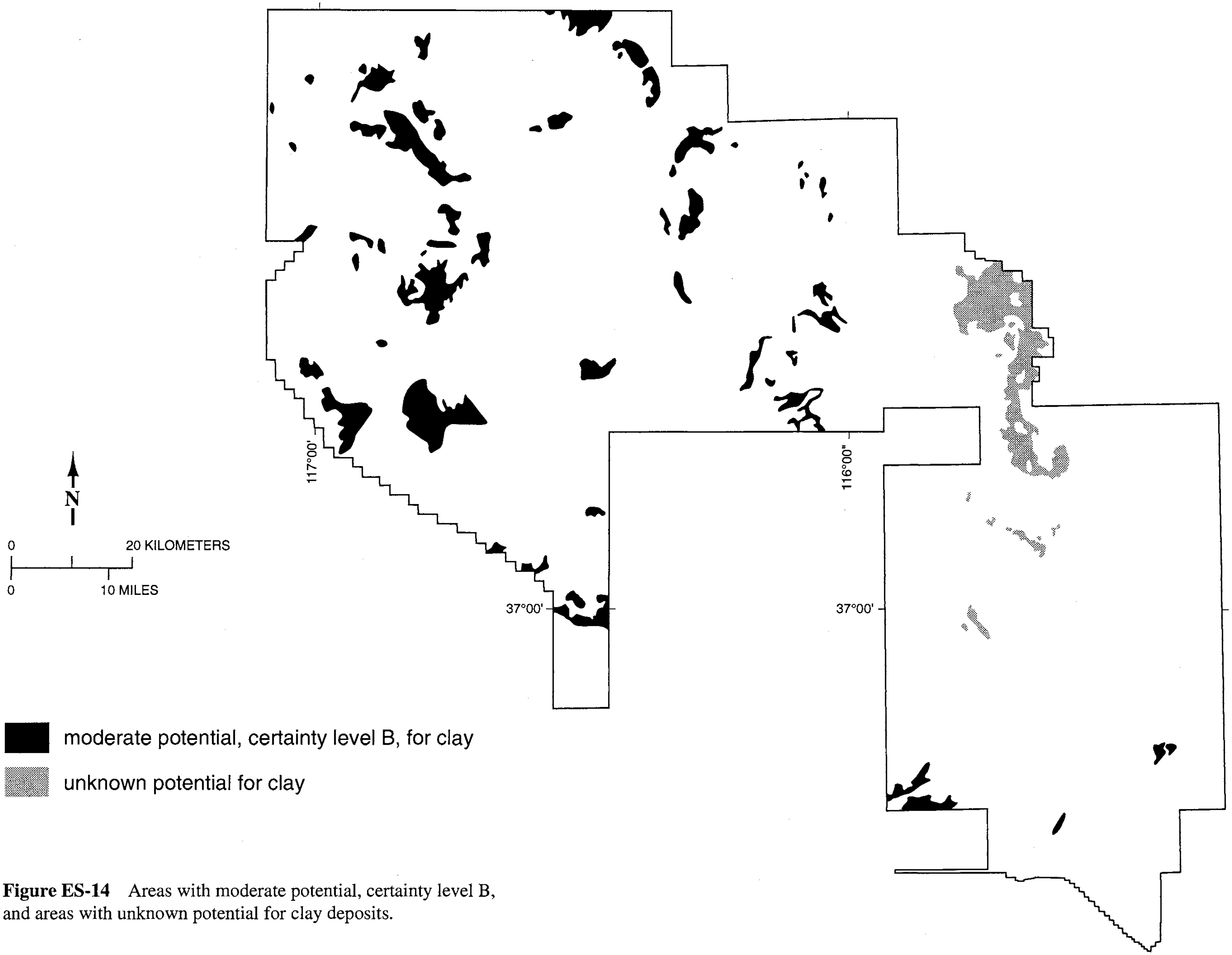


Figure ES-14 Areas with moderate potential, certainty level B, and areas with unknown potential for clay deposits.

Table ES-5. Areas of resource potential, industrial (nonmetallic) minerals.

Mineral Resource	Area	Resource* Potential	Certainty* Level	Figure	Comments
Barite	NAFR	Low	B	none	none
Borate minerals	NAFR	Low	B	none	none
Building stone	NAFR	Moderate	B	ES-13, 8-39	All bedrock
Clay	NAFR	Moderate	B	ES-14, 8-40	Tertiary rocks
Clay	NAFR	Low	C	none	Pre-Tertiary rocks
Construction aggregate (sand and gravel)	NAFR	Moderate to High	B	ES-15, 8-42, 8-43	none
Construction aggregate (bedrock)	NAFR	Moderate	B	ES-16, 8-43	none
Dolomite	NAFR	Low	B	none	none
Fluorspar	NAFR	Low	B	8-37	none
Gypsum	NAFR	Low	B	none	none
Limestone, high calcium	NAFR	Low	B	none	none
Limestone, cement	NAFR	Moderate	B	8-44	Paleozoic exposures
Limestone, cement	Area of tufa limestone	High	B	ES-17, ES-18, 8-37	none
Lithium	NAFR	Low	B	none	none
Perlite	NAFR	Low	B	none	none
Pumice/pumicite	NAFR	Low	B	none	none
Saline minerals, leasable	NAFR	Low	B	none	none
Volcanic cinders	northern NAFR	Moderate	C	ES-17, 8-37	Two cinder cones, *see* Construction Aggregate section
Zeolites	NAFR	Moderate	B	ES-19, 8-45	Tertiary rocks

*Refer to table ES-1 for definition.

8.2.5 Construction Aggregate

High-quality sand and gravel and crushed stone are undoubtedly available from areas dominated by Paleozoic highlands such as the those within the southeastern NAFR. Areas of alluvium in the southeastern NAFR that include Tertiary sedimentary detritus have considerably lower potential, because they may contain deleterious amounts of gypsum.

The valleys and alluvial fans in the northern NAFR also contain large amounts of sand and gravel. Most of the detritus in this alluvium is probably sound, durable welded ash-flow tuff. However, some structurally inferior non welded and bedded tuff fragments are probably also present in many areas. In addition, large areas of altered volcanic rock that contain deleterious materials such as clay minerals and reactive silica are known to be present in the northern NAFR. Alluvium that may contain such materials on the basis of provenance is considered to have low potential for construction aggregate.

Potential for the presence of high-quality sand and gravel deposits is considered to be high, certainty level B, in many of the large alluvial basins surrounded by pre-Tertiary bedrock, generally in the southern NAFR (fig. ES-15). Potential for high-quality sand and gravel deposits is considered to be moderate, certainty level B, in some basins surrounded by Tertiary volcanic rock, mostly in the northern NAFR (fig. ES-15). Potential for bedrock suitable for crushed stone construction aggregate production is considered to be high, certainty level B, in areas of pre-Tertiary rock in the NAFR (fig. ES-16). However, due to local features such as hydrothermal alteration, not all bedrock areas contain rock of sufficient quality for construction aggregate. Delineation of specific bedrock areas with known potential for construction aggregate is beyond the scope of this study.

Present production of construction aggregate in the Las Vegas metropolitan area, the largest market for this material near the NAFR, is mainly from Quaternary sand and gravel deposits within 12 miles of the center of Las Vegas. Under current conditions, aggregate production from the NAFR would not be economically competitive in this market due to high haulage costs. However, if conditions change, areas in the NAFR that contain large amounts of high quality sand and gravel may become valuable.

Two deposits of volcanic cinder, a relatively valuable type of construction aggregate that can be shipped longer distances, are found near the southwestern boundary of the NAFR (fig. ES-17). The largest forms an asymmetrical cone on the north side of Sleeping Butte; the other deposit, Little Black Peak, is about 2 km southwest of Sleeping Butte.

8.2.6 Fluorspar

Fluorspar (fluorite) has been identified in samples from three prospects in the NAFR. Purple to white fluorite was found in veinlets and vugs in pieces of silicified welded ash-flow tuff from the dump of a small prospect pit about 1 km north of Little Black Peak in the southern NAFR, clear to pale green fluorite cubes up to 2 mm in diameter form the matrix of breccia collected from the dump of the Zabriskie shaft in the Limestone Ridge area in the northern NAFR, and a small prospect pit in the Eastern Goldfield mining district,

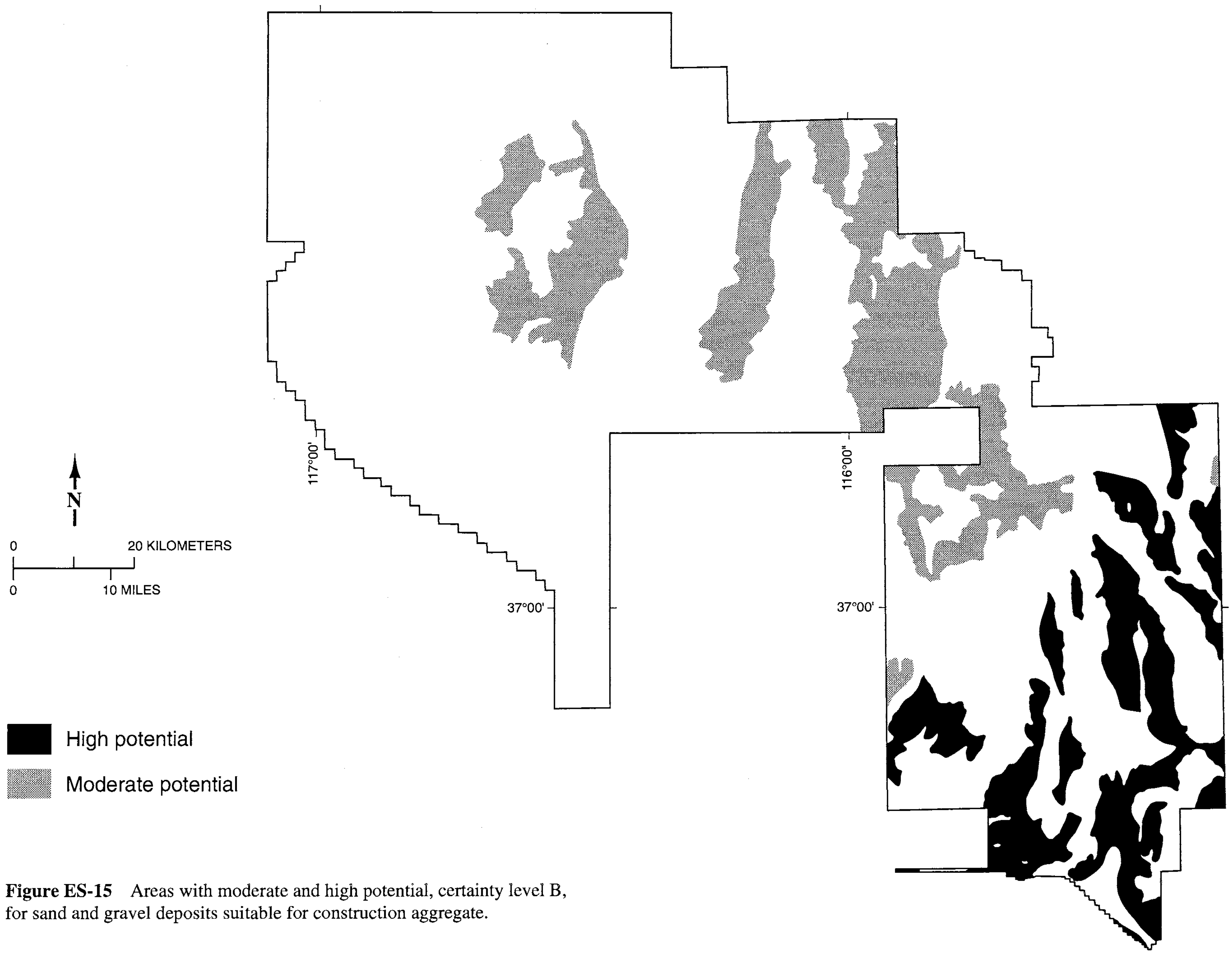


Figure ES-15 Areas with moderate and high potential, certainty level B, for sand and gravel deposits suitable for construction aggregate.

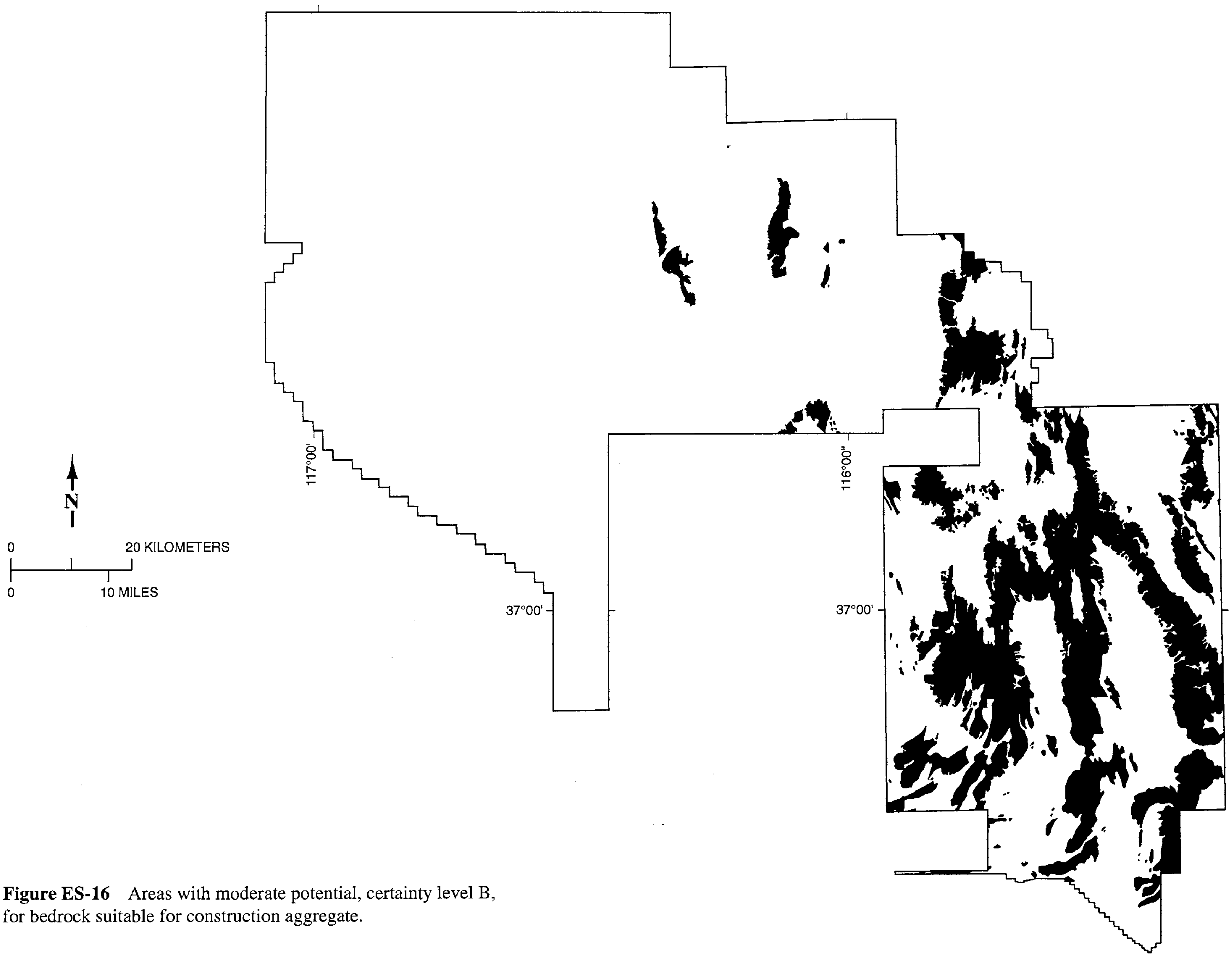


Figure ES-16 Areas with moderate potential, certainty level B, for bedrock suitable for construction aggregate.

northern NAFR, was found to contain minor amounts of fluorite. Fluorite is not known to occur in sufficient quantity in any of these areas to be considered a resource.

8.2.7 Gypsum

During sampling and reconnaissance of NAFR Tertiary sedimentary deposits, no rock with more than a few percent gypsum was noted.

8.2.8 Halite and other Saline Minerals

Playas in the NAFR were not found to have significant surficial deposits of evaporite minerals. Tertiary sedimentary rocks in the NAFR were not found to contain halite or other saline minerals during sampling and reconnaissance programs.

8.2.9 Limestone and Dolomite

The southern NAFR contains extensive exposures of Paleozoic limestone and dolomite that appear to meet specifications for lime and cement raw materials. In addition, Tertiary tufa in the Spotted Range appears to meet specifications for cement limestone.

Although the southern NAFR probably contains significant resources of carbonate rock suitable for lime or cement production, they are remote from rail transport facilities. Therefore, the potential for economic development of Nellis carbonate rock deposits for lime or cement is low in the foreseeable future. The tufa in the Spotted Range (fig. ES-17) has high potential, certainty level B, for cement rock. Areas of Paleozoic units that contain carbonate rock (fig. ES-18) are considered to have moderate potential, certainty level B, limestone suitable for cement production. However, if rail access to the proposed nuclear waste repository of Yucca Mountain is constructed, the economic potential of these deposits could improve.

8.2.10 Lithium

None of the playas examined in the NAFR have evidence of significant evaporative concentration of lithium in near-surface samples. It is therefore unlikely that a lithium-bearing brine meeting today's criteria for economic recovery is present within the NAFR.

8.2.11 Perlite

Within the NAFR, a single occurrence of potentially economic perlite was found about 2 km east of Obsidian Butte in Tolicha Wash. The perlite was observed to crop out at several places in an area about 1 km in diameter, but at all localities where the perlite was found, it was exposed in steep walls, rendering surface mining impractical because it would require removal of considerable amounts of overburden.

8.2.12 Pumice and Pumicite

Pumice deposits have not been reported in the NAFR; however, a deposit of pumicite about 6 km northeast of Beatty has had past production. This deposit was mined at irregular intervals during the 1940s for use as aggregate in the manufacture of concrete blocks. No data are available on the size and reserves of the deposit.

Large resources of domestic pumice and pumicite are available for sale into a relatively stable, long-term market. Therefore, it is unlikely that new pumice or pumicite mines will be opened in the near future in the region around the NAFR.

8.2.13 Silica

Although the Eureka Quartzite is exposed in many parts of the southern NAFR, samples indicate that it is generally unsuitable for most uses. Quartzite samples from other units in the NAFR generally have higher amounts of impurities than the Eureka Quartzite. Large amounts of silica-rich rock that was formed by nearly complete replacement of rhyolite by hydrothermal quartz occur in the Cactus Springs West mining district. However, this rock carries too much alumina, probably as kaolinite and/or alunite, for commercial silica.

8.2.14 Zeolites

Samples of tuff with high zeolite content were collected from the northern NAFR during GSC sampling and evaluation of clay deposits.

Areas of Tertiary volcanic rock and sedimentary rock in the NAFR (fig. ES-19) are considered to have moderate potential for zeolite deposits, certainty level B. However, production of zeolite minerals from these deposits is considered to be unlikely because of the vast amount of unmined high-grade zeolite resources in the United States.

8.3 ENERGY RESOURCES

8.3.1 Uranium

Uranium contents in stream-sediment and float-chip samples from the NAFR are uniformly low, but a few sporadic anomalous uranium values are found in samples of veins and mineralized rock from many of the mining districts of the NAFR. No anomalous uranium concentrations are known to form uranium orebodies in Nevada mining districts; rather, they are considered a curiosity. The anomalous amounts of uranium found during this study are at least a level of magnitude below what would be considered ore in today's market; they are not considered to be indicators of uranium deposits, and it is unlikely that any uranium deposits will be

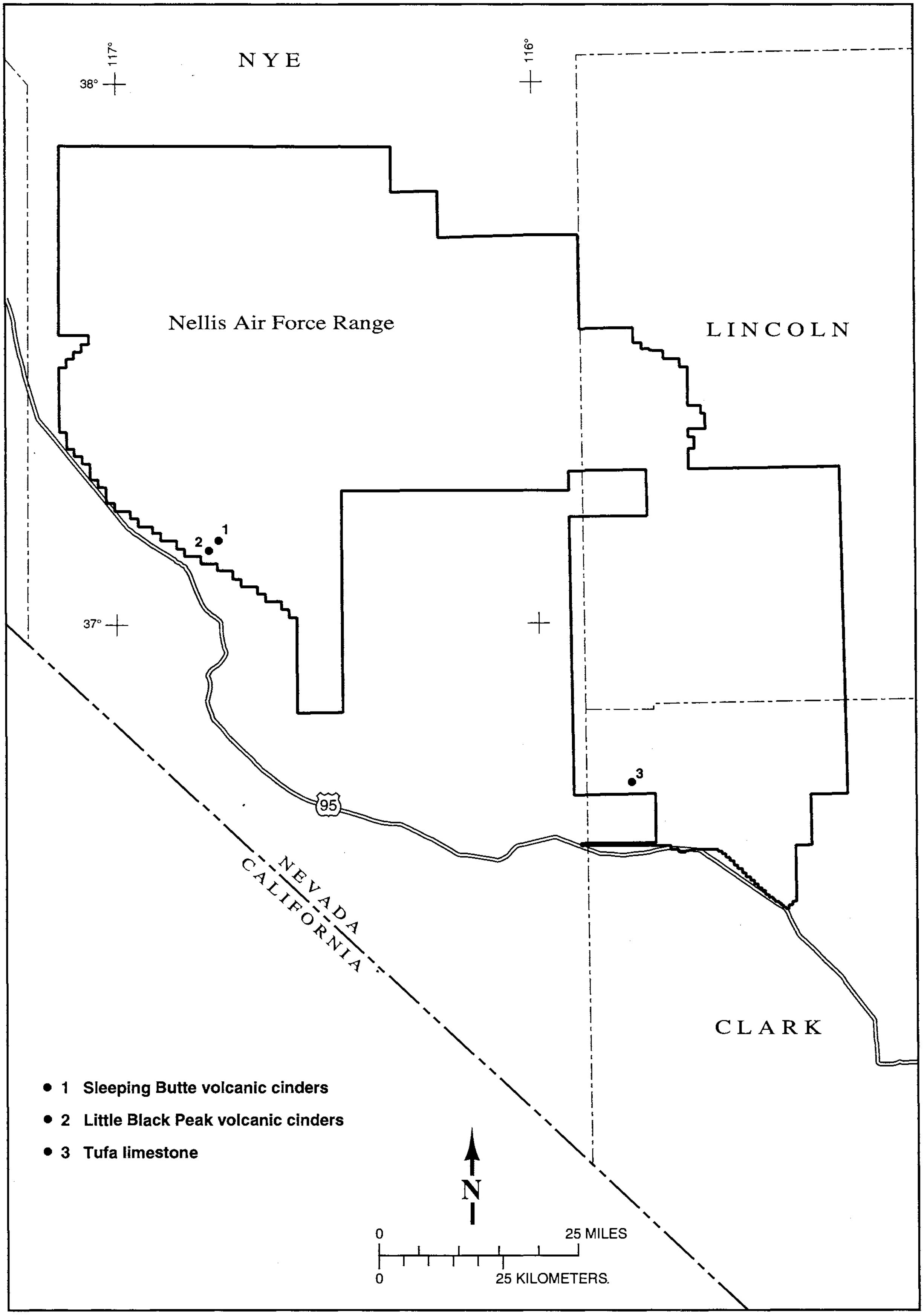


Figure ES-17 Areas with moderate potential, certainty level B, for volcanic cinder, and high potential, certainty level B, for cement limestone (tufa).

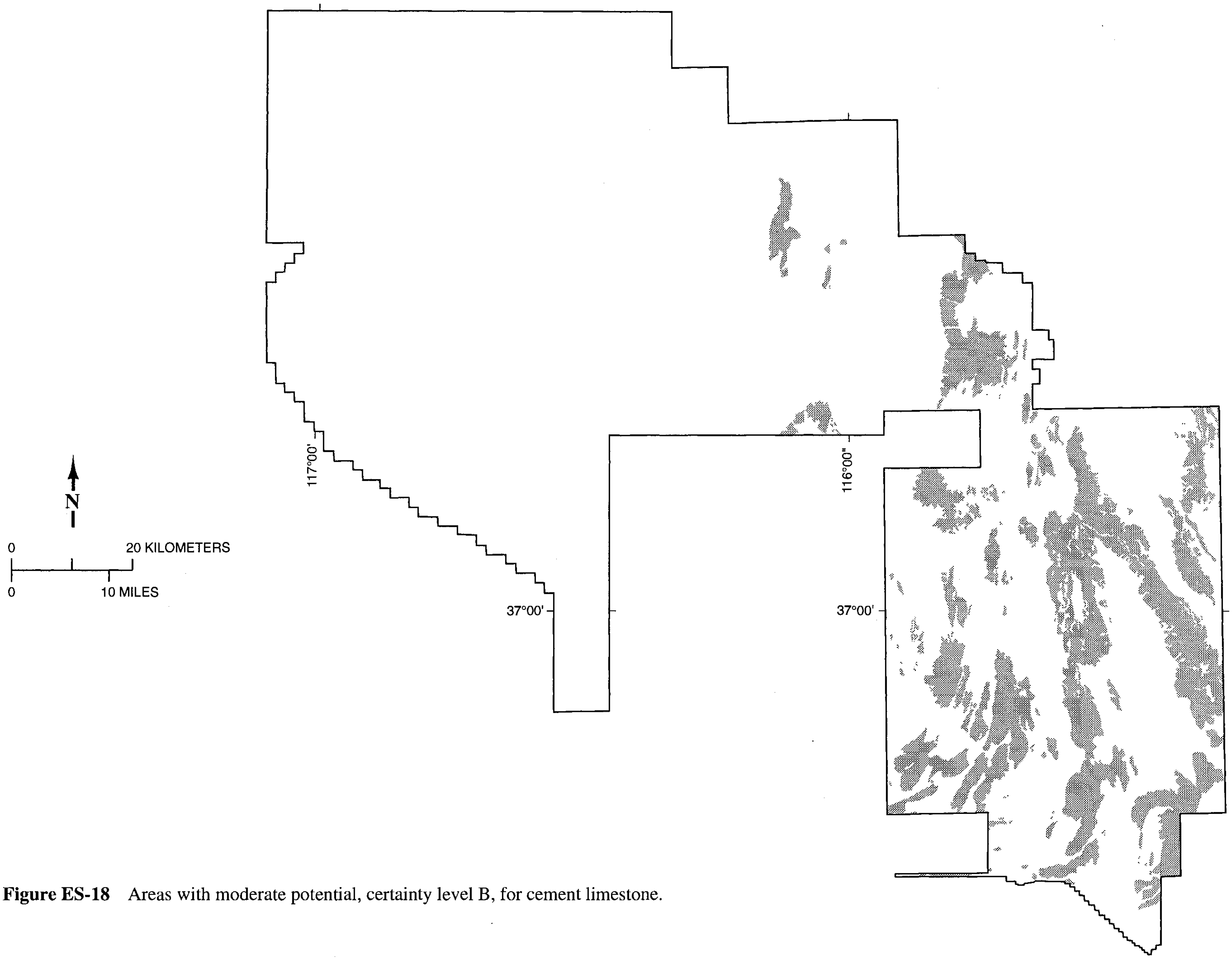


Figure ES-18 Areas with moderate potential, certainty level B, for cement limestone.

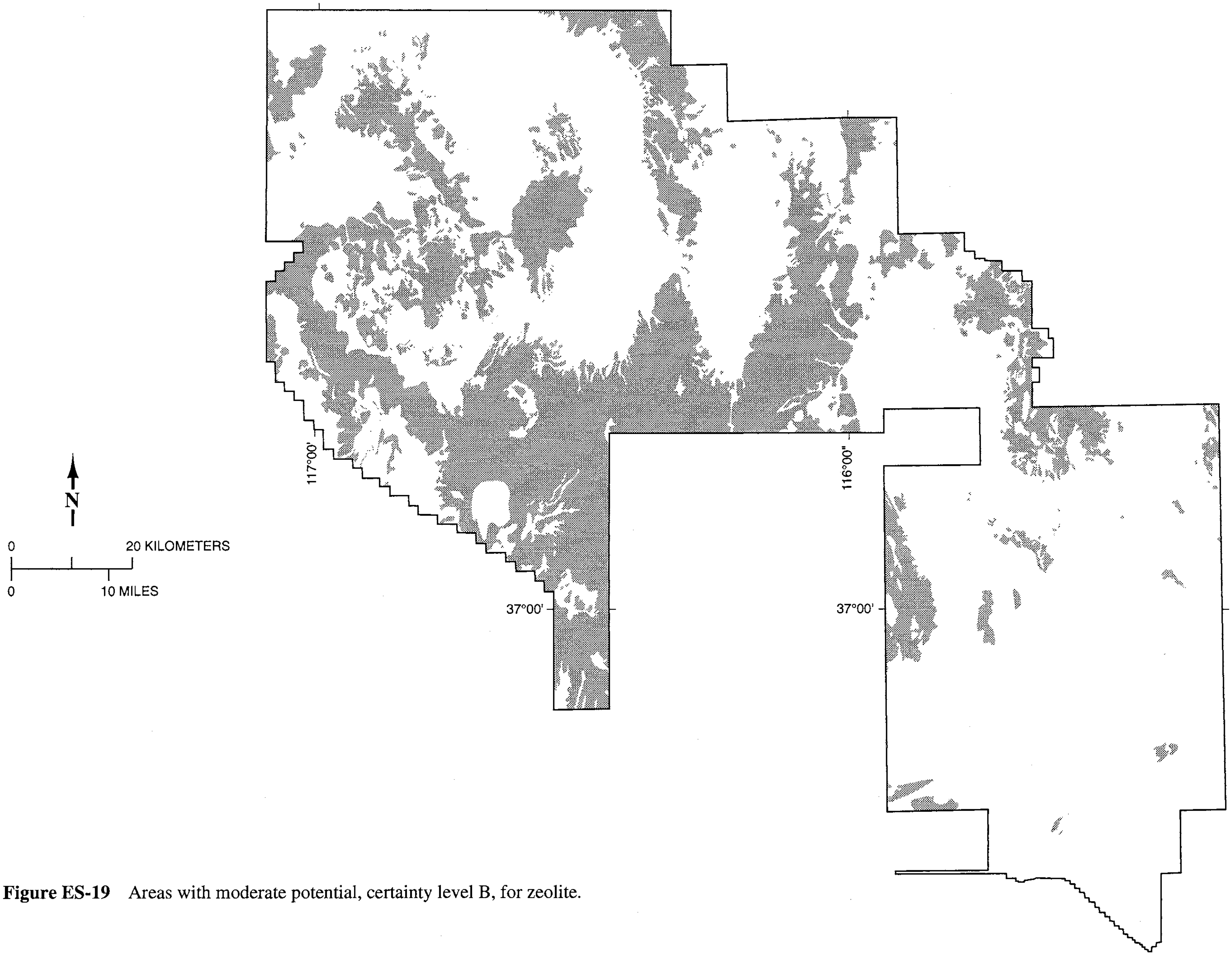


Figure ES-19 Areas with moderate potential, certainty level B, for zeolite.

found in the precious- and base-metal mining districts of the NAFR. Areas of resource potential for uranium are summarized in table ES-6.

8.3.2 Coal

There are no commercial deposits of coal in Nevada, and there has been no significant mining of coal in the last 75 years. The presence of coal in Nevada is confined to certain Tertiary lacustrine units, mainly in the northern part of the state, and Mississippian clastic rocks (Chainman Shale) in eastern Nevada. The Chainman shale is present in a part of the eastern NAFR but potential coal-bearing units were not observed in outcrop during project field work and their presence in the NAFR is unlikely. Moreover, based on information on other Chainman coals, any similar material that might be in the NAFR would almost certainly be in thin, possibly steeply dipping beds, and of poor quality; such coal would certainly not be economic. Areas of resource potential for coal are summarized in table ES-6.

8.3.3 Petroleum Resources

No petroleum exploration wells are known to have been drilled in the NAFR, either before or after its closing in the 1940s, and the nearby region has been only sparsely explored by drilling. No oil or gas shows are known to us from surface outcrops or any other wells or drill holes in or adjacent to the NAFR. Source rocks of suitable thermal maturity for the generation of petroleum are found only in a limited area of the NAFR, and much of the area has low to no potential. Igneous intrusions related to calderas may have overmatured or cut out any possible source rocks in the western part of the NAFR. Areas of resource potential for petroleum resources are shown on figure ES-20 and are summarized in table ES-6.

8.3.4 Geothermal Resources

The NAFR is entirely within an area of abnormally low heat flow for the Basin and Range. Based on thermal gradient information available for the Pahute Mesa and Nevada Test Site, most water temperatures at the economic depth for low-temperature use (1 km) are likely to be no higher than about 55°C, possibly 70°C, in areas of local upwelling. Igneous-related high-temperature geothermal resources are unlikely in the NAFR. In the few areas where geothermal fluids rise to the surface in the NAFR, temperatures are below the limit of practically all geothermal uses. The probable depth of drilling required to exploit potential subsurface thermal fluids makes their use economically unfeasible at present or in the foreseeable future. For temperatures of 70°C or less, the only practical uses are space heating, agriculture (greenhouse, soil heating) or aquaculture (fish farming, etc.). Drilling to 1 km for such fluids is not economical. Thus, the area of the NAFR is determined to have less potential for low-temperature geothermal resources than most of the rest of Nevada. Areas of resource potential for geothermal resources are summarized in table ES-6.

8.4 TURQUOISE

Turquoise has been produced from deposits located west of Sleeping Column Canyon in the Cactus Springs mining district. This turquoise occurs as irregular masses and veinlets in sericitized rhyolite porphyry. Colors of turquoise in the Cactus Spring district include blue, pale blue, pale green, and dark green, although pale blue varieties are more common in the material left behind by the earlier miners.

Near-surface exploration would likely lead to the discovery of additional turquoise resources. The area of resource potential for turquoise is shown on figure ES-11 (Cactus Springs West, No. 2) and is listed in table ES-4.

Table ES-6. Areas of resource potential, energy minerals.

Mineral Resource	Area	Resource* Potential	Certainty* Level	Figure	Comments
Coal	NAFR	Low	D	none	No known occurrences; stratigraphy unfavorable
Geothermal, intermediate and high-temperature	NAFR	Low	C	none	Resources possibly only at non-economic depths
Geothermal, low-temperature	NAFR	Low	B	none	Shallow resources too low temperature and too remote
Oil and gas	NAFR	Low	C	ES-20, 8-43	Low source-rock and preservation favorability
Oil and gas	NAFR	Low	B	ES-20, 8-43	Low preservation favorability, some source rock favorability
Oil and gas	NAFR	Moderate	C	ES-20, 8-43	Moderate source rock and preservation favorability
Uranium	Areas underlain by volcanic rocks and adjacent sedimentary basins	Low	B	none	Permissive environment, but economic concentrations unlikely
Uranium	Areas underlain by carbonate and clastic marine rocks and adjacent sedimentary basins	Low	C	none	No known occurrences; environment unfavorable

*Refer to table ES-1 for definition.

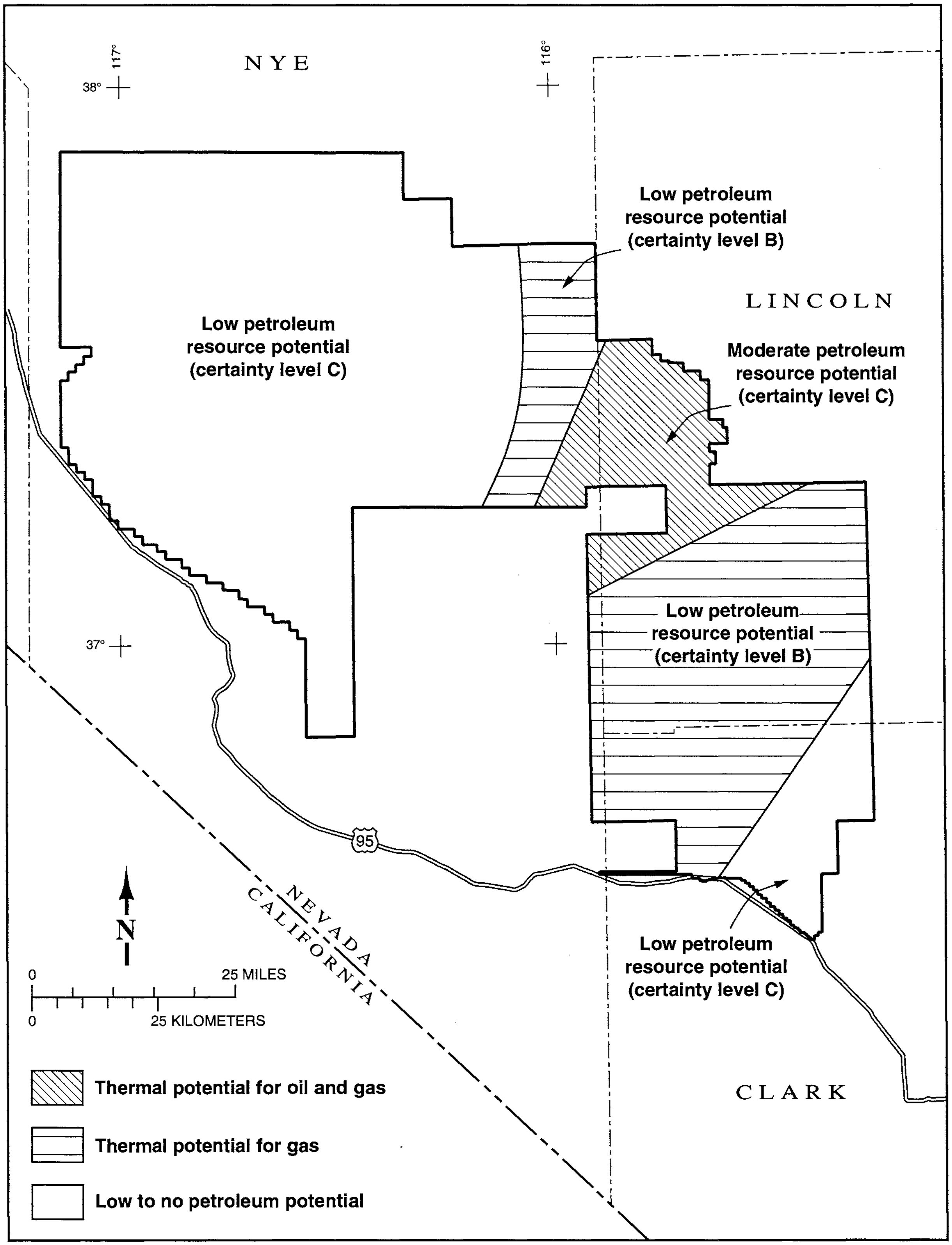


Figure ES-20 Petroleum resource potential for the Nellis Air Force Range.

9.0 RECOMMENDATIONS FOR ADDITIONAL WORK

The mandate of the NAFR mineral assessment program was to complete an intermediate-level assessment of mineral content and of potential for undiscovered mineral deposits on NAFR lands using surface evaluation methods. The assessment involved the collection, evaluation, and synthesis of large amounts of widely spaced geologic data from a broad area in order to identify regional geologic patterns, structures, and trends that could be critical to mineral evaluation. Additional detailed mapping and sampling of such features identified in this study are required to thoroughly evaluate their significance for undiscovered mineral resources.

Many of the mineralized areas on NAFR present obvious, attractive mineral exploration targets, which, if available for mineral exploration, would require only minimal additional sampling and/or mapping to justify immediate detailed exploratory drilling projects. Included in this prime group are the central Tolicha district, parts of the Antelope Springs district, the Mellan Mountain district, the Black Mule area of the Silverbow district, the central Jamestown district, the Fairday Mine area in the Cactus Springs district, parts of the Gold Crater district, and the extensive vein system in the Wilsons district. Delineation of resources by exploratory drilling is beyond the scope of an intermediate level mineral assessment and no recommendations for detailed work have been formulated for these areas.

For other areas within NAFR, however, mineral potential is not well defined. Many areas exhibit characteristics of high or moderate mineral potential but geologic data are sparse. The mineral assessment ratings given to these areas (tables ES-3 through ES-6), although suitable for the level of the assessment study, could be substantially upgraded with the collection of more data. In general, areas with high or moderate assessments and low confidence levels are most in need of additional work. In particular, these areas are in need of more detailed geologic mapping, structural analysis, and geochemical sampling.

There are also many areas within NAFR where general geologic information is either lacking or is at a level far below that available on the surrounding public lands. These areas would benefit from geologic mapping and other basic geologic studies.

1.0 INTRODUCTION

1.1 PURPOSE OF INVESTIGATION

The purpose of the investigation described in this report was to conduct a survey and provide an assessment of all energy and mineral resources on property managed by the U.S. Air Force (USAF) in south central Nevada that is subject to the provisions of the Military Lands Withdrawal Act of 1986. The USAF proposes the continued withdrawal of approximately 3.1 million acres of public land in Clark, Lincoln and Nye Counties Nevada (hereafter referred to as the Nellis Air Force Range [NAFR]) for continued support of the USAF mission at Nellis Air Force Base.

This investigation represents an intermediate level of mineral survey. An intermediate level survey considers all energy and mineral resources and classifies the land as to its potential for mineral production. The report conforms to guidelines and procedures for mineral potential reports given in section 3060.13 of the Bureau of Land Management (BLM) manual (BLM, 1994), and will provide decision makers with an understanding of the energy and mineral potential of the NAFR.

The project complies with Code of Federal Regulations 43 Section 2310.3-2(b)(3)(iii) and Section 204 of the Federal Land Policy and Management Act of 1976 (43 United States Code 1714) and other pertinent federal regulations.

1.2 METHOD OF STUDY

The energy and mineral assessment project began in late 1993 and was completed in 1996. The three year project required the combined efforts of personnel at Air Force Headquarters Air Combat Command (ACC), Nellis AFB, U.S. Army Corps of Engineers (USACE), TRC Mariah Associates Inc. (MAI), and the Nevada Bureau of Mines and Geology (NBMG).

The first stage of the mineral assessment consisted of compilation of available information and literature on geology, geophysics, geochemistry, and mineral resources of the study area. Mineral databases, including the Mineral Resource Dataset (MRDS) maintained by the U.S. Geological Survey (USGS), the Minerals Industry Location System (MILS) of the U.S. Bureau of Mines (USBM), and mining district files maintained by the NBMG, were examined.

Satellite imagery of the project area was studied, using a variety of image processing techniques employed with Landsat thematic mapper (TM) digital datasets to highlight geology, subtle structural patterns, hydrothermally altered areas, and potential mineral resource areas. Areas of anomalous structural complexity, anomalous coloration, and possible hydrothermal alteration defined during this phase of the study were examined and sampled during the field examination stage of the program. A more detailed discussion on remote sensing procedures is presented in Chapter 5.

A geochemical characterization study, which involved sampling of major lithologic units present within the project area, was conducted to provide geochemical baselines for evaluation of the regional, district, and prospect-scale sampling programs. A more detailed discussion of geochemical characterization procedures is included in Chapter 6.

Field examinations of identified mines, prospects, and mineral occurrences within the project area were carried out. "High-graded" ore samples were collected at each site, providing information on the type of mineralization present as well as trace-element interrelationships. Accessible mine workings were examined, sampled, and mapped.

Using data generated from the literature review, photo interpretation, and mineral-site examination stages, a stream sediment sampling program was designed to investigate various areas of interest outlined as well as to provide background geochemical data for regional evaluation purposes.

From these data, areas of mineral potential have been defined and estimates of the types of known and undiscovered mineral resources that may be present within the project area and of the favorability for their occurrence were made. Levels of mineral resource potential and certainty of assessment (table 1-1) were assigned using a modified version of the system described in Goudarzi (1984, p. 23-24). This information has been assembled in a mineral survey report which generally follows, with some modification, the formats outlined by Goudarzi (1984) and in the U.S. Bureau of Land Management Manual, section 3060 (1994).

1.3 PREVIOUS WORK

The earliest literature reference to mining properties within NAFR that was found during this study is a description of the Southeastern district, Lincoln County, in the Nevada State Mineralogist's report for 1871 (Whitehill, 1873). The earliest geological work in the vicinity of the NAFR was by G. K. Gilbert, who served as a geologic assistant for the Wheeler expeditions of 1871-72 (Wheeler, 1872). Gilbert visited the Groom Mine in 1871 and recorded observations on the local geology. In 1899, J. E. Spurr made a reconnaissance trip through the area and, in 1903, published geologic descriptions of the Kawich, Belted, and Desert Ranges (Spurr, 1903). Ball (1907) examined most of the northern part of the present NAFR and provided descriptions of many of the historic mining districts The first comprehen-

Table 1-1. Definition of mineral resource potential and certainty of assessment.*

Definitions of Mineral Resource Potential

LOW (L) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is unlikely. This broad category embraces areas with dispersed but insignificantly mineralized rock as well as areas with few or no indications of having been mineralized.

MODERATE (M) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a reasonable likelihood of resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

HIGH (H) mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data support mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.

UNKNOWN (U) mineral resource potential is assigned to areas where information is inadequate to assign low. moderate, or high levels of resource potential.

NO (N) mineral resource potential is a category reserved for a specific type of resource in a well-defined area.

Definitions of Level of Certainty

A Available information is not adequate for determination of the level of mineral resource potential.
B Available information suggests the level of mineral resource potential.
C Available information gives a good indication of the level of mineral resource potential.
D Available information clearly defines the level of mineral resource potential.

*Modified from Goudarzi 1984.

Relationships between levels of resource potential and certainty.

INCREASING LEVEL OF POTENTIAL (↑)

<table>
<tr><td rowspan="4">U/A
UNKNOWN POTENTIAL</td><td>H/B
HIGH POTENTIAL</td><td>H/C
HIGH POTENTIAL</td><td>H/D
HIGH POTENTIAL</td></tr>
<tr><td>M/B
MODERATE POTENTIAL</td><td>M/C
MODERATE POTENTIAL</td><td>M/D
MODERATE POTENTIAL</td></tr>
<tr><td rowspan="2">L/B
LOW POTENTIAL</td><td rowspan="2">L/C
LOW POTENTIAL</td><td>L/D
LOW POTENTIAL</td></tr>
<tr><td>N/D
NO POTENTIAL</td></tr>
</table>

INCREASING LEVEL OF CERTAINTY (→)

sive descriptions of mines and mining districts within the present boundary of the NAFR were compiled by Kral (1951). Because most of NAFR was closed to public entry by then, Kral relied heavily on the earlier work of Ball for much of his information. Tschanz and Pampeyan (1970), Ekren and others (1971), and Cornwall (1972), include some information on mining districts in their publications on the general geology of the area. Much of their mineral deposit information, however, was abstracted from the earlier works of Ball and Kral. Norberg (1977) and Cornwall and Norberg (1978) prepared summaries of the deposits within NAFR; these reports were also prepared largely from the earlier works of Ball and Kral. Important sources of geological data for the NAFR and nearby areas of the Nevada Test Site include the work of Ekren and others (1971), Byers and others (1976), Frizzell and Shulters (1990), and Minor and others (1993).

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1.4 ACKNOWLEDGMENTS

Listed below are the personnel that were involved with the development and execution of this project.

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Research Geologist	S. Weiss	MSM
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2.0 LOCATION AND LAND STATUS

The NAFR is located in south-central Nevada in Nye, Lincoln, and Clark Counties (fig. 2-1). The NAFR lies northwest of Las Vegas and southeast of Tonopah in a largely remote area bordered by U.S. Highway 95 on the south and west, U.S. Highway 6 on the north, State Route 375 on the northeast, and U.S. Highway 93 on the east. Communities that border the NAFR are Beatty and Goldfield on the west, Rachel on the northeast, Alamo on the east, and Indian Springs on the south. The NAFR, established in 1940 by President Roosevelt as the Las Vegas Bombing and Gunnery Range, reserved 3,560,000 acres of public land for military use. The military range partially overlapped what is now known as the Desert National Wildlife Range (created in 1936), resulting in co-use of 826,000 acres of the area by the U.S. Fish and Wildlife Service and the U.S. Air Force. During the years since its creation, portions of the original reservation have been transferred to the U.S. Department of Energy to establish the Nevada Test Site and related facilities and subsequent land withdrawals have added other areas. Presently, the NAFR includes approximately 3.1 million acres (U.S. Bureau of Land Management, 1989).

From the initial date of establishment until 1959, co-use of the NAFR was granted to cattlemen and miners. Between 1959 and 1965 a program to acquire these outstanding rights was pursued and, by 1981, all grazing and most mineral rights within the NAFR were reported to be terminated with the exception of three patented mining claims (U.S. Department of the Interior, 1981).

Bureau of Land Management (BLM) records in Reno, Nevada and land records in Nye and Lincoln Counties reveal that privately held patented mining claims still exist within the NAFR in at least three mining districts. Portions of patented mining claims extend into NAFR in three other districts and, in two others, patented claims shown on BLM records cannot be found in the County records and ownership of these claims is unknown. BLM records also show one block of unpatented mining claims remaining within the Groom district. Table 2-1 contains a listing of the patented and unpatented claim groups within the NAFR, known owners, and comments on location and status.

Table 2-1. Mining claims.

District	Claim Name	Mineral Survey Number	Patent Number	Patent Date	Owner of Record	Comments
Don Dale	Cadwalader Millsite	41 B	3379	Sept. 10, 1879	D/4 Enterprises, Inc.,c/o Steve Medlin, Alamo, Nevada	The Cadwalader lode claim that was associated with this millsite is located in the Tem Piute district. BLM records show location to be in sec. 6, T5S, R55-1/2 E
	Sterlling Millsite	57 B	9368	June 1884	Reland Johnson, Box 652, Farmington, Utah	The Sterlling lode claim that was associated with this millsite is located in the Tem Piute district.
Gold Crater	Black Eagle	2788	31381	Nov. 27, 1908	United States of America, Commander, LA District Corps of Engineers, P.O. Box 2711, Los Angeles, California 90053	BLM survey plats locate M.S. 2788 high on the hill south of the Gold Crater mines. During field work, two patent corners were found in the central part of the district about 1.6 km to the north; M.S. is mislocated on the BLM plats
	Manxman	2788	31381	Nov. 27, 1908		
	Peacock	2788	31381	Nov. 27, 1908		
Goldfield	Nancy Donaldson	3198	284077	July 15, 1912	William B. Golden, P.O.Box 2010, Sparks, Nevada 89432	According to BLM mineral survey plats, this claim group lies across the NAFR boundary but was excluded from the NAFR; the NAFR fence swings east around the excluded ground.
	Nancy Donaldson No. 1	3198	284077	July 15, 1912		
	Nancy Donaldson No. 2	3198	284077	July 15, 1912		
	Eclipse	3217	83152	Oct. 11, 1909	Pacific Gold Corp., 4518 Whitsett Ave., Studio City, California 91604	BLM plats locate M.S. 3217 in sec.12, T3S, R44E, east of the Goldfield Hills. It appears that the survey tie for the claims is linked to the wrong section corner; the claims, therefore, are actually located west of the NAFR boundary.
	Revenue	3217	83152	Oct. 11, 1909		
Groom	Conception	37	1660	Feb. 10,1876	D.R. Sheahan, M.F. Sheahan, H. Patrick, A.B. Sheahan, J.F. Sears, T.. Sears, B.V. Cline, W. Wheatley Estate, c/o Dan Sheahan, 2460 E. Flamingo Rd, Las Vegas, Nevada 89109	Patented claims at the Groom Mine have been held by the Sheahan family since 1885.
	White Lake	37	1660	Feb. 10,1876		
	Conception No. 2	38	1661	Feb. 10,1876		
	White Lake No. 2	38	1661	Feb. 10,1876		
	Bride	4658	1034979	Feb. 20, 1930		
	South End	4658	1034979	Feb. 20, 1930		
	South End Fraction	4658	1034979	Feb. 20, 1930		
	Southern Groom	4659	1055957	July 6, 1932		
	Groom mine lode group	none	none	not patented		Assessment work was filed for 1995.
Jamestown	Daisy	3962	285880	July 23, 1912	Fuetsch Nuclear Mines Inc., c/o Carl F. Fuetsch, 860 Crocker Way, Reno, Nevada 89509	Claims of M.S. 3962 were acquired from Nye County in 1970 by the Fuetsch family. The claims are currently leased to the Air Force.
	Last Chance	3962	285880	July 23, 1912		
	Mohawk	3962	285880	July 23, 1912		
	Golden Chariot No. 1	3971	296554	Oct. 15, 1912		Claims of M.S. 3971 have been owned by the Fuetsch family since 1908. The claims are currently leased to the Air Force.
	Golden Chariot No. 2	3971	296554	Oct. 15, 1912		
	Golden Chariot No. 3	3971	296554	Oct. 15, 1912		
Silverbow	Blue Horse	4457	1001726	May 15, 1927	Ruth and Randall Dugan, M. Kinneberg, and J.D. Kinneberg, 511 W. Flynn Lane, Phoenix, Arizona 85013	The Blue Horse claim overlaps the NAFR boundary, but the Range fence follows the claim outline and excludes it from inclusion in the NAFR
Southeastern	South Eastern	2214 A	43581	June 8, 1907	Last owner of record, Teledyne, Inc. (1977)	BLM plats show M.S. 4268 located in Secs. 29,30,31 and 32, T9S, R58E instead of the actual location in Secs. 33 and 34, T9S, R57E. Lincoln County records show no trace of these claims.
	South Eastern No. 1	2214 A	43581	June 8, 1907		
	South Eastern No. 2	2214 A	43581	June 8, 1907		
	South Eastern No. 3	2214 A	43581	June 8, 1907		
Wagner	Ish	3679	251234	March 12, 1912	Dulvick, J, W. and Eleanor, 1648 W. Tamarisk, Phoenix, Arizona 85041	There are 18 claims in M.S. 3679, only one, the Ish, extends into the NAFR. The overlap is a triangular sliver of land about 30 m wide at the south end.
Wellington	Hope Next	4268	572555	March 16, 1917	Last owner of record was Nye County (1986)	BLM patent plats show M.S. 4268 located at the mine workings at Wellington. No ownership is shown in the current Nye County assessors records although they were in County ownership between 1930 and 1986.
	Hope Now	4268	572555	March 16, 1917		

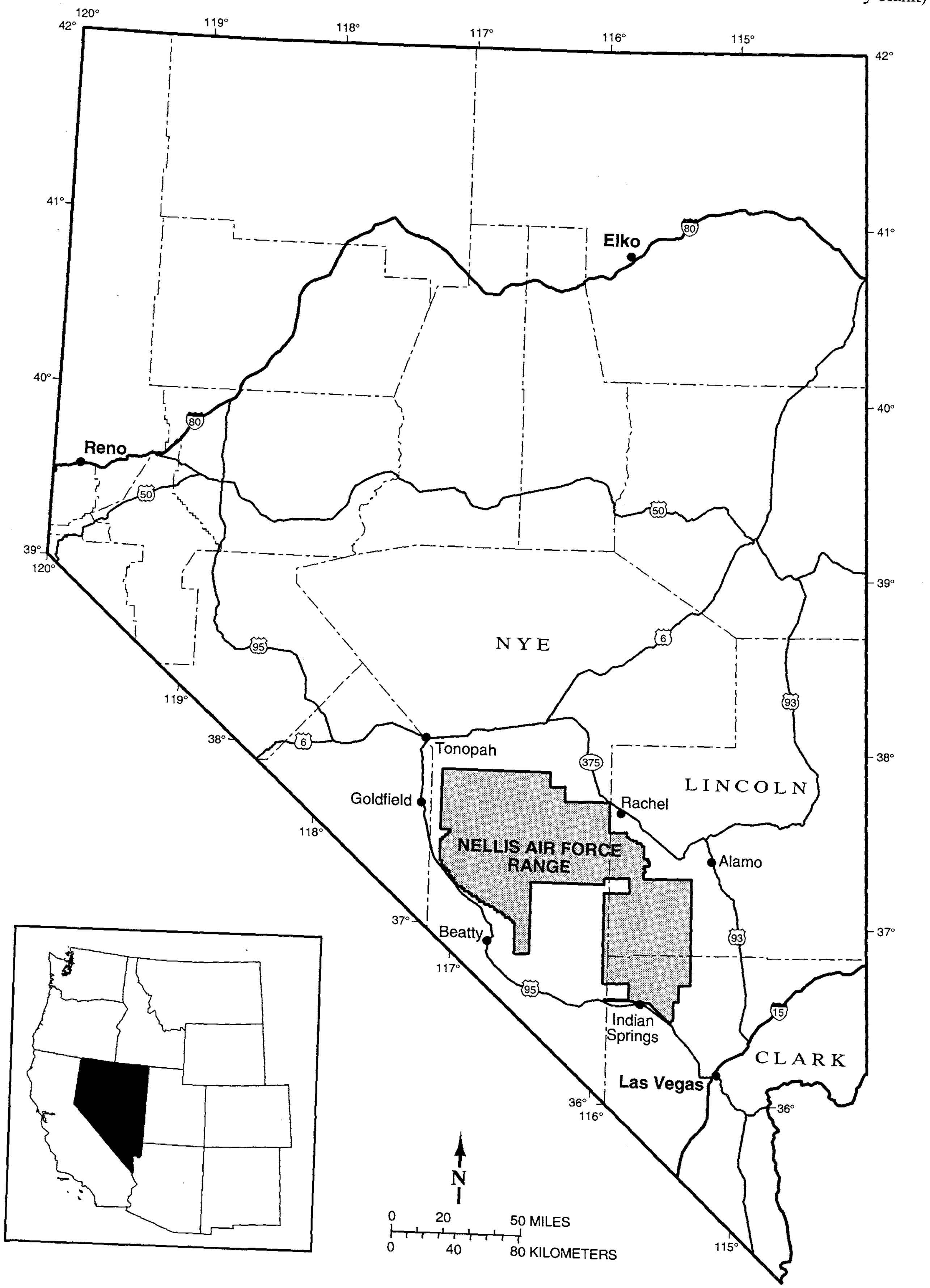


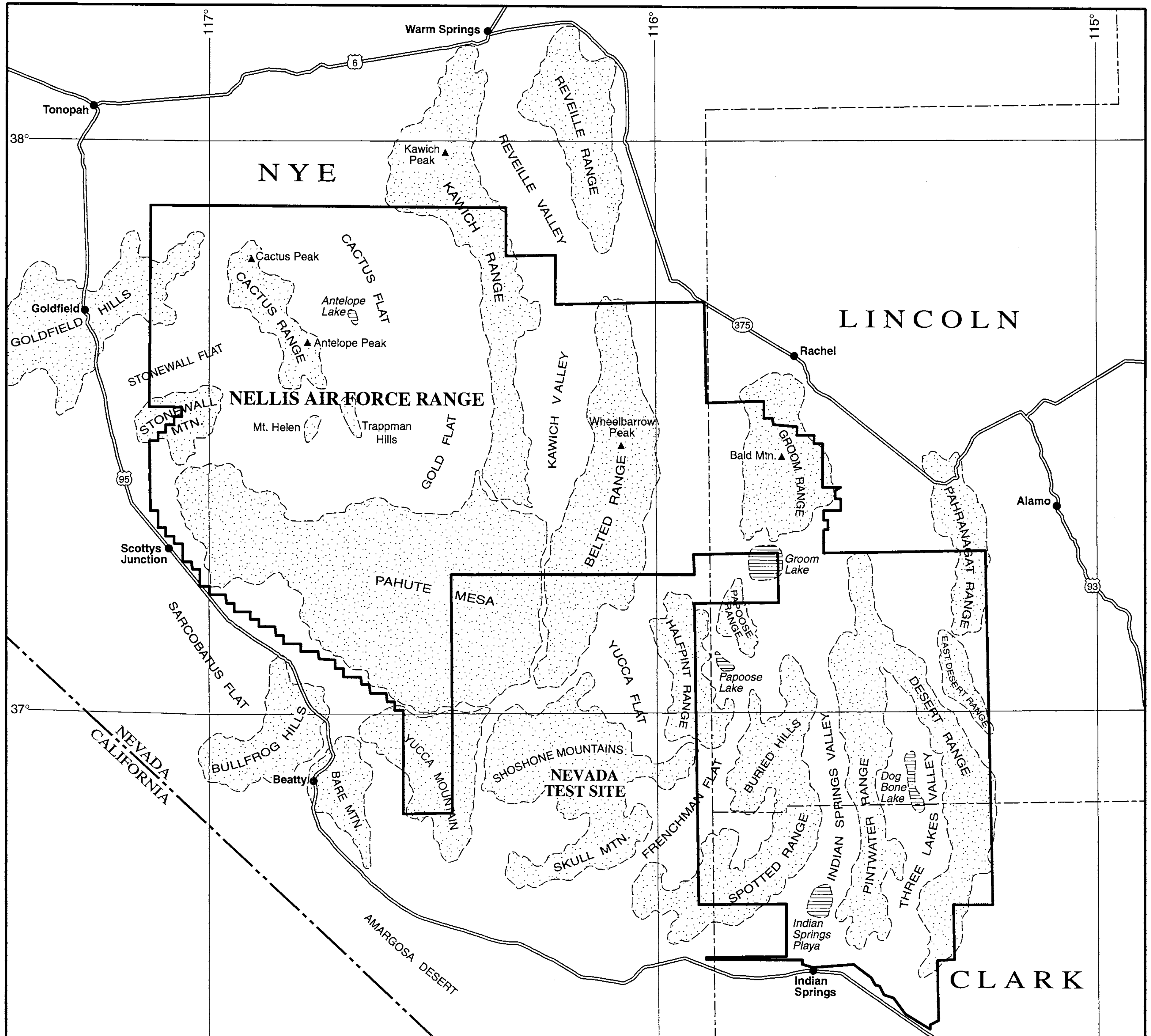
Figure 2-1 Location map, Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

3.0 PHYSIOGRAPHIC SETTING

The NAFR is situated in the southern part of the Great Basin region of the Basin and Range physiographic province, a region characterized by a series of generally north-trending mountain ranges separated by wide, alluviated valleys.

Pahute Mesa, a volcanic plateau lying on the southwestern border of the northern portion of the NAFR, separates typical north-trending mountain ranges on the east from small ranges with more random orientation along the California border area to the west (fig. 3-1). Northeast of Pahute Mesa are the Kawich, Belted, and Groom Ranges. To the southeast, in the segment of NAFR east of the Nevada Test Site, are the Spotted, Pintwater, and Desert Ranges. The highest peaks in the ranges east and northeast of Pahute Mesa are Bald Mountain in the Groom Range (2,886 m), Wheelbarrow Peak in the Belted Range (2,586 m), and Kawich Peak in the Kawich Range (2,865 m). In the south, higher peaks in the Spotted, Pintwater, and Desert Ranges are generally less than 2,000 m. The highest peak in the south, an unnamed feature on a ridge near the Southeastern Mine in the Desert Range, reaches 2,119 m.

The only notable ranges north of Pahute Mesa are the Cactus Range and Stonewall Mountain. The northwest-trending Cactus Range is flanked by Cactus Flat on the east and by Stonewall Flat on the west. The highest peaks in the Cactus Range are Antelope Peak (2,126 m) and Cactus Peak (2,279 m). Stonewall Mountain marks the northwestern boundary of Pahute Mesa, separating it from Stonewall Flat to the north. Most of the Great Basin, as the name reflects, is an area of internal drainage, and no drainage within the NAFR escapes the Great Basin. Drainages from the Stonewall Mountain and Pahute Mesa areas flow west and southwest into Sarcobatus Flat and the Amargosa Desert. Drainages from the higher mountains in the central and eastern parts of NAFR flow into closed desert valleys such as Cactus Flat, Gold Flat, Kawich Valley, Indian Springs Valley, and Three Lakes Valley. These valleys contain playa lakes in their low points but none have water other than for short periods of time following winter or spring storms or occasional flash floods. The largest of these lakes are Antelope, Groom, and Papoose Lakes in the north, and Dog Bone Lake and the Indian Springs playa lake in the south.



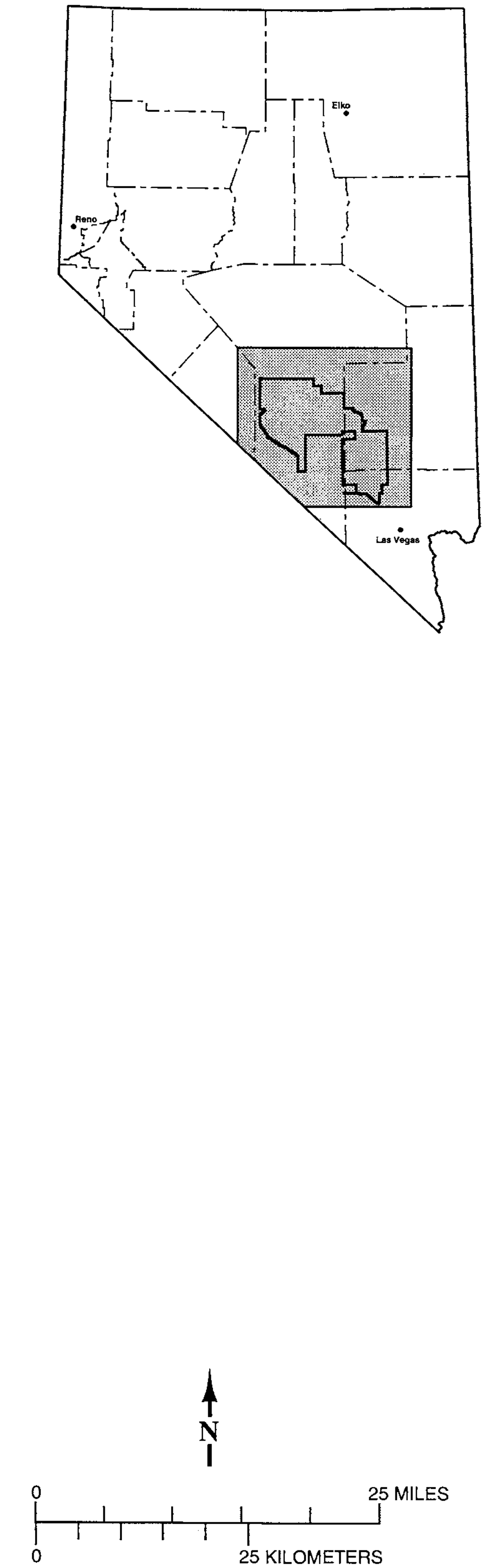


Figure 3-1 Physiographic map of the Nellis Air Force Range and surrounding portions of southern Nevada

4.0 GEOLOGIC SETTING

4.1 LITHOLOGY AND STRATIGRAPHY

The NAFR is situated adjacent to the southern Walker Lane structural belt in a region of diverse topography that includes major, north-south trending basins and ranges, as well as the broad volcanic upland of Pahute Mesa (fig. 3-1). In general, the bedrock geology of the NAFR can be divided into a southeastern area of largely Paleozoic sedimentary rocks, and a northwestern area of mainly volcanic rocks of late Cenozoic age (fig. 4-1).

Pre-Cenozoic rocks of the southeastern portion of the NAFR formed in the Cordilleran geosyncline of western North America. The geosyncline developed during the latest Proterozoic, probably by continental rifting (Stewart, 1972). Southern Nevada lies entirely within the miogeosynclinal belt (shelf province) of the geosyncline. The initial miogeosynclinal deposits consist of shallow marine siliciclastic rocks of Late Proterozoic and Early Cambrian age derived from the North American continent to the east. After the Middle Cambrian a carbonate shelf developed and many thousands of meters of marine carbonate rocks and minor shale were deposited. Their deposition continued with little interruption until the end of the Devonian Period when the Late Devonian-Early Mississippian Antler orogeny resulted in the formation of a broad highland from southwestern to northern Nevada. The Roberts Mountains thrust of central and northern Nevada was formed as a result of this orogeny, and deep marine, eugeosynclinal facies rocks of early Paleozoic age were thrust eastward over early and middle Paleozoic miogeoclinal facies rocks. Siliciclastic sediments were shed east from the Antler highland, a north-striking belt located in central Nevada, into a foreland basin (Stewart, 1980). In eastern Nevada, east of the Antler highland, the siliciclastic rocks are thinner and finer grained, and carbonate rocks are more abundant. In the NAFR, the rocks of the Antler foreland basin are represented by the Pilot Shale, the Chainman Shale, and the Eleana Formation. By Pennsylvanian time carbonate platform deposition had been reestablished in southern Nevada and the area of the NAFR. Deposition of platform carbonate rocks continued through the end of the Paleozoic Era.

During early Mesozoic time southern Nevada was the site of continued deposition of marine carbonate rocks. The Triassic and Jurassic Periods were probably times of emergence and erosion. Peterson (1988) suggested that approximately 2,000 m of Triassic rocks may have been deposited in the NAFR area. However, outcrops of Triassic rocks are not known in the NAFR and it is probable that rocks of this age were not deposited (Walker, 1988, fig. 14.6; Barker, 1994). During the Late Cretaceous and early Tertiary, nonmarine fluvial conglomerates and sandstones were deposited in the area of the Fallout Hills-Buried Hills-northern Spotted Range. These are possibly equivalent in age to Cretaceous to Eocene lacustrine rocks in northeastern and central eastern Nevada.

Granitic plutonism of Mesozoic age was widespread in western Nevada and adjacent California and was related to an extensive magmatic arc along the western continental margin. Granitic plutons are not abundant in the NAFR, although they may be concealed by Tertiary and Quaternary rocks. A Cretaceous granitic pluton is present in the Oak Springs area of the southern Belted Range, just south of the NAFR-Nevada Test Site boundary. Also, Mesozoic(?) granitic plutons crop out in a small area in the southern Kawich Range and in a small area about 3 km south-southwest of Urania Peak in the Cactus Range (Ekren and others, 1971). Additional, weakly foliated, coarse-grained granite of unknown age and containing inclusions and small pendants of schist is exposed in the Trappman Hills.

The pre-Cenozoic sedimentary and metamorphic rocks of the NAFR are unconformably overlain and intruded by volcanic and subvolcanic rocks of Tertiary age and predominantly silicic compositions. These rocks are part of a broad zone of middle Tertiary volcanic rocks that extends across Nevada, Utah, and Colorado at this latitude (Best and others, 1989). The great majority of the volcanic rocks of the NAFR are rhyolitic ash-flow tuffs of Oligocene and Miocene ages, erupted during two periods of magmatic and volcanic activity that swept through the Great Basin from north to south between 43 to 17 million years before present (Ma), and between 17 to 6 Ma.

In the NAFR the Oligocene-Miocene ash-flow tuffs comprise regionally extensive sheets tens to hundreds of meters thick that extend for as much as 100 km or more from their vent areas. These volcanic units lie unconformably on Late Proterozoic and early Paleozoic marine sedimentary rocks and, locally, on terrestrial clastic rocks of probable Late Cretaceous to early Tertiary age (Ekren and others, 1971; Stewart, 1980). Regional silicic ash-flow sheets and related lavas and intrusive rocks make up nearly all of the exposed bedrock of the northwestern area of the NAFR, including and to the west of the Belted Range and from Yucca Mountain and Timber Mountain north to beyond the north boundary of the NAFR.

Two general groups of volcanic rocks are recognized: 1) an older, late Oligocene-early Miocene sequence of ash-flow tuffs and related lavas erupted from volcanic centers within and to the north of the NAFR (Ekren and others, 1971; Best and others, 1989), and 2) a sequence of middle and late Miocene ash-flow tuffs and lavas erupted from volcanic centers of the southwestern Nevada volcanic field, an area extending from Stonewall Mountain on the north to Yucca Mountain on the south (Byers and others, 1976; 1989; Noble and others, 1991; Sawyer and others, 1994).

The older, Oligocene-early Miocene units are most widespread in the northern and northeastern parts of the NAFR and include the Monotony Tuff, which is commonly the oldest extensive regional ash-flow tuff present. This unit has been radiometrically dated at about 27 Ma and was probably erupted from vent areas in the Pancake Range of the Central Nevada Caldera Complex (Best and others, 1992). Regionally extensive ash-flow tuffs younger than the Monotony Tuff include, from older to younger, the tuffs of Antelope Springs (possibly from a caldera in the Cactus Range), the Shingle Pass Tuff (about 26.4 Ma), the 22.6 Ma Pahranagat Formation (which includes the upper cooling unit of the tuff of White Blotch Springs, Best and others, 1995) and the Fraction Tuff of Ekren and others (1971), which has been correlated with the 18.3 Ma intracaldera tuff of Cathedral Ridge (Best and others, 1993).

Rocks of the southwestern Nevada volcanic field overlie the Oligocene-early Miocene units as well pre-Cenozoic rocks in the area from Stonewall Mountain to areas south and east of Yucca Mountain (Ekren and others, 1971; Byers and others, 1976; Minor and others, 1993). Major units of this volcanic series were erupted largely between 15.2 and 10 Ma from vent areas of the overlapping and nested volcanic centers of the collapse caldera type in the Timber Mountain area (fig. 4-2), including, from oldest to youngest, the Belted Range Group, the tuff of Tolicha Peak, the Paintbrush Group, and the Timber Mountain Group (Byers and others, 1976; Noble and others, 1991; Sawyer and others, 1994). Between 9.5 and 7.5 Ma major volcanism shifted to the outlying Black Mountain and Stonewall Mountain volcanic centers with the eruptions of the Thirsty Canyon Group and the Stonewall Flat Tuff (Noble and others, 1991; Sawyer and others, 1994). In addition, subordinate amounts of rhyolitic, andesitic, and minor basaltic lavas and caldera-fill sedimentary units are present. Basaltic rocks of late Miocene and younger ages are relatively uncommon in the NAFR, cropping out mainly in areas north of Timber Mountain (Ekren and others, 1971).

Lacustrine and fluvial sedimentary units consist of bedded tuff, lacustrine limestone and shale, and volcanic sandstone. These units crop out in several areas, particularly in the southern Spotted Range, Pintwater Range, and the Desert Range where they were deposited in shallow basins produced by middle to late Tertiary extension (Guth and others, 1988; Barnes and others, 1982).

Quaternary alluvial units in large part consist of alluvial fan, pediment, valley fill, and playa deposits. These units make up nearly one-half of the surface exposures in the area.

Numerous areas of hydrothermally altered rocks of pre-Cenozoic and Tertiary ages and local mineralization are exposed within the NAFR (e.g., Ekren and others, 1971, Cornwall, 1972). In the southwestern portion of the NAFR, areas of hydrothermal alteration and local, epithermal gold-silver, fluorite and mercury mineralization are situated peripheral to, and within, major centers of volcanism and igneous activity of the mid- to late-Miocene southwestern Nevada volcanic field (Noble and others, 1991; Weiss, 1996). Contrasting styles of precious-metals deposits in the Wahmonie, Mine Mountain, Bare Mountain and Bullfrog districts, including disseminated, sedimentary- and igneous-rock hosted gold deposits, and gold- and silver-bearing fissure veins, have been discussed by Castor and Weiss (1992). Radiometric dating and stratigraphic studies indicate that hydrothermal activity and mineralization in the southwestern Nevada volcanic field were episodic, occurring mainly between about 14 and 9 Ma, coeval with and for as much as 1.5 Ma after major culminations in magmatic and volcanic activity (Weiss, 1996). Although hydrothermal activity took place within and peripheral to major centers of volcanism and igneous activity, precious-metal deposits of economic significance were structurally controlled by faults related to regional extensional tectonism, rather than by caldera ring fractures or radial faults, or faults formed by resurgent doming (Weiss, 1996).

Areas of hydrothermally altered and mineralized rocks in the northern portion of the NAFR, including but not limited to the Stonewall district, Gold Crater-Jamestown area, Cactus Springs, Silverbow, Wilson's Camp, Mount Helen area, and Gold Reed, are also situated within and peripheral to volcanic and igneous centers of middle and late Tertiary ages (Ekren and others, 1971, Cornwall, 1972). However, in most of the northern part of the NAFR the timing and absolute ages of magmatic and volcanic events are only broadly known (e.g., Ekren and others, 1971) and the geometry and precise locations of caldera structures and other centers of volcanism are very incompletely defined. In addition, very little is known of the absolute ages and relative timing of hydrothermal activity and mineralization in the region. In all, there are too few data available to determine the possible spatial and temporal (and hence genetic) relations between hydrothermal activity and mineralization, and volcanism, caldera formation and other magmatic events in the northern NAFR.

4.2 OVERVIEW OF TECTONIC HISTORY

Paleozoic deformation. There is no indication in the NAFR of compressional tectonism associated with the Antler

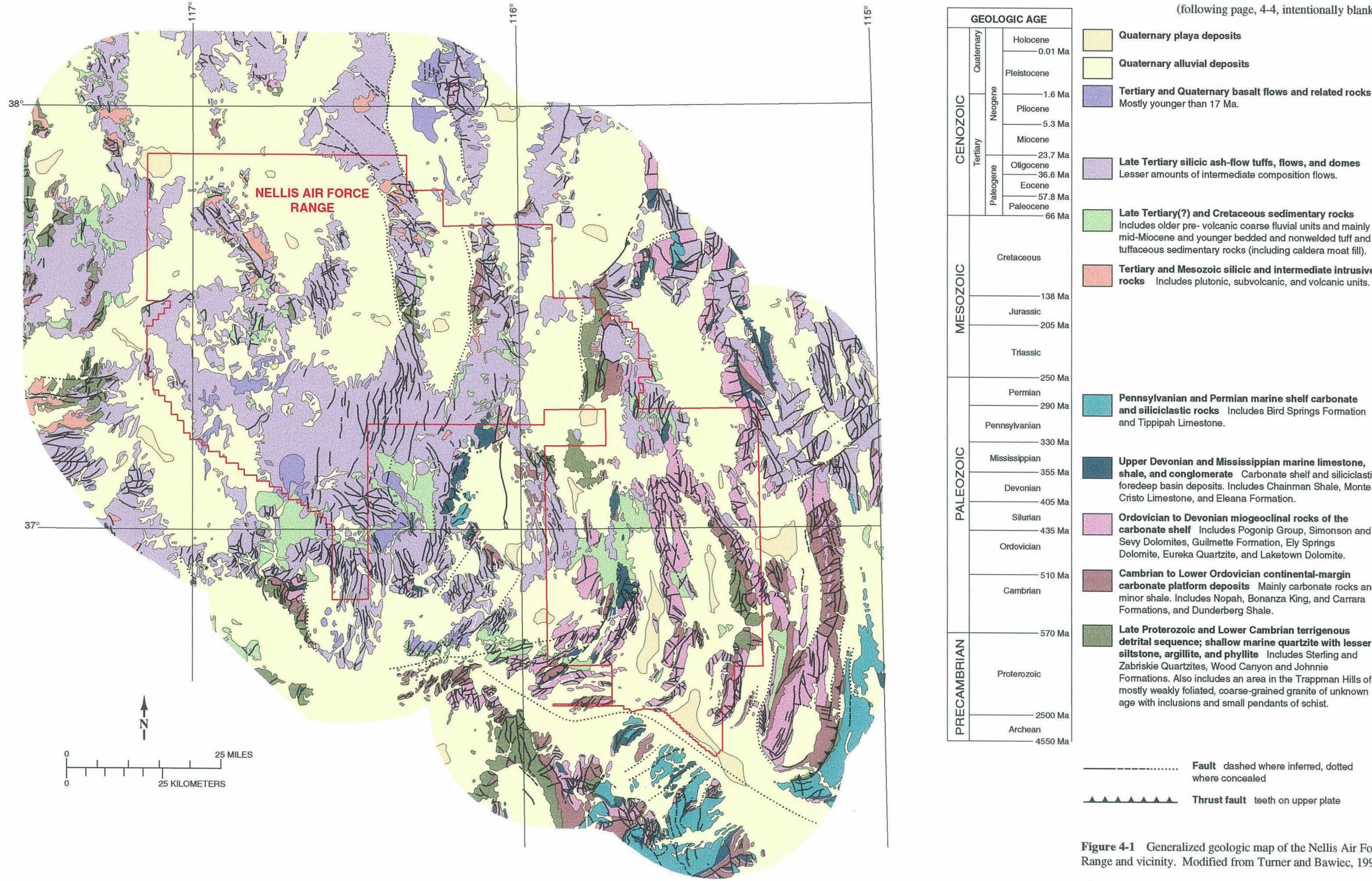


Figure 4-1 Generalized geologic map of the Nellis Air Force Range and vicinity. Modified from Turner and Bawiec, 1991.

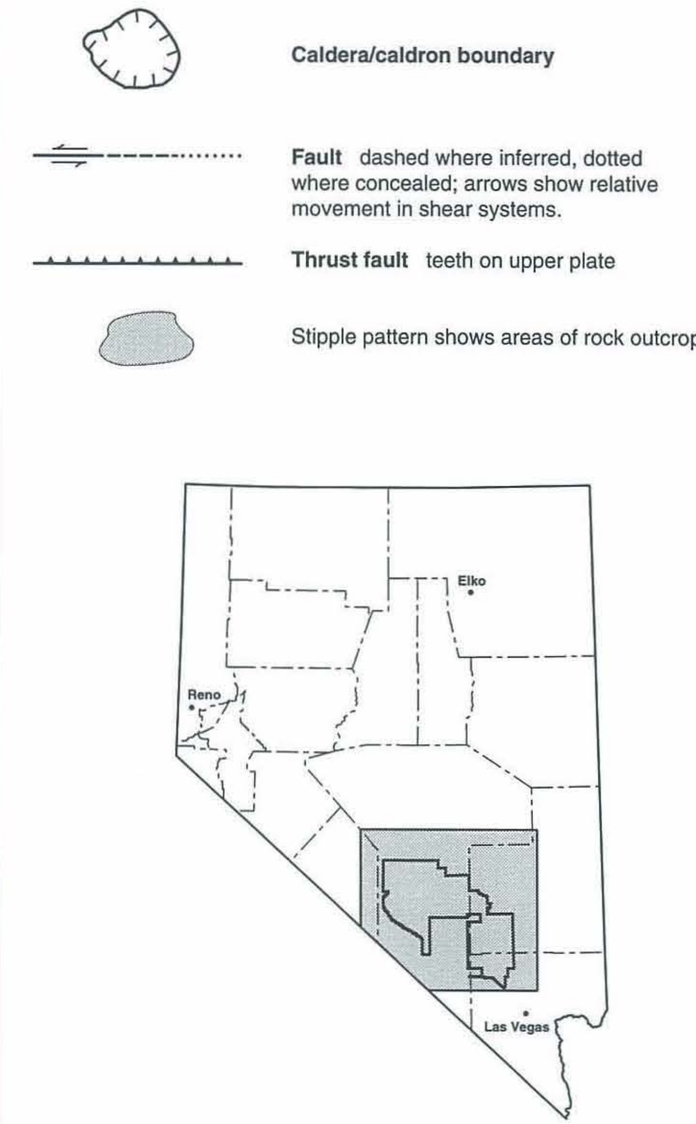


Figure 4-2 Tectonic map of the Nellis Air Force Range and vicinity. Faults from Turner and Bawiec, 1991.

orogeny, although many areas of pre-Mississippian rocks have not been studied in detail.

Mesozoic deformation. Mesozoic compressional tectonic events were largely related to the Sevier orogeny of early Late Cretaceous age and possibly to an earlier, Triassic deformation (Casky and Schweickert, 1992). The Sevier orogeny affected much of southern Nevada and western Utah along a northeast striking belt (Fleck, 1970) where east-verging folds and thrust faults were formed. Many thrust faults in southern Nevada, including those on and adjacent to the NAFR (i.e., Gass Peak and Spotted Range thrusts, see fig. 4-2), have been interpreted to belong to this eastward-directed compressional event (Stewart, 1980). Tschanz and Pampeyan (1970) have suggested that right-lateral tear faults may have developed at that time along what is now the left-lateral Pahranagat shear system in southern Lincoln County (fig. 4-2).

Cenozoic extensional faulting. Following the Sevier orogeny, prolonged periods of uplift, cooling and erosion took place in southern Nevada during Cretaceous and Paleogene time. During late Cenozoic time major tectonic activity involved mainly extensional faulting. Extension of the crust resulted in the development of both high-angle normal faults and shallowly dipping normal faults (detachments). The time of onset of extension in the region of the NAFR remains poorly known from only fragmentary evidence. Early phases of extension in the southern Great Basin are believed to have been episodic, beginning in Eocene or Oligocene time (Best and Christiansen, 1991). Pre-late Oligocene extensional deformation is documented in the northern Halfpint and Belted Ranges (Sawyer and others, 1994). Early Miocene low-angle normal faulting and associated strong tilting took place in the Cactus Range and Mellan Hills (Ekren and others, 1971) and possibly occurred elsewhere in the NAFR. High-angle basin-and-range normal faulting in the NAFR began between 17 and 14 Ma (Ekren, 1968). Two major pulses of normal faulting and tilting took place between about 12.7 and 7.6 Ma in areas southeast, south, southwest and west of the Timber Mountain caldera complex (Carr and Monsen, 1988; Carr, 1990; Noble and others, 1991; Minor and others, 1993; Sawyer and others, 1994). Small-displacement normal faults of late Quaternary age are locally present in areas of the Nevada Test Site (e.g., Frizzell and Shulters, 1990), indicating that extension has continued in the region since late Neogene time.

Strike-slip faulting. The southwestern Nevada volcanic field, located on the southwest margin of the NAFR, is located along the southeast margin of the Walker Lane Belt, a zone of diverse topography between the Sierra Nevada ranges and the typical northerly striking fault-block ranges of the basin and range to the east. This belt extends from northern California to the Las Vegas area (Stewart, 1980). In the western NAFR, this section of the Walker Lane belt (Stewart's Goldfield section) does not include significant right-lateral strike slip faults, in contrast to other sections like the Las Vegas Valley shear zone and areas in the vicinity of Walker Lake and Pyramid Lake in west-central and northwest Nevada. Carr (1988) has proposed that the southwest Nevada volcanic field is a volcanic rift which represents a pull-apart at a right step in the belt.

Both the Pahranagat shear system and the Las Vegas Valley shear zone (fig. 4-2) have been proposed to result from the accommodation of differing amounts of extension on either side of the faults (Guth, 1981; Liggett and Ehrenspeck, 1974). In the case of the Pahranagat shear, faulting may follow a Sevier-age structure (Tschanz and Pampeyan,1970; see above); displacement is estimated at 10 to 16 km (Jayko, in prep.). The Rock Valley fault and parallel left lateral strike-slip faults of the Nevada Test Site are aligned along a northeast trend that extends toward the left-lateral Pahranagat shear system. This trend may reflect some sort of deep-seated zone of weakness; by analogy, the strike-slip faults of the Nevada Test Site may also represent accommodation zones between less extended areas to the north and more highly extended to the south. Left-lateral offset on them is only a few kilometers (Barnes and others, 1982). Both the Rock Valley and Pahranagat fault zones have Quaternary-age movement. Right-lateral offset on the Las Vegas Valley shear zone has been variously estimated as 40 to 70 km (see Barnes and others, 1982), including both bending and offset.

5.0 REGIONAL REMOTE SENSING

The application of remote sensing and various geophysical and geochemical studies to the detection and mapping of potential mineral resources is based on a limited number of intrinsic bulk physical and chemical properties of the rocks. The imagery and other digital datasets used are designed to detect only a limited range (spectral and spatial relationships) of information that is useful in producing small-scale maps and potential mineral resource (exploration) targets. The delineation of these potential mineral resource targets is then used to plan field studies such as geochemical sampling and regional and district geologic mapping. Known mining district and mineral resource areas within and adjacent to the study area are also examined to develop a knowledge-based information set that is used in the delineation of potential mineral resource targets. Finally, newly acquired field observations and new geochemical sampling are added to the knowledge-based information set.

5.1 STUDY OF SATELLITE IMAGERY

Previously acquired Landsat TM data for the area became the remote sensing dataset of choice for the project. Landsat is an unmanned satellite system that was initially operated by NASA and in 1985 was transferred to the EOSAT Co. The Landsat 4 and 5 satellites consist of two scanner systems, a multispectral scanner (MSS) and a thematic mapper (TM). The MSS data has a ground resolution of 79 m and is comparable to infrared color aerial photography in its usage. The TM data has a ground resolution of less than 30 m and is composed of seven spectral bands. These bands are in the visible, reflected infrared, and thermal infrared regions. This enhanced spectral and spatial resolution of the TM scanner allows for the recognition and mapping of rock-types, geomorphology, some mineralogy and structural geology and rock alteration.

The TM scene used for most of the project was TM scene Path 40 Row 34 Quarters 1-4 acquired on 7/28/85. This scene has about 10 percent cloud cover; some of the clouds are over several important areas. A second scene used for the same path/row that was acquired on 6/10/85 had no cloud cover. An additional scene to the west TM scene Path 41 Row 34 Quarter 2 acquired on 6/28/85 was used to view the Tonopah, Goldfield, and Cuprite mining districts that lie just outside the NAFR boundaries. The acquisition date refers to the date the TM sensor system recorded the data. This information provides researchers the exact date and time the images were recorded by the satellite and allows for comparable data interpretation from one TM scene to another scene (winter sun highlights structures and alteration and provides different reflectance values than does a summer sun scene). However, acquisition date is less important in geological studies than in biological studies because the geology rarely changes from season-to-season or year-to-year.

The western side of the NAFR was subdivided into three scenes, Nellis Range North (fig. 5-1), Nellis Range Central (fig. 5-2) and Nellis Range South (fig. 5-3). Each scene consists of a Landsat TM false-color image with the location of the various mining districts shown by name.

An in-depth remote sensing analysis of several mining districts (including Goldfield, Tonopah, Cuprite, Bullfrog, Golden Arrow, and Silverbow) adjacent to the NAFR was undertaken. These studies provided background information on the alteration patterns, structures, and exposed bedrock of these areas so this information could be applied to areas within the NAFR. An example of the usefulness of this procedure is the analysis of the Goldfield district (fig. 5-4) and the Cactus Range and associated mining districts, camps and prospects (e.g., fig. 7-15). The Cactus Range includes areas of acid-sulfate that are similar to the Goldfield mining district. By studying first Goldfield with other available geologic information, similar types of alteration can be delineated in the Cactus Range. The determination of the extent of the economic mineralization is still, however, dependent upon ground-based sampling and geologic studies, aided by the remote sensing data.

A set of 1:100,000-scale topographic maps was acquired to cover the area along with a list of known mining districts. TM band 5 was examined to locate these known areas and other areas that showed a high degree of reflectance (white appearing areas) or interesting linear features. Known playa and sand dune areas were also marked and other unknown, high-reflectance areas were recorded as areas for further study.

The false-color composite images included but were not limited to: TM bands 5,4,1 as RGB (red, green, blue composites); false-color ratio composites TM ratios 5/7, 3/1, 3/7, 5/4, and other combinations as needed, combined as RGB images and Principle Component images, TM bands 1,4,5,7; 1,3,4,5; and 2,3,4,5 used in mapping hydroxyl-bearing minerals, iron oxides and hematite. Additional image processing procedures were tried on the various mining districts and NAFR sites to evaluate alteration and regional geology.

A list of the known mining districts, prospects, and remotely sensed alteration sites was composed and examined on an individual basis. During this examination, geochemical sample sites were selected. Numerous sites not already selected based upon known mining districts and prospects were added to the inventory list.

After the initial TM assessment of the NAFR was completed, a full-screen (1024 x 768 pixel) examination of the entire NAFR and adjacent areas was done. In addition, field survey crews reported additional areas of interest, alteration or unusual geology, that would be examined in detail.

All of the images were registered to easily recognized features such as road intersections on the TM images. This procedure allowed for the production of georeferenced images and for the collection of samples for the geophysical and geochemical databases in specific areas.

During the course of the assessment, there was constant interaction among the remote sensing analyst, the field geologists, and the literature researchers to find and identify all the potential mineral resource areas.

5.2 MAGNETIC AND GRAVITY STUDIES

Magnetic surveys are designed to record the intensity of the earth's magnetic field and associated variations in the magnetic properties of rocks. Gravity surveys record the intensity of the earth's gravity field. As a general rule, sedimentary basins have lower magnetic intensities than do areas of nonsedimentary rocks such as volcanic rocks and granites, and sedimentary rocks have a lower specific gravity (density) than do volcanic rocks and granites.

Magnetic and gravity data sets can be contoured to produce magnetic and gravity maps or can be combined with other data sets, such as Landsat TM imagery, to show relationships among rock units, structures, alteration, and known mineral producing areas. Major regional tectonic zones occur around the NAFR; to the west is the Walker Lane, to the east is the Pahranagat shear system, and to the southeast is the Lake Mead fault zone. All have been studied using magnetic and gravity data. In Nevada there are well known correlations among high intensity magnetic areas, structures, and mineralized areas. High intensity gravity areas are associated with major volcanic areas, plutonic bodies and with some structural zones.

Regional magnetic data for the area including the NAFR were obtained from the USGS Digital Data Series DDS-9, National Geophysical Data Grids: Gamma-Ray, Gravity, Magnetic, and Topographic Data for the Conterminous United States. Regional gravity data were obtained from the NOAA 1994 GRAVITY CD-ROM compiled for North America. A subset of the State of Nevada data was used in combination with the georeferenced Landsat TM data.

Within these regional data sets, magnetic and gravity data are relatively extensive around the NAFR but coverage is virtually nonexistent within the NAFR. Magnetic data are acquired through over-flight by magnetometer-equipped aircraft and gravity data are acquired by collecting measurements at a large number of well-placed surface stations. None of these investigations have been undertaken within most of the NAFR and, because of the vast areas between existing data sites outside the NAFR, interpolation of the data to areas within NAFR is impossible with any degree of reliability.

The available magnetic and gravity data were examined and used only as background information in the preparation of the NAFR mineral assessment; the data were not useful in the evaluation of specific areas within the NAFR.

NELLIS RANGE NORTH

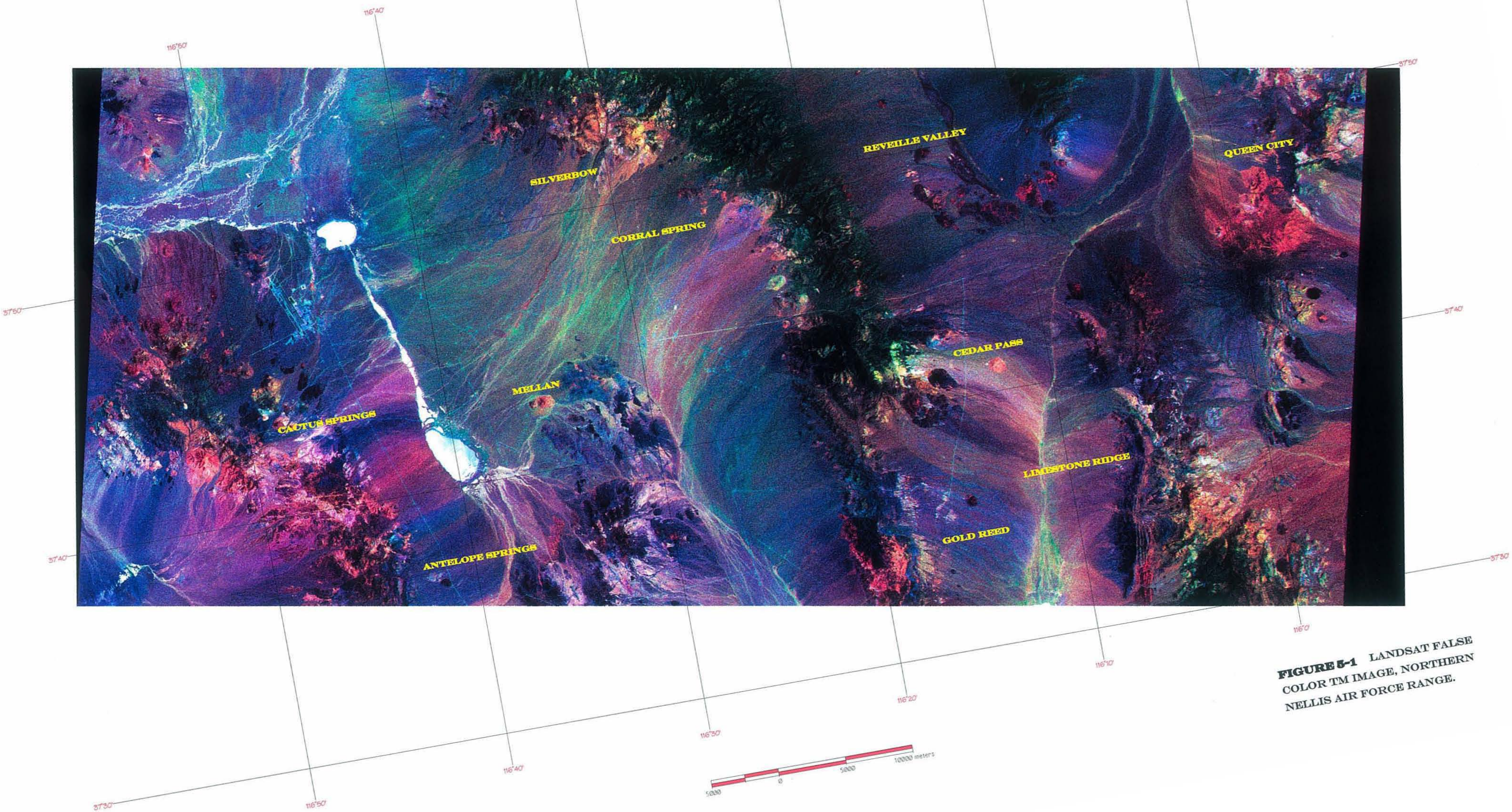


FIGURE 5-1 LANDSAT FALSE COLOR TM IMAGE, NORTHERN NELLIS AIR FORCE RANGE.

(R), 4(G), 1(B)

(following p

NELLIS RANGE CENTRAL

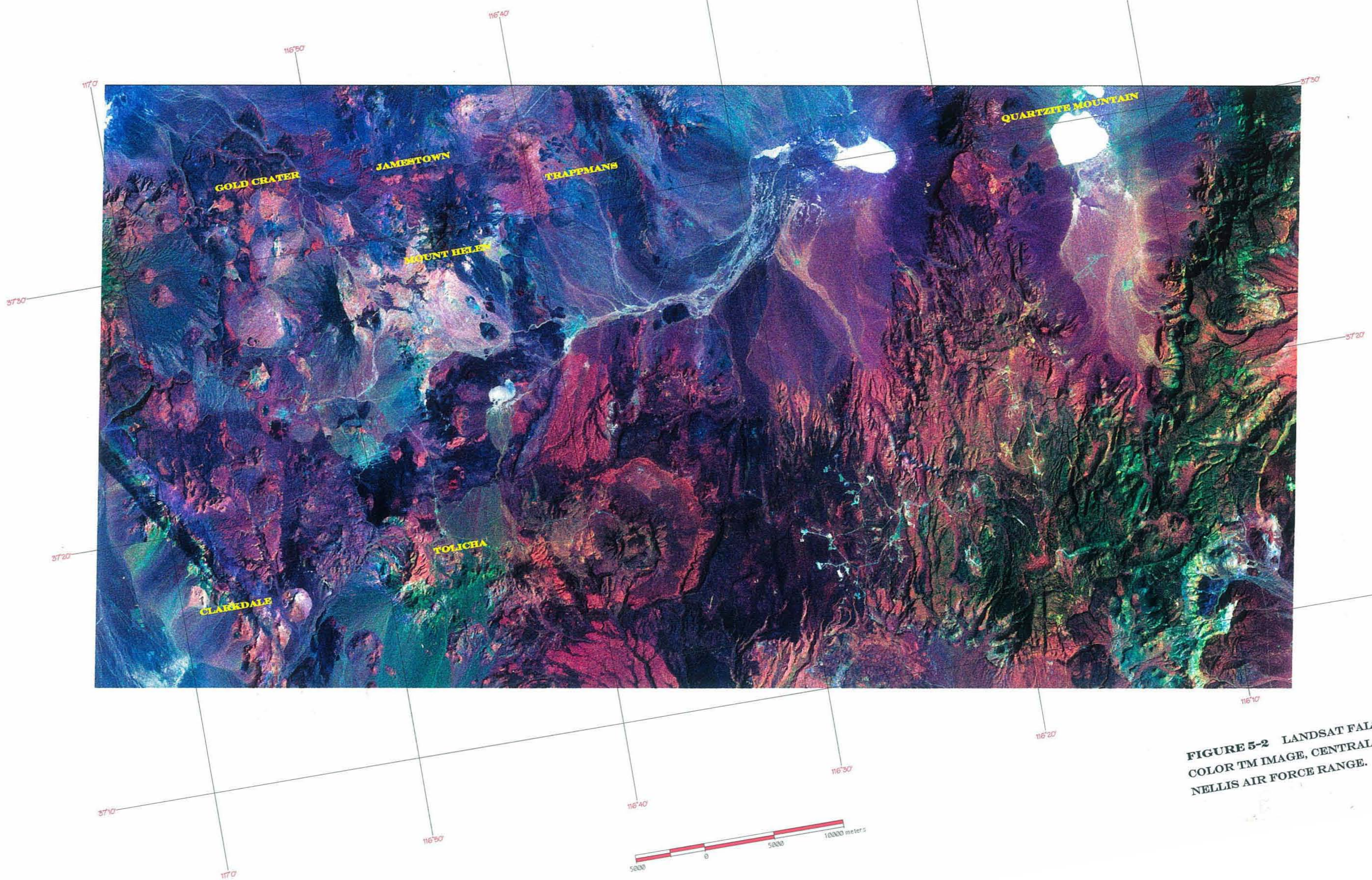
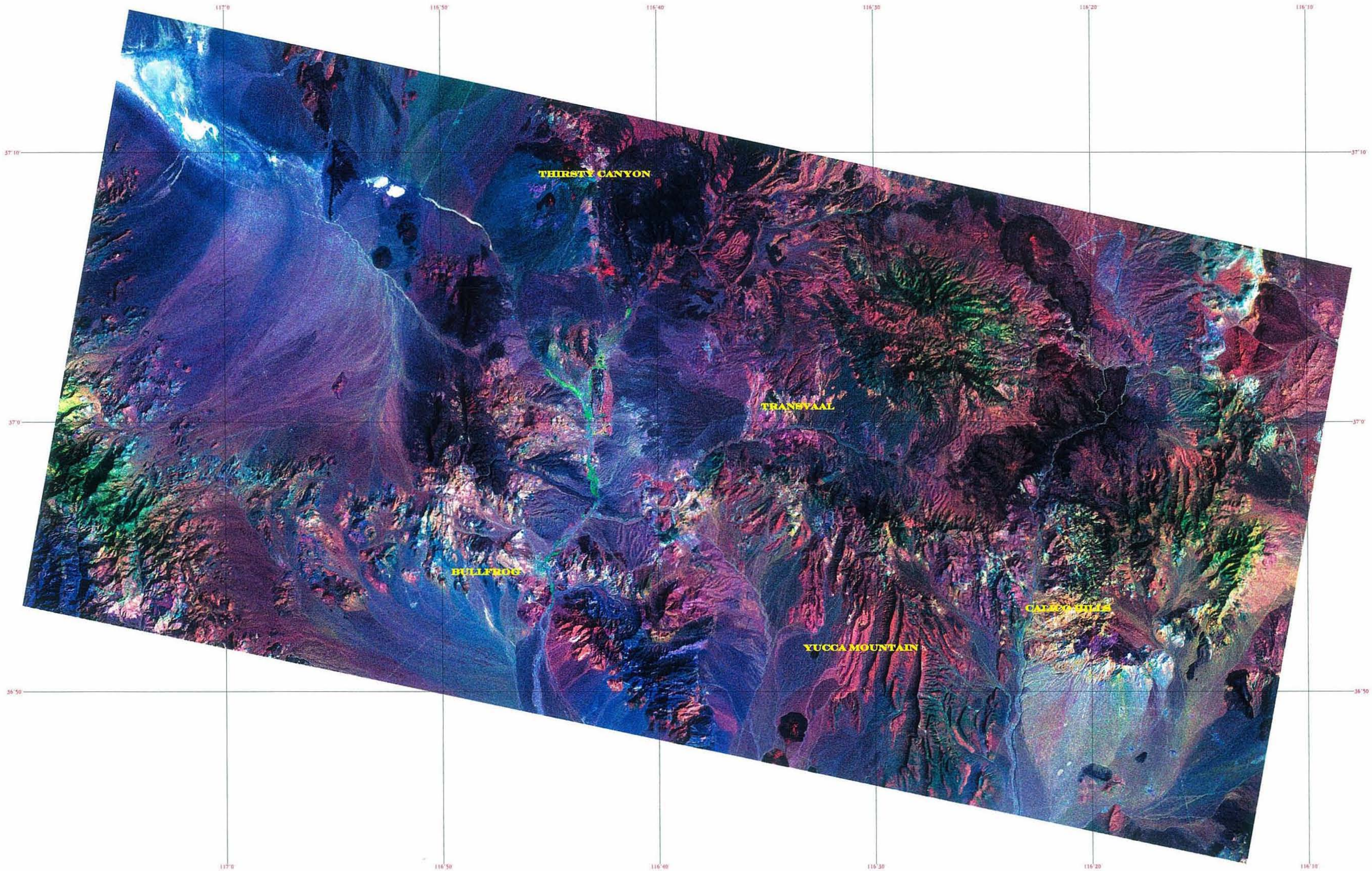


FIGURE 5-2 LANDSAT FALSE COLOR TM IMAGE, CENTRAL NELLIS AIR FORCE RANGE.

DS 5(R), 4(G), 1(B)

NELLIS RANGE SOUTH



5000 0 5000 10000 meters

TM BANDS 5(R), 4(G), B(1)

FIGURE 5-3 LANDSAT FALSE COLOR TM IMAGE, SOUTHERN NELLIS AIR FORCE RANGE.

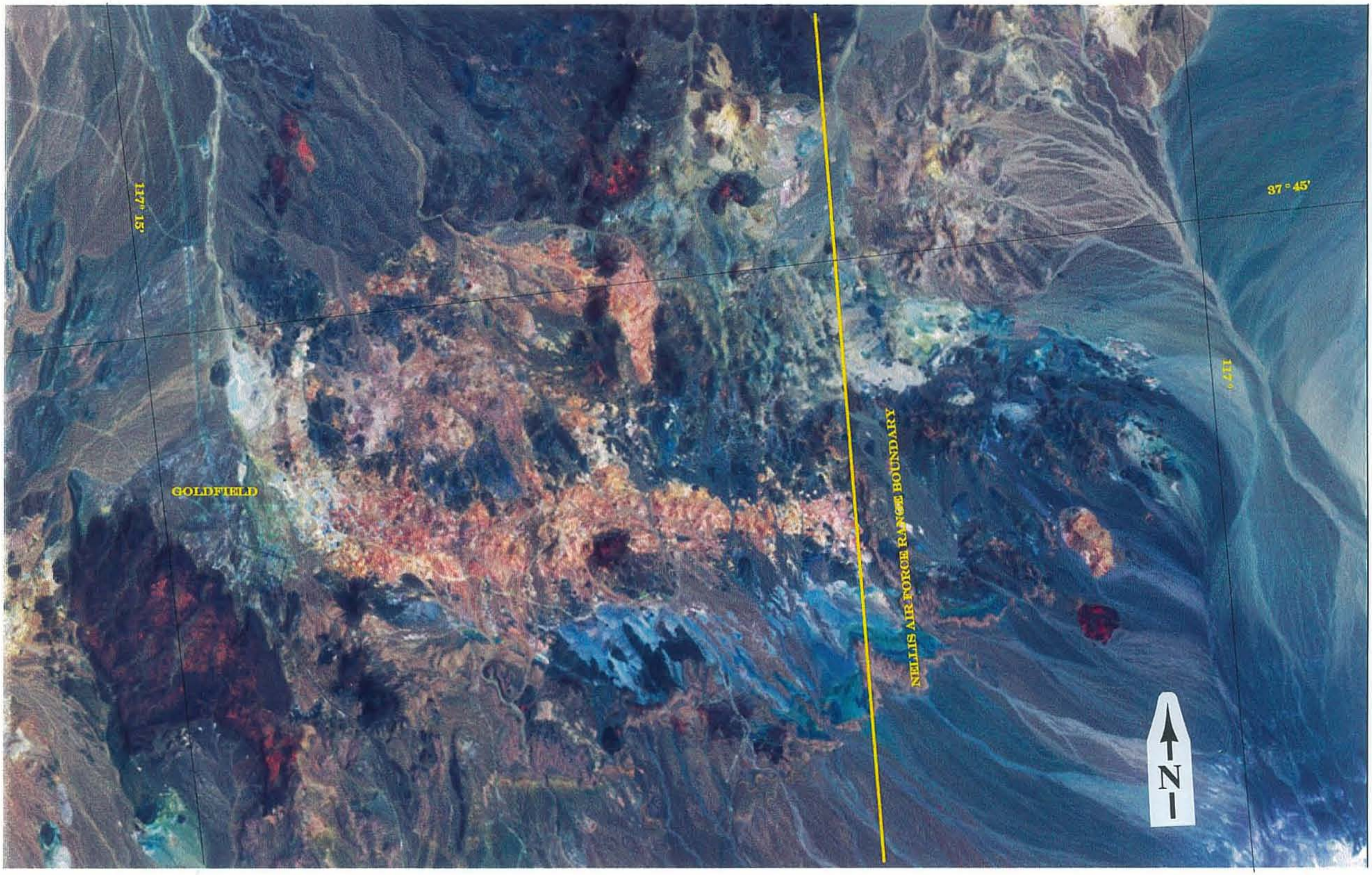


Figure 5-4 LANDSAT false color TM image, eastern Goldfield mining district.

6.0 REGIONAL GEOCHEMISTRY

6.1 NATIONAL URANIUM RESOURCE EVALUATION (NURE) PROGRAM

Geochemical data that were collected in the conterminous United States as part of the National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) program in 1976-80 were examined. Data are primarily for stream sediments, soil, surface water, and groundwater. Each sample was analyzed for uranium and for as many as 58 other elements plus sulfate. These data are contained in a USGS CD-ROM; Digital Data Series DDS-18-A, National Geochemical Data Base: National Uranium Resource Evaluation Data for the Conterminous United States.

A search was made for sample sites in the Goldfield, Caliente, Death Valley, and Las Vegas 1 × 2° quadrangles in which the NAFR is located. More than 3,500 samples are recorded as having been taken in those quadrangles, but data from within the NAFR are rather sparse. NURE stream sediment sample points located within the NAFR are shown on figure B-1, and the analytical data are tabulated in appendix B. Since the focus of the NURE program was to assess uranium resources in the United States, samples were not routinely analyzed for precious metals, base metals, or for some of the important elements associated with precious and base metal deposits. The NURE data were, therefore, of little value in the NAFR mineral assessment program.

6.2 NELLIS AIR FORCE RANGE SAMPLING PROGRAM

6.2.1 Geochemical Sampling and Lithologic Characterization

Geochemical sampling and characterization of major lithologic and stratigraphic units was carried out in the NAFR during 1994 and 1995 for the purpose of determining baseline trace element contents for use in evaluation of stream sediment and mineralized area samples. A total of 220 samples was collected during this phase of the study. The geochemical characterization of rocks in Nevada is an important, ongoing aspect of geologic work by the NBMG, having been initiated in 1990 and utilized for several projects (e.g., Tingley and others, 1993).

6.2.1.1 Methods

Because the geochemical characterization of rock units is used to delineate background trace element concentrations, it is important that samples collected for this portion of the NAFR project (which are referred to as GSC samples) reflect the chemistry of rock types that are exposed over wide areas. For this reason, the collectors attempted to take samples that are representative of each rock unit that is known to be exposed in significant areas of the NAFR on the basis of available geologic mapping. Sample sites for each unit were generally selected prior to field work, but in some instances these were changed in the field due to problems of access or lack of good exposures. At least 2 kg was collected for each GSC sample, and a representative hand sample was also taken. Sample sites are shown on figure A-1.

At most sites, the material collected for GSC samples was fresh, unaltered rock. However, in some areas only weathered and/or altered rock was available and was collected because it was considered to be representative of rock in the area. In a few cases, samples that were thought to be representative of unaltered rock units in the field were subsequently found to be altered or even weakly mineralized.

The GSC samples and sample sites were described in the field, and the samples were further characterized by X-ray diffraction and petrographic techniques in the laboratory. Field descriptions were recorded on GSC forms and are reported, along with laboratory data, in appendix A. The samples were prepared for analysis at the NBMG by crushing in a small jaw crusher, followed by crushing in equipment with chrome steel grinding surfaces.

The samples were analyzed for 48 trace elements, 11 major oxides, and loss on ignition. Analyses were carried out by organic extraction inductively-coupled plasma-emission spectroscopy (ICP) and graphite-furnace atomic absorption (GFAA) methods by USML, Inc., North Highlands CA, by instrumental neutron activation analysis (INAA) by XRAL, Inc., Ann Arbor, Michigan, and by conventional atomic absorption (AA), cold vapor atomic absorption (CVAA), and Xray fluorescence (XRF) techniques in NBMG laboratories. NBMG standard samples were submitted blind to the contract laboratories with the GSC samples and routinely analyzed as part of GSC sample batches at NBMG to assure analytical quality.

Analytical data were examined thoroughly by NBMG scientists to monitor preparation and analytical quality and to assess sample suitability for background determinations. For some elements, data from more than one type of analysis are available. In these instances, analytical techniques were evaluated on the basis of standard analyses, reproducibility, and detection limits. On the basis of these considerations, analyses that were produced by the best technique (table 6-1) are reported in appendix B. Analyses of two elements, palladium and platinum, are not reported

Table 6-1. Selection of analytical method where more than one analysis is available for a single element.

Element	Analytical Technique Selected	Reason
Ag	ICP	Lower detection limit*
As	ICP	Lower detection limit, greater sensitivity
Au	GFAA	Lower detection limit, greater sensitivity
Ba	XRF	Lower detection limit, greater sensitivity
Cr	XRF	Lower detection limit, greater sensitivity
Hg	CVAA	Greater reliability
Mo	ICP	Lower detection limit, greater sensitivity
Sb	ICP	Lower detection limit, greater sensitivity
Se	ICP	Better detection limit*
Sn	XRF	Incomplete digestion for ICP
Sr	XRF	Lower detection limit, greater sensitivity
W	XRF	Lower detection limit, greater sensitivity
Zn	ICP	Lower detection limit, greater sensitivity

* No analyses over detection limit using INAA

because experience at the NBMG laboratory shows that these data are not reliable. In addition, analyses for iridium are not reported because all are below the 20 ppb detection limit.

Pulverization in chrome steel undoubtedly influences the concentration of chromium as is shown by relatively high amounts of that element in samples of hard pre-Tertiary quartzite (up to 689 ppm in sample GSC 160, quartzite from the Emigrant Formation). However, chromium values are reported in appendix B because although silicic volcanic rocks have clearly been contaminated, in some cases yielding analyses of more than 100 ppm, silicic, intermediate, and mafic volcanic rocks can be differentiated on the basis of chromium analyses alone.

6.2.1.2 Results

In general, analyses of GSC samples were in agreement with average crustal rock type abundance data of Levinson (1974). In a few instances, higher values were obtained, either due to the presence of altered and weakly mineralized rock, or to the presence of rocks such as highly evolved igneous rocks or metal-bearing black shales that are exceptionally enriched in certain elements.

With a few exceptions, samples of glassy Tertiary volcanic rocks and pre-Tertiary carbonate sedimentary rocks (limestone and dolomite) have low trace element contents (appendix A). This is particularly true for trace elements such as arsenic and mercury that are associated with hydrothermal metal deposits, and are often referred to as "pathfinder" elements. In some areas pathfinder elements may be enriched by secondary processes such as vapor-phase or hydrothermal alteration that may have affected rocks over large areas.

Because of differences in geology, the NAFR may be divided into two geochemically distinct provinces — the northern ranges mainly contain exposures of Tertiary rocks that are dominated by silicic volcanic rocks, whereas exposures in the southern ranges are predominantly of pre-Tertiary carbonate sedimentary rocks. Background levels for some trace elements differ for these two groups of rocks as will be shown below.

Precious metals

On the basis of analyses by GFAA, no GSC sample contains more than 3 ppb gold (figs. 6-1a and 6-2a), and only one sample was found to contain gold at that level. Most analyses show gold contents at 1 ppb or less (appendix A). INAA analyses indicated that six samples contain gold in excess of the 5 ppb detection limit. These high analyses do not correlate consistently with higher ICP values (table 6-2), altered rock, or pathfinder elements such as silver. The highest INAA value, 18 ppb (sample GSC 169), which is two orders of magnitude below economic concentration for gold, is in devitrified ash flow tuff that is not visibly altered or mineralized. All six INAA gold analyses that are above the detection limit are considered to be erroneous.

Four GSC samples contain more than 0.1 ppm silver on the basis of ICP analyses (table 6-3). Three of these samples

Table 6-2. INAA gold analyses above 5 ppb and corresponding GFAA gold analyses. All analyses are reported in ppb.

Sample	Gold by INAA	Gold by GFAA	Sample Description
GSC 002	6	0.0	Devonian dolomitic sandstone, minor iron oxide
GSC 073	6	1.0	Glassy Tertiary bedded tuff
GSC 169	18	0.0	Devitrified Tertiary ash-flow tuff
GSC 185	13	0.2	Tertiary ash-flow tuff with limonite veins and high Sb
GSC 230	11	2.0	Tertiary rhyolite lava, matrix glassy
GSC 259	8	2.0	Silicified Tertiary sediment with high Sb, Bi, and As

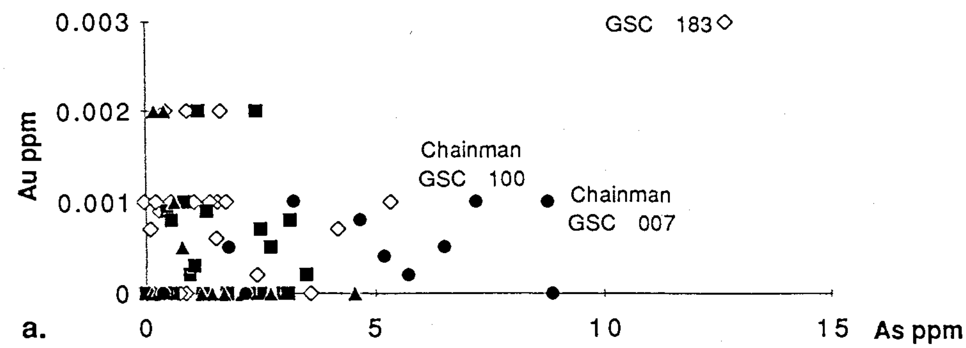


Figure 6-1a Au/As plot for GSC samples of rock types dolomite, limestone, quartzite, and mudstone.

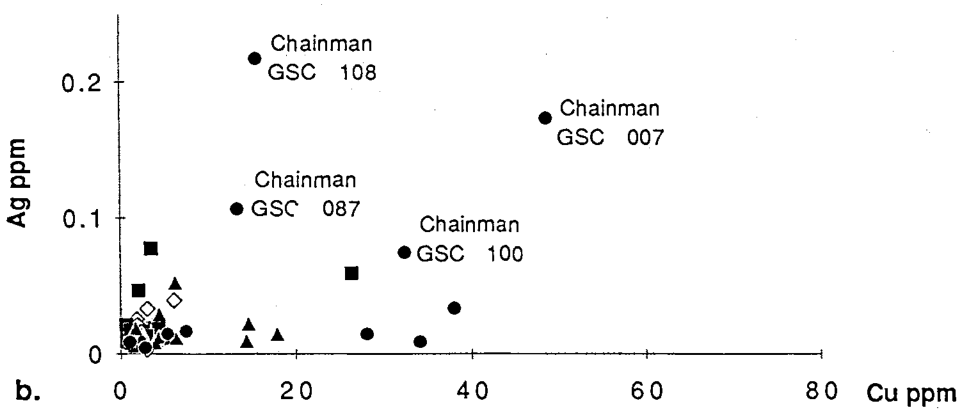


Figure 6-1b Ag/Cu plot for GSC samples of rock types dolomite limestone, quartzite, and mudstone.

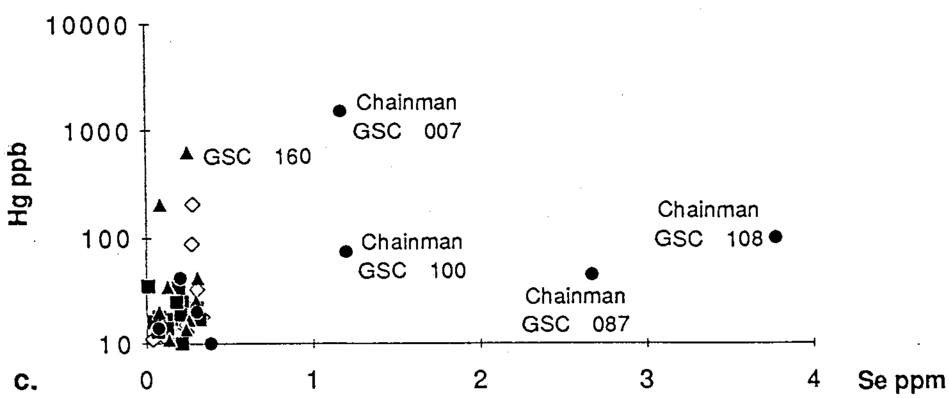


Figure 6-1c Hg/Se plot for GSC samples of rock types dolomite, limestone, quartzite, and mudstone.

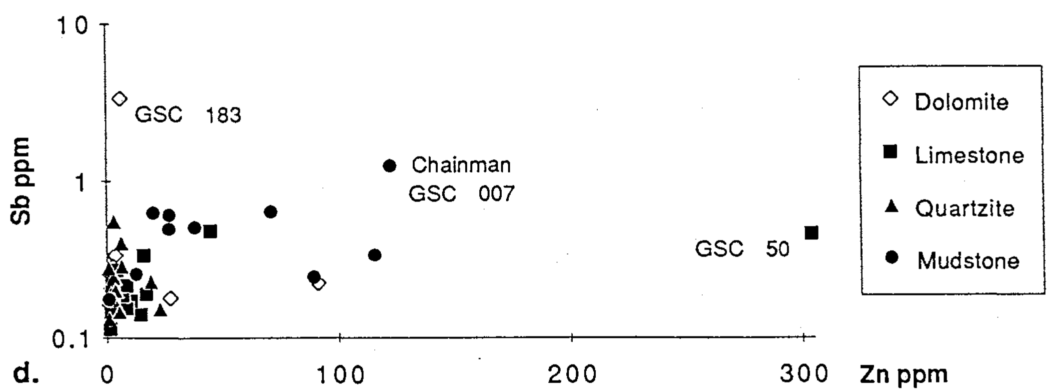


Figure 6-1d Sb/Zn plot for GSC samples of rock types dolomite, limestone, quartzite, and mudstone.

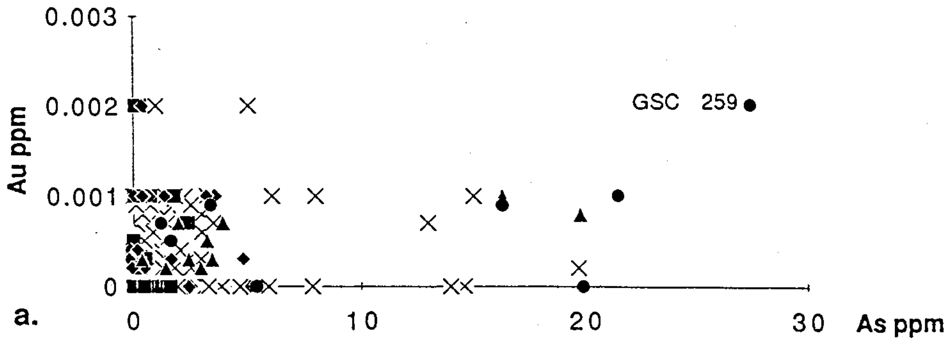


Figure 6-2a Au/As plot for GSC samples of igneous, sedimentary, and altered rocks.

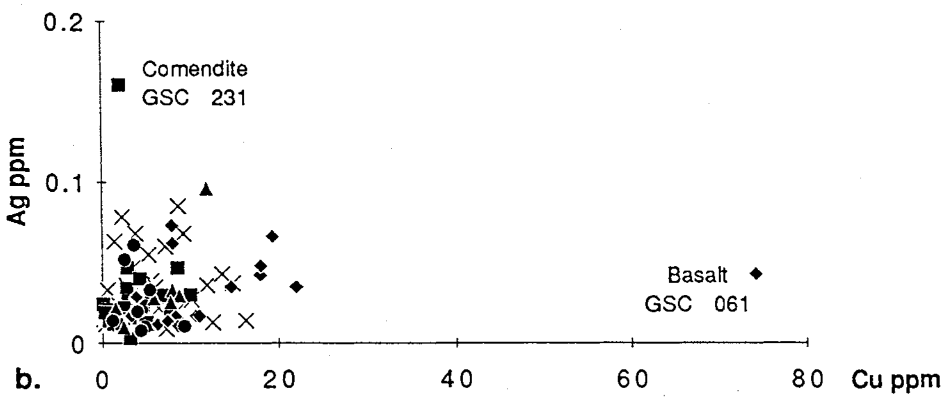


Figure 6-2b Ag/Cu plot for GSC samples of igneous, sedimentary, and altered rocks.

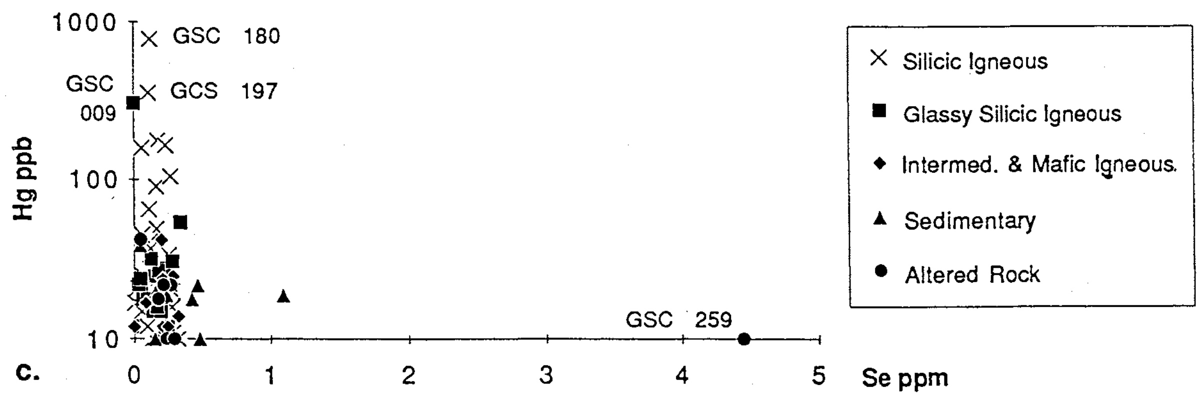


Figure 6-2c Hg/Se plot for GSC samples of igneous, sedimentary, and altered rocks.

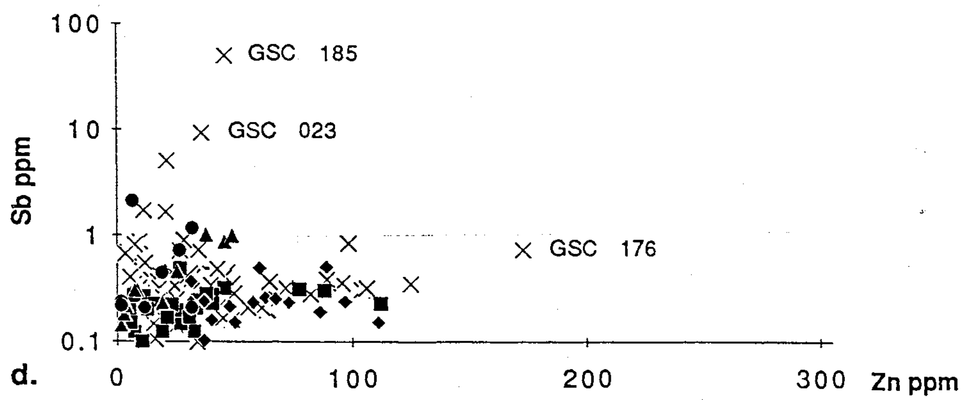


Figure 6-2d Sb/Zn plot for GSC samples of igneous, sedimentary, and altered rocks.

Table 6-3. Anomalous trace element threshhold contents and other data for NAFR GSC samples (values in parts per million (ppm)).

	Average Rock				NAFRGSC Samples									
	Sedimentary		Igneous			Pre-Tertiary Rocks				Tertiary Rocks				
	Highest in Rock*	Rock Type	Highest in Rock*	Rock Type	Type of Analysis	Highest Content	Med. + 3 S.D.	Threshold	No. Above or at Threshold	Highest Content	Med. + 3 S.D.	Threshold	No. Above or at Threshold	
Ag			0.1	gr	ICP	0.22	0.12	0.12	2	0.16	0.08	0.08	3	Ag
As	15	sh	2	gr	ICP	12.7	8.6	8.6	3	27.5	12.0	12.0	2	As
Au					GFAA	0.003	0.002	0.003	1	0.002	0.002	0.003	0	Au
Ba	700	sh	600	gr	INAA	6657	2435	1000	1	1890	1798	2000	0	Ba
Be	3	sh	5	gr	XRF	ND	ññ	5	0	30	15	20	3	Be
Bi	0.2	sh	0.15	bas	ICP	0.782	0.4	0.40	2	1.22	0.3	0.50	2	Bi
Br	6	ls	3.6	bas	INAA	7	4	4	1	5	3.1	3.1	1	Br
Cd	0.2	sh	0.2	all	ICP	1.00	0.50	0.50	2	0.556	0.30	0.30	3	Cd
Ce	50	sh	46	gr	INAA	110	45	100	2	699	381	400	3	Ce
Co	20	sh	50	bas	INAA	23	15	15	3	47	23	23	0	Co
Cr	100	sh	200	bas	INAA	689	291	291	ññ	500	188	188	ññ	Cr
Cs	5	sh	5	gr	INAA	12	6.4	10	1	13	22	10	3	Cs
Cu	50	sh	100	bas	ICP	48.6	32	32.0	4	74.3	25	25.0	1	Cu
Eu	1	sh	1.3	bas	INAA	1.9	1.7	3.0	0	4.1	2.6	3.0	1	Eu
Ga	20	sh	18	gr	ICP	8.78	5.4	10.00	0	10.8	6.6	10.0	2	Ga
Hf	3	sh	4	gr	INAA	15	8.5	10	2	100	41	30	2	Hf
Hg	0.5	sh	0.08	all	CVAA	1.520	0.606	0.500	2	0.775	0.253	0.200	3	Hg
La	20	sh	36	gr	INAA	60	51	60	1	385	233	300	2	La
Li	60	sh	30	gr	XRF	100	46	100	1	194	101	100	3	Li
Lu	0.5	sh	0.2	bas	INAA	0.63	0.5	1.00	0	5.14	2.4	2.00	2	Lu
Mo	3	sh	2	gr	ICP	3.18	2.2	3.00	1	5.21	2.5	5.00	1	Mo
Nb	20	sh	20	gr	XRF	41	21	30	1	468	207	150	2	Nb
Nd	24	sh	26	gr	INAA	50	32	50	1	210	124	150	2	Nd
Ni	70	sh	150	bas	XRF	72	51	70	1	253	74	100	1	Ni
Pb	20	sh	20	gr	ICP	92.5	36	36.0	1	205	79	79	3	Pb
Rb	140	sh	150	gr	INAA	220	133	200	1	780	449	500	3	Rb
Sb	1.0	sh	0.2	all	ICP	3.42	1.5	1.5	1	50.6	13	2.0	4	Sb
Sc	15	sh	38	bas	INAA	18.6	14	20.0	0	26.2	16	40.0	0	Sc
Se	0.6	sh	0.05	all	ICP	3.77	1.9	2.00	2	4.45	0.5	0.50	4	Se
Sm	6	sh	7	gr	INAA	9	7.9	10	0	46.4	23.2	20.0	2	Sm
Sn	4	sh	3	gr	ICP	6	4.6	10	0	28	16	16	3	Sn
Sr	500	ls	465	bas	INAA	733	520	1000	0	2400	951	2000	1	Sr
Ta	2	sh	3.5	gr	INAA	2	1.1	2	1	20	3.4	10	2	Ta
Tb	1	sh	1.3	gr	INAA	1.2	1.6	2.0	0	8.4	4.0	3.0	2	Tb
Te					ICP	0.265	0.3	0.30	0	0.667	0.3	0.50	1	Te
Th	12	sh	17	gr	INAA	16	12	20	0	140	68	50	2	Th
Tl	0.3	sh	0.8	gr	ICP	0.561	0.7	0.7	0	1.33	0.9	0.9	3	Tl
U	4	sh	4.8	gr	INAA	6.7	4.6	4.6	3	25.2	12	12.0	3	U
V	130	sh	250	bas	XRF	282	174	174	4	517	241	241	1	V
W	2	sh	2	gr	INAA	5	3.6	4	3	21	12	10	2	W
Y	25	sh	40	gr	XRF	48	35	50	0	293	146	100	2	Y
Yb	3	sh	3.6	gr	INAA	4.3	3.6	5.0	0	34.5	15.3	10.0	2	Yb
Zn	100	sh	100	bas	ICP	304	137	137	1	173	117	117	2	Zn
Zr	160	sh	180	gr	XRF	422	256	500	0	4035	1833	1000	2	Zr

* Data on trace element contents of average rocks from Levinson (1974); where no average content is reported here, Levinson data are considered of questionable value.

are of Chainman Shale (fig. 6-1b), a Mississippian formation known to contain organic-rich black shale. All four GSC samples of Chainman shale have high silver contents relative to other pre-Tertiary rocks (fig. 6-1b). Many black shales are known to contain relatively high metal contents (Huyck, 1991) and the Chainman appears to be no exception because it also has elevated antimony, arsenic, copper, mercury, and selenium for unmineralized pre-Tertiary rocks (fig. 6-1). Although elevated metal contents in Chainman samples may be primary, some are considered to be above threshold values for hydrothermally enriched rock for the NAFR as a whole. Sample GSC 231 has inexplicably high silver (fig. 6-2b) because it is unaltered comenditic vitrophyre.

Base metals

Five GSC samples contain more than 30 ppm copper. The highest, with 74.3 ppm, is a sample of Tertiary basalt (GSC 61, fig. 6-2b) that also has relatively high chromium, nickel, and cobalt. This copper concentration is reasonable for fresh basalt, and is thought to be primary, not hydrothermally enhanced. All four of the other relatively high copper values for GSC samples are in fine-grained pre-Tertiary sedimentary rocks, including two Chainman Shale samples (fig. 6-1b), and the copper enrichment in these four samples is considered to be primary and not related to hydrothermal activity.

Lead contents in all but five GSC samples are less than 50 ppm, and samples with more than 50 ppm lead are mostly volcanic rocks that show no evidence of alteration or mineralization. The highest lead content, 205 ppm, is in glassy felsic volcanic rock (GSC 023) that also contains elevated antimony, and the second highest, 189 ppm, is in an apparently unaltered sample of the peralkaline Gold Flat Member of the Thirsty Flat Tuff (GSC 176). A single sample of pre-Tertiary rock had more than 50 ppm lead, a sample of Cambrian silty limestone (GSC 050).

Eight GSC samples contain more than 100 ppm zinc, including four samples of fine-grained pre-Tertiary sedimentary rock. The highest zinc content, 304 ppm, was reported for the Cambrian silty limestone (GSC 050, fig 6-1d) that also has elevated lead. Three samples of unaltered volcanic rock contain more than 100 ppm zinc, including the sample of the peralkaline tuff that also has elevated lead (GSC 176). A sample of propylitically altered quartz latite porphyry (GSC 226) that contains the highest cadmium analysis reported for a GSC sample also has elevated zinc.

Elements commonly associated with hydrothermal precious metal deposits (pathfinder elements)

Arsenic is generally present in anomalously high amounts in both volcanic- and sediment-hosted gold-silver deposits. No GSC samples of pre-Tertiary rock contain more than 15 ppm arsenic, which is given as the average abundance of the element in shale (Levinson, 1974). However, seven samples of Tertiary rock contain more than 15 ppm arsenic, and two samples of altered Tertiary rock have more than 20 ppm arsenic (fig. 6-2a). Silicified and alunitized tuffaceous sedimentary rock (GSC 259) has the highest arsenic content, at 27.5 ppm, and also has the highest bismuth, selenium (fig. 6-2c), and tellurium contents for GSC samples. Sample GSC 259 is clearly a hydrothermally altered rock that should not be considered as a background sample.

Antimony, which with arsenic commonly accompanies precious metal mineralization, is above 1 ppm in only two GSC samples of pre-Tertiary rock, including a Chainman Shale sample (fig. 6-1d). According to Levinson (1974), the average abundance of the element in shale is 1 ppm. Eight samples of Tertiary rock contain more than 1 ppm antimony, and four contain more than 2 ppm (fig. 6-2d). All of the latter samples are considered to have antimony contents that are above background, although one with 9.34 ppm antimony (GSC 023) is glassy, unaltered tuff. Sample GSC 185, an ash-flow tuff that contains webby veins of hydrothermal breccia, contains 50.6 ppm antimony. By comparison, Levinson (1974) reported average concentrations in igneous rocks at 0.2 ppm, and Miller (1973) stated that igneous rocks contain up to 1 ppm antimony. Because of the unusually elevated antimony contents in GSC samples of Tertiary igneous rock from the NAFR, antimony should be used with caution as a precious-metal pathfinder.

Mercury, which occurs in anomalously high amounts in and adjacent to hydrothermal precious and base metal deposits, is present in excess of 1 ppm in a sample of Chainman Shale (GSC 007) (fig. 6-2c), but this probably reflects the over-all high metal values in this rock type, not the presence of hydrothermal activity. Mercury is elevated (>200 ppb) in pre-Tertiary quartzite with quartz veinlets (GSC 160) and in a nearby sample of brecciated limestone with hematite (GSN 183), and both of these samples are thought to contain anomalously high mercury as a result of introduction during hydrothermal activity. Similarly elevated mercury levels were also measured in a few samples of volcanic rock. The element is elevated in two samples of vapor-phase crystallized rhyolite lava (GSC 180 and GSC 197). Sample GSC 009, unaltered glassy ash-flow tuff, contains inexplicably elevated mercury, at 301 ppb, well above background levels for silicic igneous rock (Levinson, 1974).

Selenium, which is associated with some volcanic-hosted precious metal deposits, occurs in elevated amounts (1.0 ppm) in six GSC samples, four of which are samples of Chainman Shale (fig. 6-1c). The remaining two are in Tertiary sedimentary rocks, with the highest content, 4.45 ppm, in sample GSC 259 (fig. 6-2c), which is clearly altered and weakly mineralized.

Other pathfinder elements for precious metal deposits are present in relatively minor amounts. Bismuth and tellurium, which are typically associated with high sulfidation epithermal deposits and other porphyry-related precious metal deposits, are elevated in the hydrothermally altered sample GSC 259 described above, at 1.22 and 0.667 ppm, respectively. Thallium, characteristically associated with sediment-hosted gold deposits as well as some epithermal volcanic-hosted precious metal deposits, reaches 1 ppm in only three volcanic rock samples, two of which are altered to the low temperature zeolite mineral clinoptilolite.

Other elements

Six samples of silicic to intermediate Tertiary volcanic rocks have barium contents that exceed 1,500 ppm, and most of these are unaltered glassy rocks. None of these are thought to be the result of hydrothermal enrichment. The highest barium content in any GSC sample, 6657 ppm, is in a sample of silicified Chainman Shale that is cut by silica veinlets (GSC 100) and is clearly a mineralized sample. No other pre-Tertiary rock contains more than 920 ppm barium.

GSC samples contain low molybdenum contents; the highest, 5.21 ppm, is in an argillized and jarosite-bearing sample of intrusive rhyolite porphyry (GSC 217). Tungsten contents are also generally low in GSC samples. Only two samples contain more than 8 ppm; both are unaltered samples of the peralkaline Gold Flat Member of the Thirsty Canyon Tuff (GSC 176, GSC 191) with 21 ppm tungsten.

Uranium occurs in amounts in excess of 10 ppm in only four GSC samples and two are the samples of the peralkaline tuff mentioned above. A sample of bioclastic Tertiary limestone (GSC 089) contains 21.4 ppm uranium, along with slightly elevated selenium.

In addition to elevated base metals, tungsten and uranium, the two samples of the Gold Flat Member of the Thirsty Canyon Tuff (GSC 176, GSC 191) contain elevated amounts of metals that are normally associated with highly evolved peralkaline rocks: tin, beryllium, zirconium, hafnium, rubidium, thorium, niobium, and the rare earth elements. While these elements are present in anomalously high amounts in the Gold Flat unit relative to the other Tertiary units sampled, they have not been concentrated by hydrothermal activity and are not indicative of economic potential.

6.2.1.3 Determination of Anomalous Trace Element Levels

Threshold values for anomalously high levels of trace elements in rock in the NAFR have been selected and are shown in table 6-3. The threshold values chosen generally correspond to calculated median + 3 standard deviation values for the GSC data. Adjustments from this value are based on visual examinations of cumulative frequency diagrams for NAFR GSC analyses, average concentrations for some rock types (Levinson, 1974), and experience with characterization studies in other areas (Tingley and others, 1993; Hsu and others, 1995). Because background amounts of some trace elements are different in pre-Tertiary and Tertiary rocks, they are reported separately in table 6-3. As an example, 43 samples of Tertiary volcanic rock contain more than 1,000 ppm barium, whereas only a single sample of pre-Tertiary rock contains more than 1,000 ppm barium (GSC 100).

6.2.2 Stream Sediment Sampling

6.2.2.1 Methods

Stream sediment sampling is used as a reconnaissance evaluation method to assess large areas for mineral potential. Results of analyses of stream sediment samples represent the chemistry of rock material eroded from the drainage basin upstream from each sample site. Such information is useful for identifying those basins which contain concentrations of elements that may be related to mineral deposits.

Sample sites were selected following study of the regional geology, study of alteration and structural patterns on satellite imagery, and investigation of the known mineral deposits of the region. At each selected sample site, two separate samples were collected from the stream drainage, a silt sample and a float chip sample. The silt sample was collected by scooping material from the most active portions of the drainage channel. In wide drainages, samples were collected by traversing across the channel and collecting material from several sites up and down drainage on major, parallel sub-channels. The sample was sieved in the field to minus 10-mesh to remove large rock fragments. Later, in the NBMG sample preparation facility, each sample was sieved to minus 80-mesh and the finer fraction was sent for analysis.

In terrains of predominantly carbonate rocks such as the southern portion of the NAFR, anomalous metal contents are sometimes only found in jasperoid veining and in gossanous, iron- and manganese-oxide coatings on fractured rock. A sampling technique known as float chip sampling has been found to be successful in testing this type of environment (Erickson and others, 1966). Float chip samples are collected by simply scavenging an area of the drainage channel for fractured, iron- or manganese-oxide-stained rocks, jasperoid, vein quartz or calcite. If the pebbles or fragments are small, the entire piece is collected; larger rocks are broken and the stained, discolored material is selectively sampled.

The float chip sampling technique was found to be successful in enhancing subtle metal anomalies in both carbonate and volcanic terrains (Tingley and others, 1993), and the combination of silt and float chip sampling was used for the NAFR project.

During the sampling program, samples were taken from 380 stream drainages within the NAFR. At each site a screened silt sample (fig. B-2) was collected and at 270 of these sites a float chip sample was also collected (fig. B-3). Sample totals are different because samples from two other contract sampling projects were incorporated into the NAFR project. One of these projects, completed in 1985, did not include the collection of float chip samples. The other project included the collection of float chip samples only in its later stages.

All samples were analyzed for a total of 48 elements by a ICP, GFAA, INAA, and XRF techniques (see section 6.2.1 and table 6-1). The elements tested for, the technique used for each, and the lower detection limit for each element are listed in table 6-4. Sample analyses are compiled in appendix B.

6.2.2.2 Determination of Anomalous Trace Element Levels

Three datasets were established for the reconnaissance stage of this project. These include a geologic sampling and characterization (GSC) sample set (described in section 6.2.1.1) and two types of stream sediment samples: a set of stream silt samples, and a set of limonite float chip samples (both described in section 6.2.2.1). The GSC dataset derives from rock samples collected intentionally from fresh, unaltered formations throughout the project area, and the stream silt and limonite float chip samples were collected from selected stream drainages within the project area. Each of these three major datasets were partitioned into two subsets for statistical comparisons; a pre-Tertiary subset representing those samples collected from pre-Tertiary rock outcrops or from stream channels draining areas of pre-Tertiary rock outcrops, and a Tertiary subset representing those samples collected from Tertiary rock outcrops or from stream channels draining areas of Tertiary outcrops. Figure 6-3 shows the general areas included in each of these broad geologic divisions.

Table 6-5 shows the distributions of 42 elements measured in GSC, float chip, and stream silt samples, represented by their means, medians, and standard deviations. Threshold values for the 42 elements listed in table 6-5 are those concentrations above which the elements are considered anomalously high and indicative of possible mineralization of those elements somewhere in the respective watersheds. The threshold values for each element in each of the four stream sample datasets (pre-Tertiary and Tertiary float chips and pre-Tertiary and Tertiary stream silts) are the result of multiple considerations of the observed element distributions.

Table 6-4. Geochemical analyses, detection limits (stream, sediment and mine, prospect, and outcrop samples).

Symbol	Name	Method	Lower Detection Limit	Unit
Ag	silver	ICP	0.015	ppm
As	arsenic	ICP	1.000	ppm
Au	gold	GFAA	0.0005	ppm
Ba	barium	XRF	5	ppm
Be	beryllium	XRF	5	ppm
Bi	bismuth	ICP	0.250	ppm
Br	bromine	INAA	1	ppm
Ca	calcium	INAA	1	percent
Cd	cadmium	ICP	0.100	ppm
Ce	cerium	INAA	3	ppm
Co	cobalt	INAA	5	ppm
Cr	chromium	XRF	5	ppm
Cs	cesium	INAA	5	ppm
Cu	copper	ICP	0.050	ppm
Eu	europium	INAA	0.2	ppm
Fe	iron	INAA	0.1	percent
Ga	gallium	ICP	0.500	ppm
Hf	hafnium	INAA	1	ppm
Hg	mercury	CVAA	0.01	ppm
La	lanthanum	INAA	1	ppm
Lu	lutetium	INAA	0.05	ppm
MnO	manganese oxide	XRF	0.001	percent
Mo	molybdenum	ICP	0.100	ppm
Na	sodium	ICP	500	ppm
Nb	niobium	XRF	2	ppm
Nd	neodymium	INAA	10	ppm
Ni	nickel	XRF	5	ppm
Pb	lead	ICP	0.250	ppm
Rb	rubidium	INAA	30	ppm
Sb	antimony	ICP	0.250	ppm
Sc	scandium	INAA	0.100	ppm
Se	selenium	ICP	1	ppm
Sm	samarium	INAA	0.5	ppm
Sn	tin	XRF	2	ppm
Sr	strontium	XRF	5	ppm
Ta	tantalum	INAA	1	ppm
Tb	terbium	INAA	0.5	ppm
Te	tellurium	ICP	0.500	ppm
Th	thorium	INAA	0.5	ppm
TiO_2	titanium dioxide	XRF	0.01	percemt
U	uranium	INAA	0.5	ppm
V	vanadium	XRF	20	ppm
W	tungsten	XRF	2	ppm
Y	yttrium	XRF	2	ppm
Yb	ytterbium	INAA	0.2	ppm
Zn	zinc	ICP	1.000	ppm
Zr	zirconium	XRF	10	ppm

Float Chip Datasets. Limonite float chip samples are those pieces of rock float found in streambeds which appear to be enriched in iron and manganese oxides, contain epigenetic veinlets, or appear to be hydrothermally altered. Thus, these samples are intentionally biased and should be geochemically anomalous in those elements which are enriched or depleted during hydrothermal alteration of the original rocks. To assess the extent to which the float chip samples deviate from the geochemistry of the original rocks, the distribution of element concentrations in the GSC samples were compared with the concentration distributions in the float chip samples. The GSC samples are utilized to select background concentrations and ranges for each element as a benchmark against which to assess element concentrations

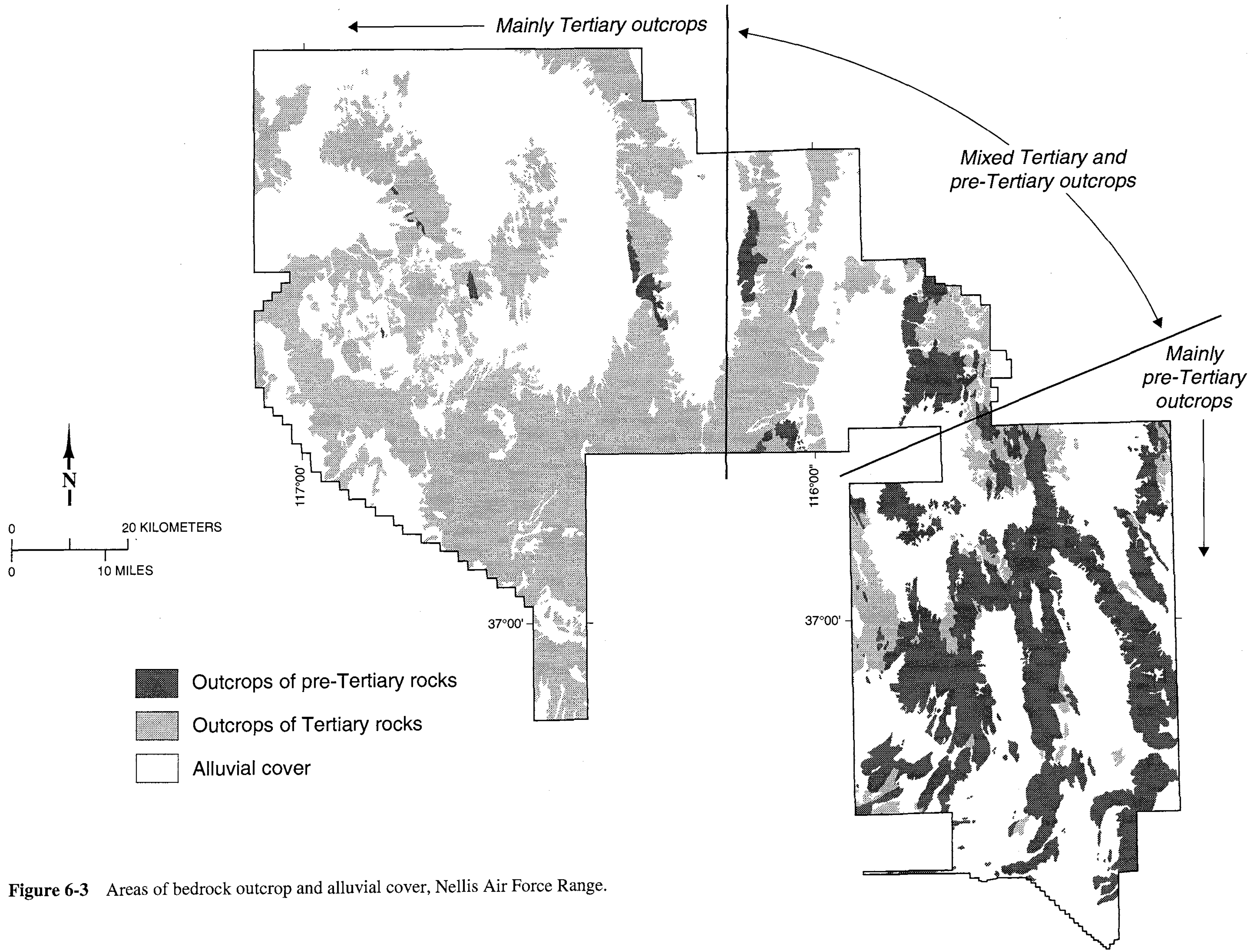


Figure 6-3 Areas of bedrock outcrop and alluvial cover, Nellis Air Force Range.

Table 6-5. Element distributions and threshold values, GSC, float chip, and silt samples (Hg in ppb; Fe, MnO in percent; all other elements in ppm)

GSC SAMPLES

Pre-Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.12	10	0.003	2000	nd	0.5	6.0	0.5	12	300	7.0	30	1.8	3.0	3.0	7.0	600	50	0.3	0.06	4.0	5000	20	35	30	100	2.0	8.0	1.0	2.0	600	1.2	0.3	8.0	0.6	0.7	5.0	90	6.0	30	150	250
Statistics:																																									
Mean + 2 std dev:	0.09	6.9	0.002	1805	nd	0.3	3.6	0.4	12	256	5.3	26	1.3	3.4	4.3	7.0	450	40	0.4	0.07	1.8	7317	17.0	41	27	107	1.1	11	1.4	4.2	438	0.9	0.2	10	0.7	0.6	3.8	138	3.2	29	108	214
Mean + 3 std dev:	0.13	9.3	0.003	2615	nd	0.5	4.6	0.5	16	349	6.9	35	1.8	4.7	6.1	9.7	645	56	0.6	0.09	2.5	10342	23.8	56	38	147	1.6	16	1.9	5.4	586	1.1	0.3	14	0.9	0.7	5.1	193	4.0	39	152	290
Median + 3 std dev:	0.12	8.6	0.002	2435	nd	0.4	4.0	0.5	15	291	6.4	32	1.7	4.1	5.4	8.5	606	51	0.5	0.08	2.2	9325	21.3	51	36	133	1.5	14	1.9	4.6	520	1.1	0.3	12	0.8	0.7	4.6	174	3.6	35	137	256

Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.10	10	0.001	1600	12	0.4	4.0	0.4	35	300	25	28	4.0	4.0	10	40	200	300	2.0	0.20	4.0	5000	150.0	60	50	450	10	18	0.5	14	1200	10	0.3	55	1.5	1.0	14	300	12	140	140	1000
Statistics:																																									
Mean + 2 std dev:	0.07	9.5	0.002	1483	12	0.2	2.6	0.2	20	149	17	20	2.2	4.6	5.5	33	189	190	1.9	0.17	2.1	4000	161.5	56	59	349	9.5	13	0.4	12	802	2.8	0.2	52	1.0	0.7	9.6	203	9.3	118	96	1437
Mean + 3 std dev:	0.09	13	0.002	1963	16	0.3	3.3	0.3	27	199	23	27	2.7	6.1	7.3	45	268	250	2.5	0.22	2.7	54126	223.4	78	84	449	14	17	0.5	16	1077	3.7	0.3	69	1.3	0.9	12	280	12	160	124	1986
Median + 3 std dev:	0.08	12	0.002	1798	15	0.3	3.1	0.3	23	188	22	25	2.6	5.6	6.6	41	253	233	2.4	0.21	2.5	56186	206.7	74	79	449	13	16	0.5	16	951	3.4	0.3	68	1.2	0.9	12	241	12	146	117	1833

FLOAT CHIP SAMPLES

Pre-Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.50	300	0.060	2000	nd	10	3.0	1.0	22	425	7.0	80	1.5	10.0	3.5	10	800	40	0.5	0.40	12	5000	15.0	50	70	85	28	11	1.5	4.0	280	0.5	0.5	10	0.5	1.0	8.0	80	30	40	250	350
Statistics:																																									
Mean + 2 std dev:	0.57	276	0.034	5491	nd	10	2.2	1.2	24	279	4.6	51	1.0	10.8	2.9	6.5	725	25	0.3	0.22	9.0	2000	9.3	52	84	55	17	6.9	1.3	6.7	200	0.6	0.4	6.8	0.4	0.9	5.8	83	23	23	193	201
Mean + 3 std dev:	0.83	383	0.049	7999	nd	15	2.7	1.7	33	346	6.0	71	1.4	14.9	3.9	8.6	1048	33	0.5	0.30	12	3316	12.2	69	120	71	23	9.2	1.9	8.8	257	0.7	0.5	9.0	0.5	1.1	7.9	112	33	30	269	261
Median + 3 std dev:	0.79	341	0.047	7557	nd	14	2.5	1.5	30	343	5.6	64	1.3	13.6	3.6	7.5	990	30	0.4	0.27	11	2865	10.8	65	110	63	21	8.3	1.8	7.5	242	0.7	0.5	8.3	0.5	1.1	7.4	97	30	28	243	237

Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.10	250	0.250	2500	3.5	2.0	3.0	0.5	12	375	12	50	2.0	8.0	6.0	30	5000	160	1.2	0.20	25	4000	80.0	30	60	360	25	12	1.2	14	1100	4.0	3.0	40	1.2	2.0	12	200	10	100	140	850
Statistics:																																									
Mean + 2 std dev:	0.19	219	0.185	1693	4.8	6.7	1.7	0.3	11	264	8.2	167	1.7	5.6	4.6	16	9800	110	0.8	0.14	17	3100	61.3	23	66	265	85	8.3	1.2	9.1	609	2.3	5.8	27	0.7	1.5	8.9	121	7.0	59	90	624
Mean + 3 std dev:	0.28	306	0.268	2221	5.9	9.7	2.1	0.5	14	336	11	243	2.1	7.4	6.1	20	14351	139	1.1	0.19	23	40707	81.0	28	91	330	124	11	1.7	12	804	3.0	8.5	34	0.9	2.0	11	161	9.2	77	116	824
Median + 3 std dev:	0.27	276	0.252	2135	5.7	9.3	2.2	0.4	12	327	10	232	2.1	6.9	5.8	19	13739	131	1.0	0.17	21	38188	74.8	27	85	322	119	9.9	1.6	11	732	2.7	8.2	33	0.8	1.9	11	146	7.8	72	112	766

SILT SAMPLES

Pre-Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.20	45	0.006	1100	nd	0.9	4.0	1.0	16	200	15	60	2.0	5.0	6.0	40	400	170	0.9	0.2	4.0	20000	35	35	100	235	10	12	0.8	10	385	3.0	0.3	28	0.9	1.0	5.5	180	6.0	45	200	1100
Statistics:																																									
Mean + 2 std dev:	0.38	26	0.003	865	nd	0.6	3.3	0.9	12	127	10	54	1.6	3.8	4.3	22	677	101	0.6	0.1	6.6	18000	29	30	415	150	8.2	9.8	0.6	6	355	1.8	0.2	21	0.9	0.8	4.3	152	2.6	40	392	652
Mean + 3 std dev:	0.54	35	0.004	1071	nd	0.8	3.9	1.3	15	163	13	73	2.0	4.7	5.2	28	982	128	0.8	0.1	9.4	22448	36	35	609	188	12	12	0.7	8	413	2.1	0.3	26	1.1	0.9	5.2	195	3.4	49	558	818
Median + 3 std dev:	0.53	33	0.003	1080	nd	0.8	4.1	1.2	15	149	13	70	2.0	4.7	5.1	27	951	124	0.8	0.1	9.1	23237	35	35	592	183	11	12	0.7	7	417	2.0	0.3	26	1.0	0.9	5.2	186	3.1	49	541	777

Tertiary

	Ag	As	Au	Ba	Be	Bi	Br	Cd	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na	Nb	Ni	Pb	Rb	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	TiO_2	Tl	U	V	W	Y	Zn	Zr
Histograms:	0.40	40	0.010	1850	nd	0.9	8.0	0.5	24	110	12	65	2.5	9.0	6.5	30	350	240	1.0	0.2	4.0	30000	85	38	40	200	4.0	15	0.6	12	900	5.0	0.5	34	1.5	1.0	7.5	250	6.0	60	165	1100
Statistics:																																									
Mean + 2 std dev:	0.40	23	0.049	1267	nd	0.5	4.4	0.3	16	75	10	34	2.0	5.9	5.3	22	253	165	0.7	0.2	2.5	27000	54	27	54	174	3.0	10	0.4	9	600	2.3	0.3	25	1.3	0.8	5.4	210	3.8	43	112	775
Mean + 3 std dev:	0.56	31	0.072	1510	nd	0.7	5.7	0.3	19	94	12	45	2.4	7.4	6.4	27	351	208	0.8	0.2	3.2	30742	69	31	74	202	4.1	12	0.5	12	712	3.0	0.4	30	1.7	1.0	6.2	265	4.9	51	140	961
Median + 3 std dev:	0.54	29	0.069	1521	nd	0.6	5.7	0.3	18	86	11	43	2.4	7.2	6.2	26	330	197	0.8	0.2	3.0	30323	66	31	72	206	3.8	12	0.5	11	692	2.7	0.4	28	1.6	1.0	6.1	255	4.4	48	134	915

in float chips. For elements that can be expected to become enriched in mineralized rocks, the threshold values selected from examination of histograms or by the various statistics listed in table 6-5 should be higher in the float chips than in the GSC samples because of the biased nature of the float chip samples. This is generally true in table 6-5 as evidenced by the enrichment of float chip concentrations over GSC concentrations in the pre-Tertiary dataset for silver, arsenic, gold, barium, bismuth, cadmium, cobalt, chromium, copper, iron, mercury, manganese oxide, molybdenum, nickel, lead, antimony, tin, tellurium, thallium, uranium, tungsten, and zinc. This relationship of elemental enrichment in float chips over GSC samples in the Tertiary dataset holds for silver, arsenic, gold, barium, bismuth, cadmium, chromium, copper, iron, mercury, molybdenum, lead, antimony, selenium, tellurium, and thallium.

It is common practice to use the simple statistic of mean, median, or mode plus 2 or 3 standard deviations to represent the concentration above which a certain element is considered to be anomalous in a given sample; the median and mode are both better estimates of the central value of the background population when extreme outliers tend to skew the mean (a condition common to several elements in these datasets). Two standard deviations above a measure of the central value of the background population is then a point at which there is only a 5 percent chance that the sample belongs to the background population. At 3 standard deviations above the central value there is only a 1 percent chance that the sample belongs to the background population and a 99 percent chance that it is truly anomalous. These relationships are theoretically true for normal distributions of data. Geochemical data are not generally normally distributed (and most elements in the datasets being analyzed here are not), but the statistics are actually quite robust in the sense that some amount of deviation from normality does not invalidate this approach. To verify that the use of these statistics was valid in this project, the histogram of every element in every dataset was examined and a visual threshold was estimated before the statistics were calculated. The statistically derived and visually derived thresholds were then compared. In most cases the median plus 3 standard deviations statistic most closely matched the visual threshold and was selected as the preferred measure of threshold in this project.

Stream Silt Datasets. While float chip samples are pieces of rock that have worked their way into the stream drainages with little modification, stream silt particles are both rock fragments and individual minerals, sometimes coated with mineral salts and organic matter. Thus a sediment derived from a parent rock may, in some cases, bear little resemblance to the geochemistry of the parent due to weathering processes, and the geochemical signal from mineralization in the watershed may not be simply superimposed on background rock geochemistry. Further, the element distributions of the stream silt samples themselves can describe common or background ranges as opposed to uncommon, infrequent, anomalous values because there has been no bias in sampling as there was in the limonitic float chips. In the particular arid weathering environment of central Nevada, however, silt and fine sand represent mainly mechanically weathered material that is largely unchanged from its parent rock outcrop. Silt samples do not display the high-graded bias of float-chip samples and anomaly development is much more subdued. The comparison of silt sample data with GSC data to establish threshold values, however, is still considered to be valid. For the purpose of the NAFR mineral assessment, threshold values from GSC samples (table 6-5) were selected, with some modifications, for use with the silt samples.

6.2.2.3 Treatment of Stream Sediment Data

Anomaly maps for the major metals and for important indicator elements have been prepared and are presented in appendix D (figures D-1 through D-23). These maps show the location of all sediment samples used in the statistical computations. Samples are plotted on a base showing bedrock areas and a generalized drainage network. Anomalous values for the individual elements are shown by contrasting, larger symbols on each element map. Three threshold values are used to determine anomalous values for each element; a value for samples collected from areas of Tertiary rock outcrops, a value for samples collected from areas of pre-Tertiary rocks, and a value for samples collected from drainages sampling areas of mixed rock outcrops. Threshold values used for Tertiary and pre-Tertiary calculations were selected from tables 6-3 and 6-5 and the lower of these two values was selected for use with samples collected from areas of mixed rock outcrop. Throughout most of the project area, both a float-chip and a silt sample were collected at each sediment sample site. There are, however, significant parts of the NAFR that do not have this dual coverage. The Groom Range, sampled in 1985 as part of a separate project, has only silt and panned concentrate samples at each site; and drainages from parts of the Papoose, Pintwater, and Spotted Ranges have only silt samples at some sites. The method of defining anomalous values by contrasting sediment sample values to threshold values derived from the GSC sample set allows the same threshold value to be used for both float-chip and silt samples. These two sets are combined, with no distinction between them, on each element anomaly map. This technique effectively adds anomalous areas where both sample types were collected. Those areas where only silt samples are available suffer from the lower sensitivity of that method and anomalous areas may have been missed.

6.2.3 Mine Site Sampling

As part of the mine evaluation program, over 800 composite rock samples were collected at mines, prospects, and mineralized outcrops within the project area (figs. C-1 through C-9). These samples were collected to provide trace-element information on mineralization present at each site. Individual samples were high-graded from material found on old mine dumps (the best-looking mineralized material was collected for analysis) or collected from altered, discolored, or mineralized outcrops. All mine site samples were analyzed for 48 elements using geochemical analysis techniques described in the sections 6.2.1 and 6.2.2. Sample descriptions, locations, and analyses are listed in appendix C. Discussions of sample results are included in descriptions of individual mines and prospects in Section 7.3.

6.2.4 Quality Assurance Procedures

Methods outlined in the Quality Assurance Project Plan (appendix E) were used to validate the accuracy and precision of the sample data collected for the NAFR mineral inventory. These methods included the submission of standard reference materials at the onset of the project to assess the accuracy of data for each element determined from each laboratory. Data from control samples submitted throughout the project were monitored to assess laboratory precision. Sample numbers and tracking forms were carefully recorded and checked in the field and in the laboratory.

At the beginning of the program, a suite of standard reference materials (SDO-1, NBS-1a, G-2, BHVO-1, Goodsprings, Lead King, and Sampson) was submitted to each laboratory to evaluate laboratory accuracy. For each element, plots showing the correlation between reported values from the labs and the recommended values for the standard reference materials (fig. E-7) allows assessment of analytical accuracy. Also, inter-laboratory comparison plots were produced from analytical results of orientation samples, to help determine laboratory accuracy (fig. E-6).

Control samples have been included with each batch of field samples submitted to laboratories for geochemical analysis. Control samples were submitted, in sequence, at a frequency of one per approximately 25 samples and also at the beginning and end of each batch. Field samples and control samples were subjected to the same analytical procedures, from sample preparation to the final report. Four control samples were submitted: 1) CON-1, an unmineralized phyllite collected west of Pyramid Lake, Nevada; 2) CON-2, an unmineralized andesite sample collected south of Tracy power plant, Nevada; 3) Goodsprings, a mineralized polymetallic vein sample from the Goodsprings mining district in Clark County, Nevada; and 4) Sampson, a mineralized polymetallic vein sample from the Sampson Mine in the Gass Peak mining district in Clark County, Nevada. To avoid contamination, mineralized controls were usually submitted as the last samples in a batch.

To evaluate analytical precision, control sample results were monitored throughout the project. Concentrations for each element have been plotted against time as on figure E-6. This type of plot permits long term monitoring of changes in analytical precision.

For GSCN sampling, the control sample identifier and the assigned sample numbers were recorded on the field worksheets. For all other sample types, including mineralized, float-chip and sieved stream sediment samples, the control sample number and the assigned sample number were recorded in the laboratory. The number assigned to each sample in the field (e.g., GSCN-23, 117606, or 5282) follows the sample through all aspects of analysis.

All analytical data have been checked and are on file in databases at NBMG.

7.0 DESCRIPTION OF KNOWN MINERAL AND ENERGY RESOURCES

7.1 MINING AND PROSPECTING HISTORY

The portion of the Great Basin now contained within the boundaries of the NAFR study area was probably first entered by Euroamericans in the fall of 1849, when a group in 100 wagons left Salt Lake City headed for the California gold fields. Some of these travelers, later called the Death Valley Forty-Niners, passed through the northeastern part of the study area, breaking up into splinter groups of which at least two passed through the NAFR study area. One group passed by Groom Lake and another group of about 12 people camped at White Blotch Spring before proceeding south through Emigrant Valley, over Groom Pass and onto Yucca Flat, across the present-day Nevada Test Site, and on to Death Valley (Alvin MacLane, unpub. report, NBMG files). One member of this group kept a log book, which contains the first written account of passage through any part of the NAFR study area. These early emigrants had a strong desire to reach the gold country of California, and they apparently did little prospecting along the way, passing close to several mineralized areas within the present-day NAFR without noting any mineralization. A few years later, John C. Frémont's final expedition in 1853 traversed the study area from the Belted Range on the northeast, across Kawich Valley, over Trailer Pass on Cathedral Ridge, west between Cactus and Gold Flats, and finally camping at Stonewall Spring on the west edge of the study area (McLane, unpub. report, NBMG files). Frémont described the physiography of the land, and pronounced it totally uninhabited from Cedar City, Utah to the Sierra Nevada at the time of his passage, and again no mining activity was noted.

The discovery of the Comstock Lode in 1859 prompted waves of prospecting activity across the state of Nevada, resulting in mineral discoveries at several mining camps around the periphery of the present-day NAFR: Pahranagat in 1865, Tem Piute in 1865, and Reveille in 1866 (Lincoln, 1923; Tingley, 1992). Within the study area during this time period the first discoveries were made at the Groom Mine in 1864, followed by the organization of the Groom district in 1869 (Tschanz and Pampeyan, 1970). Late 19th century mining activity within the study area appears to have been confined to the eastern side of the NAFR area in the Groom district, and at the Southeastern district, discovered about 1870. Adjacent areas of Nye County were also prospected, as evidenced by claims located by Antonio Aguayo, in 1889 in the Oak Springs district (Nye County Recorder's office). Although the Wheeler Survey of 1869 bypassed the NAFR, a cursory geologic reconnaissance of part of the area was done in 1899 by Josiah Spurr, who traversed the northwest part of the study area by way of Stonewall Spring, Cactus Spring, and Stinking Spring, noting no mining activity in these areas at that time (Spurr, 1903).

Prospecting activity on the west side of the NAFR study area exploded following the discovery of the rich silver deposits at Tonopah in 1900 and gold at Goldfield in 1902. Some of the mines and prospects in the eastern Goldfield district now inside the NAFR boundary were first located in 1902-03. After the best ground had been staked in Goldfield and Tonopah, the overflow of gold-and-silver seekers spread east, where claims were staked on turquoise and gold discoveries near Cactus Peak, in the Cactus Springs district, and in the Antelope Springs district from 1901 through 1903. Prospectors fanned out across the ranges and playas to the east, northeast and southeast, staking claims on precious metal discoveries at Silverbow, Wellington, Trappmans, and Wilsons camps in 1904; at Gold Reed, Tolicha (Quartz Mountain) and Gold Crater in 1905; at Transvaal in 1906; and at Jamestown in 1907-08. Wherever the initial discovery was particularly rich, or well-promoted in Tonopah, Goldfield, or Beatty, a small rush of miners ensued, followed closely by purveyors of food, drink, lodging and supplies, forming a tent city mining camp of often hundreds of people in a short time. Most of these camps dwindled rapidly after a year or less to just the hard-core lessees who could pick out enough ore to pay their expenses, or sometimes to no remaining residents at all. Brief resurgence in populations of these camps followed new strikes of rich ore, as at Antelope Springs in 1911 and Tolicha in 1917. The Silverbow district was somewhat anomalous in producing ore steadily over most of the years from its discovery until closure of the range in 1942. The Cactus Range districts did not have a "boom" period, but rather the same workers who made the initial discoveries continued to prospect and develop for several decades, unsuccessfully attempting to secure the financial backing of major mining companies necessary for larger scale exploration and development of the properties. Meanwhile, in the southeastern part of the range, the Groom district enjoyed an early period of production of lead-silver-copper ore from 1869 to 1874, followed by a hiatus in production that lasted until 1915. With only a few short lapses, the Groom district produced ore steadily from that time through 1956.

There was a brief surge in small-scale prospecting activity throughout the study area in the early 1930s, when many unemployed workers left nearby towns to work claims in formerly abandoned mining camps. Local newspapers of the time reported individuals making "better than wages" hand-working old claims. With the increase in prospectors on the ground came an increase in reports of new discoveries in the 1930s: the mining camps of Mellan Mountain, Clarkdale, and Gold Range came into being, and there was minor production from older mining claims at Gold Crater, Tolicha, and Wilsons.

Much of the area within the current study area was included within the withdrawal for the Las Vegas Bombing and Gunnery Range in 1940. This withdrawal effectively curtailed much of the mining and prospecting activity in the area, although the increased wartime demand for metals boosted production in some districts, specifically Groom, Southeastern, and Gold Crater. Even after ownership reverted back to the former owners in 1946, however, exploration activity was stymied by the possibility of future withdrawals, with several large mining and exploration companies citing concern about future access as a reason not to undertake mining exploration or development activity within the proposed withdrawal area (NBMG files).

Mining and exploration activity since closure in the 1950s has been confined to districts peripheral to the NAFR, where drilling projects have been carried out by mining companies from the 1960s to present. Several of these programs have focused on areas with known mineralization such as Silverbow, Wagner, Don Dale, and Stonewall, and some on areas with little earlier prospecting activity, such as Reveille Valley.

7.1.1 Production

Production for mining districts within the NAFR study area is summarized in table 7-1. Most production figures have been compiled from USBM records for the years 1902-69, contained in NBMG files. These figures have been augmented by production data from unpublished reports in NBMG files and from newspaper articles where tonnage and grade or value of ore shipped were given. Reports of uncertain amounts of ore production, lacking estimated tonnage or grade or value were not used to compile these statistics. Because more ore was almost certainly produced in some districts than was recorded in the published or unpublished literature, the figures in table 7-1 represent minimum values for district production. Production from the Silverbow and Stonewall districts is total district production from mines located both inside and outside the boundaries of the Nellis study area. For most years, USBM production figures were reported as district totals not broken down into individual mine contributions, so it is not generally possible to attribute production to specific mines.

7.2 TYPES OF MINERAL DEPOSITS

7.2.1 Metallic Mineral Deposits (Deposit Models)

Mineral deposit models have been employed for thousands of years in the exploration for metallic resources. Early deposit models were empirical, based upon direct observation, placer gold in streams, native copper in gossans, the occurrence of visible gold in quartz veins, etc. With the increasing demand for metals that developed with rapid industrialization in Europe and North America in the 19th and early 20th centuries, geologists and mining engineers developed increasingly sophisticated models for metallic mineral deposits based not only on empirical observations, but incorporating genetic concepts as well. Many of the models developed during this period were summarized in the Lindgren Volume (Committee on the Lindgren Volume, 1933).

Advances in geochemistry, geophysics, and geologic concepts, including the development of plate tectonic theory, led to the development of a large number of new or revised mineral deposit models in the period 1960-90. Fluid inclusion techniques began to be increasingly employed during this period to determine the chemistry, pressure, and temperature of the fluids that deposited minerals in hydrothermal ore deposits. Gangue minerals have been almost universally employed in fluid inclusion studies because of the difficulty of studying inclusions in most sulfide minerals, most of which are opaque, or nearly so. Stable isotope studies of fluid inclusions in epithermal deposits and in quartz-sericite-pyrite alteration of porphyry systems led to the conclusion that the fluids that deposited metals were derived from meteoric water and that the metals were leached from the wall rocks of deposits by circulating meteoric water. This conclusion led to genetic models based upon the derivation of metals in epithermal and porphyry deposits by wall-rock leaching.

Geologic studies of porphyry and epithermal ore deposits by a number of authors (Sillitoe, 1972, 1973; Sillitoe and Bonham 1984; and many others) reinforced the concepts of earlier workers such as Lindgren, Graton, and Spurr, that these deposits were genetically related to magmas. Hedenquist and Lowenstern (1994) summarized the results of isotope, fluid inclusion, and geologic studies on the relation between magmas and ore deposits and concluded that magmas are a primary source of most of the metals in porphyry and epithermal ore deposits. These conclusions strongly influence the choice of appropriate ore deposit models for the Nellis Air Force Range mineral assessment.

The NAFR contains a thick sequence of Tertiary volcanic and hypabyssal intrusive rocks that intrude and overlie a basement composed of Paleozoic sedimentary rocks, including carbonate and clastic units deposited on a continental shelf (Ekren and others, 1971). Ore deposit models applicable to the NAFR must take into account both the rock types present in the area, the occurrence of known ore deposits on the range, and areas of hydrothermal alteration that may be related to metallic mineral deposits.

Mineral deposit models covering most metallic mineral deposits have been published by the U.S. Geological Survey in two bulletins (Cox and Singer, 1986; Bliss, 1992). Sillitoe and Bonham (1984) and Bonham (1986,

Table 7-1. Total production by district, Nellis Air Force Range.

District	Ore (tons)	Gold (oz)	Silver (oz)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Years Produced	Comments
Antelope Springs	328	157	54,024	275	454		1912-1917, 1926, 1939	
Cactus Springs	200	15	3,147				1909-1910, 1915-1916, 1920,1927, 1940-1941	
Clarkdale	316	160	398				1932-1933, 1936-1938, 1940	Under Bullfrog 1930s; Beatty,1940)
Gold Crater	188	82	2,722		4,500		1913, 1916, 1939, 1949, 1953	
Gold Reed	335	217	475				1910-1912, 1921, 1927, 1941	
Groom	34,484	45	145,279	72,421	10,425,430	39,100	1915-1918, 1922-1931, 1933-1938, 1942-1956	
Jamestown	1	4					1908	$78 per ton
Mellan	20	3	2				1936	Under Tonopah, 1935; Kawich, 1936
Oak Springs	26	10	667	3,832			1917, 1951	
Papoose	458	1	3,029	400	301,673			
Rainstorm	39	5	918	128	42,741		1933, 1951	Under Groom
Silverbow*	3,524	1,346	95,976				1906-1914, 1920-1923, 1929-1936, 1940-1947, 1955	
Southeastern	31		352	1,400	2,700		1940, 1947	Under Groom, 1947
Stonewall*	38	16	1,165				1910, 1915-1916	
Tolicha	991	1,345	2,409				1923, 1929-1936, 1940	
Trappmans	1	1	130				1908	
Wilsons	15		527	105	993		1933	
TOTAL	**40,995**	**3,407**	**311,220**	**78,561**	**10,778,491**	**39,100**		

*Some production for Silverbow and Stonewall districts may have come from mines outside NAFR. Production for all other districts came entirely from mines within NAFR.

1988) have published descriptive and genetic models relating to volcanic and porphyry-hosted ore deposits. Castor and Weiss (1992) discussed the epithermal precious metal deposit types present in the southwestern Nevada volcanic field. Hedenquist and Lowenstern (1994), in an article on the role of magmas in the formation of hydrothermal ore deposits, discussed the models applicable to porphyry-related and volcanic-hosted hydrothermal ore deposits.

Table 7-2. Form of deposit (modified after White and Hedenquist, 1995).

Low-sulfidation	High-sulfidation
Open-space veins dominant	Veins subordinate, ore in silica-rich bodies
Disseminated ore relatively minor	Disseminated ore common
Replacement ore minor	Replacement ore common
Stockwork ore common	Stockwork ore important at some deposits

Hydrothermal ore deposits and prospects in areas on and adjacent to NAFR belong to several general deposit classes: (1) Epithermal precious metal deposits, examples within the NAFR include the Goldfield (eastern part), Antelope Springs, Gold Reed, Mellan Mountain, Jamestown, Silverbow, Gold Crater, Clarkdale, Tolicha, Gold Range, and Wellington districts. (2) Sediment-hosted gold prospects in the Belted and Groom Ranges. (3) Epithermal manganese prospects in the South of Mud Lake area. (4) Hot-spring mercury deposits in the Transvaal district and the Kawich Range. (5) Polymetallic vein deposits in the Southeastern, Papoose, and Rainstorm districts. (6) Polymetallic replacement deposits in the Groom district. (7) Porphyry-related copper-molybdenum prospects, essentially confined to the Cactus Range. (8) Skarn tungsten prospects in the Oak Spring district.

7.2.1.1 Epithermal Precious Metal Deposits

Volcanic-hosted, epithermal precious metal deposits have been divided into two main deposit models by Bonham (1989), White and Hedinquist (1990, 1995), and Hedinquist and Lowenstern (1994). The two main models are high-sulfidation epithermal ore deposits and low-sulfidation epithermal ore deposits. High-sulfidation deposits are characterized by extensive areas of argillic and advanced argillic alteration related to acid-leaching associated with low-pH hydrothermal fluids, surrounded by areas of propylitic alteration. Low-sulfidation epithermal deposits are typically associated with propylitic alteration, and with quartz-carbonate deposition in main hydrothermal conduits. Adularia and sericite may occur with the quartz-carbonate veins.

The fluids that produce low-sulfidation deposits are reduced, are near-neutral pH, and contain hydrogen sulfide, carbon dioxide, and sodium chloride as principal species. The magmatic source in low-sulfidation systems is typically at greater depths than in high-sulfidation types, allowing for a greater degree of equilibration with wall rocks and, in many epithermal silver-gold deposits, is more silicic. In contrast, high-sulfidation fluids are derived from high temperature vapors emitted from an oxidized magmatic source that condense in near-surface meteoric water producing a hot (200-300°C), low pH fluid that leaches and reacts extensively with adjacent wall rock (White and Hedenquist, 1995).

Table 7-2 is modified after White and Hedenquist (1995); principal differences in this compilation are that stockwork style mineralization is more common in high-sulfidation deposits than in their table, for example, at Goldfield, Nevada and Pueblo Viejo in the Dominican Republic, and disseminated ore can be very important in low-sulfidation deposits, as at Round Mountain, Nevada.

Epithermal high and low-sulfidation gold-silver deposits can be further classified into Silver-rich (silver-gold), and gold-rich (gold-silver) and then further subdivided on their base-metal and trace element content as shown in table 7-3.

Table 7-3. Deposit classifications.

Low-Sulfidation				High-Sulfidation		
Ag-Au	Ag-Au	Au-Ag	Au-Ag	Au-Cu	Ag-Au	Ag-Au
High base metals	Low base metals, Sb, As	Low base metals, Sb, As	Low base metals, low Sb-As	High Sb-As-Bi	High base metals	Low base metals, Sb-As-Bi-Hg
Creede	Tonopah	Round Mtn.	Bullfrog	Goldfield, El Indio	Julcani	Paradise Peak

Table 7-4. Gangue and alteration mineralogy (modified from White and Hedenquist, 1995).

Mineral	Low-sulfidation Au-Ag	High-sulfidation Au-Ag
quartz	ubiquitous, abundant	ubiquitous, abundant
chalcedony	common, variable	common, variable
opal	rare, variable	common, variable
calcite	common, variable	absent, except as overprint
sericite-illite	common, abundant	sericite, common, illite, rare
Mn-carbonates	common, variable	absent, except as overprint
Mn-silicates	rare, variable	absent, except as overprint
adularia	common, variable	absent, except as overprint
kaolinite	rare except as overprint	common, abundant
alunite	absent except as overprint	common, variable
pyrophyllite	absent except as overprint	common, variable
diaspore-zunyite	absent except as overprint	common, minor
barite	common, minor	common, variable
smectite	common, variable	common, abundant

A third category of epithermal gold-silver deposits is associated with alkalic magmatism and has a distinct alteration and geochemical signature. Since there are no alkalic rocks on NAFR, this category of deposit will not be further described.

Table 7-4 lists the main gangue and alteration minerals in and adjacent to ore zones. Propylitic alteration is present in both deposit types and the mineralogy is essentially similar, except that disseminated pyrite is commonly more abundant in the propylitic halo of high-sulfidation deposits.

Table 7-5 lists the characteristics for distinguishing between the two types of epithermal gold-silver deposits.

7.2.1.2 Sediment-Hosted Gold Deposits

Sediment-hosted gold deposits, also known as Carlin-type deposits have been described by Percival and others (1988), Bagby and Berger (1985), and many others. The following summary is updated from Bonham (1986).

Carlin-type deposits are hydrothermal, disseminated-replacement gold deposits, characterized by a high gold-to-silver ratio and a geochemical association of gold, arsenic, antimony, mercury, and thallium. Tungsten, barium, fluorine, tellurium, and zinc are commonly present in anomalous amounts. Tin and bismuth are known to be present in several deposits and may be present in a number of others. Copper is present at the Genesis-Blue Star and Mike deposits on the Carlin trend. The preferred host rocks for high-grade disseminated ore are carbonaceous, silty, thin-bedded or laminated carbonate or carbonaceous, calcareous siltstone. Ore grade mineralization also occurs in intrusive rocks, skarn, argillite, siltstone, sandstone, chert and hornfels, typically as stockwork breccias.

Spatially associated with nearly all Carlin-type deposits are intrusive rocks ranging from diorite, lamprophyre, monzonite, granodiorite to quartz monzonite and quartz monzonite porphyry in composition and from dikes, sills, and plugs to stocks in form. The intrusive rocks are commonly altered and mineralized and, in some deposits, contain mineable orebodies. Silicified rocks, including massive jasperoid, are present in essentially all Carlin-type deposits. The jasperoids and silicified rocks, typically exhibit multiple periods of hydrothermal brecciation and silicification. Jasperoids may occur either capping the main ore horizon, within it, peripheral to it, or below it. In addition to silicification, alteration types include decalcification of carbonate rocks, argillization, and pyritization. Common alteration minerals, include quartz, illite, kaolinite, and chlorite. Sericite replacing biotite is present in a few altered intrusive rocks, as at Getchell.

Regional controls on the occurrence of Carlin-type deposits are major lineaments, such as the Carlin trend and the Eureka-Battle Mountain trend along which a number of deposits occur in a linear array. These trends are also the loci of intrusions and aeromagnetic anomalies. They are clearly deep-seated crustal penetrating flaws, which have localized both intrusions and hydrothermal fluids. The deposits also occur in anticlinal and domal structures related to Mesozoic folding. Mine-scale controls on ore deposition are high-angle faults that act as conduits for hydrothermal solutions and transect favorable lithologies, anticlinal folds, and the presence of tectonic, hydrothermal, and collapse breccias.

Table 7-5. Field characteristics for distinguishing epithermal types of Au-Ag deposits (modified from Sillitoe, 1993).

	Low-sulfidation	High-sulfidation
Genetically related volcanic rocks	Andesite-rhyodacite-rhyolite	Andesite-dacite
Alteration zone	commonly restricted and visually subtle	Areally extensive (several km^2) and visually prominent
Key proximal minerals	Sericite-illite ± adularia	Crystalline alunite
Quartz gangue	Quartz and/or chalcedony displaying cockade, crustification and carbonate-replacement textures, open-space filling, multiple episode vein breccias	Fine-grained, massive, mainly replacement origin, "vuggy silica," late, crosscutting, banded quartz-sulfide veins
Carbonate gangue	Common, frequently manganiferous	Absent
Other gangue	Barite and/or fluorite present locally	Barite common with ore, native sulfur commonly fills vugs
Sulfide abundance	1-20 but commonly <5 vol. %	10-90%, mainly fine-grained banded pyrite
Common sulfide minerals	sphalerite, galena, chalcopyrite, tetrahedrite, Ag sulfides and sulfosalts	Enargite, luzonite, covellite, chalcopyrite, bornite, sphalerite common, minor to locally common galena
Other metals typically present	Mo, Sb, As, Au, Ag, Se, Hg	Bi, Sb, Au, Ag, Sn, Te, Mo, W, Hg

The gold in Carlin-type deposits is typically submicroscopic and occurs in arsenic-rich rims, a few microns wide, coating pyrite in unoxidized ore (Arehart and others, 1993). Some gold may also occur on amorphous carbon grains and within sulfides. Visible gold is rare.

Sulfide minerals present in Carlin-type deposits include pyrite (2-3 percent), and widely varying amounts of stibnite, realgar, orpiment, and cinnabar. Base-metal sulfides are present in minor amounts and include sphalerite, galena, molybdenite, and chalcopyrite. Sphalerite, tellurobismuthite, proustite-pyrargyrite, and tetrahedrite-tennantite are present at the Meikle Mine (Volk and others, 1996) and may be more common than realized at other deposits. Several rare thallium minerals have been identified at the Carlin Mine (Radtke, 1985) and at a few other deposits. The principal hypogene sulfate mineral present in these deposits is barite, which is locally abundant, and typically late in the paragenetic sequence. Alunite is a common supergene sulfate. The amount of arsenic present in Carlin-type deposits varies widely. Arsenic sulfides are abundant at Getchell and the original Rabbit Creek Mine, but are sparse at Northumberland and Alligator Ridge.

A number of articles on Carlin-type deposits have emphasized their epithermal character and presumed shallow depth of formation (Radtke, 1985). Geologic evidence (Bonham, 1986) and, more recently, several fluid inclusion studies, (Kuhn, 1989; J. Cline, personal commun., 1994) indicate a minimum depth of formation of 1 km and possibly as much as 2 to 4 km for some deposits. Recent deep drilling along the Carlin trend has verified vertical continuity of gold mineralization over intervals in excess of 1 km. This clearly shows that the deposits were not formed at shallow depths and are not typical epithermal deposits.

The following attributes are exploration parameters for Carlin-type deposits:

1. Deposits generally occur in linear mineral belts or trends.
2. Intrusive rocks ranging from lamprophyres, diorite, granodiorite to granite, including porphyries, are present as small stocks, dikes, plugs, or sills, either in the deposit or nearby in the district.
3. Jasperoids are invariably present in or adjacent to ore grade mineralization.
4. Gold predominates over silver in abundance, and is nearly always submicroscopic. Gold is associated with arsenic, antimony, and mercury. Present in anomalous amounts in most deposits are fluorine, thallium, tungsten, tin, zinc, molybdenum, barium, bismuth, and tellurium.

5. There is no specific age of mineralization; known deposit ages in Nevada range from Mesozoic to middle Tertiary.
6. The deposits were not formed at shallow depths and have known vertical extents in excess of a km in some districts.
7. Hydrothermal, tectonic, and solution breccias are invariably present and can form excellent ore hosts. Thin-bedded, carbonaceous, carbonate rocks are the best hosts for high-grade, disseminated orebodies, but argillite, chert, sandstone and igneous rocks can host stockwork mineralization.
8. High-angle faults are the main conduits for the hydrothermal fluids that formed the ore deposits.
9. The main alteration types are silicification, decalcification and argillization.

7.2.1.3 Epithermal Manganese Deposits

Mosier (1986) described epithermal manganese mineralization as commonly occurring as veins and fracture fillings in volcanic rocks of varying composition. His model includes deposits having both manganese oxide and manganese carbonate (rhodochrosite) minerals, as well as calcite, quartz, chalcedony, barite, and zeolites.

A subtype of epithermal manganese mineralization is one in which manganese was apparently deposited originally as hypogene manganese oxide minerals, as in the Luis Lopez mining district southwest of Socorro, New Mexico (Farnham, 1961). There, mineralization consists of seams, fracture fillings, and veins of wad (a soft colloidal mixture of hydrous manganese oxides with clay and iron oxides) and(or) psilomelane with minor pyrolusite, milky chalcedony, calcite (both black and white), and quartz in massive and fractured rhyolite. The textures and physical setting indicate deposition at shallow depths, and in fact there may be a continuum with hot springs manganese deposits like those at Golconda, Nevada (Kerr, 1940).

Epithermal manganese deposits are reported to have anomalous amounts of manganese, iron, and phosphorus, and in some deposits one or more of the following: lead, silver, gold, copper, and tungsten (Mosier, 1986). However, they are not known to have been mined for these metals. Tungsten has been produced from hot spring manganese deposits (Kerr, 1940).

7.2.1.4 Hot-Spring Mercury Deposits

Deposits of cinnabar and native mercury within hydrothermally altered volcanic and volcanic-sedimentary rocks have been included in the "hot-spring mercury" descriptive model of Rytuba (1986). Deposits consisting of disseminated grains and fracture-coatings of cinnabar ± native mercury, are found in areas of shallow acid-sulfate alteration of the steam-heated type, associated with kaolinite, alunite, cristobalite, opal, iron oxides and native sulfur (e.g., Sulfur Bank, CA; Sulfur, NV), within hot-spring silica sinter formed at the paleosurface (e.g., Manhattan, CA), and with pyrite, zeolites, quartz, chlorite, and potassium feldspar below the water table of active and fossil geothermal systems.

7.2.1.5 Polymetallic Vein Deposits

Cox (in Cox and Singer, 1986) published a descriptive model for polymetallic veins. He relates polymetallic veins to felsic intrusion associated, quartz-carbonate veins containing gold-silver with associated copper, lead, and zinc. The veins occur in or adjacent to intrusions ranging from porphyries to equigranular in texture and from diorite to granite in composition. The veins may occur peripheral to porphyry copper-molybdenum deposits, within plutons or adjacent to plutons. The veins may contain electrum, sphalerite, galena, chalcopyrite, pyrite, arsenopyrite, tetrahedrite-tennantite, and silver sulfides and/or sulfosalts in a gangue of quartz and carbonate. The veins may exhibit mineral and metal zoning with an inner copper-gold zone sometimes with tungsten, zoning outward to copper-lead-zinc-silver ores then to lead-zinc-silver, and in some veins, to an outer antimony-arsenic-mercury zone. The veins are typically multiphase with crustiform, comb, and massive textures.

Associated alteration in igneous hosts includes narrow areas of sericitic and/or argillic alteration as vein envelopes, surrounded by a broad halo of propylitic alteration. The veins may be associated with polymetallic replacement deposits in areas where they intersect carbonate rocks. Ore controls are areas of enhanced permeability such as high-angle faults and breccias, and intrusive contacts. Polymetallic veins may be of any age, but in the Circum-Pacific most are Mesozoic or Tertiary.

7.2.1.6 Polymetallic Replacement Deposits

Morris (in Cox and Singer, 1986) described a model for polymetallic replacement deposits. The host rocks for polymetallic replacement deposits are chiefly limestone, dolomite or shale in the vicinity of porphyritic igneous intrusions, which can be copper-molybdenum porphyries. Mineralogy of polymetallic replacement deposits can be simple or complex ranging from deposits like Pioche, Nevada where the principal carbonate replacement orebodies contained pyrite, argentiferous galena, sphalerite and manganosiderite to districts like Tintic, Utah which is zoned around a porphyry copper-molybdenum system. At Tintic, the inner replacement bodies are copper-gold ores containing enargite, famatinite, tennantite, tetrahedrite, digenite, argentite and sphalerite. This is succeeded outward by a lead-silver zone containing galena, sphalerite, silver sulfosalts and tetrahedrite. In the outermost zone zinc-manganese ores are present consisting of sphalerite and rhodochrosite. The orebodies are typically surrounded by jasperoid containing barite.

Polymetallic replacement bodies may grade into base metal skarns, as in many of the Mexican manto deposits. Hydrothermal alteration in carbonate rocks is manifested by dolomitization of limestone, silicification (jasperoid), and sanding of carbonate rocks. Associated igneous rocks are argillized, propylitized, or sericitized. Orebodies are localized by faults, favorable beds, impermeable horizons such as shale beds, channels or caves, and by breccias of tectonic, hydrothermal or solution origin. Orebodies may be tabular (mantos), podlike, or form pipes. They are commonly stratiform and sometimes stratabound. Exploration criteria include geochemically anomalous jasperoid, and carbonate rocks in the vicinity of porphyritic igneous rocks.

7.2.1.7 Porphyry Copper-molybdenum and Calc-alkaline Molybdenum deposits

A number of models describe porphyry copper-molybdenum deposits including Lowell and Guilbert's (1970) classic paper based on deposits in Arizona and northern Mexico. Porphyry copper-molybdenum deposits, by definition, are associated with porphyritic intrusions. The deposits may occur in stockworks within the intrusions or in adjacent silicate wall rocks. In some districts where porphyries have been emplaced into carbonate wall rocks, the orebodies are dominantly in skarns or polymetallic replacement deposits.

The causative porphyries range in composition from diorite, to tonalite, syenite, granodiorite, monzonite, and quartz monzonite. The porphyry stocks are commonly cylindrical-shaped, are 1 to 2 km in diameter, and consist of several intrusive pulses closely related in space and time. The ore occurs both in quartz-sulfide stockworks and as disseminated sulfides in the porphyries. Early hypogene alteration, associated with the main copper-molybdenum stage consists of a central core of potassic alteration grading outward into a propylitic halo. This early hypogene alteration, related to magmatic fluids, may be overprinted by quartz-sericite-pyrite alteration dominated by meteoric water. The upper part of many porphyry systems, when preserved, typically exhibits advanced argillic alteration in silicate rocks.

Sulfides are dominantly pyrite, chalcopyrite, bornite, and molybdenite. Some deposits have enargite-luzonite. Magnetite is commonly present. Some porphyry deposits can be classified as porphyry copper-gold, because they contain >0.4 ppm gold, (Sillitoe, 1988). Gold is typically present as electrum, but occurs as a telluride in enargite-rich upper levels of porphyry systems. In addition to copper and molybdenum, geochemically anomalous elements in many, but not all porphyries, include gold, silver, bismuth, tellurium, zinc, lead, boron, selenium, strontium, rubidium, potassium, arsenic, and antimony. Some porphyries, particularly those with alkali-calcic or alkaline affinities, contain elevated levels of platinum group elements. Each intrusive pulse in a copper-molybdenum porphyry system contains its own metal budget. Late intrusive pulses tend to contain significantly less amounts of metals than earlier ones and can form the barren cores typical of many porphyry deposits. Hydrothermal breccia pipes are typical of many porphyries and may contain significant orebodies. Late stage diatremes are also present in many porphyries and are usually barren and cut out part of the earlier formed porphyry mineralization as at El Teniente in Chile where the Braden pipe cuts out the central portion of the orebody.

Calc-alkaline porphyry molybdenum deposits occur in granite or rhyolite porphyries. Their deposit characteristics are essentially as described above, except that molybdenite predominates over chalcopyrite in the quartz-sulfide stockwork veinlets that form the porphyry orebodies. Supergene copper enrichment may form copper orebodies in some deposits as at Hall in Nevada. This deposit type is also known as low fluorine porphyry molybdenum, because unlike Climax-type porphyry molybdenum deposits, the calcalkaline molybdenum porphyries do not contain highly elevated levels of fluorine. Mineralogy is relatively simple, pyrite and molybdenite predominate, lesser amounts of scheelite, chalcopyrite, and tetrahedrite may occur. Hypogene alteration is essentially the same as for porphyry copper-molybdenum, a central zone of potassic alteration enveloped by propylitic alteration. A late quartz-sericite-pyrite alteration may overprint the potassic and propylitic zones. as in the porphyry copper-molybdenum systems, the molybdenum porphyries are multi-pulse intrusions. Grades are lower than in Climax-type molybdenum porphyries, typically about 0.1 percent molybdenum, but tonnages are often higher; the Buckingham deposit in Nevada contains over 1 billion tons of 0.1 percent molybdenum.

7.2.1.8 Skarn Tungsten Deposits

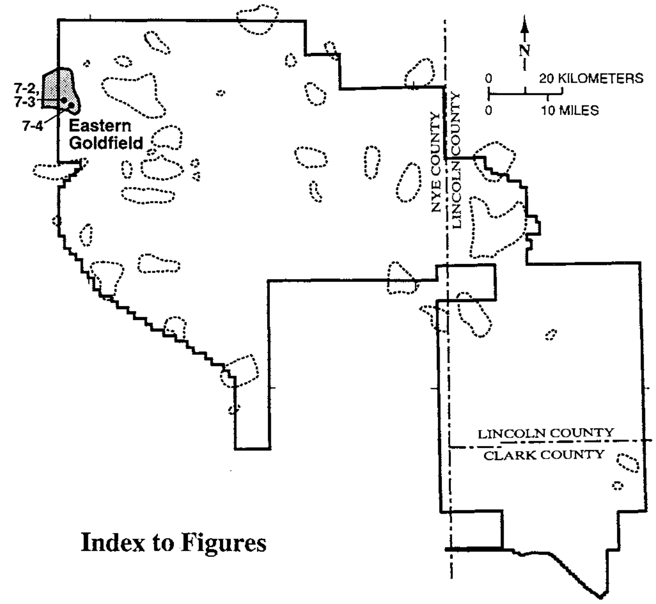
In the skarn tungsten deposit model described by Cox (in Cox and Singer 1986), the tungsten mineral scheelite occurs in calc-silicate contact metasomatic rocks. Rock types include tonalite granodiorite, quartz monzonite intrusive rocks, and carbonate or calcareous clastic wall rocks. Deposits form as irregular or tabular bodies in carbonate rocks or calcareous rocks near igneous contacts. Associated igneous rocks are commonly barren. Alteration is mainly silication; alteration minerals include diopside-hedenbergite plus grossular-andradite in a central zone, wollastonite with or without tremolite in an outer zone, and a peripheral marble zone. Igneous rocks may be altered to epidote-pyroxene-garnet endoskarn. Retrograde alteration to actinolite, chlorite, and clays may be present. Minerals present include scheelite, molybdenite, pyrrhotite, sphalerite, chalcopyrite and pyrite with traces of wolframite and fluorite. The geochemical signature of this type of deposit is tungsten, molybdenum, zinc, copper, tin, bismuth, beryllium, and arsenic in some combination. Favorable prospecting indications for these deposits include geochemical anomalies of tungsten along with one or more of the other listed elements and the presence of skarn minerals in carbonate rock near an intrusive contact. Important deposits of this type include the Nevada-Massachusetts, Getchell, and Tem Piute Mines in Nevada, the Pine Creek Mine in California, the Cantung Mine in Northwest Territories, Canada, and the Sang Dong deposit in Korea. The Climax Mine on the Nevada Test Site is the closest deposit of this type to the NAFR.

7.3 MINES, PROSPECTS, MINERAL OCCURRENCES, AND MINERALIZED AREAS

Prospecting and mining within the area now included within the Nellis Air Force Range (NAFR) began in the late 1860s and continued unrestricted to 1942 (Section 7.1). Evidence of this activity can be seen throughout the NAFR, but most mining took place in the northern part. All or parts of some 25 major mining districts and areas are within the NAFR, and 13 additional smaller areas of prospecting activity were defined during this investigation (fig. 7-1). Most of the larger areas have had mineral production. The smaller areas may consist of only a few concentrated prospects and have escaped notice in earlier studies.

Each of the areas shown on figure 7-1 is discussed in the following sections of the report and an estimate of mineral resource potential is made. Numerous maps and figures are included in this section but all sample descriptions and analyses have been placed in appendix C. The district and area descriptions are organized into logical geographic groups. Descriptions progress from the Goldfield Hills, on the northwest border of the NAFR, east to the Cactus Range-Cactus Flat area, south to Pahute Mesa and Yucca Mountain, then north to the Kawich, Belted, and Groom Ranges, and finally south through the Pintwater, Papoose, and Halfpint Ranges to end in the Spotted and Desert Ranges on the southeast border of the NAFR. The physiographic areas are shown on figure 3-1.

The discussion in each section generally follows the format of: location; history of discovery, exploration, and mining; geologic setting; mineral deposits; identified mineral resources; and mineral resource potential. In some sections, the additional headings of previous investigations, present investigation, and geochemistry are used. In other sections, the headings of geologic setting and mineral deposits are combined.



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7.3.1 Goldfield Hills

7.3.1.1 Eastern Goldfield District

Location

The area described as the eastern Goldfield district consists of that portion of the Goldfield mining district that lies east of the boundary of the NAFR on the east flank of the Goldfield Hills. The area is bounded on the east by the alluvial margin of northern Stonewall Flat. The western boundary is entirely arbitrary, defined for the purposes of this study. The main part of the Goldfield district lies east and northeast of the town.

History of Discovery, Exploration, and Mining

Gold was discovered in the Goldfield district in 1902, the first and most valuable of the new district discoveries which followed the discovery of Tonopah and the beginning of Nevada's second mining boom. The major lodes in the southwestern part of the main district were discovered in 1903, and production began late that year (Ashley, 1990). By 1906, most of the major mining operations were consolidated as the Goldfield Consolidated Mines Co., and rail connections were completed in 1905 and 1907. The peak district production came in 1910; most production was prior to World War I. During the 1930s, production included gold reprocessed from mill tailings (Ashley and Keith, 1976). Following that, the district was mostly inactive until the 1980s, when drilling outlined several areas of low-grade mineralization. Open-pit mining and heap-leaching of these low-grade, disseminated oxidized ores has been carried on for the last 15 years or so. Exploration continues in the district, especially in areas where deposits may be concealed by postmineralization cover.

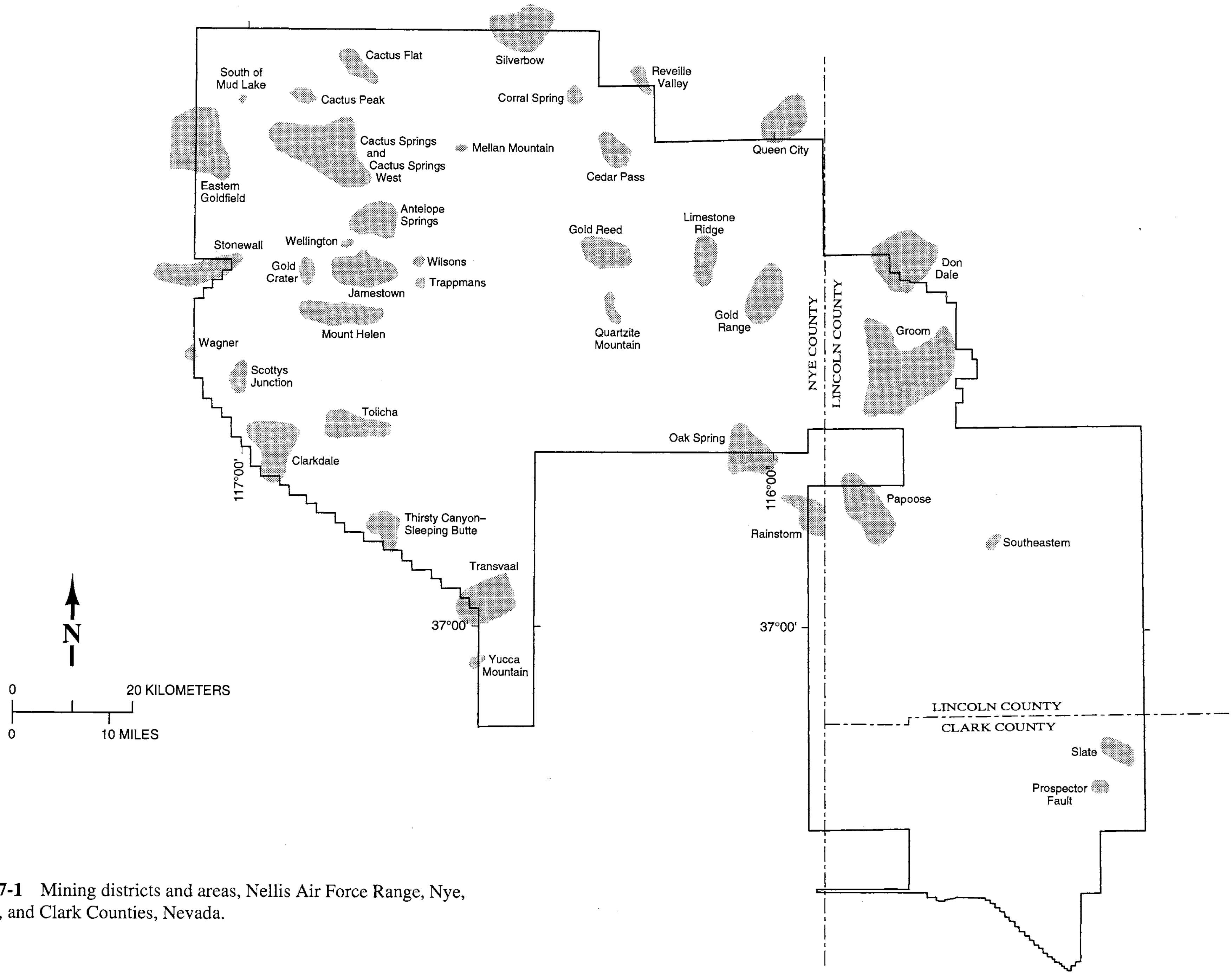


Figure 7-1 Mining districts and areas, Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

Exploration and mining activity in the eastern Goldfield district was apparently coincident with the activity in the main part of the district; as Kral (1951) stated, "Any mining area as important as Goldfield stimulates much interest." The considerable number of minor prospects in the eastern part of the district attests to this exploration interest. A number of mining claims in this area were surveyed for patent during the period 1906-16 (Mineral Survey Plats, BLM). Where appropriate, these claim names are used in the following descriptions and on individual sample sites. According to Mineral Survey Plats, Mineral Patents were actually granted for only two areas within or on the boundary of the eastern Goldfield district. One area, the Nancy Donaldson Group (patent no. 284077), lies across the general boundary of the NAFR (fig. 7-2); these patented claims were apparently excluded from the NAFR, based on the existing fenced boundary; also, taxes are being paid on the property by private owners (Nye County tax records). One other group of patented claims, the Revenue and Eclipse Lodes (patent no. 83152), deserves mention. The plat map of these claims show them to be mainly in the NW° and NE° of section 12, T3S, R44E. This legal land location is about 2.5 km east of the easternmost bedrock outcrops of the eastern Goldfield Hills and is entirely in alluvium of Stonewall Flat. The physical features displayed on the plat map of these claims do not match the section-township-range location given. It appears that the survey plat ties the claims to a section corner (SW corner, section 36, T2S, R44E) which should have been identified as the same section corner in T2S, R43E, that is, about 10 km to the east. This location is in an area of ridges and valleys similar to that displayed on the plat, and prospects are present as well. Thus, the patent plat for the Revenue and Eclipse claims most likely mislocates them; the actual location of the minerals in place that prompted the application for patent is near the center of section 12, T2S, R43E, west of the NAFR boundary, and thus outside the area of this study.

Although no record of production from the Nancy Donaldson Mine was found during the present investigation, The Goldfield News on Jan. 18, 1908 reported that the mine had produced ore "valued at thousands of dollars per ton" two years earlier. The amount of dump material and the probable depth of workings (about 35 m) suggest at least some lateral underground workings. Production was almost certainly minor. The gasoline-powered hoist for the mine (photo 7-1) was removed from the property in the 1960s and is preserved at the Central Nevada Historical Society Museum in Tonopah.

The mines in the vicinity of Quartz Mountain were active in the mid-1920s, being referred to as the Bell Claim group or Sailors' Mine (photo 7-2)(Weed, 1922, 1926). During this time the claims were held by a Los Angeles group of investors headed by A. I. Sailors. After Sailors' death in 1932, a 3-km pipeline was laid to the property (probably from a spring to the northwest) in anticipation of mill construction (photo 7-3). A foundation on the site is an indication that the mill was built, but it is unlikely that any appreciable amount of ore was processed, because no tailings from it were noted during this study. Several historical accounts mention the presence of free-milling gold, and one assay reported in the Goldfield News and Weekly Tribune (July 30, 1926) was 1.72 oz gold per ton and 0.92 oz silver per ton. Kral (1951) briefly mentions the Free Gold and Extension Group of claims in the area, reporting them to be owned at that time by O. J. Brincefield of Goldfield and Emil Perolaz of Reno.

Geologic Setting

Main Goldfield District

Because Goldfield was a quite significant gold mining camp with locally high grades, there are numerous published descriptions of the geology and major mines in the main district. Most of the significant Goldfield references are cited by Ashley (1974, 1990). However, reference to the easternmost part of the district is limited to brief descriptions of the Free Gold Mine (Kral, 1951; Smith and Tingley, 1983). Detailed unpublished geologic maps of this eastern area were obtained from Roger Ashley of the USGS (written commun., 1994); these were used during the study of the district, and form the basis of the generalized geologic map of the district (fig.7-3).

The Goldfield district has produced more than 4.2 million oz gold and 1.45 million oz silver, mostly before World War I (Ashley, 1990). Production of a few thousand ounces of gold per year has been reported for the 1990s (see Bonham and Hess, 1994), and continues today. Recent gold production is relatively low-grade (0.05-0.1 oz per ton) from open-pit, bulk-mineable material adjacent to or between high-grade lodes mined in the early part of this century. These ores are processed by heap-leach methods. Remaining reserves of a few hundred thousand ounces have been announced. Additionally, Kennecott Exploration has discovered gold mineralization in an area just north of the town of Goldfield that is covered by postmineral Siebert Tuff and Quaternary alluvium (their Gemfield project). This area, west of Columbia Mountain, was deemed prospectively interesting by Searls (1948) based on his interpretation of developments in the district in the 1920s as well as exploration in the 1940s. The mineralization is reported to be low-grade gold ores with erratic higher-grade zones in quartz-alunite altered volcanic rocks (Tingley, 1994).

The Goldfield district is an epithermal precious-metal deposit of the quartz-alunite type (sometimes referred to as high sulfidation or enargite-gold types (Berger, 1986). It is the largest deposit of this type in North America, and is commonly cited as a representative of the type. Gold-rich bonanza deposits were mined from an area of about 1.3 km^2 in a district having an area of surface exposures of altered rock of over 38 km^2 (Ashley, 1990). The gold orebodies occur in quartz-rich zones, commonly referred to as ledges, that occur within larger areas of advanced argillic alteration (quartz ± alunite ± kaolinite ± pyrophyllite ± sericite ± diaspore + leucoxene + pyrite). Phyllic, argillic, and propylitic alteration zones of lesser intensity are found around the advanced argillic alteration. The tabular ledges commonly follow faults or fractures (Ashley, 1990). The gold orebodies are associated spatially and temporally with a calc-alkaline volcanic center of early Miocene age. Flows, tuffs, and breccias of this center (commonly rhyodacites and andesites) overlap a small (about 6 km in diameter) caldera of Oligocene age (Ashley, 1990). The main area of gold mineralization is along the west margin of this caldera; deposits are hosted by both the Oligocene rocks that are cut by the caldera ring fracture, and by Miocene rocks that intrude or overlie it. The lower Miocene volcanic rocks range from about 22 to 20.5 Ma; hydrothermal alteration and mineralization took place at about 20.5 Ma (Ashley, 1990). The ore minerals in the main district are typical of this deposit type, and occur in irregular sheets and pipes in some of the silicified lodes. Many silicified lodes, however, are nonproductive, although they do not differ in appearance from the productive ones. Ore and gangue minerals include quartz, pyrite, famatinite, tetrahedrite-tennantite, bismuthinite, native gold, and local gold-silver tellurides. Minor chalcopyrite and sphalerite were reported, as well as sparse galena. Barite is found with gold at a few localities (Vikre, 1989). Gold fineness is high (greater than 980 for two samples examined) and the gold-to-silver ratios for most unoxidized ore mined in the district were about 3:1. Ore containing 100 or more oz gold per ton was not uncommon (Ashley, 1990). Thus, in contrast to many Nevada deposits of that time, silver was a by-product.

Fluid inclusion and isotopic studies indicate that the ores formed at relatively shallow depths from meteoric water at about 200 to 300°C. There is evidence for boiling of the solutions, and sulfur from pyrite in the ores had a magmatic source. The hydrothermal circulation system was likely a result of the release of SO_2-rich plumes of magmatic gas from the intermediate-composition igneous centers associated with mineralization (Ashley, 1990). The most likely source of the metals in high-sulfidation type deposits is magmatic fluid of the associated igneous rocks (see Hedenquist and Lowenstern, 1994).

The geochemical suite of associated metallic trace elements includes, in addition to gold, silver, copper, arsenic, antimony, bismuth, tin, tellurium, lead, zinc, mercury, and molybdenum (Ashley and Keith, 1976; Ashley, 1990). Ashley and Albers (1975) suggested that gold, silver, and lead are potentially useful as geochemical prospecting guides to ore in oxidized samples.

Eastern Goldfield District

Field work on the portion of the Goldfield district east of the NAFR boundary was conducted during the summers and falls of 1994 and 1995. Samples were collected from all significant mines and prospects in the study area, and a minor amount of geologic mapping was done in a small area that was not shown on published and unpublished geologic maps of the area provided by Roger Ashley (1975; written commun., 1994). Because the area is adjacent to a major mining district, it has been extensively prospected. Some prospects display so little significant hydrothermal alteration or mineralization that they were not sampled; however, most were examined in the field, at least if bedrock was exposed in them.

The major geologic units exposed in the eastern Goldfield district are briefly described in figure 7-3. About one-half of the pre-Quaternary (bedrock) outcrop area consists of rock units which are older than the alteration and mineralization in the main district (about 20.5 Ma). These rocks are predominantly intermediate in composition (rhyodacites and andesites), and are part of the calc-alkaline early Miocene rocks that are associated with mineralization. Based solely on potassium-argon ages of the unit, the Rhyolite of Wildhorse Spring should be considered a part of this premineralization group; however, it is not affected by the hydrothermal alteration of the main district (Ashley and Silberman, 1976), appears to overlie locally altered Milltown Andesite northeast of Tognoni Mountain, and is considered a postmineralization unit (Ashley and Silberman, 1976). The remaining bedrock units, constituting more than one-half the outcrops, are clearly post-main-stage Goldfield mineralization. Included in this younger group are the Meda Rhyolite, porphyritic latite, the rhyolite of Cactus Peak, and the Spearhead Member of the Stonewall Flat Tuff. Hydrothermal alteration and mineralization of the low-sulfidation type is found in these younger rocks in the northern part of the eastern Goldfield district.

Mineral Deposits

High-Sulfidation Deposits

Hydrothermal alteration associated with high-sulfidation epithermal deposits is commonly much more extensive than the areas of ore-grade mineralization, and is highly visible due to bleaching, silicification, iron-staining, etc. The surface expression of the altered area in the main Goldfield district is a donut-like feature shaped much like the letter "Q", having a long tail extending eastward toward the area of this study, the eastern Goldfield district (fig. 5-4; Ashley, 1990, fig. H3). This east-striking alteration zone ends at about the west boundary of the NAFR (near the area of the Table Mountain, Dahlonega, and Vistula claims of fig. 7-2),

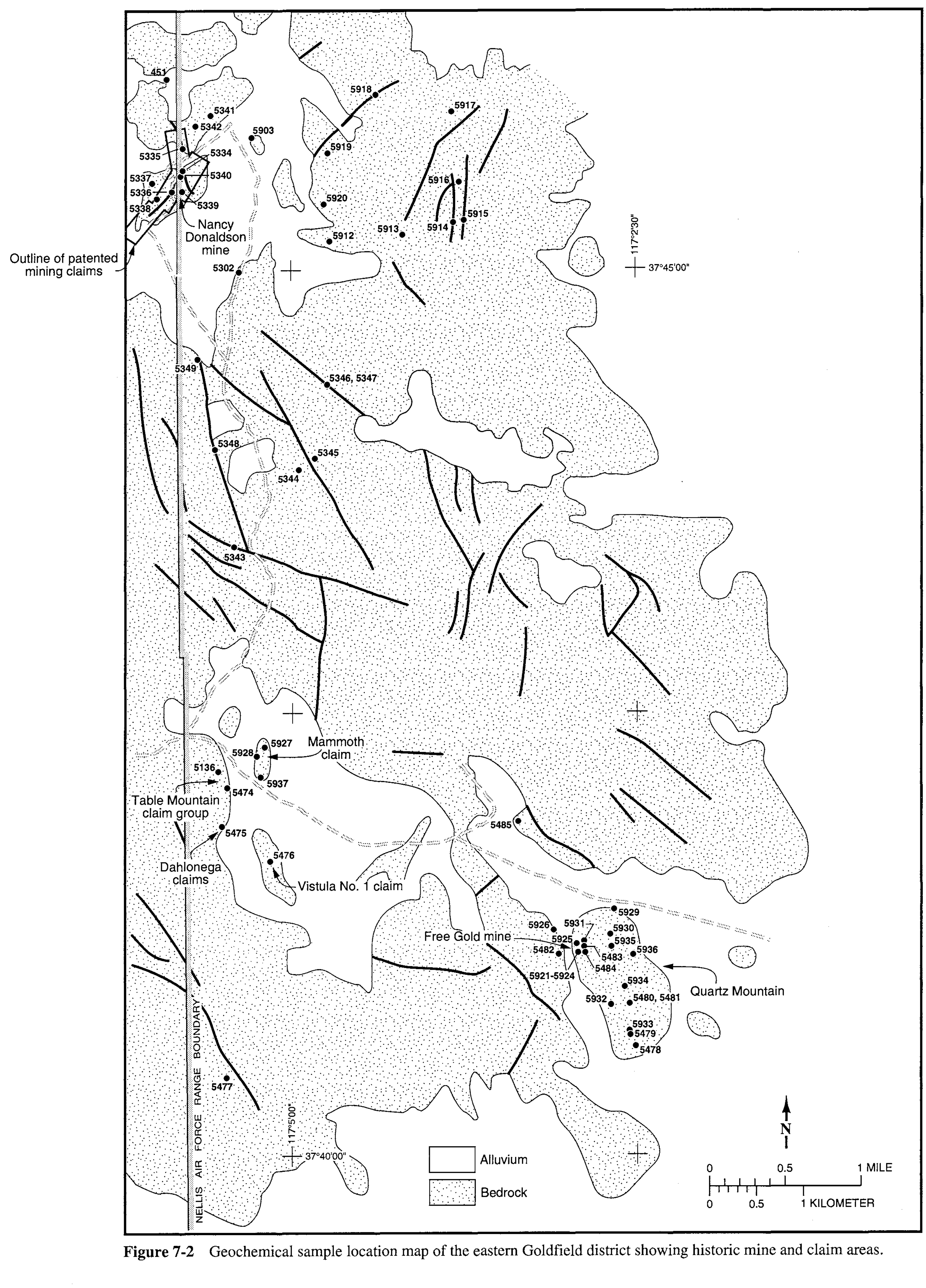
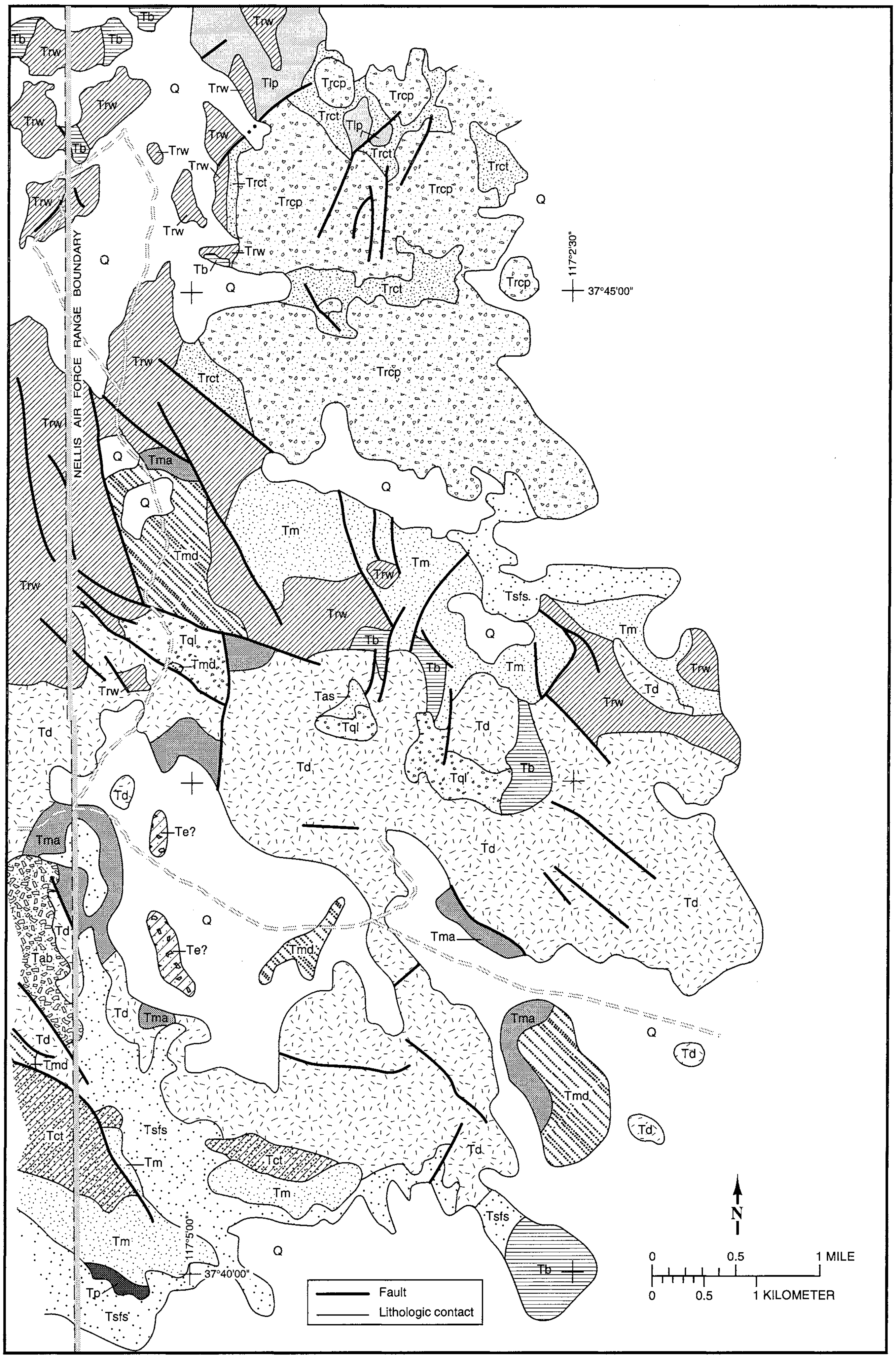


Figure 7-2 Geochemical sample location map of the eastern Goldfield district showing historic mine and claim areas.



Q **Alluvium, colluvium, and pediment gravel** Sand and gravel, locally bearing cobbles and boulders.

Tsfs **Spearhead member of the Stonewall Flat Tuff** Sodic rhyolite ash-flow tuff containing sanidine phenocrysts. 7.2 Ma; 7.6 Ma (Weiss and others, 1993).

Tp **Pozo Formation** Fluvial conglomerate.

Trcp **Rhyolite of Cactus Peak** Aphyric rhyolite flows and sparsely-phyric rhyolite flows bearing quartz and sanidine phenocrysts. Locally spherulitic; flow breccia common at base. 11.5 Ma.

Trct **Rhyolite of Cactus Peak** Rhyolite tuff and tuff breccia associated with rhyolite flows. Units Trcp and Trct are correlated with extensive exposures in the northern Cactus Range (Ekren and others, 1971).

Tlp **Porphyritic latite** One or more flows containing plagioclase, biotite, and sanidine phenocrysts.

Tb **Basalt of Blackcap Mountain** Aphanitic aluminous olivine basalt flows. Locally bedded scoria at base. K-Ar ages range from 10.7 to 13.2 Ma.

Tm **Meda Rhyolite** Rhyolite ash-flow tuff, moderately crystal rich, containing sanidine, quartz, and biotite phenocrysts. 18.3 Ma.

Trw **Rhyolite of Wildhorse Spring** Porphyritic rhyolite flows and flow breccias, locally vitrophyric near base. Phenocrysts include quartz, sanidine, and biotite; some flows also have plagioclase. 21.2 Ma.

Tab **Andesite megabreccia** Jumbled blocks derived from older andesite and rhyodacite units (Tma, Tmd and Tdb of Ashley, 1975). Probably represents landslide deposits.

Te(?) **Espina Breccia** Aphanitic, flow-banded spherulitic rhyolite intrusive(?). 22.6 Ma.

Tct **Tuff of Chispa Hills** Rhyodacite-quartz latite ash-flow tuff. Contains moderately abundant to abundant plagioclase, quartz, and biotite phenocrysts. 21.7 Ma.

Tql **Porphyritic quartz latite and quartz latite virtrophyre** Contains abundant quartz, plagioclase, biotite, sanidine, and hornblende phenocrysts.

Td **Porphyritic rhyodacite** Rhyodacite flows containing plagioclase phenocrysts and varying proportions of hornblende, biotite, and hypersthene phenocrysts. Some flows contain scattered corroded quartz phenocrysts. Forms flow dome complexes. 21.8 Ma.

Tas **Sedimentary rocks composed of Milltown Andesite (Tma) clasts** Fluvial sandstone and conglomerate.

Tma **Milltown Andesite** Flows and tuffs, including pyroxene-hornblende and pyroxene trachyandesite, pyroxene-hornblende and hornbende-biotite rhyodacite, and minor quartz latite and basalt. Finely porphyritic or aphanitic. 22.1 Ma.

Tmd **Porphyritic rhyodacite** Flow-banded rhyodacite containing abundant plagioclase, hornblende, and biotite phenocrysts, and scarce, large, rounded potassium feldspar phenocrysts.

Figure 7-3 Geologic map of the eastern Goldfield district. Geology simplified and slightly modified from Ashley (1975) and unpublished mapping by R. P. Ashey in 1971 (assisted by D. Foley), 1972, and 1974 (R.P. Ashley, written commun., 1994). Unit descriptions modified slightly from Ashley (1975, written commun., 1994); K-Ar ages are modified from Ashley and Silberman (1976) to reflect new constants (Steiger and Jager, 1977).

although spotty and mainly weaker alteration continues to the east. Stronger hydrothermal alteration is evident to the east at one location along this zone, however, at a hill that has been referred to as Quartz Mountain (Kral, 1951, p. 72) because of silicification over much of the hill. This alteration is indicated as a circular anomaly east of the tail of the "Q" on figure 5-4). This anomaly on the Landsat Thematic Mapper (TM) imagery reflects elevated amounts of minerals containing ferric iron or hydroxyl ions (e.g., clays and iron-oxide minerals; see Abrams and others, 1977).

As described previously, high-sulfidation mineralization typical of the main Goldfield district is found only in the southern part of the eastern Goldfield district, because pre-mineralization-age rocks are only exposed there. Significant alteration and mineralization seems to be confined to the two oldest units of the study area, Milltown andesite and porphyritic rhyodacite (units Tma and Tmd of fig. 7-3).

Hydrothermal alteration in the southwest part of the eastern Goldfield district (the area of the Table Mountain, Dahlonega, Vistula, and Mammoth claims of the early 1900s; see fig. 7-2) is predominantly argillic, with spotty silicification. Swelling clay minerals (smectite) are observed in some areas. Spotty, elongate ledge-like silicified areas have generally east-west strikes in the Table Mountain and Dahlonega areas; however, a north-striking ledge is present in the Mammoth area and may continue to the south the Vistula area (sample site 5476). Alunite is likely associated with areas of stronger silicification. Except for a minor amount of pyrite disseminated in the wall rock of dump sample 5476, no sulfide minerals were observed. It is likely that sulfides were oxidized below the level of exploration at most properties in this area. Selenite noted in argillized rock at one locality suggests that pyrite and/or other sulfide minerals have been oxidized near the surface. The mine workings in this altered area are generally shallow (3-30 m). Select dump samples were commonly collected to include the most strongly mineralized rock; even these samples do not have significant gold values. The workings are apparently rather typical exploration efforts on the periphery of Goldfield; it is quite unlikely that any appreciable production came from them.

Kral (1951) refers to a strongly silicified hill of volcanic rock in the eastern part of the Goldfield district as Quartz Mountain (figs. 7-2 and 7-4). The main property in this area is the Free Gold Mine (Free Gold and Extension Group). Kral's (1951) report of 1,800 feet (548 m)of workings in one adit and an additional 500 feet (152 m) of adits and shafts is somewhat high. The "Stope Adit" has about 175 feet (53 m) of workings, and a lower long adit has about 750 feet (229 m). Other horizontal workings at the Free Gold on the northwest flank of Quartz Mountain total less than 100 feet (30 m). Additionally, a shaft near the wash to the west of Quartz Mountain (site 5482) is likely 100 feet (30 m) or so deep and may have an equal amount of horizontal workings. Thus, a total of about 1,200 feet (365 m) of workings is more reasonable. Additionally, prospect pits and short adits are found at a number of places on the mountain; the most concentrated area of such workings is near its south end at an area of strong silicification, plus hematite and alunite alteration. One adit there is about 20 m long, and there are several other shorter horizontal workings.

R. P. Ashley (unpub. mapping, see fig. 7-3) has mapped Quartz Mountain as intermediate composition flows and intrusive rocks. Rocks over most of the mountain are silicified, argillized, and iron stained, and commonly only the sparse, relatively large, corroded quartz phenocrysts remain unchanged. Locally, hydrothermal fluids have produced a vuggy silica type of alteration (see Stoffregen, 1987) as well as local concentrations of alunite, hematite, and kaolinite. Two areas of silicification, vuggy silica alteration, and strong hematitization with alunite and kaolinite are present on the mountain (see fig. 7-4), a northern area at the Free Gold Mine and a southern, less extensive unnamed area. Silicification of the rocks of Quartz Mountain is essentially confined to the mountain and a small area near the Free Gold shaft at the northwest edge of the mountain. Relatively unaltered younger rhyodacite is present to the west, and to the north across an alluvium-covered area. Similar fresh rhyodacite is also present in small outcrops on the pediment to the east of the mountain. Only to the south is there an opportunity for altered rocks to extend for any appreciable distance under shallow alluvial cover and postmineralization rock units.

Mineralized faults at Quartz Mountain most commonly are north-striking, although shorter, less obvious easterly striking altered and mineralized structures are observed. At the Free Gold Mine, a stope underground is developed along a north-striking brecciated zone that appears, based on surface and subsurface information, to strike about N20°W and dip about 80°SW. At unnamed areas of workings near the south end of the mountain (sample sites 5479 and 5480) both north-striking high-angle faults and low-angle northwest-dipping faults are mineralized. The shaft near the wash in the Free Gold area (site 5482) may have been sunk to explore a fault and silicified zone; the fault has an attitude of N5°W, 55°E. Hydrothermal breccias are observed at the Free Gold Mine in and near the most mineralized areas.

Workings on Quartz Mountain are shallow, with the deepest shaft about 30 m deep. Probably all of the rocks observed on dumps and underground are from within the zone of oxidation. However, as described below, it is likely that pyrite was sparse to rare, and that the mineralization originally consisted of a largely pyrite-free suite including quartz + hematite + alunite + kaolinite ± jarosite ± barite. At the Free Gold Mine and elsewhere on the mountain, the strongest alteration is highly hematitic. In strongly silicified ore and

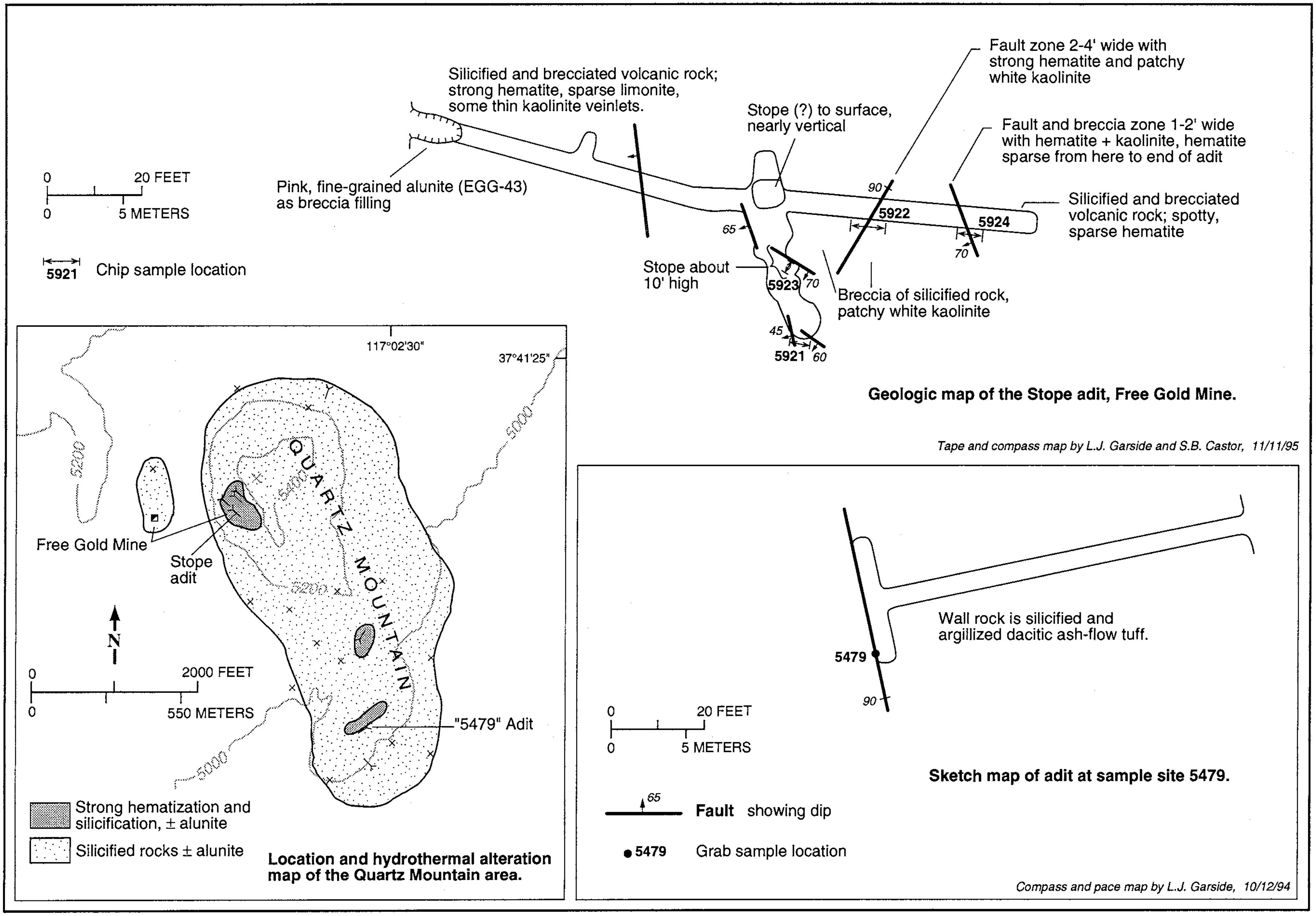


Figure 7-4 Underground maps and surface alteration map of the Quartz Mountain (Free Gold) area, eastern Goldfield mining district.

mineralized rock the hematite occurs as small (about 0.5 mm), black, iridescent to earthy rhombohedral crystals disseminated in light gray silica and white alunite. Kaolinite is also common, and barite is found locally in samples with higher gold values. Hematite is apparently locally oxidized to limonite; pseudomorphs of limonite after pyrite were not observed, and a few crystals of pyrite were noted only at site 5481. Finely crystalline alunite occurs as pink, white, and yellow replacements of feldspars phenocrysts and groundmass minerals and as 1 to3 cm wide veins. The veins are commonly fine-grained white, pure alunite having an indistinct coarse fibrous texture oriented perpendicular to the vein walls and a 1-3 mm selvage of red hematite at vein margins. At one locality on the northeast flank of Quartz Mountain (site 5935) small (about 0.5 mm) crystals of fluorite occur as drusy open-space coatings on hematized and kaolinized rhyodacite. Illite and a trace of gypsum were also found by X-ray diffraction methods in the sample, which was determined to contain 0.15 percent F.

Kral (1951) reported ore grades of about 0.5 oz of gold per ton from the Free Gold Mine. Select surface and dump samples collected during the early part of this study confirm this gold mineralization, but at lower values. Chip samples from underground in the Stope Adit at the Free Gold Mine (the main area of appreciable production) were highly anomalous (0.045 to 1 ppm) but are generally an order of magnitude less than the 0.5 oz gold per ton reported by Kral (1951). A select sample from a short adit nearby approached those levels (7 ppm or about 0.25 oz gold per ton). Samples from other minor prospects and hydrothermally altered areas on Quartz Mountain confirm that anomalous (but not ore grade) precious and indicator element values are widely distributed throughout the mountain.

The mineralization at Quartz Mountain is almost certainly part of the mineral deposition of the main Goldfield district, and is thus likely about 20.5 Ma, although no dating of alteration minerals was done during this study. The style of mineralization is, however, somewhat different, and is believed to represent largely sulfide-free mineralization characterized by hypogene quartz, hematite, alunite, kaolinite and barite. The presence of hematite instead of pyrite in the mineral association is an indication of highly oxidized hydrothermal solutions (Holland and Malinin, 1979). Such highly oxidized hypogene mineralization, where it has been described elsewhere, is believed to be shallower than the more typical sulfide-rich, enargite-gold veins. Siddeley and Araneda (1986) reported that barite-alunite ore at the El Tambo deposit (located about 5 km from El Indio, Chile) is observed to pass with depth (at about 75 m) to sulfide-bearing silicified enargite ore. Hypogene alunite-barite ore similar to that at the Free Gold Mine has also been reported at Summitville, Colorado (Stoffregen, 1987) and intergrown hypogene alunite and jarosite are reported from Preble Mountain in the main Goldfield district (Keith and others, 1980; see also Albino, 1994).

A considerable number of prospects are shown on the East of Goldfield 7.5-minute topographic map in the southern part of the eastern Goldfield district, mainly along the Goldfield-Cactus Spring road. These prospects are not included in the above descriptions of the Table Mountain-Dahlonega-Mammoth-Vistula area or the Free Gold Mine area. These scattered prospects were only sampled at two sites (5477 and 5485), although many were examined. Some prospects are in alluvium, some are in slightly bleached rhyodacite, some are not represented on the ground by any workings, and some are in slightly argillized rock. Many of the prospects are on the margins of outcrops of rhyodacite flow domes (unit Td, fig. 7-3). Hydrothermal alteration in this unit appears to be quite limited.

In geochemical samples from the southern part of the eastern Goldfield district, elements present in anomalous amounts are typical of epithermal quartz-alunite (high sulfidation) gold deposits, and particularly of the main Goldfield district. Anomalous values are sporadic because of the varied nature of the samples collected, from highly to only slightly mineralized. With that qualification in mind, many samples are slightly to strongly anomalous in gold, silver, arsenic, barium, bismuth, mercury, lead, antimony, and tellurium. Additionally, slightly anomalous values in copper and zinc are noted, and one or more samples are anomalous in tin, tungsten, selenium, thallium, or uranium.

Low-Sulfidation Deposits

A number of prospect pits and shallow workings (usually shafts) are found in rhyolitic rocks in the northern third of the eastern Goldfield district, north of Wildhorse Spring. Vertical workings are commonly a few meters to 10 m or so deep; the deepest are probably about 30 m deep. The most extensive localized group of workings is at the Nancy Donaldson Mine on the boundary of the NAFR (fig. 7-2).

Mineralization is mainly in rhyolitic pyroclastic and flow-dome rocks of the rhyolites of Wildhorse Spring or Cactus Peak (fig. 7-3). Banded vein material, commonly spotty, is present at most prospects, and consists of bluish white chalcedony, sacchroidal to commonly drusy or comb clear quartz, and white to cream massive or parallel bladed (lamellar) calcite. Quartz and chalcedony commonly display parallel or lattice bladed textures indicative of replacement of calcite. Calcite is apparently earlier in some veins, and sparse iron- and manganese-staining is noted. The veins range in width from a few centimeters to half a meter or more and are apparently oxidized below the level of exploration, but limonite boxworks after pyrite(?) were observed. Hydrothermal breccias occur at a number of properties. Wall-rock alteration includes silicification, sericitization, local development of smectite clay minerals, and adularization. A thin section from adjacent to the vein at the Nancy Donaldson Mine shows the following alteration minerals:

calcite, sericite after biotite, clay(?), limonite after pyrite, and patchy replacement of feldspar phenocrysts and groundmass by adularia. The veins and associated silicified zones of the northern area have northerly or northwesterly strikes, and are either near vertical or dip steeply west. A similar style of mineralization and strike of mineralized structures is noted at mine workings west of the NAFR boundary (e.g., sample 452 of Smith and Tingley, 1983).

The age of low-sulfidation type mineralization in the northeastern Goldfield Hills is unknown, but is apparently younger than the rhyolite of Cactus Peak (11.5 Ma), as veins cut that unit. However, only veins at the Nancy Donaldson Mine have significant amounts of precious metals and other trace elements, and those veins cut the rhyolite of Wildhorse Spring (21.2 Ma). Because the gangue minerals and vein textures at these essentially nonmineralized prospects are similar to those at the Nancy Donaldson Mine, it seems reasonable to consider all the veins as one period of mineralization. Using this reasoning, mineralization must be about 11.5 Ma or younger.

Twenty-six samples were collected from surface outcrops of veins and dumps at prospects in the northern third of the eastern Goldfield district (the Wildhorse Spring-Nancy Donaldson Mine area). A number of samples from the Nancy Donaldson Mine and immediately adjacent workings are strongly anomalous in silver and gold (silver being tens to hundreds of times more abundant than gold) and some samples are strongly anomalous in arsenic. These samples are also moderately anomalous in tungsten and weakly anomalous in barium. A few samples are weakly anomalous in lead and weakly or moderately anomalous in antimony; molybdenum and thallium may be considered anomalous in one or two samples. Beryllium is anomalous in one sample. Samples collected from near Wildhorse Spring and to the north and northeast of there have sporadic strongly anomalous mercury, and moderately to strongly anomalous arsenic; silver, barium, and possibly tungsten are also anomalous in some samples. All of the samples collected at minor prospects located in the hills about 1 to 3 km east of the Nancy Donaldson Mine were essentially non-anomalous in all trace elements. None of the samples from the area of low-sulfidation mineralization were anomalous in copper, zinc, bismuth, selenium, tellurium, or tin.

The trace-element geochemical signature of mineralized samples from the area is comparable to other low-sulfidation epithermal systems in the NAFR, for example the Mellan Mountain district. Such a suite of anomalous trace-elements (silver, gold, arsenic, mercury, antimony, ± barium, thallium, tungsten, and molybdenum) combined with high silver-to-gold ratios and low to non-anomalous base metals (e. g., copper, lead, zinc) are typical of certain low-sulfidation hydrothermal systems (White and Hedenquist, 1995), particularly the hot-spring gold-silver type (Berger, 1986) and probably the upper levels of silver-rich systems like Tonopah (see Bonham and Garside, 1982). In fact, a continuum may exist between such deposit types.

Surface indications of mineralization at the Nancy Donaldson Mine appear to be confined to the area of the patent claims. Based on geochemical sampling, the prospects and narrow veins found east of the Nancy Donaldson are not very prospectively interesting. Geochemical samples from prospects in the vicinity of Wildhorse Spring do have some indications of anomalous indicator elements, and thus have more prospective value. Possibly these prospects represent the more weakly mineralized periphery for an area of mines just west of the NAFR boundary (west of Wildhorse Spring). These mines were not examined during this study.

Identified Mineral Resources

There are no known identified mineral resources in the Eastern Goldfield district.

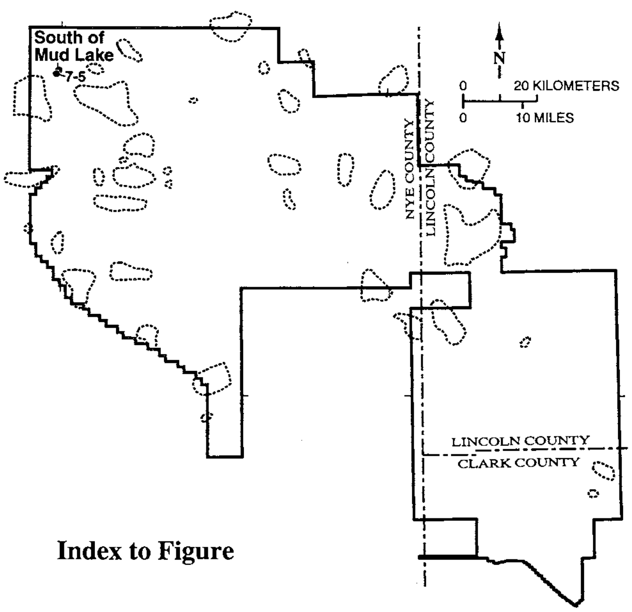
Mineral Resource Potential

Based on the above information, Quartz Mountain has a high potential for high-sulfidation type epithermal gold mineralization, certainty level C. There is high potential here for both high-grade lodes below the depth of present exploration and for shallower bulk-mineable deposits. Two areas of prospects and anomalous pathfinder-element geochemistry located adjacent to the NAFR boundary have moderate potential for precious-metal deposits, one area for high-sulfidation gold-silver and the other for low-sulfidation deposits. In both cases, bulk-mineable deposits are more likely. A certainty level of B is attached to these estimations.

<u>7.3.1.2 South of Mud Lake District</u>

Location

An area of several shafts and nearby prospects is located in an area of about 2.5 km^2 in volcanic hills to the southeast of Mud Lake. The hills can be considered the northeastern extension of the Goldfield Hills. The shafts and prospects (photo 7-4) are located in Sections 11 and 12 (protracted), T2S, R44E. The workings consist of several shallow shafts, less than 15 m deep, along a quartz-calcite-wad vein which trends N20°E to N50°E and varies in dip from vertical to 40° northwest. In addition to these workings along the vein, nearly a dozen other small pits are found in the surrounding area. Only the shafts are associated with vein mineralization; the remaining prospects shown on the Mud Lake South 7.5-minute topographic map are in talus, alluvium,



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rhyolite vitrophyre, or iron-stained and brecciated flow-banded rhyolite. The shafts are estimated to range from 3 to 15 m deep.

History of Discovery, Exploration, and Mining

No records were found of when or by whom the prospecting was done. Probably, the work was done during the period of the mining activity at Goldfield, in the early part of the twentieth century. There is no indication of any more recent activity. It is unlikely that there was any significant production from these workings.

Present Investigation

Field work in the area was mainly in the fall of 1995; two samples were collected from the area of the main workings in 1994.

Geologic Setting

The mineralized area is confined to a fault zone in flow-banded rhyolite and a small capping of rhyolitic pyroclastic rock (fig. 7-5). Prospects are found to the east of the fault (mainly at areas of minor iron staining) over an area about 1.5 km long in an east-west direction and 1 km wide. This area appears to be predominantly intrusive rhyolite, surrounded by outcrop areas which include more flows.

Mineral Deposits

The mineralized vein at the main workings consists of a wide zone (1-6 m) of very dark brown to black, crustiform and locally cockade material consisting of platy and lamellar dark and white calcite, bluish white chalcedony, porous manganese oxide (wad), and sparse drusy quartz and iron oxides. The only manganese oxide mineral identified (by X-ray diffraction analysis) is vernadite. The northeast-striking vein (about 600 m long) occurs in a wide fault breccia zone in flow-banded rhyolite; this wall rock is silicified and iron-stained adjacent to the vein (especially in the hanging wall), and iron-stained faults and fractures are common in the rhyolite over an area of about 2.5 km^2. If the altered and mineralized flow-banded rhyolite unit is a part of the 11.5 Ma (new constants) rhyolite of Cactus Peak, the mineralization is that age or younger. Silver was apparently the metal sought, as it occurs in amounts of 1 to nearly 2 oz per ton in select dump samples.

Calcite-silica-wad veins with textures indicative of shallow hydrothermal deposition are most likely of the epithermal manganese deposit type (Mosier, 1986). Manganese in such veins was probably deposited originally as oxide minerals, as in the Luis Lopez mining district southwest of Socorro, New Mexico (Farnham, 1961), which contains some of the best examples of such epithermal manganese veins. Vernadite is most commonly identified in deep-sea manganese nodules, although it has a structure similar to pyrolusite and often occurs in fine mixtures with cryptomelane. Workings on the vein are shallow and entirely in oxidized material; it is not known if vernadite is an oxidation product of other oxide or carbonate manganese minerals or if it is a hypogene phase. Thus, although it is possible to speculate on what the mineralogy of the vein may be deeper in the system (e.g., epithermal silver-gold with manganese-carbonates and silicates, and base-metal sulfides), there is little evidence available to support it.

In samples collected from the calcite-silica-manganese vein, manganese, silver, lead, and zinc are strongly anomalous, and copper, arsenic, and mercury are weakly anomalous. Gold is not anomalous, and trace elements in samples collected from minor prospects some distance (fig. 7-5) from the main vein are essentially not anomalous.

Identified Mineral Resources

There are no identified mineral resources in the South of Mud Lake district.

Mineral Resource Potential

The vein is too narrow to be considered for potential for manganese; a small area in the immediate vicinity of the mineralized vein has a moderate potential for silver in epithermal manganese mineralization, certainty level B. However, similar epithermal manganese veins elsewhere have not been mined for silver, and extraction of silver from manganese-rich ore may be difficult. The mineral potential for such deposits in the adjacent area is low, certainty level C.

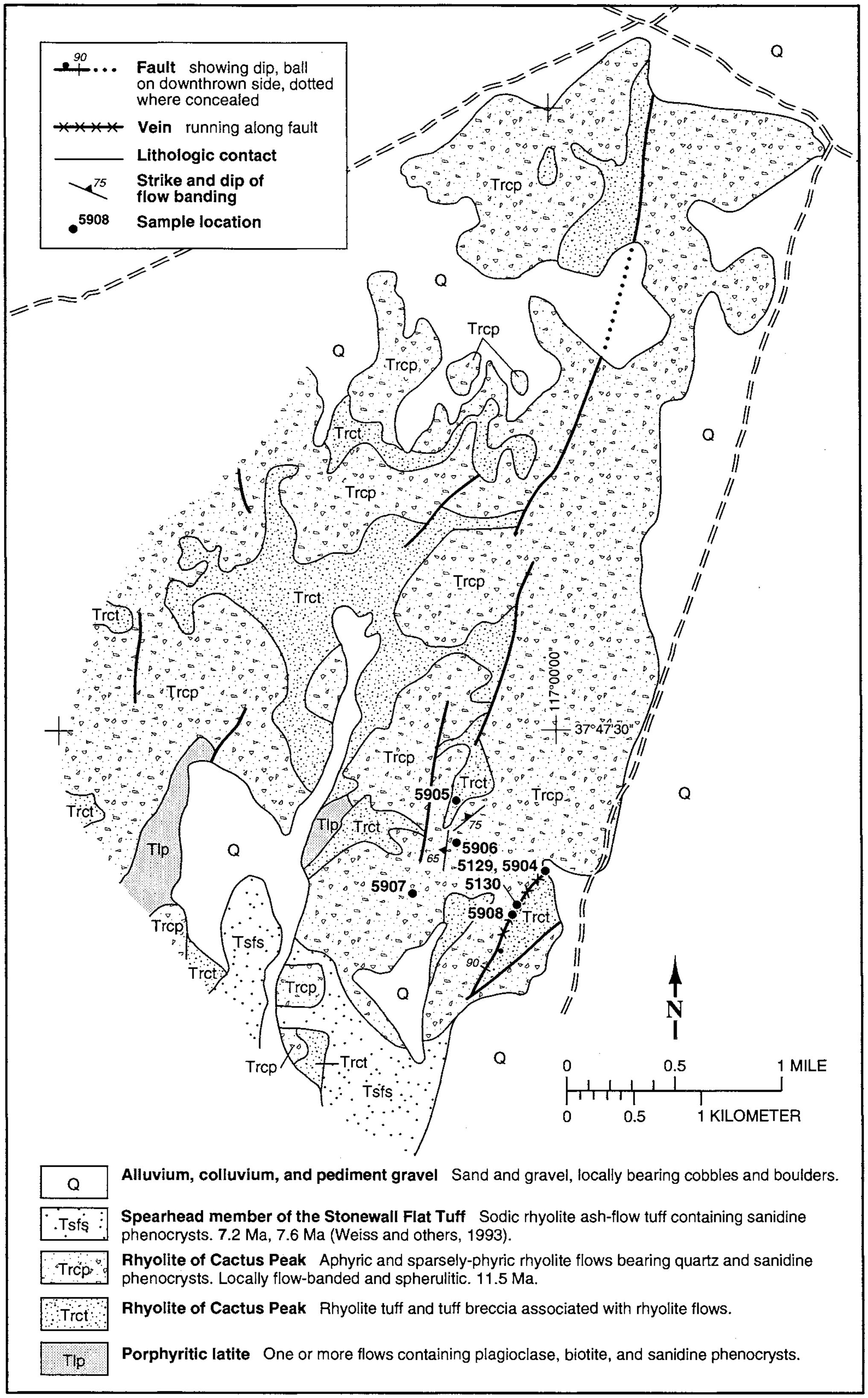


Figure 7-5 Geologic map of the South of Mud Lake mining area. Geology simplified from unpublished mapping by R. P. Ashley in 1971 (assisted by D. Foley), 1972, and 1974 (R. P. Ashley, written communication, 1994). Modifications and additional mapping by L. J. Garside, Sept. 1995. Unit descriptions modified slightly from Ashley (1975; written communication, 1994); K-Ar ages are modified from the original reference to reflect new constants (Steiger and Jager, 1977).

7.3.2 Cactus Range-Cactus Flat

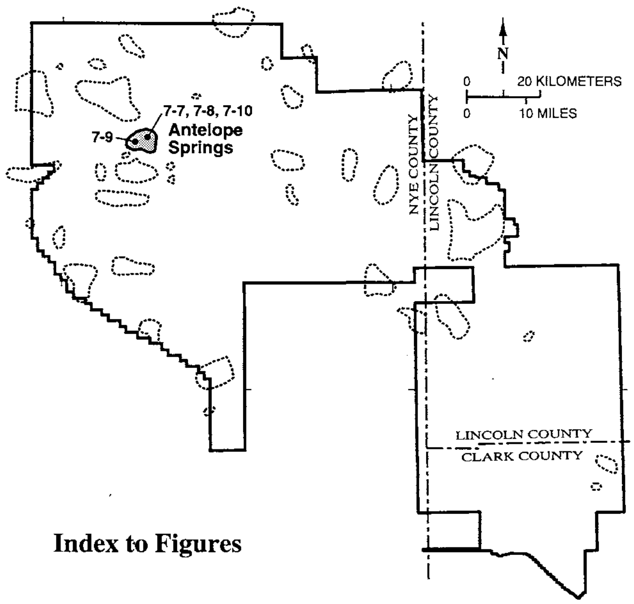
Historic mining districts and additional areas of potential mineral resources in the Cactus Range include the Cactus Springs, Antelope Springs, and Wellington districts and areas in the vicinity of Sleeping Column Canyon (Cactus Springs, west area), southeast, south, and southwest west of Urania Peak, and west of Antelope Peak. Discoveries of silver at Tonopah in 1901 and gold at Goldfield in 1902 attracted tremendous attention to the surrounding region and spurred mineral exploration in the Cactus Range. Turquoise was discovered in 1901 near Sleeping Column Canyon on the west flank of the range (fig. 7-6). Gold and silver-bearing quartz veins were discovered on the east flank of the range near Antelope Springs in 1903, and near Cactus Springs in 1904 (Hall, 1981). In 1905 work began at the Thompson claim group area between Sleeping Column Canyon and White Patch Draw (fig. 7-6). Minor production of silver-gold ores was recorded from these areas during the period of 1904-16. Intermittent mining activity and small amounts of production took place from the early 1920s through the middle 1930s, and included the excavation by Adolph Neher of about 1 km of exploratory workings in and near Urania Peak. The most recent recorded production consisted of 8 oz gold and 1852 oz silver shipped from the Cactus Springs district in 1940, and 1 oz gold and 14 oz silver produced at the Thompson Mine in 1941 (USBM records, NBMG files).

The bedrock geology of the Cactus Range is summarized below to provide a geological framework for the descriptions of the individual areas of mineralization and potential mineral resources, and for the application and evaluation of mineral deposit models in the estimation of resource potential. Much of the following summary is drawn from the unpublished geologic maps of the Cactus Range prepared by R. E. Anderson at a scale of 1:62,500 during 1962-67, which were incorporated in the 1:125,000-scale map and descriptions of Ekren and others (1971).

Most of the Cactus Range consists of thick sequences of rhyolitic ash-flow tuffs of late Oligocene and early Miocene age that are intruded by hypabyssal stocks, laccoliths, dikes, plugs, and flow-domes of intermediate and silicic compositions. The intrusions vary in composition and texture from inequigranular porphyritic diorite and lamprophyre to coarsely porphyritic quartz-monzonite, granite and rhyolite, aplite porphyry, and sparsely porphyritic rhyolite. Ekren and others (1971) assigned most of the ash-flow tuffs to the tuffs of Antelope Springs and the tuff of White Blotch Spring, which has been reassigned to the Pahranagat Formation (Best and others, 1993, 1995). Based mainly on thicknesses of the tuffs in excess of 1,000 m in the northern part of the range, and the local presence of large and abundant lithic fragments, Ekren and others (1971) regarded the Cactus Range as a likely volcanic center of the collapse-caldera type. The dikes and plugs have mainly east- and northwest-trending orientations; it remains unclear to what extent the intrusions may be related to a subcaldera magmatic system and the thick ash-flow deposits.

The tuffs of Antelope Springs and the Pahranagat Formation have been tilted as much as 90° in several localities, but the aphanitic, sparsely porphyritic rhyolite plugs and flow-domes assigned to the rhyolite of Cactus Peak have been tilted little, if at all, and apparently intrude and overlie earlier, coarsely porphyritic intrusions (Ekren and others, 1971). The major tilting of the ash-flow tuffs has been attributed to both regional extensional faulting, and to caldera collapse (Ekren and others, 1971). Bodies of the rhyolite of Cactus Peak in the central Cactus Range both crosscut, and locally are intruded by the aplitic to granitic intrusions (R. E. Anderson, unpub. mapping, 1962-1967; Ekren and others, 1971). This suggests that the dikes, plugs, and flow-domes of the rhyolite of Cactus Peak, though largely the youngest igneous rocks present, are temporally and probably genetically related to the aplitic to coarsely porphyritic intrusions.

Igneous and local sedimentary rocks in the Cactus Range have been affected by hydrothermal alteration over large areas. Ekren and others (1971) reported the presence of propylitic alteration assemblages characterized by variable amounts of quartz, albite, chlorite, sericite, calcite, epidote and pyrite. Field examinations, supplemented by optical microscopy and X-ray diffraction studies, indicate that additional types of alteration assemblages are present. These include 1) widespread sericite-pyrite alteration with little added quartz in the Thompson claim group area, White Patch Draw, and adjacent to quartz veins in the Fairday Mine of the Cactus Springs district, 2) zones of stockwork veins of granular quartz + pyrite ± muscovite, within ash-flow tuff and intrusive rocks that have been replaced by quartz and muscovite in the lower part of Sleeping Column Canyon, 3) resistant quartz-sericite-pyrite alteration with narrow quartz veins, largely within ash-flow tuff between Sleeping Column Canyon and White Patch Draw, 4) advanced argillic (acid-sulfate) alteration, including vuggy-silica textures, within many of the dikes, plugs and domes of the rhyolite of Cactus Peak and adjacent units of ash-flow tuff, from Roller Coaster Knob to Endless Draw, and 5) a large area of argillic alteration within ash-flow tuff and granitic intrusive rocks about 1.5 km southeast of Cactus Spring. Throughout the range, disseminated pyrite has been largely removed from near-surface rocks by weathering, but is ubiquitous in rocks from mine workings that penetrated below the level of oxidation. Tabular bodies of sandstone and conglomerate cemented by gossanous iron oxides (ferricrete) are present overlying altered bedrock and underlying Tertiary(?) and Quaternary alluvial deposits in numerous localities (photo 7-5). These deposits apparently formed from acidic runoff and/or shallow groundwater and provide fossil evidence for the weathering of large amounts of pyrite, particularly in the northern part of the range.



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7.3.2.1 Antelope Springs District

Location

The Antelope Springs mining district covers the southern tip of the Cactus Range (fig. 7-7), south of Antelope Peak. The major mines of the district are located south of Antelope Springs on the east side of the range (photo 7-6). Also included in the Antelope Springs district are scattered mines and prospects on the west side of the range in the area between the north end of the Wellington Hills and the main Cactus Range, and south of the range in the area known as Sulfide Well.

The mines on the east side of the present district have been included within an Antelope Springs district from the time of discovery in 1903 to the present although Schrader (1912) shortened the name to Antelope in his geologic report on the area. A small area surrounding Sulfide Well, on the old Goldfield Road at the southern tip of the Cactus Range, may once have been considered to be a separate district but it is now included within the main Antelope Springs district. Local newspaper accounts in 1914 mention a Blackthorn Camp located on the west side of the Cactus Range, west of Antelope Pass (NBMG mining district file 210). This settlement probably served the cluster of prospects located northeast of the Wellington Hills.

History of Discovery, Exploration, and Mining

Gold was discovered by the Bailey brothers of Cactus Springs near the site of the Antelope View Mine in 1903 (Hall, 1981). Other locations were made in 1906 but the district was fairly quiet until November 1911 when rich ore was found at the site of the original discovery. By January 1912, the district had been organized, two town sites were being developed, and about 150 men were at work on the Antelope View, Chloride, and Western Union claims. George Wingfield's Goldfield Consolidated Mines Co. had optioned the Antelope View property and there was talk of installing a mill in the district (Schrader, 1912). In 1912, 161 tons of ore are reported to have been shipped for a return of $21,526 (USGS, 1912). Most of the value of this shipment was in silver. Production by lessees continued into 1913, and a new gold strike at Blackthorn (Antelope Springs West) was reported in 1914 (NBMG file 210, press clippings). Lessees worked in the district up to about 1917 and small amounts of hand-sorted ore were shipped (USGS, 1913, 1916, 1917). Goldfield newspapers carry many accounts of mining activity at Antelope Springs through late 1929. Minor production was recorded from the district in 1926 (USBM 1926). In 1928, development work at the Antelope View Mine was underway, the shaft was reportedly being deepened from 230 feet (70 m) to 300 feet (90 m) and ore was being stockpiled. Development activity ended abruptly in 1929 due to lack of funds but the Mines Handbook in 1931 (Weed, 1931) still listed the Antelope View as an active mine employing three persons. The last production from the property was apparently in 1940 when about 5 tons of ore was mined from a pillar in the old mine for a return of about $50 a ton (unpub. report, NBMG files). The actual date of this may have been in 1939, however, as USBM records show production in 1939, not 1940. Hewett and others (1936) credited the Antelope Springs district with a total production of 338 tons ore yielding 113.63 oz gold, 43,380 oz silver, 627 pounds copper, and 26,750 pounds lead (not counting the small 1939 or 1940 production). Kral (1951) credited the Antelope View Mine with some $80,000 total production although there is no official record of that amount. There are no mill foundations or tailings present near the old mines, indicating that the vision of a mill in 1912 never came to pass. There is evidence, however, that ore was crushed at the mine site before being shipped elsewhere for treatment. Kral (1951) mentioned a small production (100 tons ore) from the Surprise Group of claims in the west portion of the district but he included the Surprise property in the Wellington district to the south.

Mines and prospects in the Antelope Springs district were examined and sampled in July and October 1994 and March 1995.

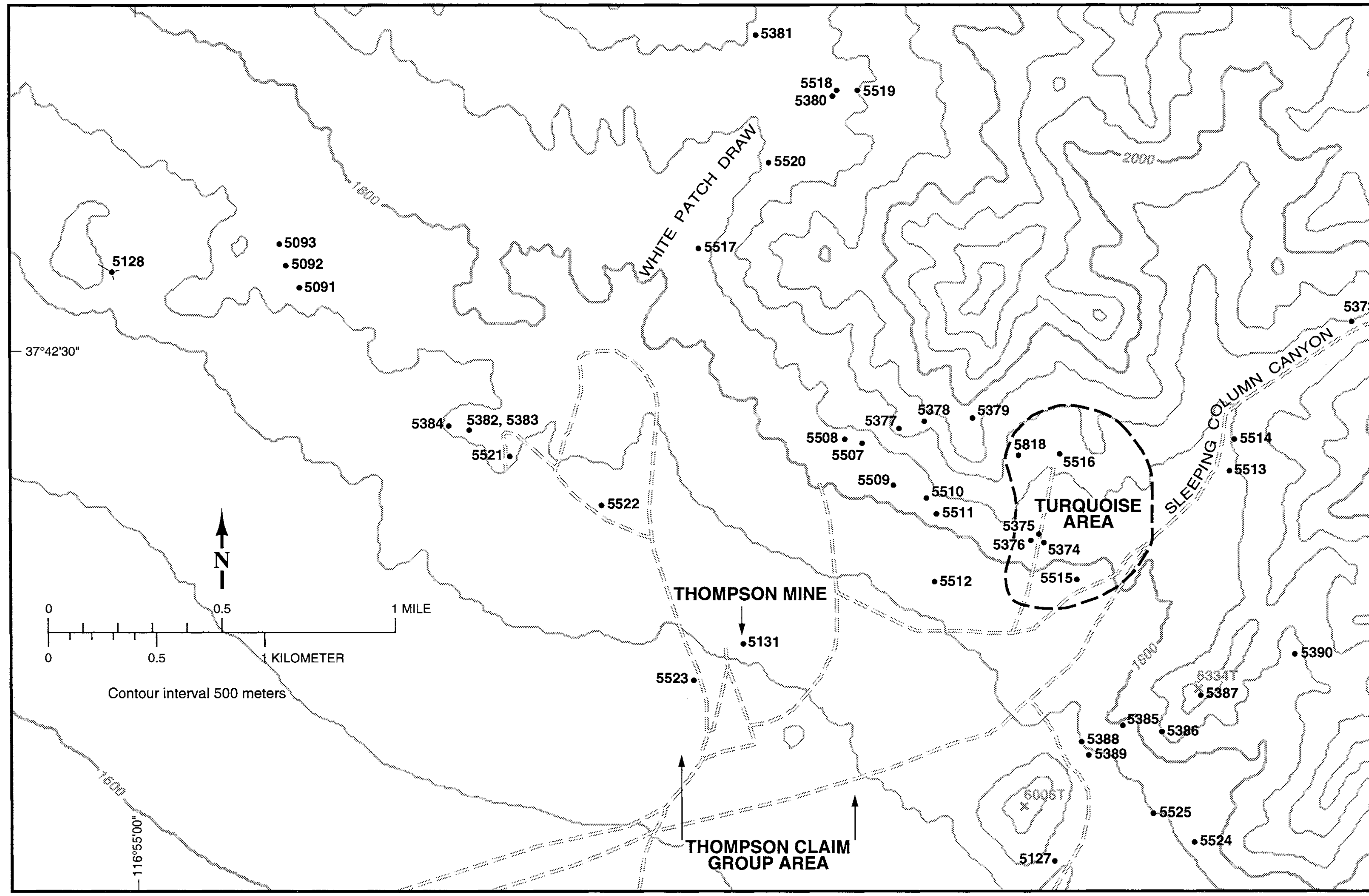


Figure 7-6 Map showing the locations of geochemical samples in the area of White Patch Draw and Sleeping Column Canyon, Cactus Range, Nevada.

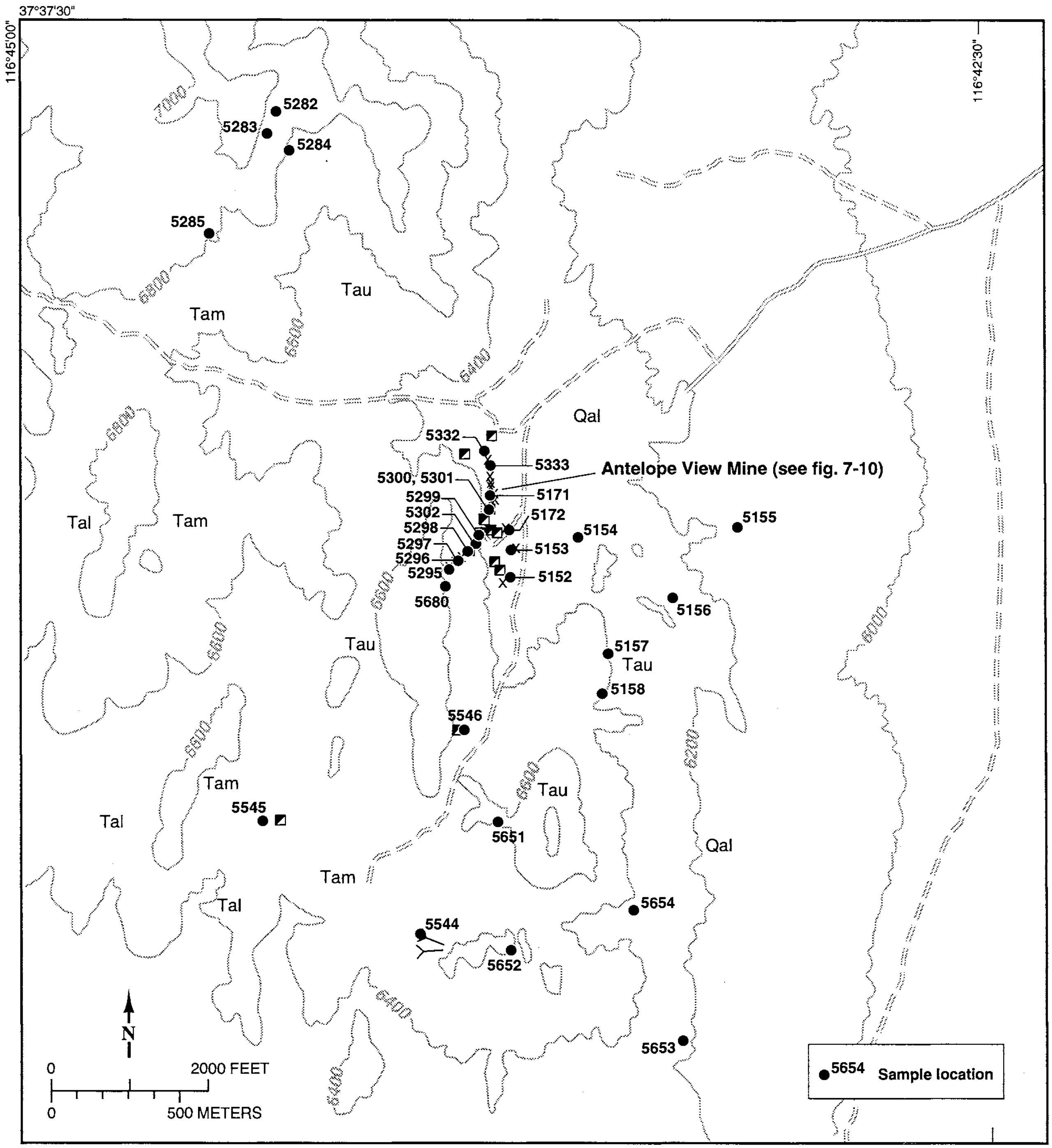


Figure 7-7 Sample location map of the Antelope View Mine area, Antelope Springs district.

Geologic Setting

The Antelope Springs district is underlain mainly by rhyolitic to rhyodacitic ash-flow tuffs. The oldest of these units, the late Oligocene Monotony Tuff, crops out in several areas in the western part of the Antelope Springs district. The Monotony Tuff is described by Ekren and others (1971) as a phenocryst-rich welded ash-flow tuff with an abundance of large quartz and biotite grains. In many areas, the Monotony Tuff is hydrothermally altered and mafic minerals have been partially replaced by chlorite, calcite, and iron oxide. Overlying the Monotony is a sequence of ash-flow tuffs called the tuff of Antelope Springs by Ekren and others (1971). Most of these rocks have been moderately to intensely altered by hydrothermal solutions and the primary minerals (except quartz, apatite, and zircon) have been modified or replaced in the altered rocks. The rocks are generally drab, and many have greenish colors resulting from abundant secondary sericite, chlorite, and epidote (Ekren and others, 1971). The rocks are bleached to light gray, pink, or pale yellow adjacent to faults and intrusive masses where hydrothermal alteration has been intense. In the Antelope Springs district and adjacent parts of the Cactus Range, the tuff of Antelope Springs has been broadly divided into three members (lower, middle, and upper) based on the abundance of quartz and alkali feldspar and on color. On the east side of the district, in the vicinity of the Antelope View Mine, the tuffs dip generally east between 30° and 40° and are cut by north-, northwest-, and northeast-trending faults (fig. 7-8). The north-trending mineralized fault zone along which the Antelope View Mine workings are located dips about 30°W and displaces the upper part of the tuff of Antelope Springs at least 300 m down to the west (Ekren and others, 1971). The tuffs are propylitically altered throughout the area, and adjacent to ore-bearing veins they are either intensely silicified or argillized and are bleached to light greenish gray and light gray (Ekren and others, 1971). Schrader (1912) noted that the flows (tuffs) are crosscut by a prominent system of sheeting which dips 30°-60° W, about parallel with the mineralized fault planes. Locally, fissures and cracks associated with this sheeting contain small veins, ledges, and stringers of quartz.

The youngest tuff unit exposed in the Antelope Springs district is the tuff of White Blotch Spring (reassigned to the Pahranagat Formation), a sequence of quartz-rich welded tuffs that, in the northern Cactus Range, rests with major angular unconformity on the upper tuffs of Antelope Springs (Ekren and others, 1971). The rocks are intensely faulted and, except locally, are moderately to intensely hydrothermally altered.

West of Antelope Pass, in the west section of the district, silicified Paleozoic conglomerate, argillite, quartzite, and minor carbonate rocks crop out in the low foothills of the range. These rocks lie beneath the Monotony Tuff, the tuff of Antelope Springs, and the tuff of White Blotch Spring (Pahranagat Formation) and all are cut by intrusive bodies of dacite, rhyodacite, and porphyritic granodiorite (Ekren and others, 1971, R. E. Anderson, unpub. mapping, 1962-67) (fig. 7-9).

Mineral Deposits

Deposits in the eastern Antelope Springs district are low-sulfidation silver-gold veins with moderate to high base-metal content. The base-metal associations and the form and texture of some of the veins, notably the Antelope View vein, could also place these deposits in the polymetallic vein classification. Because these two classifications may represent different parts of a single mineralized system, with the polymetallic vein lying deeper in a low-sulfidation system, veins in the Antelope Springs district may be transitional between these two deposit types.

Silver-to-gold ratios in the Antelope Springs district are highly variable and range from about 10:1 to over 1,000:1 with ratios of about 1:1 found rarely. Schrader (1912), in a very general fashion, mapped about 20 veins in the district. Examination of the district found many of these veins to be narrow iron-oxide-stained fissures with no visible vein material present. Most of these veins were never explored beyond the hand prospecting stage. Only the Antelope View vein, and to a lesser extent the Chloride, Auriferous, and Mocking Bird veins have been prospected beyond the stage of shallow pits and cuts. Veins in the vicinity of the Antelope View Mine (fig. 7-8; photo 7-7) strike northwest to northeast but most follow a north-northeast trend; dips are mainly to the west, but some are vertical or are east-dipping. The veins are brecciated, vuggy, with open spaces occupied by clear, acicular quartz crystals. Most vein material is oxidized, and dumps and outcrops are stained with iron- and manganese-oxides. Green oxide-copper minerals are present in a few locations (photo 7-8) and pyrite, tetrahedrite, galena, sphalerite, and rare chalcopyrite are also present. Argentite may be present in high-grade ore.

Gold and silver occurs at the Antelope View Mine in a silicified, brecciated zone (Antelope View vein of Schrader, 1912), probably a fault breccia cutting a rhyolitic ash-flow tuff (Tuff of Antelope Springs). The zone strikes N12°E and dips 35°W into the hill (Schrader, 1912). The "vein" material consists of pyritic-limonitic, silicified breccia with white quartz and some sphalerite and galena. The ash-flow tuff is highly altered with the destruction of all mafic minerals. Feldspar has been replaced by sericite and some kaolinite. Two samples of altered wall rock, one collected from the hanging wall and one collected from the footwall of the vein zone exposed at the collar of the main Antelope

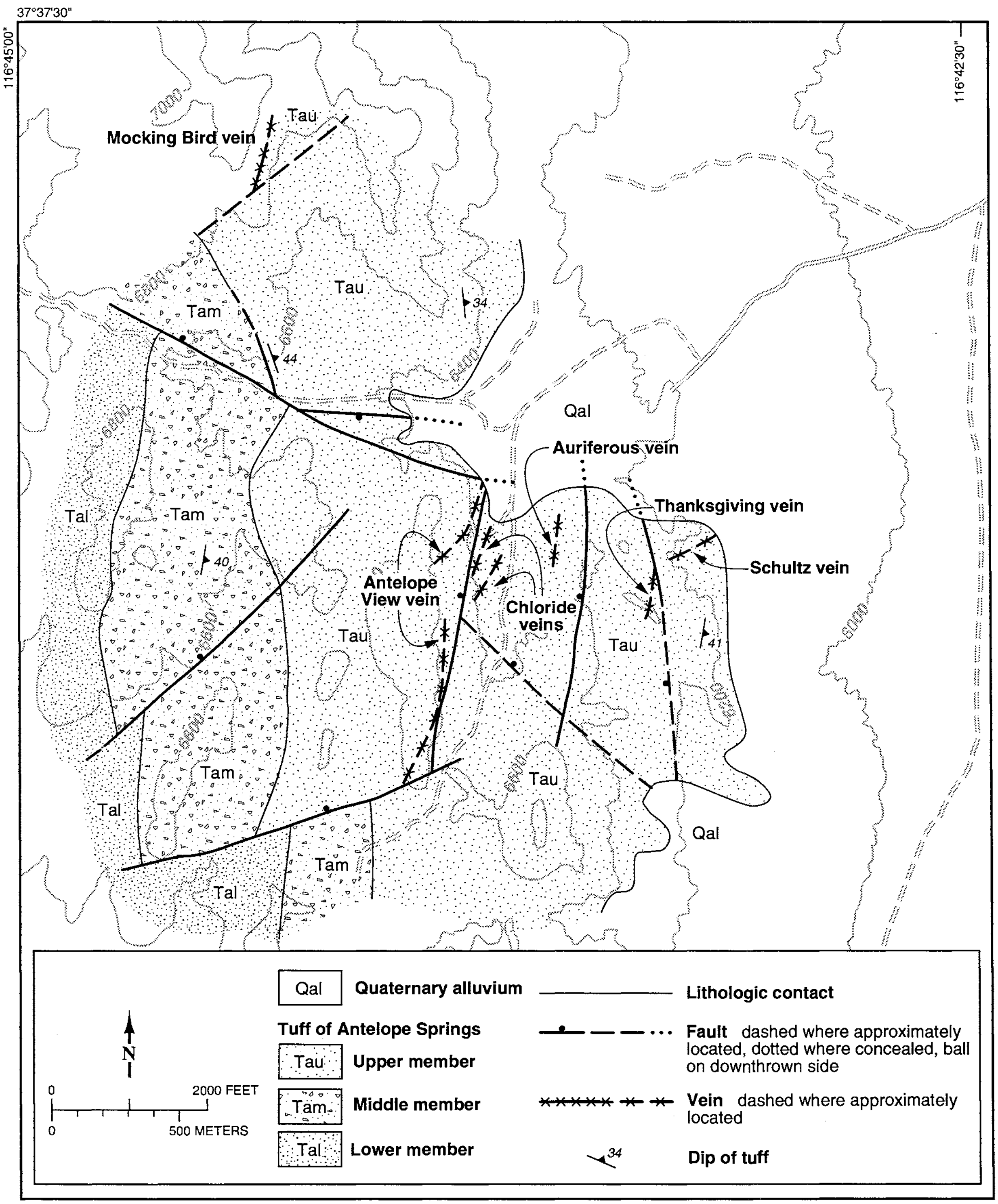


Figure 7-8 Generalized geologic map of the Antelope View Mine area, Antelope Springs district (geology modified after Anderson, 1962-67) .

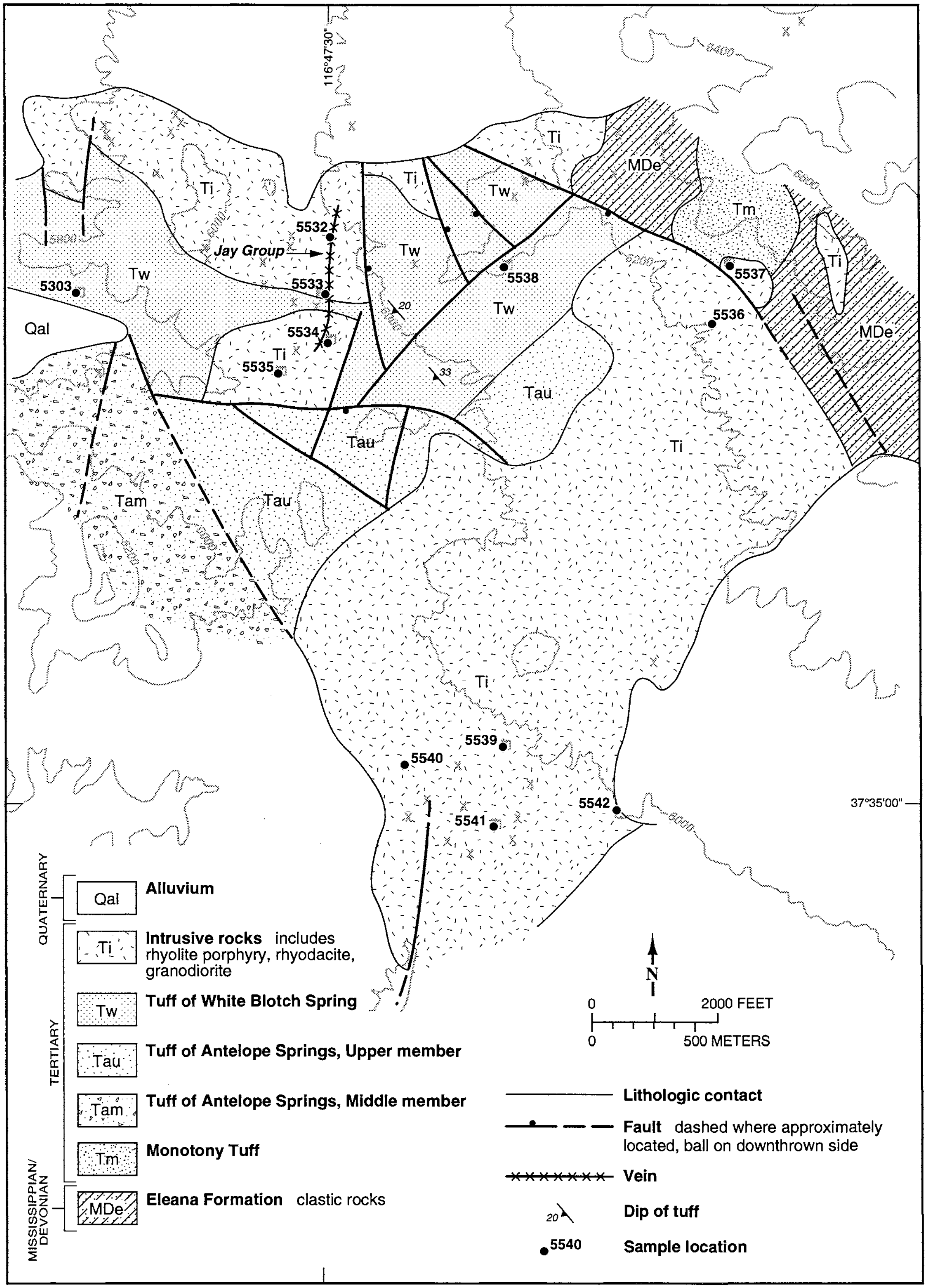


Figure 7-9 Generalized geologic map of the Antelope Springs West area, Antelope Springs district (geology modified after Anderson, 1962-67.

View decline showed quartz-sericite alteration in both with no discernible difference between the two. The vein is shattered along its entire extent and is at most 1-m thick, locally only 0.5 m. This agrees with old reports on the property that indicate "the ore was spotty and occurred in a 2- to 7-foot (0.7-to 2.1-m) wide band in the hanging wall portion of the silicified vein." The early operators had hopes for higher-grade, secondary-enrichment zones, but sulfides were found at the water table at about 50 m with no increase in value.

High-grade samples collected from the Antelope View Mine contained over 120 oz silver and almost 1 oz gold along with highly elevated copper, lead, zinc, tin, mercury, and tellurium. Molybdenum was highly elevated in one sample. Arsenic and antimony values are low to slightly elevated (samples 5300, 5301, appendix C). A series of chip and grab samples collected from vein exposures in workings along strike contained elevated silver and gold values along with elevated values in associated base-metals. Vein widths varied from 0.3 to 2 m in thickness, but averaged about 1 m (samples 5171, 5295-99, appendix C). These samples corroborate earlier assessments (ASARCO, Inc., personal commun., 1994; Carper, 1920) that the Antelope View vein is narrow and the values are spotty.

The Chloride vein, where exposed at sample site 5152, strikes N30°E, dips about 30°NW, and is estimated to be about 0.75 m thick. It is composed of rubbly-appearing, fractured, iron-stained quartz. To the northwest at site 5253, the vein strikes N15°E and dips 45° NW. The vein here consists of about 1.5 m of sheared, brecciated vein quartz in the footwall of a 3-m thick sheeted zone exposed in a 3-m deep 45° decline. Silicified, brecciated material occurs in the hanging wall. At site 5172, to the north of both of the other sites, a N5°W-striking, 30° SW-dipping vein is exposed in the northernmost of two small pits. This vein, about 1.5 m thick and vuggy with cockade texture, is actually a silicified fault zone with open spaces between silicified breccia fragments. Clear, acicular quartz crystals line many of the openings. Schrader (1912) reported that the Chloride vein was "about 10 feet (3 m) thick in places, and contained good gold values." Exposed widths of this vein vary from about 0.3- to 1.5-m, but all metal values, both precious- and base-metal, were very low. Gold:silver ratios in samples varied from 9:1 to 70:1 (samples 5152-53, 5172, appendix A).

The Auriferous vein, east of the Chloride Group (fig. 7-8) is a fractured, iron-oxide-stained stockwork formed in a purplish, lithic-rich, densely welded ash-flow tuff. The vein-zone is traceable in the tuff by iron-oxide-stained patches of kaolinized, bleached tuff. Individual veins are up to 10-cm thick, are vuggy, and cut randomly across the iron-oxide-stained fracture zone. Portions of the vein are stained by manganese oxides. Silver-to-gold ratios in samples collected from Auriferous vein exposures ranged from 90:1 to about 1:2 and all other metal values were very low.

The Thanksgiving and Schultz veins of Schrader (1912) are east of the Auriferous vein (fig. 7-8). These veins, where seen in outcrop, are narrow coatings and fillings of vein quartz in sheeted fracture zones in altered tuff. The Thanksgiving structure has been prospected by several small pits and adits along strike but an iron-stained fracture zone that may be the Schultz vein was found only in one small pit. Samples collected at these sites were low in both gold and silver. One sample was slightly elevated in molybdenum but values of all other elements were low.

About 1.5 km northwest of the Antelope View area, the Mocking Bird and Antelope Group veins (fig. 7-8) have been prospected by pits and several shallow inclined shafts. Irregular quartz veins and quartz stockwork zones follow north-trending faults in strongly argillized rhyolite tuff. The vein and stockwork quartz is weakly to moderately limonite stained and is shattered and cemented by rock flour and silica with some open-space filling by later crystalline quartz. Individual veins are 1 to 4 cm thick; the zone of stockwork veining varies from 1 to 3 m thick. Mineralization consists of pyrite, chalcopyrite, sphalerite, and copper oxide minerals. Samples collected at sites on these two veins were elevated in silver, gold, and most base-metals (samples 5282-5285, appendix C). Tellurium values were moderately to highly elevated. Element associations in samples from this area are similar to those at the main Antelope View property although silver and gold values were much lower. Silver-to-gold ratios varied from about 12:1 to 600:1.

Elsewhere in the eastern part of the Antelope Springs district, similar veins have been prospected, but the exposures are limited and little information is available on them. About 1,000 m south of the Antelope View Mine, on the Antelope View vein, high silver and gold values associated with elevated base-metal and tellurium values were obtained from a 3-m wide silicified breccia in sheared tuff (sample 5546, appendix C). Southwest of this prospect at sample sites 5544 and 5545 (appendix C), two other veins have been prospected by short adits and trenching. Samples from both of these locations have elevated silver, gold, arsenic, antimony, and base metals. Sample 5544 reported very high values in base metals, mercury, and tellurium.

About 3 km south of Antelope View, in the vicinity of Sulfide Well, three declines, a vertical shaft and several cuts explore northeast- and east-northeast-striking fault zones in altered ash-flow tuff of the Tuff of Antelope Springs. This is the property described as the Gold Bug Group by Kral (1951). The vein material is iron-oxide stained and contains some preserved pyrite. Samples from these sites are geochemically distinct from samples from the central part of the Antelope Springs district. Silver-to-gold ratios in the two samples collected were very close to 1:1, gold values were elevated, but no other elements are more than slightly elevated (samples 5277, 5288, appendix C).

Deposits in the western part of the Antelope Springs district are similar to those described in the eastern part of the district. The veins are narrow, brecciated fillings of clear and white quartz in locally silicified, kaolinized rhyolite tuff and dacite. Veins tend to be sugary and vuggy, with open spaces lined with clear quartz crystals. Most veins are iron-oxide stained, some are manganese-oxide stained, and rarely, some copper-oxide staining is present. Sulfide minerals present are mainly pyrite with minor tetrahedrite, sphalerite, and chalcopyrite.

The Jay claim group (Kral, 1951) is located in the northern part of this area, south of the wash traveled by the old Antelope Springs - Goldfield road. Blackthorn Camp was probably in the wash near this road. Location notices found at this site state the Jay claims were located in June 1933. The Jay claims cover a N15°-25°E-striking, steeply southeast-dipping brecciated quartz vein in a silicified dacitic rock (fig. 7-9). The wall rock is propylitized with a narrow zone of kaolinized rock enveloping the narrow central vein. Where exposed in pits, the vein has a maximum thickness of about 0.5 m, but there may be other parallel veins in the band of altered rock. Much of the vein material is white quartz or silicified quartz breccia. Vugs and open spaces are coated with clear quartz crystals and the vein material is coated with iron- and manganese-oxides. Malachite coats some fracture surfaces and the vein material locally contains clots of pyrite with trace amounts of chalcopyrite and tetrahedrite. At the Jay No. 5 Claim, the southernmost of the Jay Group, gypsum crystals litter the mine dump. Samples collected at the Jay Group workings contained high silver values with slightly elevated gold; silver-to-gold ratios varied from about 400:1 to over 14,000:1. Bismuth values are moderately to highly elevated; antimony and tellurium are highly elevated; and copper, lead, and zinc are moderately to highly elevated.

A little over 0.8 km east of the Jay Group, two shafts and several pits explore a narrow quartz vein in rhyolite tuff (Sample site 5538, figure 7-9). Workings in this area somewhat match those of the Surprise Group described by Kral (1951), but the Surprise Group could also be further to the south at the sites of samples 5539-5542 (fig. 7-9). Workings at sample site 5538 (photo 7-9) explore a low-angle, veined shear zone cutting greenish-gray, propylitized rhyolite tuff. The veined zone strikes N55°W and dips 50°E. The sample collected at this site contained very high silver (about 10 oz) and elevated gold, bismuth, copper, lead, mercury, antimony, and tellurium. The silver-to-gold ratio was about 300:1.

Other workings in the Antelope Springs West sub-district are located east of the Jay-Surprise Group area (Sample sites 5536, 5537, figure 7-9) and also to the south (Sample sites 5539-5542, figure 7-9). as mentioned above, either of these sites could be the Surprise Group of Kral (1951), but the workings described by Kral best fit those found at the northern site. Workings at sample sites 5536 and 5537 follow narrow, iron-oxide-stained quartz veins in altered rhyolite tuff and dacite. Other than iron-oxide staining and sparse pyrite, these sites show little evidence of mineralization; sample results show uniformly low values in all metallic elements. Samples 5539-5542 also contain very low values for all metallic elements. Mineralization in this area, however, is markedly different from that seen in all other parts of the Antelope Springs district. Alteration and rock coloration resemble that seen in the Jamestown district to the south, and it is possible the alteration is related to a high-sulfidation gold system, as is present at Jamestown. Workings at sample sites 5541 and 5542 explore the margin of a 6-m-wide silicified ledge in a dacitic intrusive rock. The white, bleached ledge material contains disseminated pink alunite and is stained with iron-oxides. Except for highly elevated barium values, samples from this area were barren.

Identified Mineral Resources

Based on very limited data, there are identified mineral resources at the Antelope View property. A report on the mine by Carper (1920) contains results of sampling of the main inclined shaft and scattered samples along the vein at surface and on the 100-foot (30 m) level of the mine. There is not enough information to calculate ore reserves of even the lowest confidence level, but Carper's data can be used to show what might be present in an area of the Antelope View Mine roughly 150 feet (45 m) along strike, 150 feet (45 m) deep along the vein, and 3.5 feet (1 m) average width (fig. 7-10). This block of ground could contain some 4,400 tons averaging 19.8 oz silver per ton and 0.04 oz gold per ton with a value, at current metal prices, of about $525,000. Sample widths and vein footages are estimated from Carper's 1920 report (table 7-6). Even though this is an impressive dollar amount, Carper's conclusions are still felt to be valid: "Though a number of good samples were obtained, the smallness of the vein, its very spotted character, and no ore present in any other workings on the vein makes this property too small for further consideration."

There are no other identified mineral resources in the Antelope Springs district

Mineral Resource Potential

There is moderate potential, certainty level C, for the discovery of small ore shoots of silver-gold ore along the

Table 7-6. Sample descriptions, Antelope Mine (from Carper, 1920).

Sample No.	Width Feet	Gold Ounces	Silver Ounces	Description
1	2.0	0.08	20.92	Cut across vein sulfide ore 5 feet above water, 145 feet below surface, south side of shaft
2	2.3	Trace	8.90	Cut across footwall section, oxidized ore, 145 feet below surface, extension of sample #1, south side of shaft
3	1.7	1.00	299.10	Cut across vein, sulfide streak, junction sulfide and oxide ores, 135 feet below surface, south side shaft
4	2.2	Trace	9.30	Cut across same streak as sulfide ore, 125 feet below surface, south side shaft
5	1.5	0.05	18.15	Cut across vein south side shaft, 85 feet below surface
6	1.5	0.11	30.49	Cut across vein south side shaft, 85 feet below surface
7	2.1	0.26	123.04	Cut across vein, south side of shaft, 65 feet below surface
10	5.0	Trace	2.80	Cut across vein 5 feet below surface, rhyolite and quartz mixed,
11	5.5	Trace	8.00	Cut across vein north side shaft, 5 feet below surface
12	5.3	Trace	0.40	Cut across vein south side shaft, 15 feet below surface
13	5.1	0.04	15.96	Cut across vein north side shaft, 15 feet below surface
14	6.5	Trace	10.30	Cut across vein, south side shaft 25 feet below surface
15	5.6	0.06	39.14	Cut across vein, north side shaft 25 feet below surface
16	7.3	Trace	13.40	Cut across vein south side shaft, 35 feet below surface
17	4.9	0.06	20.16	Cut across vein north side shaft, 35 feet below surface
18	4.5	0.04	45.16	Cut across vein south side shaft, 45 feet below surface, 1-foot best ore mined not in sample
19	4.6	Trace	1.80	Cut across vein, north side shaft, 45 feet below surface
20	2.8	0.04	13.26	Cut across vein south side shaft 55 feet below surface, 5 feet best ore not in sample, mined out
21	3.3	Trace	2.00	Cut across vein north side shaft, 65 feet below surface
22	3.6	Trace	1.70	Cut across vein south side shaft 75 feet below surface, 8 feet best ore mined not in sample, mined out
23	2.6	0.04	12.76	Cut across vein north side shaft 75 feet below surface
24	4.8	Trace	3.60	Cut across vein, north side of shaft, 85 feet below surface
25	2.3	Trace	0.90	Cut across vein face, short drift, 95 feet below surface, 16 feet south of center of shaft
26	2.0	Trace	3.80	Cut across vein, north side shaft, 95 feet below surface
27	3.7	0.05	35.45	Cut across vein south side shaft, 115 feet below surface
28	2.6	Trace	0.90	Cut across vein, north side shaft, 115 feet below surface
29	1.8	0.04	17.76	Cut across vein, surface cropping 62 feet north of main shaft
30	3.0	Trace	1.30	Cut across foot-wall vein in tunnel about 50 feet east of shaft
31	2.0	Trace	3.40	Cut across west side, north drift, 100-foot level, Murty shaft, 20 feet north of shaft
32	1.8	Trace	6.90	Cut across west side, north drift, 100-foot level, Murty shaft, 40 feet north of shaft

Average width of vein sampled = 3.5 feet
Weighted average gold = 0.04 ounces per ton (Trace asssigned value of 0.00)
Weighted average silver = 19.8 ounces per ton

known veins in both the east and west parts of the Antelope Springs district. These deposits could be expected to be of similar size and grade to the small block of ore that possibly remains in the upper Antelope View workings.

There is low potential, certainty level B for development of large-tonnage reserves of disseminated silver-gold mineralization in porous or fractured tuff units where intersected by the vein systems. The intervening rock between the veins is, in places, silicified and cut with stockwork veins. Samples of silicified, veined wall rock adjacent to the main mineralized structure at the Antelope View Mine were collected in two locations along the length of the vein outcrop. Trace element associations in these samples resemble those found in the adjacent vein mineralization, but only trace amounts of silver and gold were found (samples 5302, 5332, appendix C). Detailed mapping and sampling of the district would be required to further evaluate this concept.

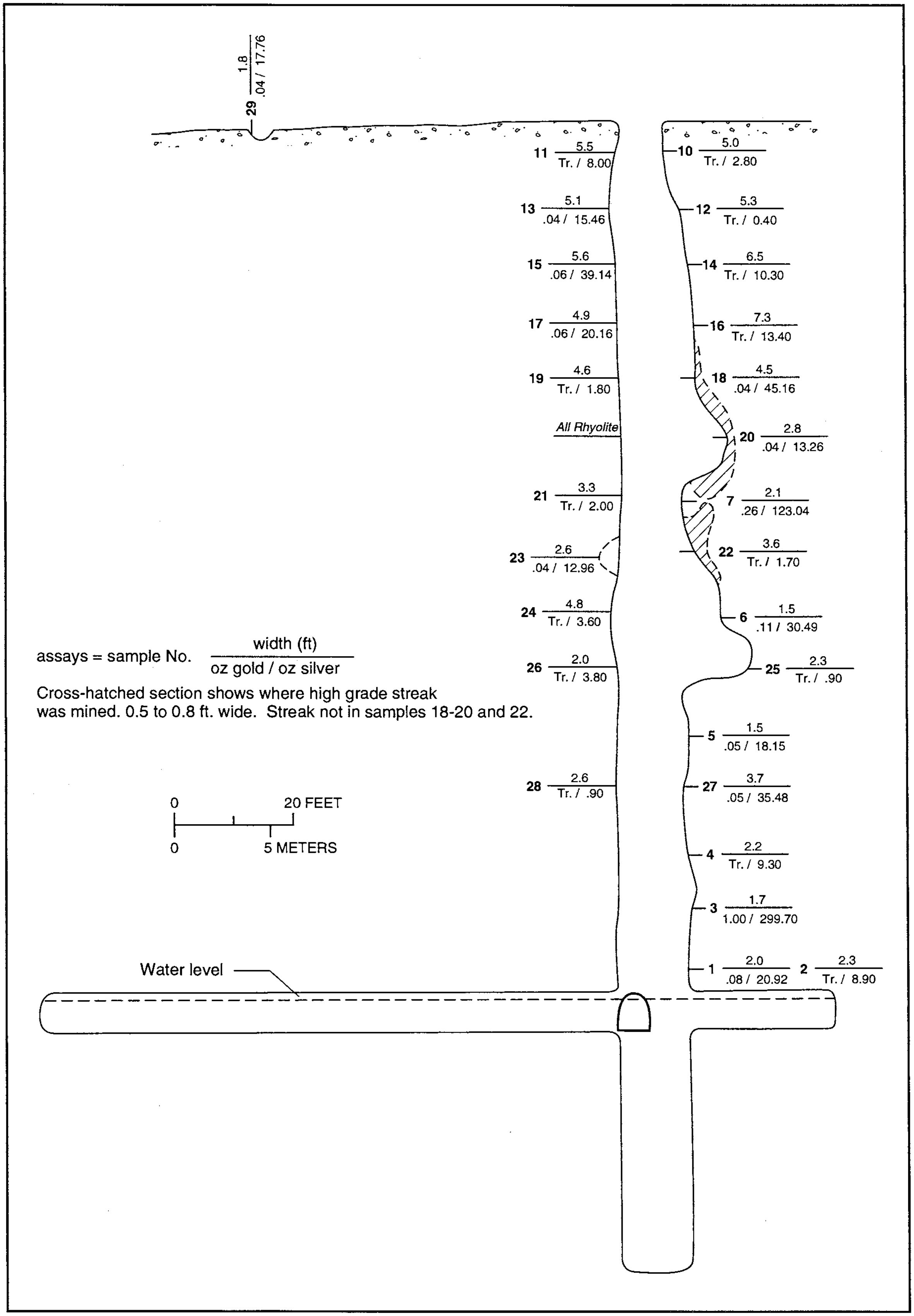
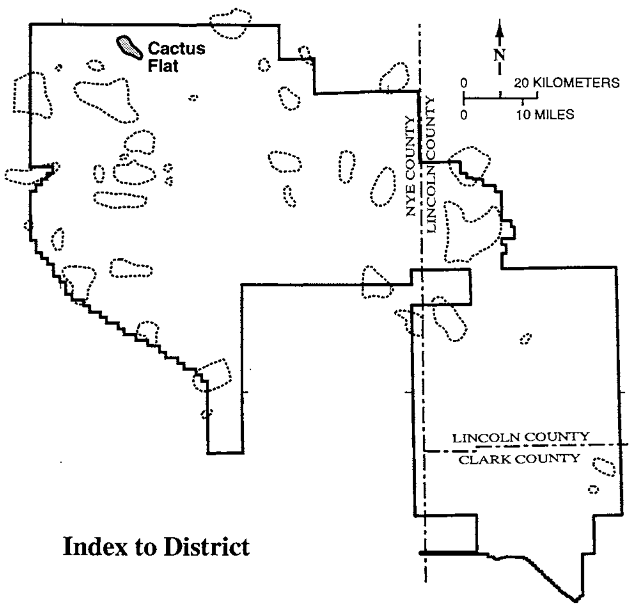


Figure 7-10 Assay cross section of shaft (looking east), Antelope Mines Company, Antelope Springs district.



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7.3.2.2 Cactus Flat Area

Location

Cactus Flat is the large interior basin lying between the Cactus Range and the Kawich Range (fig. 3.1). The Cactus Flat mining area is restricted to a small portion of Cactus Flat on the northeast flank of the Cactus Range. The area includes two areas of prospects in the low hills and surrounding pediment that extends from the range northeast toward the northern NAFR boundary.

History of Discovery, Exploration, and Mining

Nothing is known of the sequence of discovery and prospecting in this area but activity was probably coincident with that in the surrounding districts. The prospects are small and there is no evidence of any production from them.

Geologic Setting

The low foothills of the Cactus Range included in this area are composed of Tertiary volcanic-sedimentary rocks and tuffs that are intruded by small plugs of dacite and granite porphyry (Anderson, unpub. map). Most of the area surrounding these hills and extending for several kilometers to the east is a pediment surface with a shallow cover of alluvium.

Mineral Deposits

From limited field evidence, prospecting in this area was for vein deposits of gold and silver in low-sulfidation systems. Prospects were found in only two locations. On the east line of section 10, T2S, R46E a small prospect pit explores a silicified zone along a N15°W-striking, 65°SW-dipping fault in rhyolite tuff (sample 5713, appendix C). The tuff is brecciated and cemented with silica. Silicification is restricted to narrow fractures and extends only 1 to 2 cm away from the fracture surfaces. Fractures are coated with white opalite and minor iron-oxide, but the wall rock is unaltered. To the northeast about 5 km, in section 31, T2S, R47E, three pits within a north-south distance of about 200 m expose a N20°W-striking, near-vertical fault zone in silicified volcaniclastic rocks. At the southernmost site (sample 5714, appendix C), wall rock is brecciated, has hairline veinlets of white, chalcedonic quartz, some red jasper, and hematite staining on fracture surfaces. The outcrop is moderately manganese-oxide-stained. At the northernmost site (sample 5715, appendix C), brick-red jasper occurs the fault. The jasper zone is 1 to 2 m wide and is brecciated and silicified.

Sample 5713, collected at the first described location, was uniformly low in all metallic elements. Samples 5714 and 5715, collected at the second location, were weakly elevated in gold, but were low in all other metallic elements.

Identified Mineral Resources

No identified mineral resources are present in the Cactus Flat area.

Mineral Resource Potential

Mineralization exposed in the workings in the Cactus Flat area is very weak and does not contain evidence of metallic mineral potential. The potential for discovery of low-sulfidation vein deposits of gold and silver is low with a certainty level C.

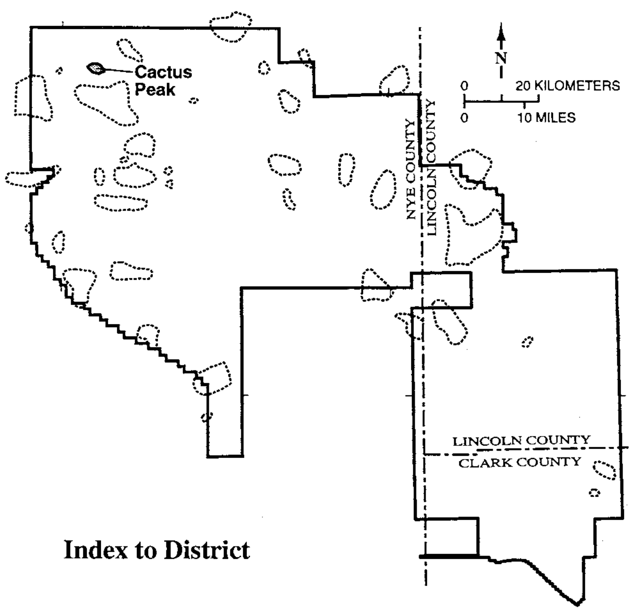
7.3.2.3 Cactus Peak Area

Location

Three shallow shafts estimated to be less than 30 m in depth and several shallow pits and cuts less than 3 m in maximum dimension are present about 1 km west of Cactus Peak, and include the two shafts in the northwest-trending wash known as Endless Draw. Presumably these workings were developed during the period of about 1905 to 1920 (Kral, 1951). Published geologic information for the area is limited to the 1:125,000 scale map of Ekren and others (1971).

Present Investigation

The dumps of the two shafts in Endless Draw and nearby outcrops were examined briefly in July 1994 by C. D.



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Henry, at which time specimens for geochemical analyses were collected. In November 1995, the area was revisited by S. I. Weiss.

Geologic Setting and Mineral Deposits

Much of the area is underlain by hydrothermally altered porphyritic intrusive rocks of coarse-grained, low-silica rhyolite (quartz latite) and hornblende-biotite andesite. The altered rocks are intruded and overlain by unaltered plugs and flow-domes of the rhyolite of Cactus Peak, and elsewhere are overlain by ferricrete and Pliocene(?) to Quaternary alluvial fan deposits. Most of the prospect workings, including the shafts in Endless Draw, and another shallow shaft 500 m to the west, apparently explored silicified, iron-oxide-stained fracture zones. Unoxidized rocks from the dumps show that underlying rocks consist of mixtures of chlorite, sericite, quartz, kaolinite(?), albite(?), and abundant disseminated pyrite. These mixtures are best interpreted as propylitic alteration assemblages and are consistent with the strong and pervasive propylitic alteration observed over large areas within the thick sequence of Pahranagat Formation (tuff of White Blotch Spring) a few kilometers to the south (Ekren and others, 1971). Locally, such as at the site of sample 5953, densely welded, steeply dipping ash-flow tuff is cut by hydrothermal breccia veins containing abundant iron oxides.

West of Endless Draw a large dike of aphanitic rhyolite, assigned to the rhyolite of Cactus Peak (Ekren and others, 1971), has been altered to mixtures of quartz, kaolinite, sericite or pyrophyllite, and alunite. Large blocks of float of rock altered to quartz and alunite and having vuggy-silica texture were observed.

Geochemistry

Only one specimen from each of the two dumps in Endless Draw and one specimen of hydrothermally brecciated and iron-oxide-stained ash-flow tuff were analyzed. The results show that weakly elevated arsenic, antimony, mercury, molybdenum, and tellurium are present, suggestive of the distal portions of epithermal-type hydrothermal systems (appendix C). Concentrations of base metals, manganese, gold, and silver are low.

Identified Mineral Resources

No identified mineral resources are currently present in the Cactus Peak area.

Mineral Resource Potential

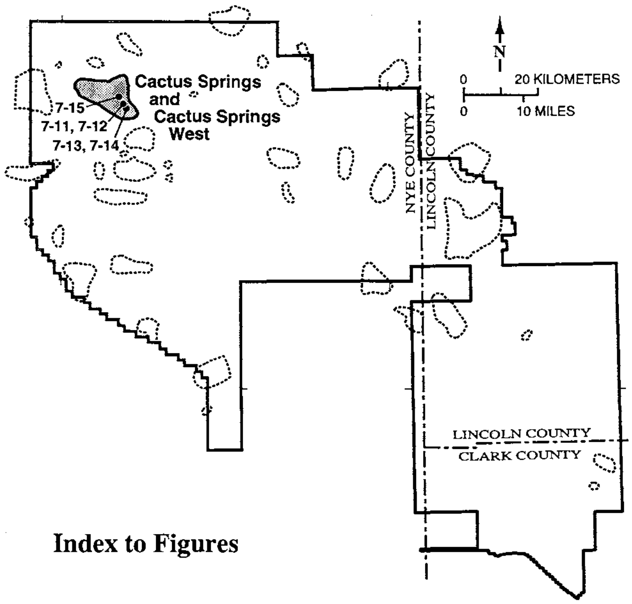
Although only two specimens from silicified fracture zones have been analyzed, the results suggest that the potential for epithermal, volcanic-hosted precious-metals deposits within the area of propylitic alteration is moderate, and a certainty of level B is assigned. Areas of acid-sulfate alteration within rocks of the rhyolite of Cactus Peak may be prospective for high-sulfidation type epithermal precious-metals deposits at depth, but no geochemical and very little geologic data are presently available. Consequently, a moderate potential, level B is assigned for high-sulfidation type epithermal precious-metal deposits.

7.3.2.4 Cactus Springs District

Location

The principal workings of the Cactus Springs district are 1 to 1.5 km southwest of Cactus Spring and are located within the Silver Sulfide claim group. Most production from the district is believed to have been from the Fairday Mine, which consists of several shafts less than 100 m in depth and a number of interconnecting subsurface workings (fig. 7-11; photo 7-10). The Cactus View property is located about 0.5 km west of the Fairday Mine and workings consist of several shallow cuts and trenches.

Many shallow shafts, cuts and pits less than a few meters in maximum dimension, as well as six major adits, are scattered across Urania Peak (photo 7-11), the large, northwest-trending ridge adjacent to the south flank of Urania Peak, and in the large hill (x6860T) about 1 km northeast of Urania Peak (photo 7-12). Two of the adits in the east side of Urania Peak were driven by Mr. Adolph Neher, working mainly alone in the 1920s and early 1930s, to distances totaling about 1,000 m (photo 7-13). These workings are believed to comprise the Urania Mine. It is noted that the



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Urania Mine is incorrectly shown on the Cactus Spring 7.5′ Quadrangle at the site of a small spring about 1 km east of the actual mine site. Two adits of several hundred meters in length are situated in the ridge south of Urania Peak. At least in part, these workings are believed to be more recent than the Urania Mine because blasting materials dating from the late 1950s or later were observed. In this report, these workings are informally referred to as the Twentieth Century Mine (photo 7-14).

Outlying, additional areas included in the Cactus Springs district for the purpose of this report are 1) an adit of about 100 m in length and several trenches and shallow cuts and pits 25 km east-southeast of Urania Peak, 2) several shallow cuts 2.5 km south of Urania Peak, northwest of "Urania Wash" and 3) shallow cuts and short adits, all less than 30 m in maximum dimension, associated with narrow, steeply dipping quartz veins located about 5 km southeast of Urania Peak.

Previous Investigations

Brief descriptions of mines and ores of the district were given by Ball (1906, 1907) and Stotesbury (1915). Sharp (1937) reported on the Urania Mine. Kral (1951) provides a brief summary of Ball (1906; 1907) and some information on the history of the area, but apparently did not visit the district. The district and outlying areas are within the areas of geologic mapping by R. E. Anderson (unpub. data, 1962-67), which were compiled and presented at the scale of 1:125,000 by Ekren and others (1971).

Present Investigation

Samples for geochemical analyses were collected by H. F. Bonham, Jr., C. D. Henry, and J. V. Tingley during brief visits to the area in July and October of 1994. Follow-up visits were made to the Fairday and Urania Mines in March and April 1995 by V. Calloway, J. G. Price, J. V. Tingley, and L. J. Garside. S. I. Weiss visited the Fairday Mine and the Urania Peak area briefly in May 1995. Geologic mapping, field evaluation of alteration mineral assemblages and additional sample collection were carried out in November 1995 by J. G. Price, J. V. Tingley and S. I. Weiss. Field observations of ore and wall rock alteration mineralogy were supplemented with X-ray diffraction studies and scanning-electron and optical microscopic examinations of selected specimens.

Geologic Setting and Mineral Deposits

Workings at and near the Fairday Mine and Cactus View (fig. 7-11) properties in the Cactus Springs district explored narrow, steeply dipping fissure veins, <2 m in width, hosted by rhyolitic ash-flow tuffs assigned by Ekren and others (1971) to the tuffs of Antelope Springs and the Pahranagat Formation (tuff of White Blotch Spring of former usage). The veins consist of fine- to medium-grained white to clear, commonly vuggy quartz and quartz-cemented breccia, and minor amounts of illite/sericite. The principal veins strike N50°E to N60°E, with dips of about 60° to 85° to the northwest and southeast, and crop out discontinuously for as much as about 800 m along strike (fig. 7-11; photo 7-15). Other veins strike about N60°W. Brecciation within the veins and the presence of quartz vein fragments cemented by later stages of quartz suggest possible hydrothermal brecciation and/or fault movements during the formation of the veins. Densely welded ash-flow tuff adjacent to the veins at and near the Fairday Mine has been altered to mixtures of sericite, quartz and small amounts of pyrite and kaolinite for several meters away from the veins.

Ore minerals within the veins consist of small disseminated grains and irregular, granular aggregates of pyrite, acanthite, chalcopyrite, galena and a silver-telluride mineral, probably hessite. Small amounts of secondary chalcocite and covellite form coatings on the chalcopyrite. Unusual, remarkably spherical grains composed of concentrically interlayered pyrite, galena and the silver-telluride phase are locally present, suggesting that ore minerals may have precipitated in part as colloidal particles suspended in the hydrothermal fluids (photo 7-16).

Urania Peak (photo 7-11), the northwest-trending ridge south of Urania Peak, and the ridge about 1 km northeast of Urania Peak (photo 7-12) are resistant topographic features due to pervasive, vuggy-silica texture acid-sulfate alter-

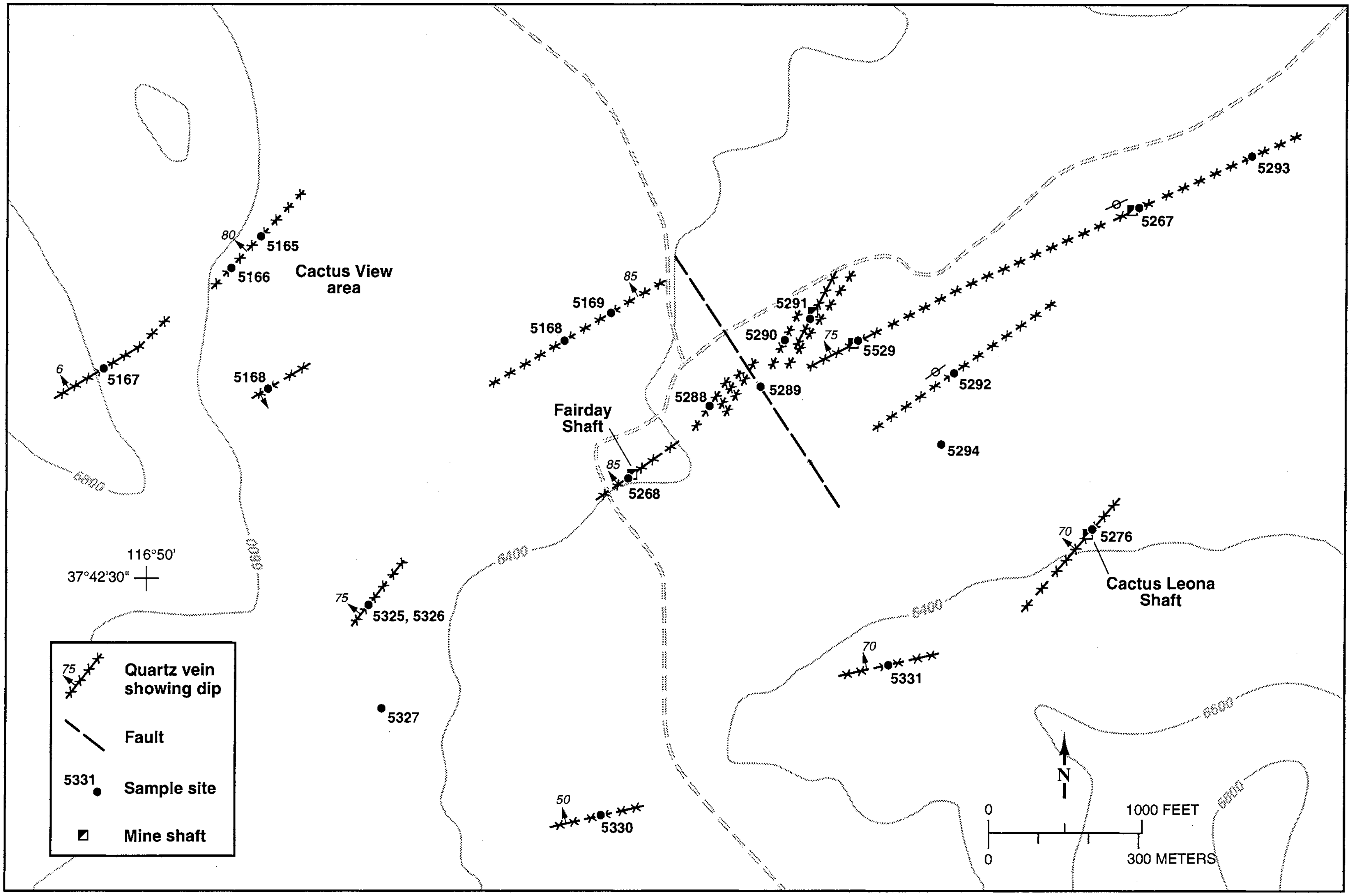


Figure 7-11 Cactus Nevada Mine (Fairday Mine, Bailey Group, Silver Sulfide Group), Cactus Springs district, Nye County.

ation. The resistant rocks originally consisted mainly of flow-banded to massive and brecciated rhyolite of Cactus Peak, and are inferred to comprise at least three separate plugs and/or flow-domes that intrude and overlie moderately west-dipping welded ash-flow tuffs of the tuffs of Antelope Springs and the Pahranagat Formation (R. E. Anderson, unpub. mapping, 1962-1967). Pink, white and clear alunite have replaced the feldspar phenocrysts and locally the rhyolite groundmass, forming coarse clots along flow bands and lithophysae(?) within the rhyolite bodies. Small amounts of disseminated and vuggy barite and illite/sericite, and veins and fracture coatings of dickite are present as well. Unoxidized rocks contain as much as about 5 percent fine-grained pyrite. Adjacent and nearby wallrocks of the ash-flow tuff units have also undergone intense acid-sulfate alteration (photo 7-17) to mixtures of quartz, alunite, pyrophyllite, kaolinite, diaspore, dickite and pyrite; vuggy-silica quartz-alunite-pyrite rock formed within the tuffs along northeast- and northwest-trending, steeply to moderately dipping fractures. Ribs of highly fractured ash-flow tuff altered mainly to quartz and smaller amounts of pyrophyllite and diaspore crop out at considerable distances from the major quartz-alunite ledges, as, for example, at the location of sample 5271 (fig. 7-12).

Most of the rocks have undergone oxidation associated with near-surface weathering which has removed most of the pyrite. Oxides of iron and iron+manganese are locally abundant on fracture surfaces. Fracture fillings of crustiform-banded and botryoidal hematite and limonite as much as a few cm in thickness were found to contain high concentrations of gold, mercury, bismuth, antimony and tellurium (see below).

Geologic mapping (figs. 7-13 and 7-14) and examinations of mine dumps show that the workings of the Urania and Twentieth Century Mines penetrated northeast- and northwest-striking ledges of sulfide-rich vuggy-silica rock. These locally contain disseminated grains and stringers of pyrite, sphalerite, galena, freibergite (silver-tetrahedrite), enargite(?), silver-telluride (hessite?) and sparse small grains of an as yet unidentified copper-tin-S phase, and presumably composed the ores. Although enargite and/or luzonite have not been confirmed, the sulfide assemblage and the style and mineralogy of the alteration are typical of high-sulfidation (enargite-type) epithermal precious-metals deposits such as in parts of the Julcani district, Peru (e.g., Petersen and others, 1977).

Alteration and mineralization in outlying areas differs markedly from that of the Fairday Mine and the Urania Peak area. About 5 km southeast of Urania Peak a number of shallow cuts and short adits explored narrow, steeply dipping, northwest-trending quartz veins. The veins are less than 0.5 m in width along faults and fractures cutting rhyolitic welded ash-flow tuffs assigned to the Monotony Tuff and the tuffs of Antelope Springs (Ekren and others, 1971). Thin selvages of argillic or sericitic assemblages locally border the veins and grade rapidly out into propylitically altered rocks.

About 2.5 km south of Urania Peak, pyritic rhyolite porphyry dikes with aplitic groundmass texture intrude gently dipping, coarse, poorly sorted, massive beds of carbonate-clast breccia and underlying, quartz-rich conglomeratic rocks tentatively assigned to the Mississippian Eleana Formation (Ekren and others, 1971). Gossanous iron and manganese oxides and calcite locally form the matrix between the fragments of limestone in beds of carbonate-clast breccia. The gossanous material contains highly anomalous amounts of zinc and abundant barium (see below), and is inferred to be of an epigenetic, hydrothermal origin.

Landsat Thematic Mapper imagery (fig. 7-15) shows the presence of abundant limonite in rhyolite lavas and flow-domes of the rhyolite of Cactus Peak about 2.5 to 3.5 km north of Cactus Spring, and in areas east of Cactus Peak. In the area north of Cactus Springs the limonite is present in irregular, steeply dipping, commonly anastomosing veins of hydrothermal breccia less than a few cm in maximum thickness. There appears to be little alteration of the devitrified high-silica rhyolite host rocks. Geochemical analyses show only minor enrichments in antimony (appendix C), suggesting a distal, near-surface epithermal environment.

Geochemistry

Fairday Mine and Cactus View claims: Quartz veins and narrow vein-cemented breccia bodies are locally rich in silver (maximum value of ~22 oz silver per ton) and contain as much as 1.7 ppm gold (appendix C).Silver-to-gold ratios are typically in the range of 200 to 400. The veins are characterized by modest to strongly elevated concentrations of bismuth (max. = 22.3 ppm), tellurium (max. = 264 ppm) and molybdenum, and locally elevated tin (max. = 10 ppm), suggestive of a magmatic-hydrothermal component in the vein-forming hydrothermal fluids. Concentrations of mercury, antimony, and arsenic are modest in view of the locally high silver concentrations; thallium is low (appendix C). The base metals copper and lead (max. = 1,678 and 32,774 ppm, respectively) are more abundant than zinc (max. = 565 ppm), and manganese is low.

Urania Peak area: Specimens from the Urania Peak area are all composed of rocks affected by hypogene acid-sulfate alteration. Sporadic high concentrations of silver (max. = 114.0 ppm), zinc (max. = 17,145 ppm), lead (max. = 2,416 ppm), copper (max. = 5,476 ppm), antimony (max. = 837 ppm), bismuth (max. = 25.40 ppm), tin (max. = 166 ppm), and mercury (max. = 66 ppm) are associated with sulfide-bearing vuggy-silica type quartz-alunite ledges on the east side of Urania Peak and at the Twentieth Century Mine in the ridge south of Urania Peak. Other specimens from topographically higher levels of the ledges and from adjacent areas contain low-level to modest enrichments of gold (0.006 to ~0.200 ppm) and silver (0.5 to ~35 ppm), along with nearly ubiquitous elevated bismuth, molybdenum and arsenic (appendix C). Barium and tungsten are inconsistent, with maximum concentrations of ~6,000 ppm and 23 ppm, respectively.

The highest concentrations of gold (12.400 and 0.742 ppm, respectively) were determined in specimens of crustified-banded and botryoidal open-space fillings composed of hematite and limonite obtained from the northeast slopes of Urania Peak (samples 5328 and 5826; fig. 7-12). High concentrations of tellurium (17 ppm), bismuth (13.20 ppm) and mercury (1.64 ppm) in sample 5328 suggest a geochemical link to the hypogene acid-sulfate alteration.

Outlying areas: Outlying quartz veins in the area of propylitic alteration 5 km southeast of Urania Peak contain weak to modestly elevated arsenic, mercury, bismuth, antimony, molybdenum, and tellurium (appendix C). Copper, lead and zinc values are modestly elevated, but the maximum silver and gold contents determined are only 2.10 and 0.008 ppm, respectively.

Two specimens of gossanous, iron-oxide cemented breccia within beds of coarse, carbonate-clast supported breccia assigned to the Eleana Formation(?) (Ekren and others, 1971), about 3 km south of Urania Peak, have highly anomalous concentrations of zinc (7034 ppm and 3807 ppm, respectively). These rocks consist largely of iron (23.6 and 26.6 weight percent) and also contain unusual concentrations of manganese (0.84 and 3.82 weight percent), nickel (86 ppm and 82 ppm), cobalt (180 ppm and 130 ppm) and beryllium (29 ppm and 16 ppm). Precious metals and indicator elements are low, except for weakly elevated arsenic (41 ppm) in one sample.

Identified Mineral Resources

No identified mineral resources are present in the Cactus Springs district.

Mineral Resource Potential

The vein textures, ore mineralogy, wall-rock alteration assemblages and geochemical data of the Cactus Springs district are typical of low-sulfidation, volcanic hosted epithermal precious-metals districts throughout the western United States. Although the veins are narrow and the ores have high silver:gold ratios, small-tonnage high-grade silver-gold ore shoots amenable to small-scale, selective mining methods could be present. Additional, perhaps bulk-mineable, precious-metals deposits may be present in stockwork breccia at structural intersections. A high potential, level C is estimated for small-tonnage low-sulfidation epithermal precious-metals vein deposits in the area of the Fairday Mine. A moderate potential, level C is estimated for bulk minable precious-metals deposits of the low-sulfidation epithermal type.

The elevated bismuth, tellurium, and molybdenum contents of the ores suggest that the mineralizing fluids included components derived from a porphyry magmatic-hydrothermal system. It is possible that the veins represent a distal part of a genetically related porphyry mineral deposit at depth or in areas to the west where porphyry-type igneous rocks and stockwork veins are exposed.

High-sulfidation epithermal precious- and base-metal-bearing deposits may be present in the Urania Peak area based on the presence of widespread advanced argillic alteration assemblages and extensive vuggy-silica type quartz-alunite-pyrite ledges that locally contain precious- and base-metal sulfide, sulfosalt and telluride minerals. The alteration style and aerial extent of the ledges, combined with the presence of visible ore minerals and low-level gold, silver, copper, bismuth, antimony, etc., enrichments at considerable lateral and vertical distances from the ore showings, would be highly attractive criteria for present-day commercial exploration. Nevertheless, only small, discontinuous bodies of mineralized rock were intersected in the workings of the Urania and Twentieth Century Mines. Consequently, a moderate potential, certainty level C, is estimated for high-sulfidation precious-metals and copper-molybdenum deposits in the Urania Peak area.

Increasing geologic and isotopic evidence strongly suggest that high-sulfidation mineral deposits form in the upper parts of, and are genetically related to, underlying porphyry magmatic systems (e.g., Sillitoe, 1983, 1991; Rye, 1993). This suggests potential for porphyry-type copper-molybdenum and/or copper-gold deposits at depth beneath the altered rhyolite plugs, dikes and domes in the Urania Peak area and beneath the pervasively altered, mutually crosscutting, porphyritic intrusions that underlie much of the central Cactus Range. A moderate potential, level B, is estimated for porphyry-type copper-molybdenum and/or copper-gold deposits in this large area, although potential porphyry deposits may lie at considerable depths (about 1-3 km) from the paleosurface.

Based on the widespread propylitic alteration and scattered outcrops of banded and vuggy quartz veins, a moderate potential, level B is estimated for low-sulfidation epithermal precious-metals deposits in much of the south-central part of the Cactus Range. Geochemical data and the narrow widths of the veins 5 km south of Urania Peak suggest that the potential is probably limited to narrow, small-tonnage, silver-rich vein deposits. Such deposits, although possibly amenable to selective mining, would

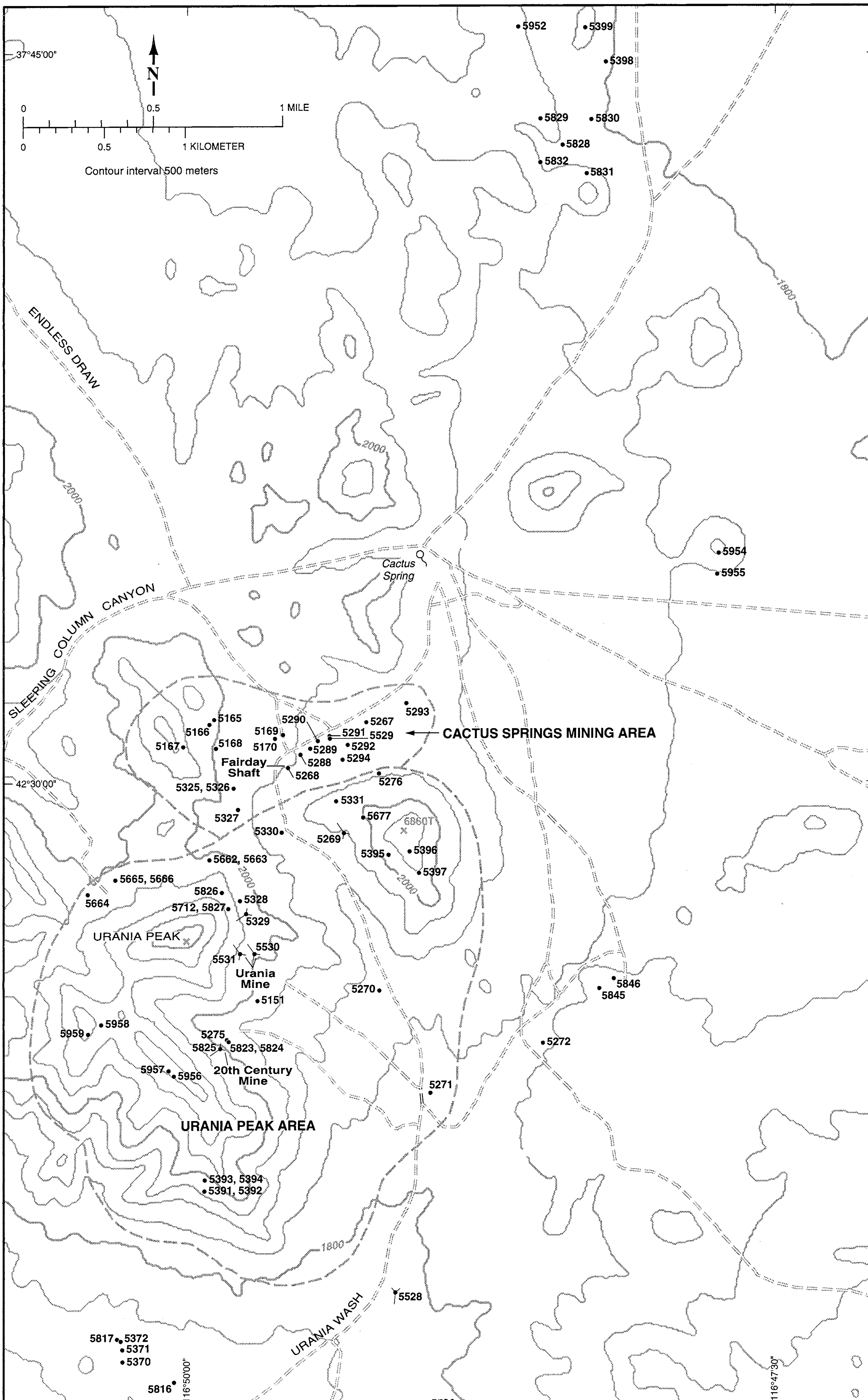


Figure 7-12 Map showing the locations of samples in the area of the Cactus Springs district.

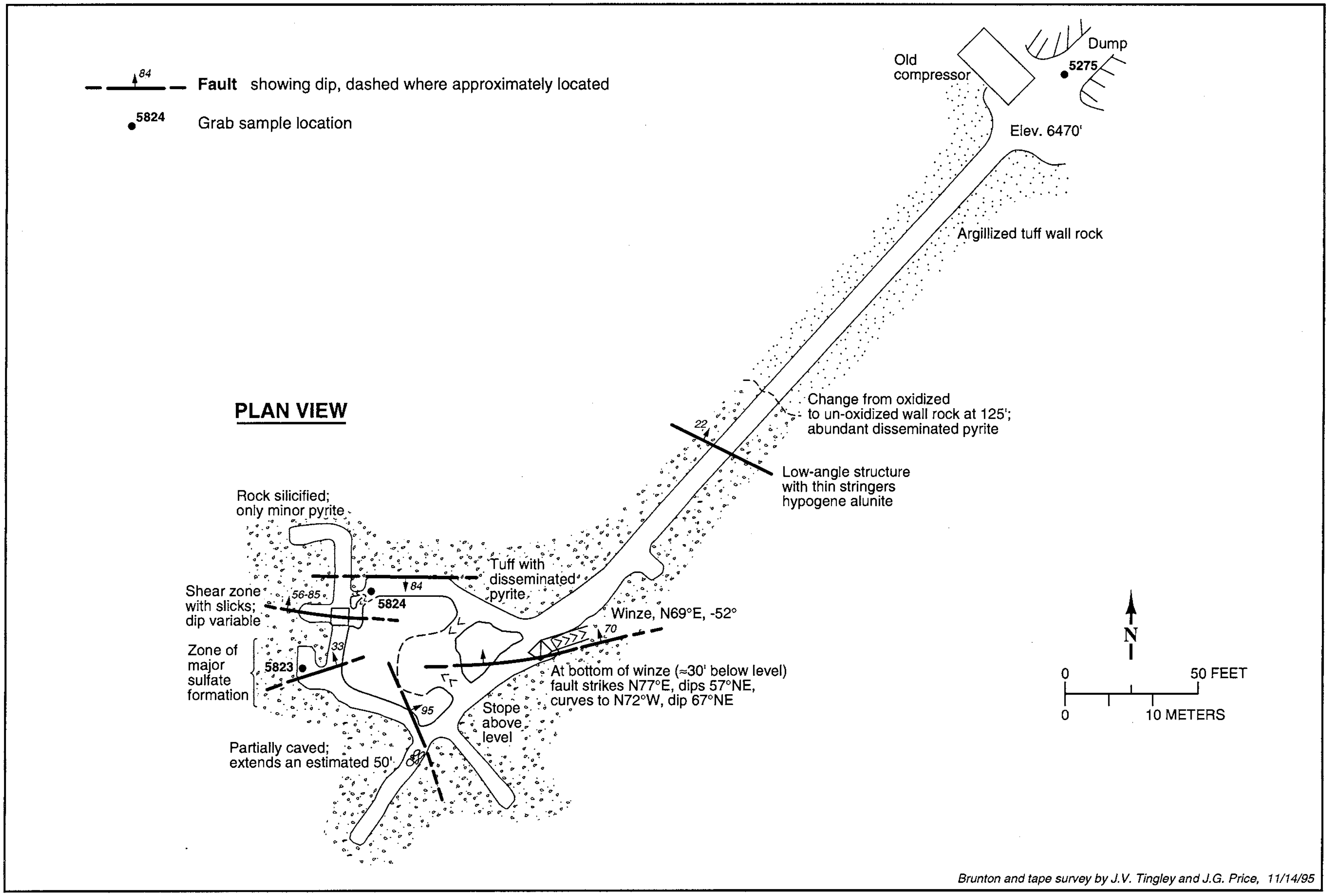


Figure 7-13 Geologic map of the 20th Century Mine, Cactus Springs district, Nye County, Nevada.

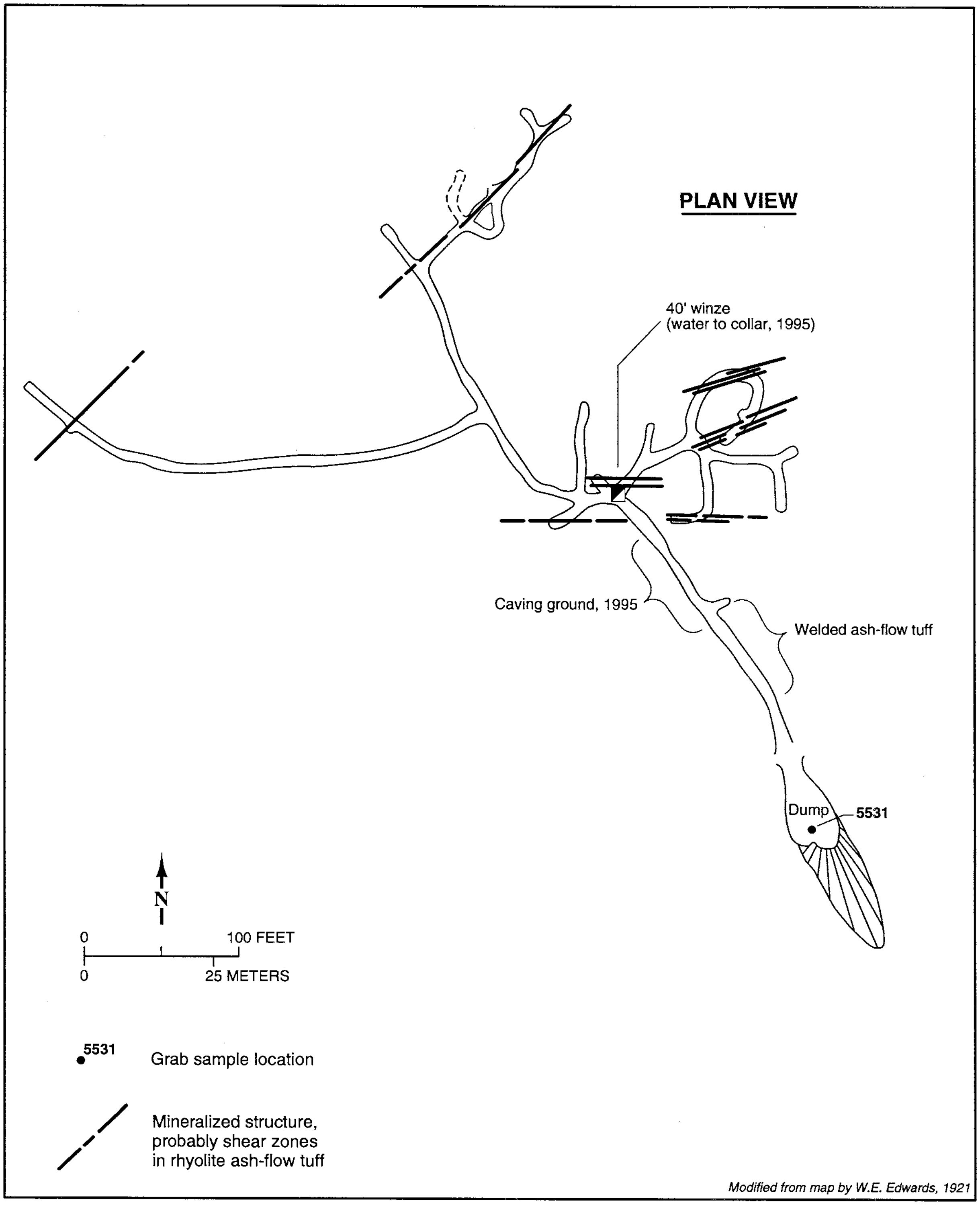


Figure 7-14 Urania Mine, upper adit, Cactus Springs district, Nye County, Nevada.

1=ACID-SULFATE (ADVANCED ARGILLIC)
2=PHYLLIC (SERICITE/MUSCOVITE, PYRITE +/- QUARTZ)
3=ARGILLIC
4=LIMONITE AFTER PYRITE(?)

Figure 7-15 LANDSAT false color TM image, Cactus Range, Nellis Air Force Range, Nye County, Nevada showing areas of different hydrothermal mineral assemblages.

likely remain unattractive at the present price of silver. The high concentrations of zinc and elevated nickel, cobalt, and beryllium in bedded carbonate-clast breccia south of Urania Peak are difficult to interpret due to the lack of lead and silver. Nevertheless, the presence of the gossanous breccia matrix and the high zinc concentrations can not be ignored. One possibility is a distal association with carbonate-hosted polymetallic replacement deposits, perhaps related to the porphyry intrusions at depth, which fed the dikes, or to intrusions in the ridge about 1.5 km to the north. Based on the sparse information at hand, a moderate potential, certainty level B, is estimated for carbonate-hosted polymetallic replacement deposits.

North of Cactus Spring, the abundant limonitic hydrothermal breccia and elevated antimony within the rhyolite of Cactus Peak may represent the uppermost part of a shallow, low-sulfidation, low indicator-element type epithermal system, perhaps associated with the emplacement and cooling of the host lavas and/or the underlying feeder dikes. Such a geologic and hydrothermal setting is typical of a number of low-sulfidation, dome-hosted epithermal precious-metals deposits, such as at Sleeper, Nevada (Nash and others, 1995) and Castle Mountain, California (Capps and Moore, 1991). A moderate potential, certainty level B, is estimated for low-sulfidation epithermal precious-metals deposits. If present, such deposits would likely be located at depths of a few hundred meters and would be difficult to detect from surface-based geochemistry and drilling.

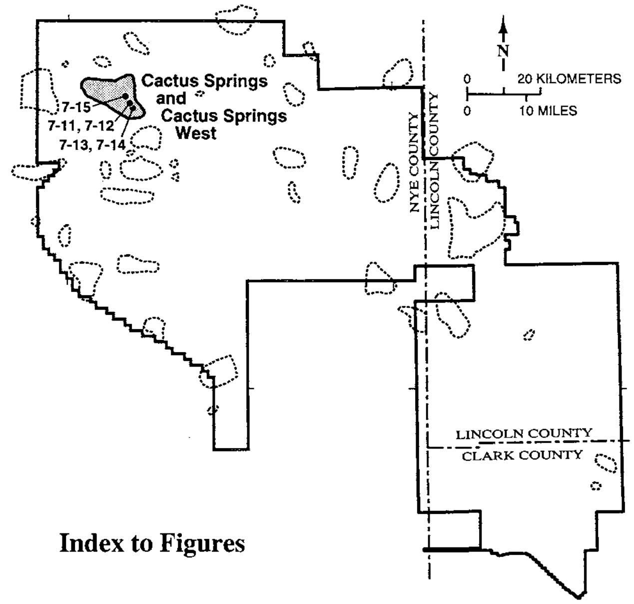
7.3.2.5 Cactus Springs West Area

Location

The Cactus Springs west area is centered on the Thompson claim group and the Thompson Mine, northwest of the lower part of Sleeping Column Canyon (fig. 7-6). Several shafts and short adits, all estimated to be less than 100 m in depth or length are scattered over an area of approximately 5 km². At the Thompson Mine the main shaft has a reported depth of 70 m (photo 7-18) (Kral, 1951). Adjacent areas in the west flank of the range in and southeast of Sleeping Column Canyon, in White Patch Draw, and for as much as 3.5 km west of White Patch Draw contain numerous short adits and shallow shafts, less than 50 m in maximum dimension, and cuts and pits mainly less than 5 m in maximum dimension (fig. 7-6).

Previous Investigations

Published geologic information for the area is limited to that of Ekren and others (1971) and is based on mapping at a scale of 1:62,500 carried out by R. E. Anderson in 1962-67. Ball (1906, 1907) visited the area, but described mainly the economic geology of the Cactus Springs and Antelope Springs mining areas.



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Present Investigation

Samples for geochemical analyses were collected from mine dumps and prospect workings by J. V. Tingley in July and October 1994. S. I. Weiss made several traverses in the area in November 1995 to assess the types and aerial extent of hydrothermal alteration features in the district. At this time additional specimens were collected, mainly from outcrops, for geochemical analyses and X-ray diffraction and thin-section petrographic determinations of alteration mineralogy in the area. A brief, follow-up visit was made to the area by J. V. Tingley, H. F. Bonham, Jr., S. B. Castor, and S. I. Weiss in December 1995.

Geologic Setting and Mineral Deposits

The core of the northern Cactus Range, from the slopes at the north base of Urania Peak to west of Cactus Peak, consists of thick sections of rhyolite ash-flow tuffs assigned to the tuffs of Antelope Springs and the Pahranagat Formation (formerly the tuff of White Blotch Spring) cut by intrusions of rhyolite porphyry, porphyritic granite and aphanitic rhyolite. The variable textures and crosscutting relations of the intrusive rocks indicate that they were derived from an extensive, composite (multi-pulse) magmatic system at depth. All rock units except certain bodies of the aphanitic rhyolites, assigned to the rhyolite of Cactus Peak by Ekren and others (1971), have undergone pervasive propylitic alteration over wide areas. Most of the mine and prospect workings of the west area of Cactus Springs are situated within smaller areas of different types of alteration hosted by the same major rock units within and between Sleeping Column Canyon and White Patch Draw (fig. 7-6). In the lower slopes of the range, from Sleeping Column Canyon into White Patch Draw, most rocks have undergone phyllic alteration. Rocks present on the dumps of the Thompson Mine and numerous other shallow workings in the surrounding, lower slopes of the range consist of low-silica rhyolite (quartz-latite) porphyry, coarsely porphyritic rhyolite/quartz monzonite, and rhyolitic ash-flow tuffs that have been altered mainly to mixtures of illite/sericite and disseminated pyrite, with minor amounts of kaolinite and sparse, narrow stringers of quartz. Identical alteration is present within rocks on the dumps of workings in White Patch Draw at the site of samples 5518 and 5519 (fig. 7-6). In certain localities, such as near the site of sample 5508, the intrusive rocks have been altered to potassium-feldspar stable assemblages characterized by chlorite, illite/sericite, calcite and turbid potassium feldspar.

Within the area of phyllic alteration, northwest-trending ribs of resistant rock crop out in the vicinity of the locations of samples 5374-5376 (fig. 7-6) and comprise the ridge of X6334T along the southeast side of Sleeping Column Canyon. The resistant nature of these rocks is due to their complete replacement by fine-grained, interlocking crystals of quartz and muscovite, and the presence of stockwork veins of quartz ± muscovite. The veins are mostly <10 cm wide and include early, irregular veins with indistinct margins, which are cut by multiple generations of planar, non-banded, granular veins (photo 7-19). Vein densities of dozens of veins per square meter were observed in many outcrops. Although most of the rocks are thoroughly oxidized and contain abundant jarosite, small amounts of pyrite are present in the veins at the sites of samples 5375 and 5376 (fig. 7-6). Hypersaline fluid inclusions containing as many as four daughter crystals, including halite, hematite and a highly birefringent phase (anhydrite?), are present in the vein and replacement quartz, and as secondary inclusions in the quartz phenocrysts. Although barren of copper and molybdenum sulfide minerals at the surface, the stockwork veins and hypersaline fluid inclusions are features typical of porphyry-type mineral deposits throughout the World and, by analogy with many well-studied deposits, formed from high-temperature magmatic-hydrothermal fluids.

Rocks altered to phyllic and propylitic assemblages, and containing the stockwork quartz-muscovite veins, can be traced upward into a large area of iron-oxide stained, relatively resistant rocks between Sleeping Column Canyon and White Patch Draw. Most of the rocks are densely welded rhyolite ash-flow tuff of the Pahranagat Formation (tuff of White Blotch Spring) type, and have been pervasively altered to mixtures of quartz, muscovite and small amounts of pyrite (largely oxidized), and are cut by veins of clear to gray, granular quartz ± muscovite. The veins are identical to many of the later veins of the stockwork zones, but are spaced at distances of a few centimeters to a few tens of meters apart and reach widths of as much as 20 cm.

The areas of nonresistant to quartz-rich phyllic alteration grade laterally over short distances into rocks containing albite, chlorite, and calcite ± sericite ± epidote. Near this transition from phyllic to propylitic assemblages in the west side of White Patch Draw, sheared and silicified ash-flow tuff contains narrow, sulfide-rich stringers at the site of sample 5381. Scanning electron and reflected-light optical examinations of the stringer material indicates that the sulfides include pyrite, galena, sphalerite, chalcopyrite, covellite, chalcocite, freibergite, and argentiferous galena.

Shallow plugs and flow-domes of the rhyolite of Cactus Peak type crop out along the southwestern margin of the range in the area of the lower parts of Sleeping Column Canyon and White Patch Draw and probably intrude a major, northwest-striking, range-bounding normal fault (Ekren and others, 1971). Each of these bodies has been intensely altered to various mixtures of quartz, alunite, pyrophyllite, kaolinite, and diaspore. Textures vary from vuggy-silica types to dense rocks completely replaced by fine-grained quartz and minor alunite. Veins of hydrothermal breccia containing rounded clasts of quartz+alunite in a matrix rich in alunite crop out at the sites of samples 5382 and 5383. Ash-flow tuff adjacent to the rhyolite plugs and flow-domes has been altered to mixtures of quartz, pyrophyllite and minor kaolinite, and is locally cut by veins of pink, fine-grained alunite as much as 1 m in width (photo 7-20). The advanced argillic assemblages are interpreted to result from intense, hypogene acid-sulfate alteration of the magmatic-hydrothermal type of Rye (1993). Supergene iron and manganese oxides form surface coatings and, where abundant, seem to have been preferred sites for shallow prospect cuts and short adits.

Turquoise, a hydrated copper-aluminum phosphate-hydroxide prized as a semiprecious gemstone, has been produced from an area of stockwork veins located on the northwest side of Sleeping Column Canyon (fig. 7-6). Production has been estimated at approximately $25,000 (Morrissey, 1968). Turquoise occurs as irregular masses and veinlets in oxidized, sericitized quartz-feldspar rhyolite porphyry. Nearby rocks are cut by stockwork quartz and quartz+muscovite veins and veinlets that are characteristic of porphyry copper deposits. Presumably the copper in the turquoise was derived from supergene oxidation of hypogene copper-bearing sulfide minerals.

Colors of turquoise include blue, pale blue, pale green, and dark green, although pale blue varieties are more common in the material left behind by the earlier miners. Because masses thicker than 1 cm or larger than 10 cm in longest dimension are uncommon, only small pieces of pure turquoise could be worked from this material. Nonetheless, the rock (including the rhyolite porphyry matrix) can be formed into cabochons or cut with diamond saws and shaped into forms for jewelry, bookends, or paperweights.

Numerous prospect pits have been dug in this rock, and turquoise of variable quality can be found at many. The workings are largely surface scrapings. Only one deep shaft appears to have yielded much material, and this was a small volume (judging from the few tens of tons of material on the dump), as the production figure also indicates.

Geochemistry

Precious-metals concentrations are low in most of the specimens analyzed from the Cactus Springs, west area. An exception is the galena and sphalerite-bearing rock of sample 5381, in White Patch Draw, which assayed at 169 ppm silver (appendix C). Although specimen 5507 was found to contain about 52 ppm gold and 31.5 ppm silver, reexamination of the dump from which the specimen was collected strongly suggested that the specimen is not representative of the site and was in all probability transported from another mining district.

Rocks altered to mixtures of illite/sericite (muscovite), quartz and pyrite, including rocks with stockwork veins of quartz and muscovite, are characterized by elevated concentrations of bismuth (1 to ~6 ppm), molybdenum (commonly 10 to ~100 ppm) and copper (~20 to 1292 ppm) (appendix C). Tellurium concentrations are low, <0.5 ppm, with a maximum value of 0.67 ppm. One specimen (sample 5522) contained 23 ppm tin. Very low-level, but perhaps significant, gold concentrations of about 5 to 20 ppb are present in several specimens. Many of the specimens of the resistant and nonresistant quartz-sericite-pyrite altered rocks included quartz stringers and silicified rock and, consequently, there appears to be little difference in trace-metal concentrations compared to specimens containing stockwork veins and veinlets.

Specimens collected from areas of acid-sulfate alteration contain elevated bismuth, copper and molybdenum in concentrations similar to those found in rocks of the phyllic alteration area, but are characterized by elevated antimony, arsenic, and mercury as well (appendix C). Low, but significant concentrations of gold (10 to 24 ppb) and silver (maximum = 5.2 ppm) are associated with hydrothermal breccia veins.

The iron-oxide cemented sedimentary rocks (ferricretes) consist of about 25 to 35 weight percent iron (appendix C). Specimens of the ferricretes contain anomalous amounts of barium (~1,000 to 2,200 ppm) and molybdenum (~30 to 150 ppm), and weakly elevated concentrations of arsenic and mercury. Two of the three specimens contain abundant copper at 130 and 234 ppm, respectively. The three specimens analyzed show little or no enrichment in gold or silver.

Identified Mineral Resources

No identified mineral resources are currently present in the Cactus Springs, west area.

Mineral Resource Potential

Potential mineral resources of three types may be present. These are 1) porphyry copper-molybdenum and/or porphyry molybdenum deposits, 2) high-sulfidation (acid-sulfate) type precious metals deposits, and 3) turquoise deposits amenable to selective mining techniques.

The porphyry textures of the intrusive rocks in the Cactus Springs, west area, together with the large area of phyllic alteration and the presence of porphyry-type, high-temperature stockwork quartz ± muscovite veins, are consistent with a porphyry-type, composite magmatic system at depth, and the possible presence of porphyry mineral deposits. Based on the subalkaline, metaluminous, modestly to possibly highly evolved nature of the types of intrusive rocks exposed in the northern part of the range (Ekren and others, 1971), possible porphyry deposits of copper-molybdenum, and perhaps molybdenum would be most probable, if present. The lead-zinc-silver-bearing sulfide stringer veins in White Patch Draw (site of sample 5381) and the base-metal and silver-gold-bearing quartz veins in the Cactus Springs district may be distal veins related to porphyry-type mineral deposits at depth in the Cactus Springs, west area. Although hypogene copper-molybdenum deposits are not exposed at the surface, and only weak supergene concentration of copper is observed in the showings of turquoise, weakly elevated concentrations of copper and modest concentrations of molybdenum and bismuth are widespread. The widely scattered ferricrete sedimentary deposits reflect the weathering of major amounts of pyrite, and are a common feature of mineralized porphyry districts elsewhere in the southwestern United States and in the Andes Mountains of South America. In view of the types and aerial extent of hydrothermal alteration features exposed at the surface, and the probable composite nature of the underlying magmatic system, a moderate potential, level C, is estimated for subsurface porphyry copper-molybdenum and porphyry molybdenum deposits in the Cactus Springs, west area.

Acid-sulfate alteration of the magmatic-hydrothermal type occurred during(?) and or very shortly after the intrusion and eruption of the plugs, dikes and domes of the rhyolite of Cactus Peak, probably as a result of the degassing of magmatic volatiles from the underlying magma bodies. This inference is strongly supported by the close spatial correspondence between the intrusive rhyolite bodies and areas of vuggy-silica quartz-alunite alteration. High-sulfidation (enargite-type) epithermal precious-metals deposits are considered to be genetically related to, but late in the processes of such magmatic degassing and low-pH, acid-sulfate alteration (e.g., White and Hedenquist, 1995). The modest to strongly elevated concentrations of arsenic, antimony, copper, bismuth, and mercury, and slightly elevated gold and silver in the acid-sulfate altered rocks suggests that high-sulfidation type epithermal precious-metals deposits may be present, perhaps at depths of <1,000 m. A moderate potential, level B, is estimated for high-sulfidation type epithermal precious-metals deposits beneath the areas of acid-sulfate alteration along the southwestern margin of the range.

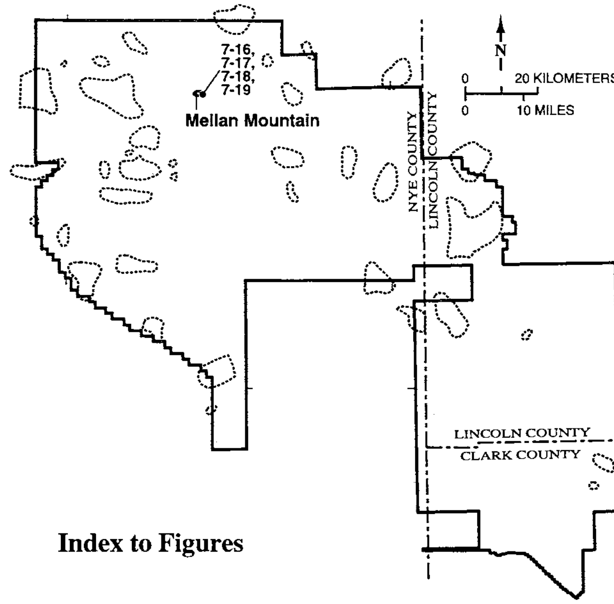
A high potential, level C, is estimated for turquoise resources amenable to selective, small-scale mining methods. Additional near-surface exploration (such as trenching and detailed mapping of turquoise concentration, size of turquoise masses, color, density of hypogene quartz veining, and distribution of limonite) would likely lead to the discovery of additional turquoise resources. Discovery of larger masses of pure turquoise would make the area more attractive. Prospective areas include the entire outcrop of the quartz-feldspar rhyolite porphyry.

Because the bodies of rhyolite of the Cactus Peak type apparently intrude and overlie the major units of ash-flow tuff and coarser-grained intrusive rocks in the northern part of the Cactus Range, it seems highly probable that acid-sulfate type hydrothermal activity occurred after the phyllic and quartz-muscovite stockwork alteration and more widespread propylitic alteration. Possible evidence for this is observed in the lower part of the zone of stockwork quartz ± muscovite veins northeast of hill x6006T, in the vicinity of the locations of samples 5385 and 5386, where pyrophyllite and diaspore are present in rocks composed mainly of quartz and muscovite. The fact that the altered bodies of rhyolite are tilted little, if at all, indicates that acid-sulfate type hydrothermal activity postdates major tilting in the range. It remains unclear, however, to what extent the propylitic, phyllic, and quartz-muscovite stockwork alteration predates or postdates the major tilting. This question bears considerably on the assessment of potential for porphyry-type copper-molybdenum and/or molybdenum deposits and on strategies that might be used to explore for such deposits.

7.3.2.6 Mellan Mountain District

Location

The Mellan Mountain mining district is located in the immediate vicinity of Mellan Mountain, an area of two joined hills near the old townsite of Mellan (photo 7-21) in southern Cactus Flat that is isolated from nearby mountains. The entire area of bedrock outcrop is slightly less than 1 km^2 entirely within section 3 (protracted), T3S, R48E. Mellan Mountain is at the northern end of a ridge of low hills that join with the Cactus Range south of Cactus Flat. Workings in the district, mainly underground, consist of an inclined shaft (the Mellan Incline, photos 7-22 and 7-23) reported to have over 800 feet (244 m) of total workings, a vertical shaft (on the Golden Leo Claim, photos 7-23 and 7-24) reported as having about 700 feet (214 m) of total workings, and two adits (the Daniels Lease and the townsite)



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each having about 200 feet (60 m) of total workings (Kral, 1951; unpub. data at NBMG). Additionally, there are a number of short adits and a short inclined shaft, all generally less than 60 feet (18 m) each, throughout the district. Total subsurface workings are thus more than 2,000 feet (600 m).

History of Discovery, Exploration, and Mining

The district was reportedly discovered by Jess and Hazel Mellan in 1930. No claims are known to have been patented in the district, and unpatented claims staked in the 1930s cover most of Mellan Mountain (Turner, 1934). Claim names from that time include: Auen, Leo, Charlotte, Vista, Forked Willow, Jackson, Colorado, and Viola (Turner, 1934). Mellan Gold Mines, Inc. and at least two other groups held claims in the district during that time, and three sets of lessors were reported to be working in 1933 (Goldfield News and Weekly Tribune, Aug. 25, 1933). Production has been estimated at about $1,000, prior to World War II (Kral, 1951, p. 131). Records of the USBM indicate that 33 tons of ore yielding 11 oz gold and 50 oz silver were mined in 1936 and 1937. Apparently the major development effort was in the mid-1930s. Newspaper accounts report that some vein material from the district could be crushed and panned to obtain up to $100 per ton (gold was valued at $20.67 per oz at that time, so this was about 5 oz); select samples were said to carry up to $500 per ton (about 24 oz) (Goldfield News and Weekly Tribune, Aug. 25, 1933). Unpublished data at NBMG indicates that sacked ore from this period had a grade of 0.33 oz gold per ton and 2(?) oz silver per ton, in general agreement with the USBM grades. Also, it is reported that some ore was sent to the McGill (Nevada) smelter that graded 1 oz gold per ton. There is no record of operations in the district after World War II. The property was apparently offered to a number of mining companies during the 1930s, based on copies of correspondence and property examinations from that period of time.

Present Investigation

Most of the geologic mapping and sampling done at Mellan Mountain was completed during March 1995 (fig. 7-16), although brief visits were made at other times. Underground mapping was confined to horizontal workings; no attempt was made to enter the inclined or vertical shafts of the district. However, unpublished maps of the workings from 1930s and 1940s (for example, see fig. 7-17) were of considerable assistance in understanding mineralization in the subsurface.

Geologic Setting

Mellan Mountain is underlain by rhyolitic ash-flow tuffs and local intercalated tuffaceous and volcaniclastic sedimentary rocks. Ekren and others (1971) assigned these rocks to a lower unit, the tuff of White Blotch Spring, and an upper unit, the tuff of Wilsons Camp.

The tuff of White Blotch Spring was has been dated by potassium-argon methods elsewhere at 22.4 to 25 Ma (new constants) by Ekren and others (1971), and was later reassigned by Best and others (1993) to the 22.6-Ma Pahranagat Formation. At Mellan Mountain, this unit consists of light pinkish gray, moderately welded ash flow tuff with moderately compacted light gray pumice (commonly 1 by 3 cm), sparse volcanic lithic fragments less than 1 cm in diameter, and phenocrysts of reddish vermicular quartz, plagioclase, sanidine, and biotite.

Nonwelded rhyolitic ash-flow tuffs and intercalated volcaniclastic sedimentary rocks are exposed over most of Mellan Mountain. These rocks have been referred to as the tuff of Wilsons Camp by Ekren and others (1971). The rock is light brown to locally dark reddish brown weathering (light yellowish gray on fresh surfaces) with uncollapsed pumice and lithic fragments that are commonly in the 0.5-2 cm range and up to several centimeters in diameter (rarely 20 cm for pumice). Phenocrysts consist of vermicular quartz, sanidine, plagioclase, and biotite. The lithic fragments are commonly silicic volcanic rocks, but at least one fragment of foliated metamorphic rock was observed; this rock type was most likely derived from the Trappman Hills area about 20 km to the southwest. The ash-flow tuffs and sedimentary rocks are silicified in all outcrops; in the tuff, this alteration has resulted in removal of some of the nonwelded pumice from the rock and deposition of drusy quartz in the resulting cavities.

Sedimentary beds of volcaniclastic sandstone, conglomerate, and tuffaceous siltstone are intercalated in the tuff of Wilsons Camp at a number of localities. These sedimentary rocks are sufficiently thick and exposed well enough to be mapped only in the northwest Mellan Mountain area (fig. 7-16); however, thinner units are observed, especially in adits and pits, throughout the district. The sedimentary rocks are also silicified, and locally iron stained. The conglomerate units contain pebbles of volcanic rocks, commonly of felsic composition, but a few basalt(?) pebbles were noted. The pebbles in conglomerate and conglomeratic sandstone are commonly 1 cm or less in diameter. Finely laminated silicified sedimentary rocks represent bedded and reworked ash.

Regionally, the tuff of Wilsons Camp rests on the Pahranagat Formation (formerly tuff of White Blotch Spring) (Ekren and others, 1971, p. 39). At Mellan Mountain, the tuff of Wilsons Camp is in fault contact with the tuff of White Blotch Spring along a north-northwest-striking normal fault. The tuff of Wilsons Camp may directly overlie Pahranagat Formation in an area southwest of the Mellan Incline; however, exposures are poor in that area. Other north-northwest-striking faults are observed in the area southeast of Mellan Mountain (Ekren and others, 1971, plate 1), and the region is likely one of considerable extension and low-angle normal faulting (R. E. Anderson, unpub. geologic mapping, 1967; McKee, 1983). Although no low-angle faults were noted in the Mellan Mountain district, local steep dips in sandstone units interbedded with the tuff of Wilsons Camp suggest considerable rotation and thus extension.

Mineral Deposits

Mineral deposits at Mellan Mountain consist of chalcedonic quartz veins and silicified breccia zones carrying values in gold and silver hosted by silicified tuff of Wilsons Camp. For the higher grade samples, the silver-to-gold ratio is about 5:1 to 10:1, while the lower grade samples (0.0X oz gold per ton) have ratios of 15:1 to 50:1. The main underground workings were not easily accessible, as they are vertical or steeply inclined. However, based on examination of all the surface workings and unpublished information (Turner, 1934), it appears that the predominant strike of the major veins is N30°W; the veins dip 55°-75°NE. The Mellan Incline (names are from Turner, 1934), located on the west flank of the eastern hill of Mellan Mountain, was sunk to explore a quartz vein along a N30°W, 55°NE normal fault zone which separates the hanging wall tuff of Wilsons Camp from the footwall tuff of White Blotch Spring (fig. 7-16). The vein is exposed, at least sporadically, for nearly 100 m along the surface trace of this fault, and is more than 1 m wide at the surface. Shallow workings explore the fault further to the northwest, but vein material was not observed (e.g., fig. 7-18, Mellan Townsite Adit). Underground in the Mellan Incline (fig. 7-17), good values in gold are found in veins and veinlets across a mineralized zone that varies from 3 to 15 m in

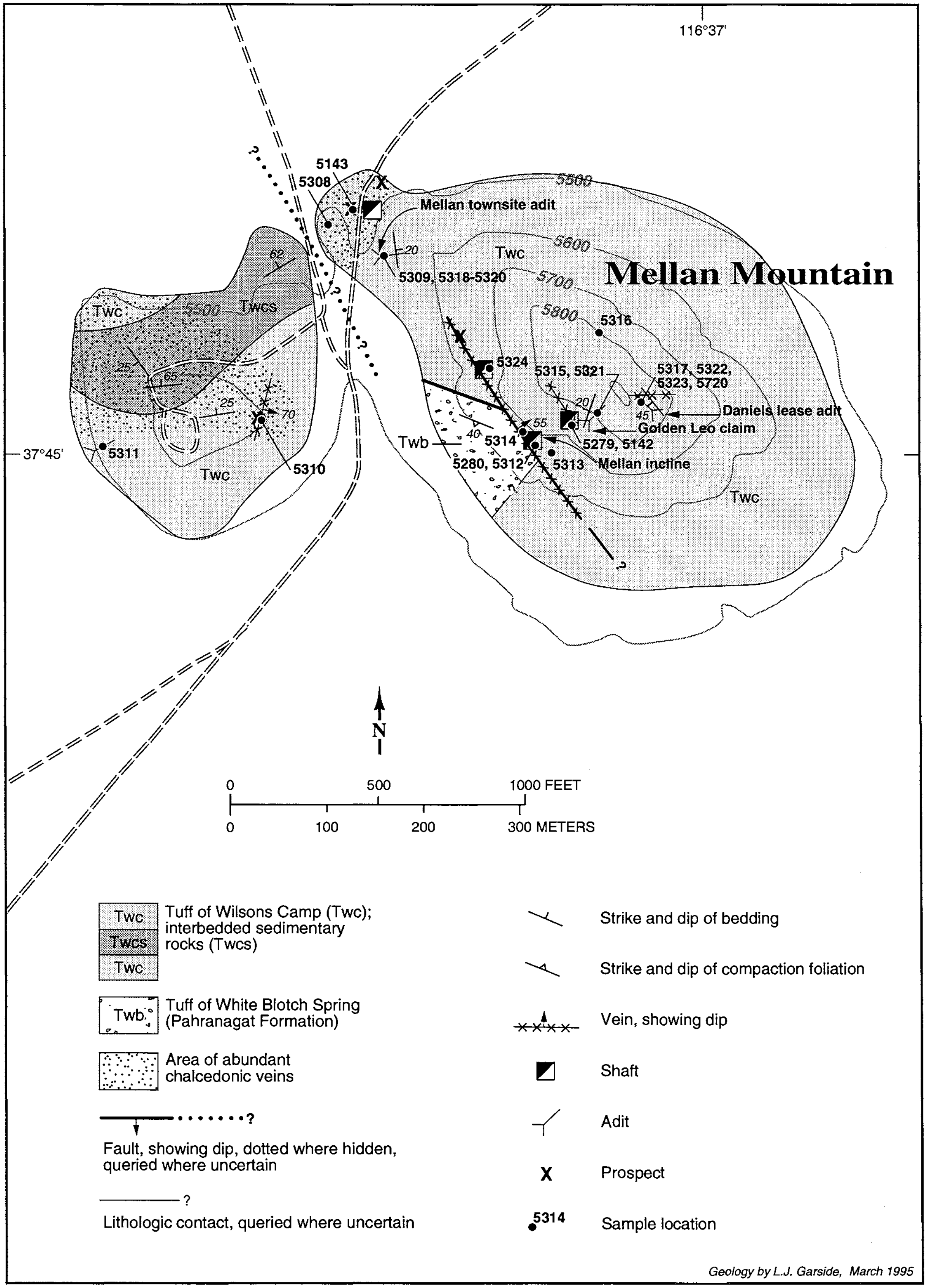


Figure 7-16 Geologic map of the Mellan Mountain district, Nye County, Nevada.

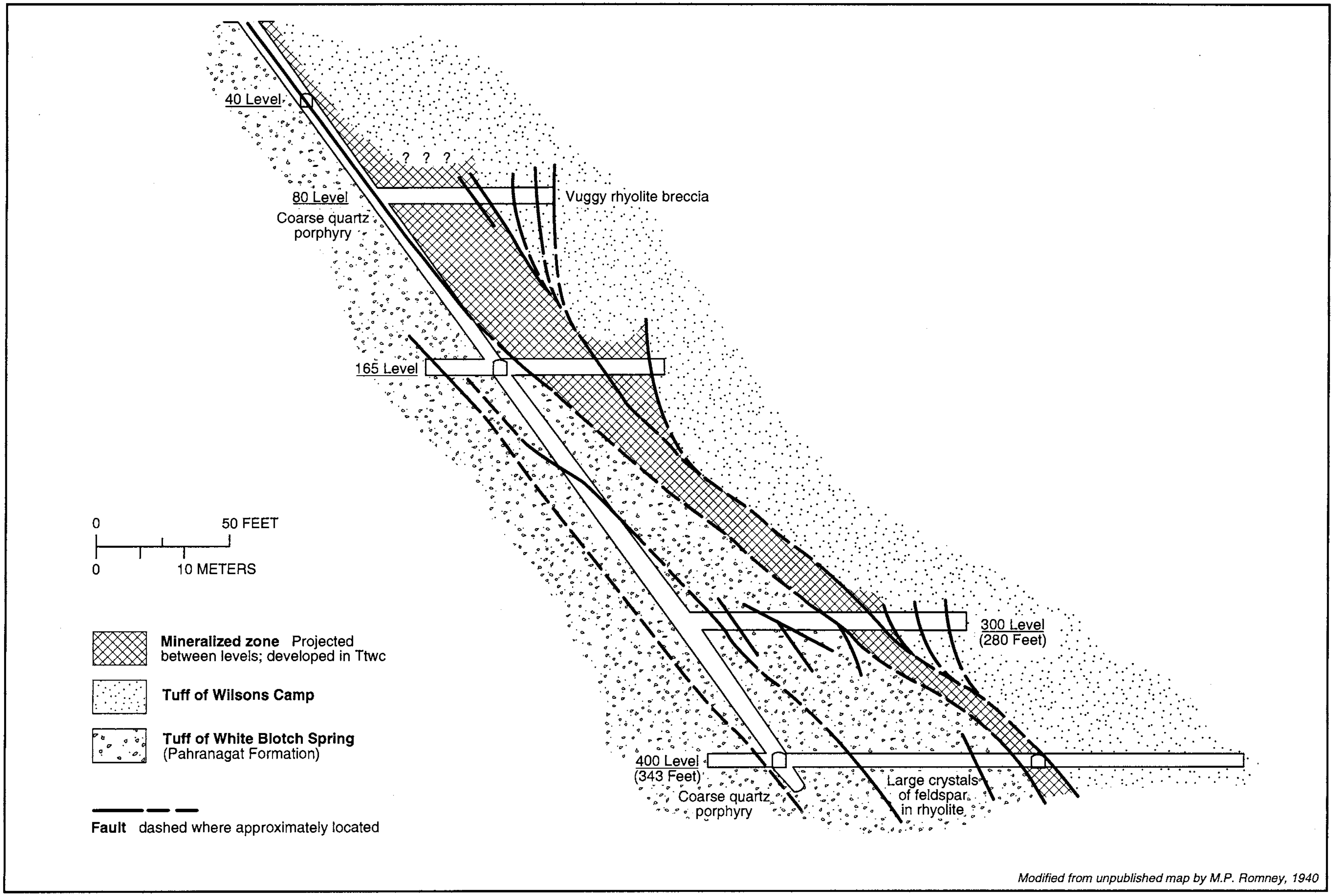


Figure 7-17 Cross section of the Mellan incline, Mellan Mountain district, Nye County, Nevada.

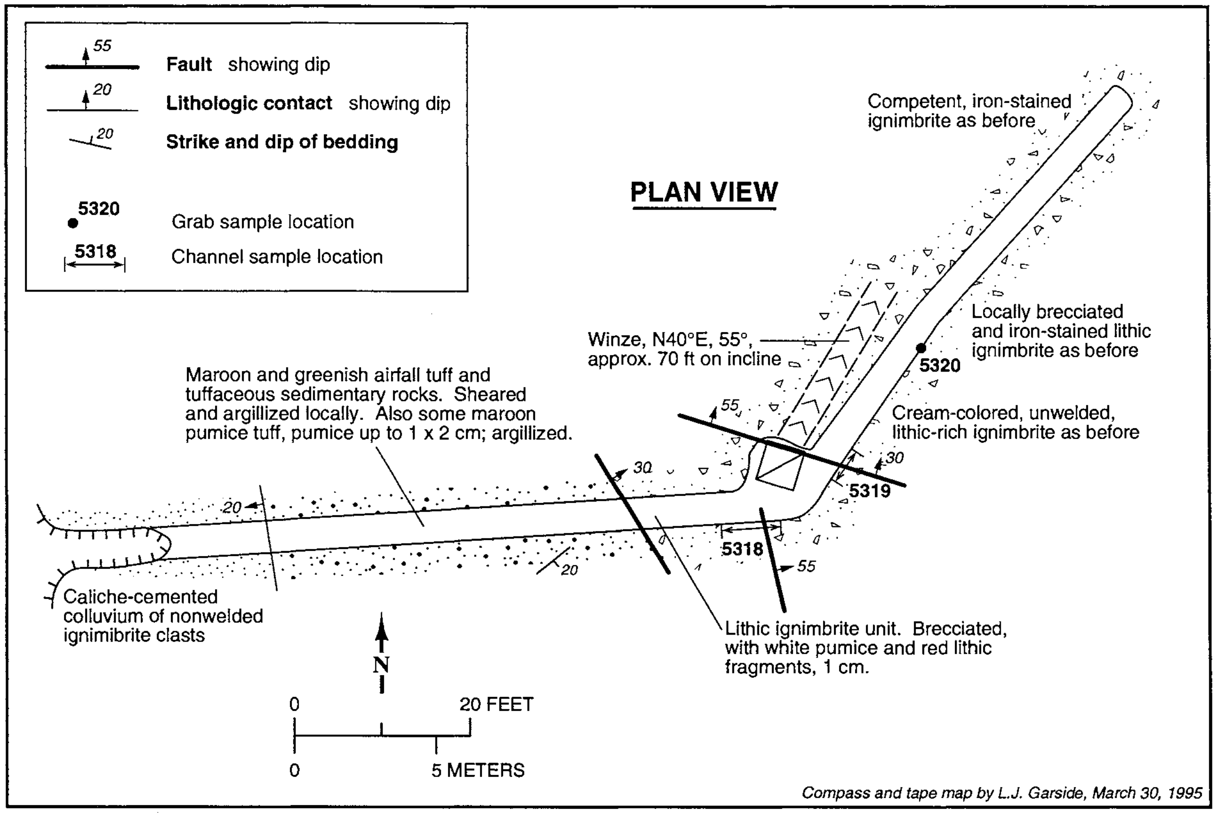


Figure 7-18 Geologic map of the Mellan townsite adit, Mellan Mountain district, Nye County, Nevada.

width. However uncertainty in previously existing unpublished data (NBMG files) on channel and chip samples from underground at the Mellan Incline allows only rather general estimates of grade. One report of grades across the mineralized zone (M. P. Romney, Field Engineer for U.S. Smelting, Mining, and Refining Exploration Co.) indicates 0.03 oz gold per ton over 46 feet (14 m) on the 165-foot (50 m) level, 0.0075 oz gold per ton over 12 feet (3.7 m) on the 280-foot (85 m) level, and 0.025 oz gold per ton over 10 feet (3 m) on the 343-foot (105 m) level. Dollar values reported for underground samples collected by Professor C. L. Chapman (Arizona University), if interpreted as all gold, indicate from trace to 0.1 to 0.34 oz per ton over 5- to 10-foot (1.5-to 3-m) widths. Although Chapman cut some 4.5- to 6-foot (14.- to 1.8-m) samples with grades up to about 0.6 oz gold per ton, values across these widths on the 343-foot (105 m) level appear to average only about 0.05 oz gold per ton equivalent. Higher values than those described above are reported by J. C. Robinson (unpub. maps, NBMG) for a number of areas in the Mellan Incline workings. A narrow vein of similar strike to the Mellan Incline vein (and having a 70°NE dip) was noted in a short adit in the hanging wall near the Mellan Incline collar. If a block of mineralized rock 300 feet (100 m) long, 400 feet (122 m) down the dip of the vein, and 20 feet (6.1 m) thick is assumed to have an average grade of 0.025 oz gold per ton and the specific gravity of quartz (or 75 percent of quartz for a lower estimate), this yields 150,000 to nearly 200,000 tons of material containing about 3,700 to nearly 5,000 oz gold. Grades in this range are not economically mineable underground today. Even if higher grade zones were selectively mined they would likely total, based on the above calculations, a few thousand ounces.

About 45 m northeast of the Mellan Incline is the other major working of the district, the vertical shaft on the Golden Leo Claim. There, Turner (1934) reported that three good veins were cut in drifts off the shaft. Only one vein is shown on Turner's map of the workings; it strikes N35°W and dips 75°NE. Unpublished maps and other data by M. P. Romney indicate that this shaft was probably originally situated to intersect the Mellan Incline vein, but was not extended that deep. His underground maps indicate that N45°W and N60°W as well as N55°E mineralized faults were encountered in the drifts off the shaft. A northwest striking crushed and iron-oxide stained zone about 40 feet (12 m) wide had reported grades of 0.03 to 0.05 oz gold per ton. Drifts from the bottom of the 100-foot (30 m) shaft extend north and east-northeast, totaling almost 600 feet (180 m). At an adit (the Daniel's Lease) located about 170 m east of the vertical shaft, a narrow (less than 10 cm), east-west, 90° vein was stoped along for a short distance (fig. 7-19). A chip sample of this vein and adjacent silicified wall rock taken during this study (5322) contained only about 0.09 oz gold per ton across 2 feet (60 cm). Silver was about 1.5 oz per ton in this sample.

The veins of the Mellan Mountain district are vitreous to milky, sacchroidal to chalcedonic, and are locally stained with limonite. No sulfide minerals were observed, and limonite pseudomorphs after pyrite are rare; thus, oxidation is apparently complete to depths below those of mining (about 85 m). Although Turner (1934) reported manganese oxides, they are rare in the veins examined during this study. Locally, the veins have a parallel bladed texture (as defined by Morrison and others, 1991) that indicates selective replacement of an early bladed carbonate mineral (calcite?) by quartz. No visible free gold was noted during this study, but Turner reports that gold can be panned from crushed ore. The quartz vein material is highly brecciated in some veins. Silicification in the wall rock is ubiquitous at Mellan Mountain in the porous unwelded tuff and sedimentary rocks of Wilson's Camp. No coarse crystals of adularia were observed in the Mellan quartz/chalcedony veins, but adularia occurs in local concentrations and thin bands in a vein sample from the Daniels Lease and in adjacent wall rock (as defined by the hydrofluoric acid-sodium cobaltinitrite stain test). It is likely present elsewhere as well.

The hills of the district, surrounded by an area of alluvium, result from the preservation of the more erosion-resistant silicified rocks. In thin section, altered pyroclastic rocks have overgrowths on quartz phenocrysts, patchy alteration (adularization?) of feldspars, sericitization of biotite, and clay and calcite alteration of groundmass and plagioclase phenocrysts. In a few areas along faults beyond the continuation of a vein, or adjacent to narrow veins, argillic alteration was noted. Illite and smectite were identified from two different samples from the district.

In certain areas of the district, narrow (commonly 1-10 cm) veins of cream to light tan, locally banded, chalcedonic silica are very common in the tuff of Wilsons Camp. These concentrations of veins are generally somewhat separate from the major veins of the district. Some of these veins have curving fractures within them that are reminiscent of dehydration cracks observed in silica gel (amorphous silica). The texture indicates that the veins were originally filled with amorphous silica and have recrystallized to chalcedony and finely sacchroidal quartz (see Fournier, 1985). One vein near the Mellan townsite has a corrugated or rippled (fluted) surface that is likely produced by deposition of silica gel during hydrothermal fluid streaming. Similar fluting textures have been observed at other hot-spring gold-silver deposits (Tingley and Berger, 1985, p. 36; L. Garside,

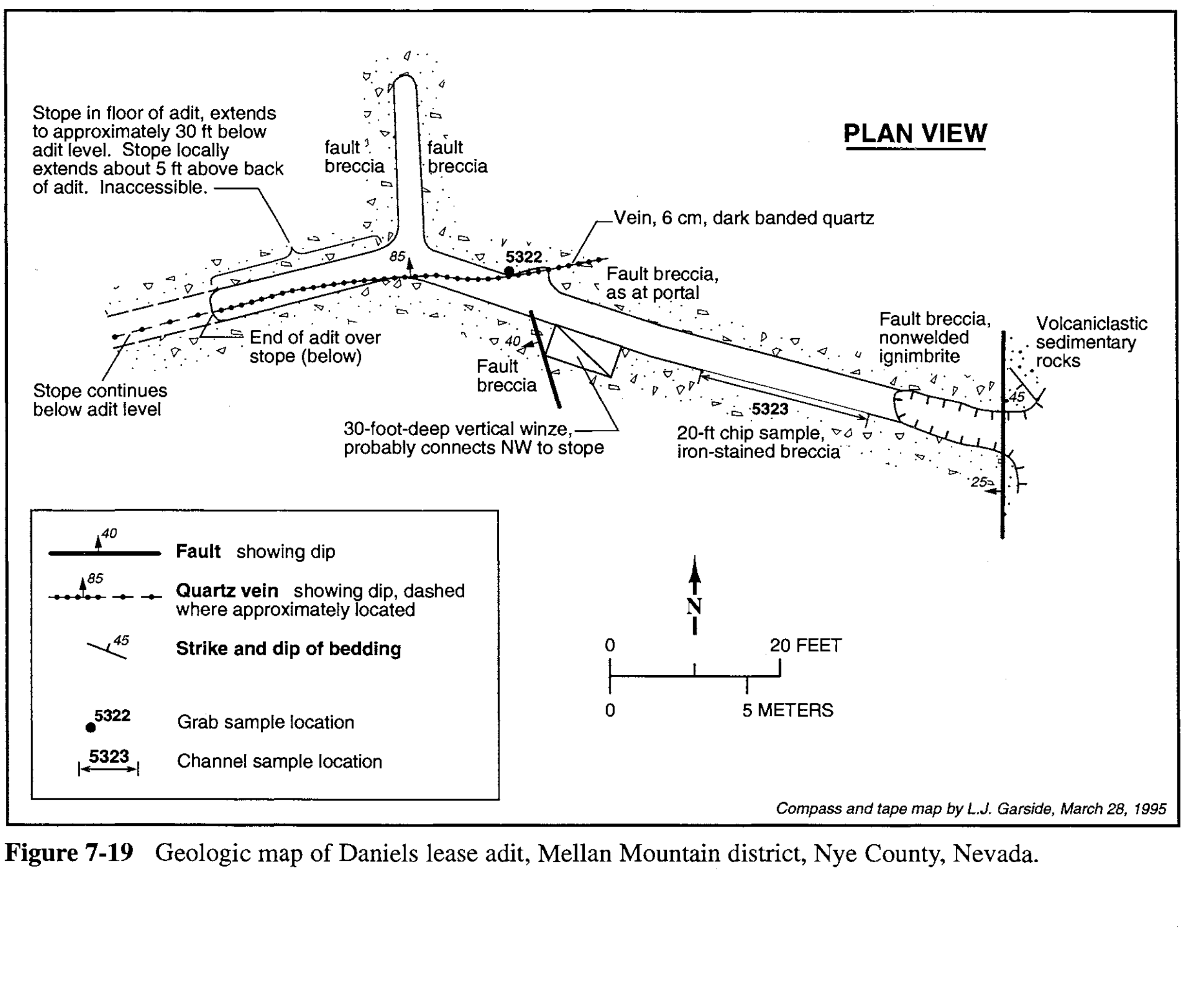


Figure 7-19 Geologic map of Daniels lease adit, Mellan Mountain district, Nye County, Nevada.

J. Tingley, and H. Bonham, unpublished data from the Hasbrouck Mountain area, Divide district, Nevada). Iron staining is not intense, indicating that pyrite was sparse to absent in these veins. They do not seem to have any particular orientation, and are more common in two areas in the district (fig. 7-16). The chalcedonic veins did not receive much attention during mining and exploration in the 1930s, probably because they were not found to contain appreciable gold and silver values. A sample collected during this study (no. 1508) tends to confirm this speculation, having only very slightly anomalous values in gold and silver (although mercury was anomalous).

The narrow chalcedonic veins described above were likely deposited at temperatures below 180°C as amorphous silica (see Fournier, 1985); later conversion to chalcedony does not necessarily require heating to significantly higher temperatures. The character of these veins, combined with the chalcedonic to sacchroidal texture of the major veins, the sparsity of crustiform textures, occurrence of sparse illite and smectite as the argillic alteration minerals, and sparsity of adularia (especially coarse crystals) all suggest a shallow depth and low temperature of deposition. Boiling of the hydrothermal fluids can be inferred from the presence of parallel bladed or lattice textures (White and Hedenquist, 1990). Silicification in the porous tuff most likely represents a silica cap high in the hydrothermal system. All these features suggest that the Mellan Mountain district represents the upper part of a low-sulfidation (adularia-sericite) type hydrothermal system (Heald and others, 1987; White and Hedenquist, 1990). A continuum likely exists between low-sulfidation epithermal gold-silver deposits and hot-spring gold-silver deposits (Berger, 1985, 1986), which include mineralization formed at or within 100 m of the paleosurface (Bonham, 1985). The model that best describes the epithermal mineralization at the present level of exposure at Mellan Mountain is that of the hot spring gold-silver deposit (Berger, 1986), although hot-spring sinter deposits are not present. Such systems with anomalous gold in the upper portions (the chalcedonic superzone of Morrison and others, 1991) are considered by many economic geologists to be likely to overlie a well-mineralized crustiform-colliform vein zone and/or bonanza ores, which could lie within a few tens to a few hundred meters below the depth of present exploration.

Geochemistry

Twenty-one rock geochemical samples were collected in the Mellan Mountain district, mainly from prospects and mines; they include select, grab and chip samples from dumps, outcrops, and underground workings. In these samples (refer to appendix C), gold and silver are anomalous, as is antimony; arsenic is anomalous to strongly anomalous, and mercury is weakly to strongly anomalous. Additionally, tungsten is commonly moderately anomalous, barium is weakly anomalous in a few samples, and bismuth is anomalous in one sample. Base metals (copper, zinc, lead) are non-anomalous in essentially all samples, as are most other metals (nickel, chromium, vanadium, tin). Selenium, tellurium, and thallium are not anomalous, although molybdenum and uranium are elevated, silver-to-gold ratios for the higher-grade samples range from 16:1 to 25:1, generally comparable to ratios determined from ore samples reported in unpublished sources (see below).

The group of associated trace elements in ore and mineralized rock samples from the district is similar to that reported from hot-spring type gold-silver deposits (Berger, 1986). The silver-to-gold ratios from the Mellan Mountain district are also low (generally less than 50:1), as is characteristic of hot-spring gold-silver deposits. Although Berger (1986) reported that anomalous thallium should be expected in such hot-spring type deposits, it is not anomalous at the Mellan Mountain district; however, it is not certain that it is universally present in such deposits. Anomalous molybdenum, although not noted by Berger (1986) is reported from some hot-springs deposits, especially those hosted by or associated with silicic volcanic rocks (e.g., Hasbrouck Mountain, Nevada - Bonham and Garside, 1982, appendix 1; Hog Ranch, Nevada - Bussey and others, 1993; Red Butte, Oregon - Zimmerman and Larson, 1994).

Anomalous uranium values are noted from mineralized samples in the Golden Leo and Daniel's Lease areas. Radioactivity readings taken with a scintillometer at these properties were up to 5 times background at certain locations. Uranium values from mineralized rock samples of the mining districts sampled in the NAFR are commonly a few ppm (generally less than 10 ppm; see appendix C). This range is similar to unmineralized rock samples from the area (appendix C). Thus, the sporadic anomalous uranium values (about 20 and 30+ ppm) noted in Mellan Mountain district samples are most likely related to uranium redistribution and concentration during alteration of the wall rock or later supergene groundwater movement.

Some select samples collected during this study contain gold and silver values comparable to those described in reports from the period of active mining, and some chip samples, taken across widths of a meter or more in veins or breccia zones which include vein material, have gold values from 1 to 3 ppm. These values are presently economic using bulk-mining methods. Select and chip rock samples that are not from or adjacent to veins have gold values below 0.1 ppm. Thus, no direct indication of disseminated, bulk-mineable material was found by sampling. However, disseminated deposits might be located by a more closely spaced surface and underground sampling program and/or by drilling.

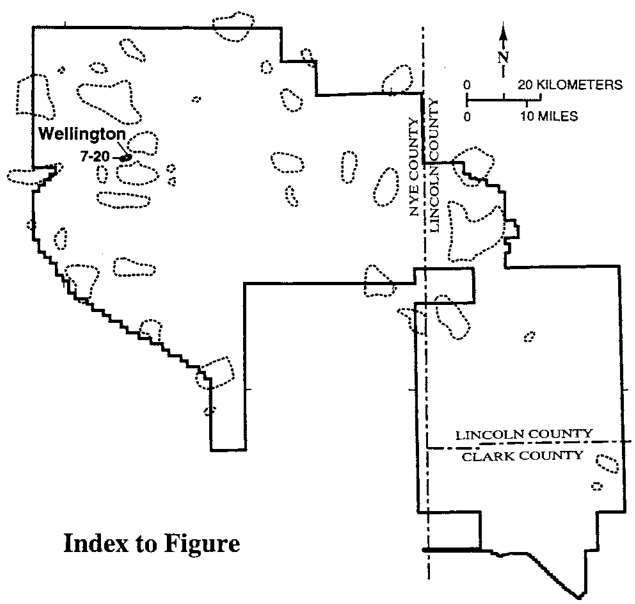
The hills that make up Mellan Mountain are preserved as erosional remnants due to silicification of the rocks; thus, although there may be an area of potential alteration and mineralization concealed by pediment deposits which surround Mellan Mountain, this area is likely to be small. Further exploration in the distinct is warranted both at depth (for bonanza-type gold-silver deposits) and in the silicified area in the vicinity of the veins (for bulk-mineable disseminated deposits of the Round Mountain ore Rawhide types, e.g. Tingley and Berger, 1985; Black and others, 1991).

Identified Mineral Resources

There are no identified mineral resources in the Mellan Mountain district.

Mineral Resource Potential

The Mellan Mountain district is considered to have high potential for bulk-mineable disseminated gold-silver deposits near the surface, and for bonanza-type vein gold-silver deposits at depths below the level reached by exploration. The certainty level for this potential is C.



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7.3.2.7 Wellington District

Location

The Wellington mining district is located at the south end of the Wellington Hills, a north-trending outlier west of the southern Cactus Range. The district is about 8 km southwest of Antelope Peak, the highest peak in the range. O'Briens Knob, a local landmark, rises from the basin separating the Wellington Hills from the main Cactus Range. Mines and prospects are concentrated in sections 22, 26, and 27, T 4S, R46E; the only major mine workings are confined to section 27. In 1904-05 the road between Goldfield and Wilson's Camp passed through Wellington and provided access to the mines and prospects. Over time and with no use, this road has faded back into the desert and there is now no road access into the district.

Wellington was known as O'Briens Camp for a time shortly after it was discovered (Ball, 1907), and is sometimes included in the nearby Jamestown district. Tingley (1992) included both Wellington and Jamestown in the Wellington district. The two areas, however, are separated spatially and contain distinctly different types of mineral occurrences. In this report, these are consider to be two separate districts, Wellington to the north and Jamestown to the south.

History of Discovery, Exploration, and Mining

According to Ball (1907), the camp of Wellington was established in August 1904 shortly after gold was discovered in the nearby hills. The camp was active only until mid-1905 and was reported abandoned later that year. The Wellington Development Co., however, was being promoted in local newspapers in 1907 (Goldfield News, annual review issue, 1906-1907). The only mining claims in the district that were taken to patent, the Hope Now and Hope Next claims, were located in September 1904, amended in 1915 and eventually patented in 1917, long after work is reported to have ceased in the district (Hall, 1981). Hall also mentions that, as late as the 1920s, a few buildings and a mill remained at the site of the old camp. No production has been reported from the district and no structures were in evidence in 1994. Mine workings depicted on the 1915-era patent maps match closely with those seen during examination of the district in 1994 indicating that, in fact, little has happened at Wellington since the first flurry of activity.

Previous Investigations

Wellington is described in early geologic descriptions of the Cactus Range by Ball (1907). Kral (1951) and Cornwall (1972), restated Ball's earlier description, but placed the mines in Jamestown about 3 km to the southeast. USGS geologist R. E. Anderson mapped this portion of the Cactus Range in 1962-64. His work was used in a 1971 compilation of the geology of northern Nellis Air Force Base (Ekren and others, 1971) but his detailed mapping has not been published.

Present Investigations

Prospects in the Wellington district were examined and sampled in July and October 1994 as part of the NAFR inventory and assessment.

Geologic Setting

The southern Wellington Hills are underlain by the Monotony Tuff and the tuff of Antelope Springs of late Oligocene age (fig. 7-20). The Monotony Tuff, a densely

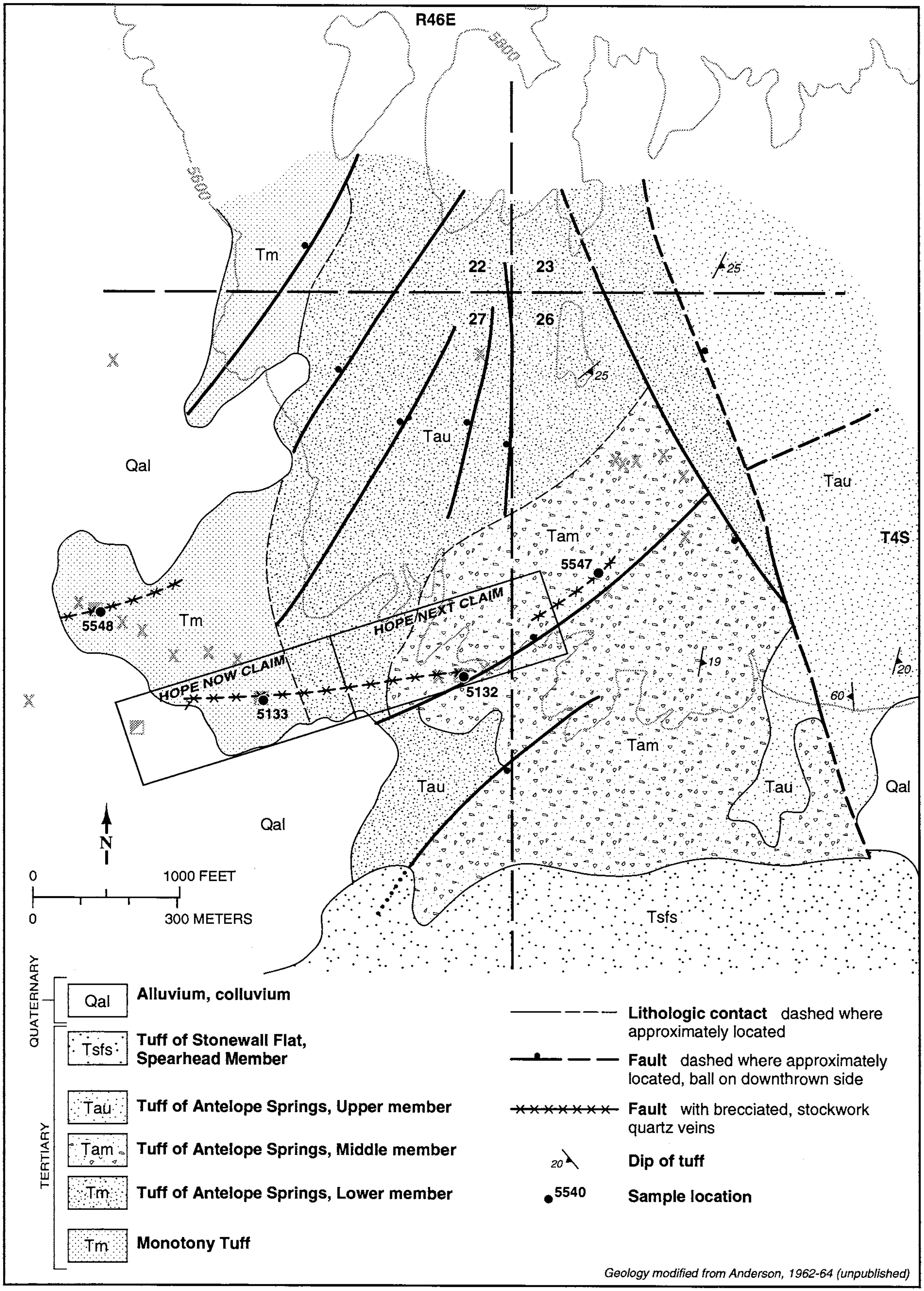


Figure 7-20 Generalized geologic map of the Wellington district, Nye County, Nevada.

welded, crystal-rich unit usually containing abundant quartz phenocrysts, crops out in the western part of the Wellington district. The Monotony is overlain to the east by the tuff of Antelope Springs, a sequence of rhyolitic to rhyodacitic ash-flow tuffs. These tuffs are described by Ekren and others (1971) as densely welded, crystal-poor rocks with sparse quartz. The tuff of Antelope Springs generally weathers to red, purplish, or reddish-brown outcrops. All of the units dip generally to the east and are cut by northeast- and north-northwest-trending normal faults (fig. 7-20).

Mineral Deposits

The mine workings in the Wellington district explore low-sulfidation (quartz-adularia) gold-silver veins. Narrow quartz veins and quartz stockwork zones occur along steep faults in silicified rhyolite tuff. These zones are locally brecciated and are stained with iron and manganese oxides. The veins commonly contain vugs lined with small quartz crystals. Ball (1907) reported that values of the ores were mainly in gold, silver constituting but one-twentieth of the assay value. The ore was free-milling and the gold was found in close association with limonite.

Where seen in outcrop in the eastern part of the district (Bellows Adit, sample site 5547, photo 7-25), the veined stockwork zone is up to 1.5 m wide and occurs within an envelope of bleached, argillically altered tuff up to 50 m wide that is, in turn, within a much larger envelope of propylitically altered tuff. The stockwork zone contains lenses of silicified breccia up to 6 cm thick. The zone strikes N55°E and dips about 40°NW. This structure appears to turn to the west along strike and either merges with or becomes the structure exposed at the Hope Now-Hope Next shafts.

At the main workings of the district, on the Hope Now and Hope Next patented claims (photo 7-26), the major vein structure strikes N80°E and is vertical. Tuff exposed at the site is laced with stockwork quartz veining. Individual quartz veinlets are up to 2 cm in thickness and contain disseminated pyrite and clots of limonite-after-pyrite. The two shafts on the claims are about 450 m apart and the narrow, veined structure is exposed in cuts and pits several places between the two.

A similar, parallel structure is exposed about 300 m northwest of the Hope Now shaft. Exposures here are poor, but iron-oxide-stained, vuggy quartz and calcite vein material occurs along a N70°E shear zone within propylitized rhyolite tuff.

Samples collected at Wellington were generally low in base metals although molybdenum was slightly elevated (appendix C). Antimony, arsenic, and mercury were slightly to moderately elevated, and barium was elevated in two of the four samples collected. Gold values were elevated in two samples collected from the Hope Now and Hope Next shaft dumps. The highest grade gold sample, collected from the main shaft on the Hope Now Claim, ran 9.85 ppm gold (0.35 oz per ton). Silver values were only slightly less than gold, silver-to-gold ratios in the samples collected ranged from about 1:1 to about 0.5:1.

Identified Mineral Resources

There are no identified mineral resources within the Wellington district.

Mineral Resource Potential

There is moderate potential, certainty level C, for the discovery of small lenses of gold ore within narrow quartz veins at Wellington.

7.3.3 Pahute Mesa

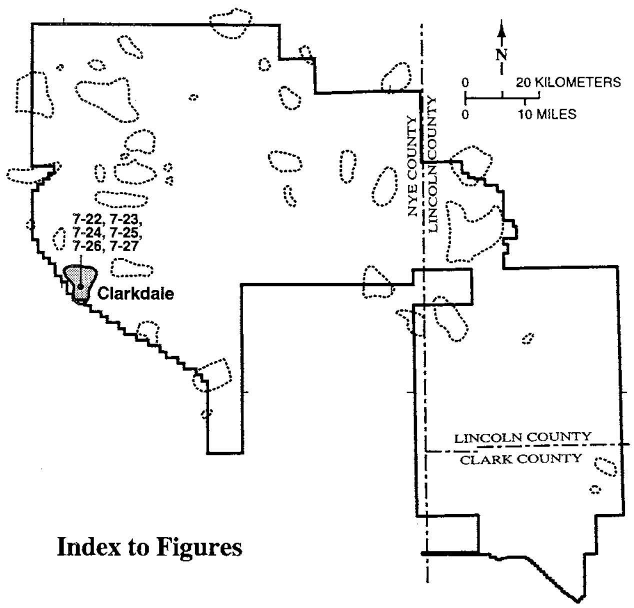
Northwestern Pahute Mesa includes several areas of negligible to small past production, such as the Gold Crater, Jamestown, Wilsons Camp, Trappman Hills, Wagner, Stonewall Mountain, Clarkdale, and Tolicha mining districts (fig. 7-21). Other areas of hydrothermally altered rocks, all with little or no past production, are present near Thirsty Canyon-Sleeping Butte, at the base of Pahute Mesa northeast of Scottys Junction, and south and west of Mount Helen (fig. 7-21).

7.3.3.1 Clarkdale District

Location

The Clarkdale mining district is located about 7 km northeast of U.S. Highway 95 in the ridges and hills that border Tolicha Wash (fig. 7-21). Most of the mine workings are located at the Clarkdale Mine, and in the vicinity of the Yellow Gold Mine (fig. 7-22). The principal workings at the Clarkdale Mine consist of three inclined shafts and three vertical shafts, each estimated to be about 60 to 100 m deep, and a stope 18 m long at the surface, open to a depth of at least 10 m (fig. 7-23, photo 7-27). These workings are shown incorrectly on the Tolicha Peak SW 7.5' Quadrangle. Shallow trenches and cuts and a short adit are present as well.

The Yellow Gold Mine (photo 7-28) comprises three principal adits, each with about 60-120 m of drifts and crosscuts, and a main shaft estimated to be about 60 m in depth; all are open. A partly collapsed ore bin is situated near the main adit (fig. 7-24) and the main shaft is located about 150 m north of the ore bin. Two subsidiary shafts and two subsidiary adits, each estimated to be <30 m in depth or length, are also present, along with at least four shallow surface



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cuts. Additional shallow shafts, short adits and numerous shallow pits and cuts are scattered between the Clarkdale and Yellow Gold Mines, in the ridges south and south west of the Yellow Gold Mine, and in the valley southwest of the Yellow Gold Mine (fig. 7-22). An outlying 30-m vertical shaft and nearby shallow pits and cuts located about 1 km northwest of the Clarkdale Mine have been referred to as the Wyoming-Scorpion workings (Kral, 1951; Quade and Tingley, 1983). Shallow pits and cuts, and the ruins of a satellite camp (Carr's camp), are located near the drainage divide about 2.3 km southwest of the Yellow Gold Mine (fig. 7-22).

History of Discovery, Exploration, and Mining

John "Curly" Carr reportedly made the initial discoveries at Yellow Gold, "formerly the old camp of Trapman" in 1931 (Goldfield News and Weekly Tribune). This is not to be confused with Trappman's Camp in the Trappman Hills, but it was possibly named for the same original prospector. Although Carr first located his Yellow Gold claims in 1931, it was not until after a "boulder of quartz...sprinkled with gold visible to the eye" was brought to Tonopah from the property in May 1932 that the rush to the area began. It was spurred on by the discovery of rich ore by Tom Clark at what became Clarkdale, north of Carr's original Yellow Gold discoveries. By September 1932, the camp had grown so much that fresh water and vegetables were being trucked in daily to supply the prospectors, and Clark and Forman incorporated their holdings into the Clarkdale Gold Mines Co., sold stock, and opened the area to leasers. The Goldfield News and Weekly Tribune gave weekly accounts of the growth of the camp and development activity by the many groups of leasers strung out along the vein north and south of the original discovery. At one time that fall, 13 different leasers were reported to all have windlasses installed and were deepening their workings on the veins. Humorist Will Rogers even visited the camp in September 1932, and the Tonopah-Beatty stage stopped there with plans for daily service to the boom town.

Weekly news reports of mining activity continued following the incorporation of Clarkdale Gold Mines Co. until the first shipment of ore was trucked from the mine to Beatty where it was loaded on a railroad car for shipment to a Salt Lake City smelter in October 1932. In August 1933, Clark was reported to have secured some Los Angeles capital to finance deepening of the shaft on the Mulqueeny lease, and he shipped a carload of ore from the Booth brothers' lease, recorded by USBM as consisting of 54 tons yielding 66 oz gold and 120 oz silver. There were no news reports from the district for a year, until it was reported that tungsten. R. McDonald had discovered a gold-bearing quartz vein at a depth of 6 feet (1.8 m) on the Gold Queen claims adjacent to the Clarkdale Gold Mines Co. property and the Yellowgold Mine (Goldfield News and Weekly Tribune, 8/31/34). After another year of no newsworthy developments in Clarkdale, a new 5-year lease was taken on the Clarkdale Gold Mines Co. property by Ernest Holloway of Hollywood, California, who installed a 20-ton [per day] mill "five miles south of Drum's Well, ten miles from the mine, near the highway," presumably Highway 95 (Goldfield News and Weekly Tribune, 11/1/35). USBM records indicate that Holloway produced 59 tons of ore in 1936, 67 tons of ore in 1937, 12 tons of ore in 1938, and 4 tons of ore in 1940 from claims in this general area, presumed to be the Clarkdale property, although the production is attributed in USBM records to the Bullfrog and Beatty districts, possibly because of the proximity of Holloway's mill to those districts. The camp was abandoned following this production, but Carr and others held valid claims in the district at the time that Kral did research for his 1951 Nye County report.

Total recorded production from the Clarkdale district was 316 tons of ore yielding 160 oz gold and 398 oz silver. There was probably some unrecorded production by lessees.

Previous Investigations

Prior to the 1990s, little was known of the geology of the district, other than its location in an area of silicic volcanic rock of presumed Miocene age (Kral, 1951; Cornwall, 1972). Geochemical and textural data from reconnaissance samples hurriedly collected in 1982 from mine workings in the district (Quade and Tingley, 1983) corroborated previous reports (e.g., Kral, 1951) of the presence of vein-type precious-metal ores. It had been known since the mid-1960s that the ash-flow sheets of the Timber Mountain Group were extensively hydrothermally altered southwest of the district, near U.S. Highway 95 (D. C. Noble, personal commun., 1988), but geologic mapping of the northern NAFR

(Ekren and others, 1971) did not include the area of the district. Examination of color aerial photographs in 1992-1993 led Weiss and others (1994; 1995) to propose that the Clarkdale district is situated within an area of post-11.4 Ma hydrothermal activity associated with the latter stages of magmatic activity of the southwest Nevada volcanic field. Publication of a geologic map of the Pahute Mesa 30' x 60' Quadrangle (Minor and others, 1993) provided additional stratigraphic information for the district.

Present Investigation

For this report, reconnaissance and locally detailed geologic mapping and sample collection were carried out, mainly by S. I. Weiss in December 1994 and April 1995, to investigate the nature and extent of hydrothermally altered and mineralized rocks in the district. Results of this work include 1) a generalized geologic map of the Clarkdale district compiled from field mapping at a scale of 1:12,000 (fig. 7-25), 2) a sketch map of the surface geology at the Clarkdale Mine prepared by tape and compass methods at a scale of 1:600 (fig. 7-23), and 3) a geologic map of the underground workings of the main adit at the Yellow Gold Mine prepared with tape and compass methods at a scale of 1:300 (fig. 7-26). The distribution of geochemical samples collected in the district is shown in figures 7-22, 7-24, and 7-27.

Geologic Setting and Mineral Deposits

Clarkdale Mine: The Clarkdale Mine workings are situated along a quartz+calcite fissure-vein that strikes N10°E and dips about 60°E. At and near the surface this vein is about 0.5 to 1 m in width and crops out discontinuously for about 60 m along strike (fig. 7-23). At the surface the vein consists of finely and crustiform banded quartz, and quartz boxwork after calcite. Thin, discontinuous bands of black limonite are present. Virtually all of the banded vein material, including that on the mine dumps, is oxidized due to weathering. Microscopic examination reveals the presence of sparsely disseminated, small, granular to subhedral pyrite grains and anhedral electrum interstitial in fine-grained quartz. The vein formed within a fault that cuts altered volcanic conglomerate (map unit Tc) that elsewhere in the district overlies ash-flow units of the Timber Mountain Group, and an intrusive body of porphyritic rhyolite and rhyolite breccia assigned by Minor and others (1993) to the rhyolite of Obsidian Butte (map unit Tyip) (figs. 7-23 and 7-25). Unaltered rhyolite of Obsidian Butte, from a locality several kilometers to the north, has been dated radiometrically at about 8.8 Ma (Noble and others, 1991).

Near-vein alteration of the conglomerate and porphyritic rhyolite includes pervasive silicification, locally with thin veins and veinlets of quartz, accompanied by about 1 percent disseminated pyrite and the replacement of feldspar grains by adularia, albite, quartz, and variable amounts of illite-sericite. The groundmass of the conglomerate has been replaced by fine-grained mixtures of anhedral quartz, anhedral to euhedral adularia, illite, pyrite, granular epidote, minor barite, and traces of chlorite. Traces of adularia, pyrite and sericite are present in the quartz veins and veinlets.

Yellow Gold Mine: Workings of the Yellow Gold Mine explored narrow, discontinuous veins of crustiform-banded and drusy comb quartz and calcite and bodies of quartz-calcite-barite-cemented breccia. The veins and vein-cemented breccia fill mainly north- and northeast-trending, steeply dipping faults and fractures cutting the Rainier Mesa(?) Tuff and overlying volcanic sandstone and conglomerate (fig. 7-25). The main adit intercepts a steeply west-dipping normal fault between pyritic, adularized and silicified Rainier Mesa(?) Tuff to the east and argillically altered, gently west-dipping cobble-conglomerate to the west (figs. 7-25 and 7-26). Vein-cemented breccia includes well-developed cockade texture, but comprises narrow bodies of less than a few meters in width (fig. 7-26). Near-vein alteration of the Rainier Mesa(?) Tuff is similar to alteration at the Clarkdale Mine, with silicification and adularization accompanied by veinlets of quartz+illite-sericite+pyrite. Although the plagioclase and sanidine phenocrysts of the Rainier Mesa(?) Tuff have been entirely replaced by turbid adularia, which in turn has been partly replaced by illite, calcite, and quartz, phenocrysts of biotite are partly preserved, indicating relatively high ratios of ${}_{\alpha}K^{+}/{}_{\alpha}H^{+}$ in the hydrothermal fluids.

Veins similar to those of the Clarkdale and Yellow Gold Mines, but filling faults and fractures in the post-Timber Mountain Group conglomerate, were explored in and near the Wyoming-Scorpion shaft, and in shallow workings 500 m southwest of the Clarkdale Mine (fig. 7-25). A finely banded vein as much as 1.5 m in width and rich in dark gray calcite fills mainly northwest and north-trending fractures within partially adularized Rainier Mesa Tuff about 850 m south of the Yellow Gold Mine.

North of the Clarkdale Mine and between the Clarkdale and Yellow Gold Mines the conglomeratic rocks overlie, are in fault contact with and in buttress unconformity with the Rainier Mesa(?) Tuff, and are intruded and overlain by plugs, dikes and a flow-dome of the rhyolite of Obsidian Butte (fig. 7-25). All of these units have undergone intense, advanced argillic alteration to mixtures of kaolinite, alunite, quartz, tridymite, chalcedony, and cristobalite (fig. 7-25). Feldspathic pebbles in the conglomerate are commonly composed of pure, medium-grained alunite. Rhyolitic volcanic glass in the conglomerate and the flow-dome is locally incompletely destroyed, and partial (non-equilibrium) replacement of glass directly by alunite ± dolomite and calcite is not uncommonly visible in thin sections. Veins and irregular replacement bodies of finely crystalline alunite+quartz are present, but vuggy-silica textures are absent.

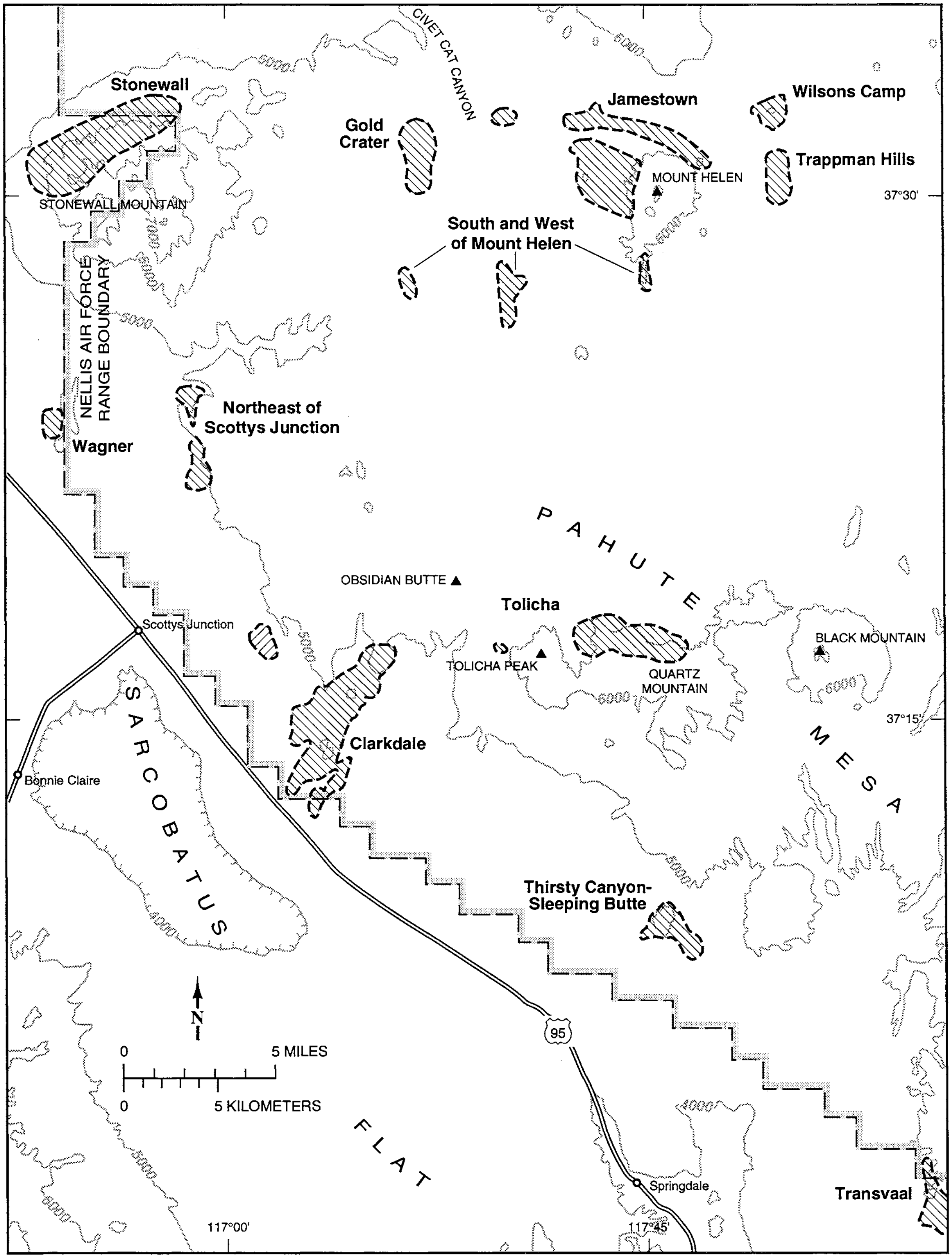


Figure 7-21 Map of northwestern Pahute Mesa showing areas of hydrothermally altered rocks.

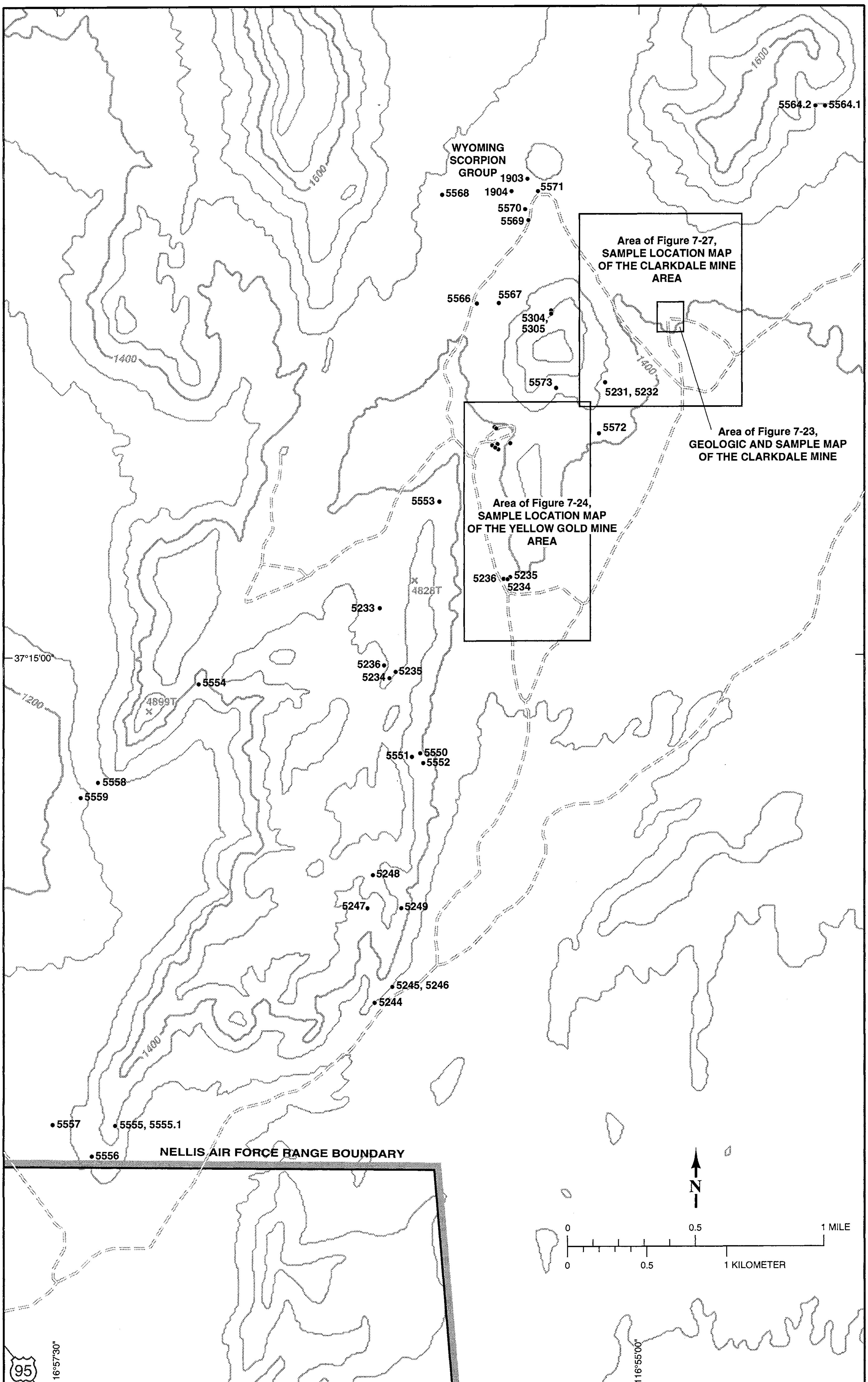


Figure 7-22 Sample location map for the Clarkdale-Yellow Gold Mine area.

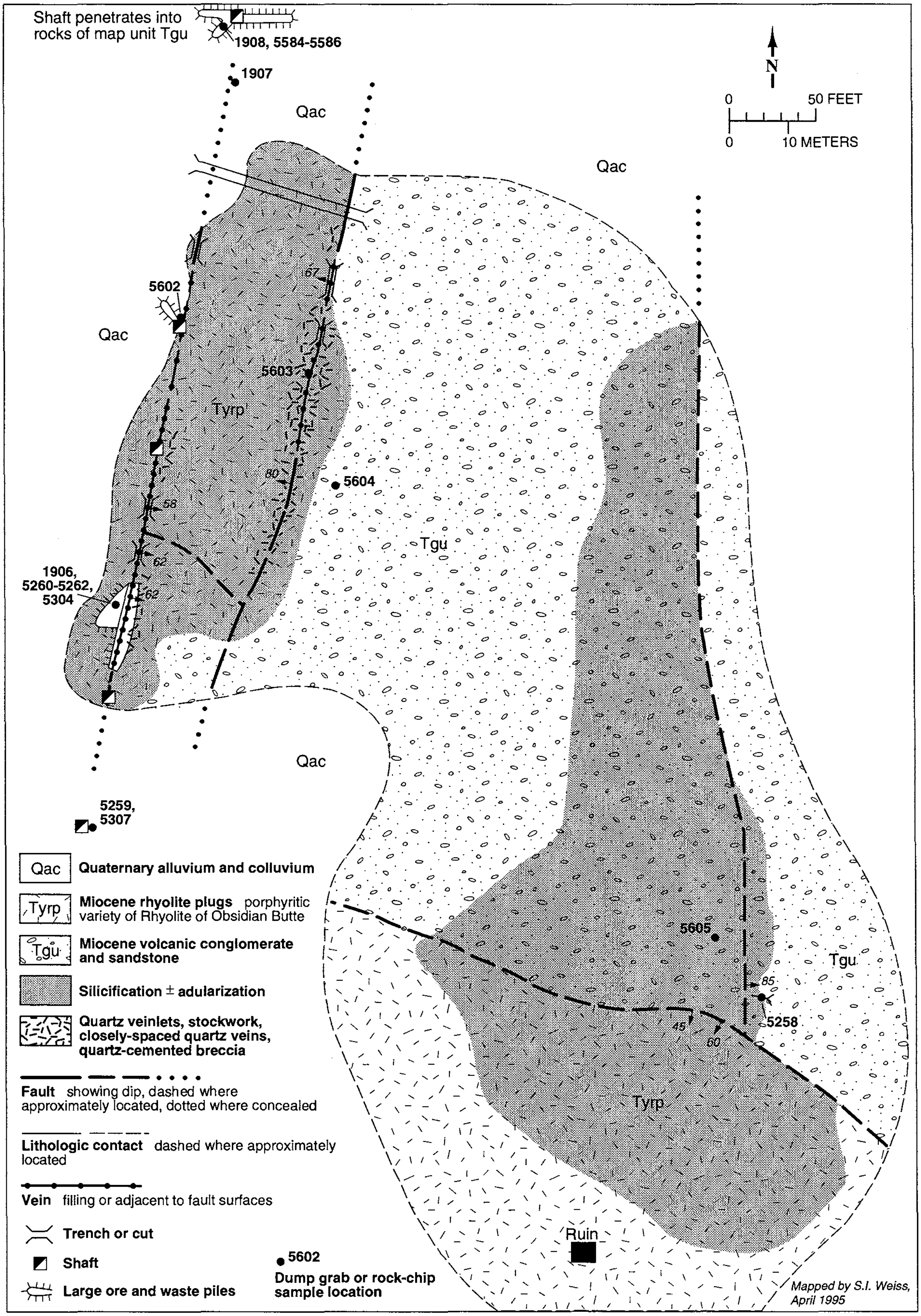


Figure 7-23 Geologic and sample map of the Clarkdale Mine, Section 3, T8S, R45E, Nye County, Nevada.

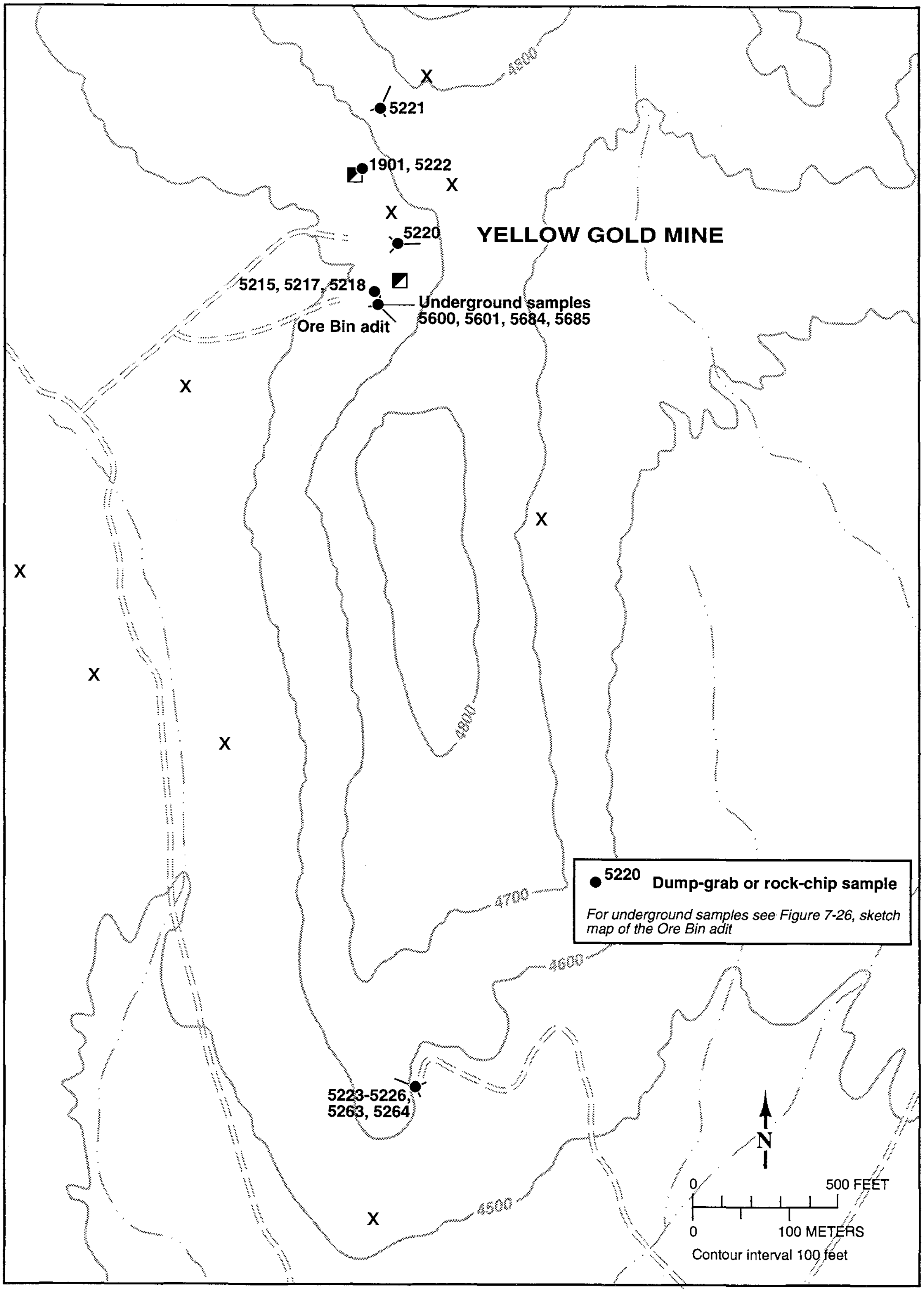
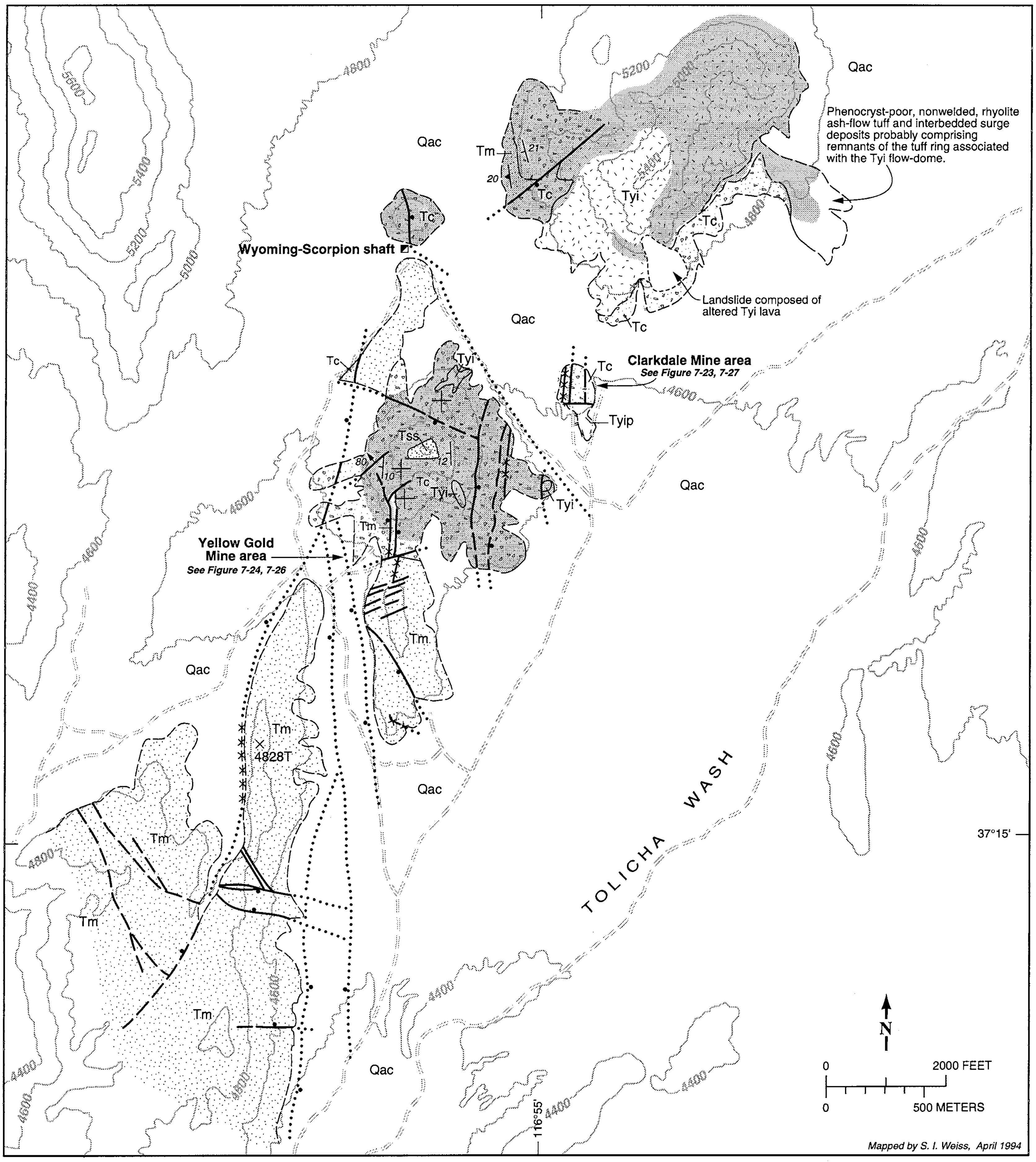


Figure 7-24 Sample location map of the Yellow Gold Mine and vicinity, Section 10, T8S, R45E, Nye County, Nevada.



Qac — **Quaternary and Recent alluvium and colluvium** unconsolidated silt, sand, gravel, and talus

Tss — **Miocene Spearhead Member of the Stonewall Flat Tuff** rhyolite ash-flow tuff

Tyi, Tyip — **Miocene rhyolite of Obsidian Butte** phenocryst poor, commonly spherulitic rhyolite lava and high-level plugs and dikes. Tyip denotes porphyritic intrusive rocks near the Clarkdale mine.

angular unconformity

Tc — **Tertiary volcanic conglomerate** consists of well-bedded to massive, tuffaceous cobble conglomerate, sandstone, and siltstone. Cobbles include pre-Cenozoic quartzite, carbonate, chert, phyllite, and granite, as well as Miocene volcanic rocks.

angular unconformity

Tm — **Miocene Timber Mountain Tuff, undivided** welded, devitrified rhyolite ash-flow tuff; includes Rainier Mesa Tuff and Ammonia Tanks Tuff.

Lithologic contact dashed where approximately located

80 — **Fault** showing dip, ball on downthrown side, dashed where approximately located; dotted where concealed

Quartz ± calcite fissure veins dashed where concealed by thin alluvium

Strike and dip of bedding

21 — Inclined

Horizontal

20 — **Strike and dip of foliation**

Areas of advanced argillic alteration

Figure 7-25 Simplified geologic map of the Clarkdale district.

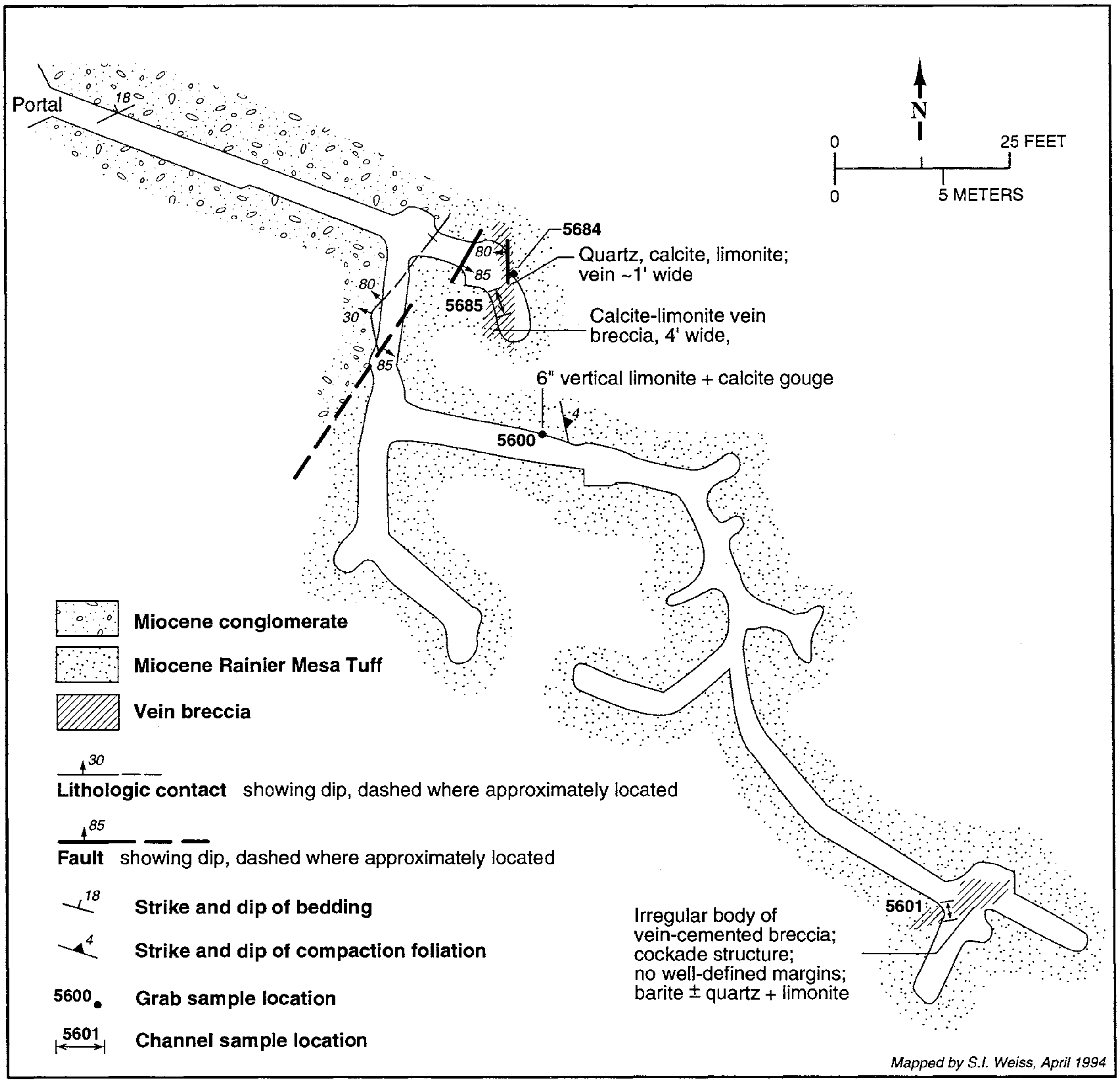


Figure 7-26 Sketch map of the Yellow Gold Mine, main adit near ore bin.

The geologic setting, and the texture and mineral assemblage of the alteration suggest a shallow, perhaps vapor-dominated, steam-heated type of acid-sulfate hydrothermal environment.

Numerous shallow prospect pits and cuts are scattered in the ridges west and southwest of the Yellow Gold Mine (fig. 7-22), within a large area underlain by hydrothermally altered ash-flow tuff of the Rainier Mesa and Ammonia Tanks Tuffs. These units are particularly resistant and form massive, dark-weathering outcrops where affected by silicification and adularia flooding associated with north and northeast-trending faults and fracture zones. Banded and drusy chalcedonic quartz and quartz+calcite veins and calcite-cemented breccia are widely distributed along faults and fractures. Reddish iron oxide stain, in part after disseminated pyrite, is common in fracture zones. Many of the prospect pits and cuts are situated along the surface projections of faults near the alluvium-bedrock contacts, such as along the west side of the ridge west of the Yellow Gold Mine where the Ammonia Tanks Tuff has been offset at least 100 m. Quartz and calcite veins similar to those of the Yellow Gold Mine are present along this fault and are exposed in a shallow adit. Locally, such as in the northern part of this ridge, disseminated pyrite (now entirely oxidized by weathering) was present in amounts of less than about 0.5 percent. Plagioclase phenocrysts have been entirely replaced by turbid adularia ± quartz ± illite ± calcite and sanidine phenocrysts are partially to completely replaced by adularia over wide areas. Veins, areas of fluted

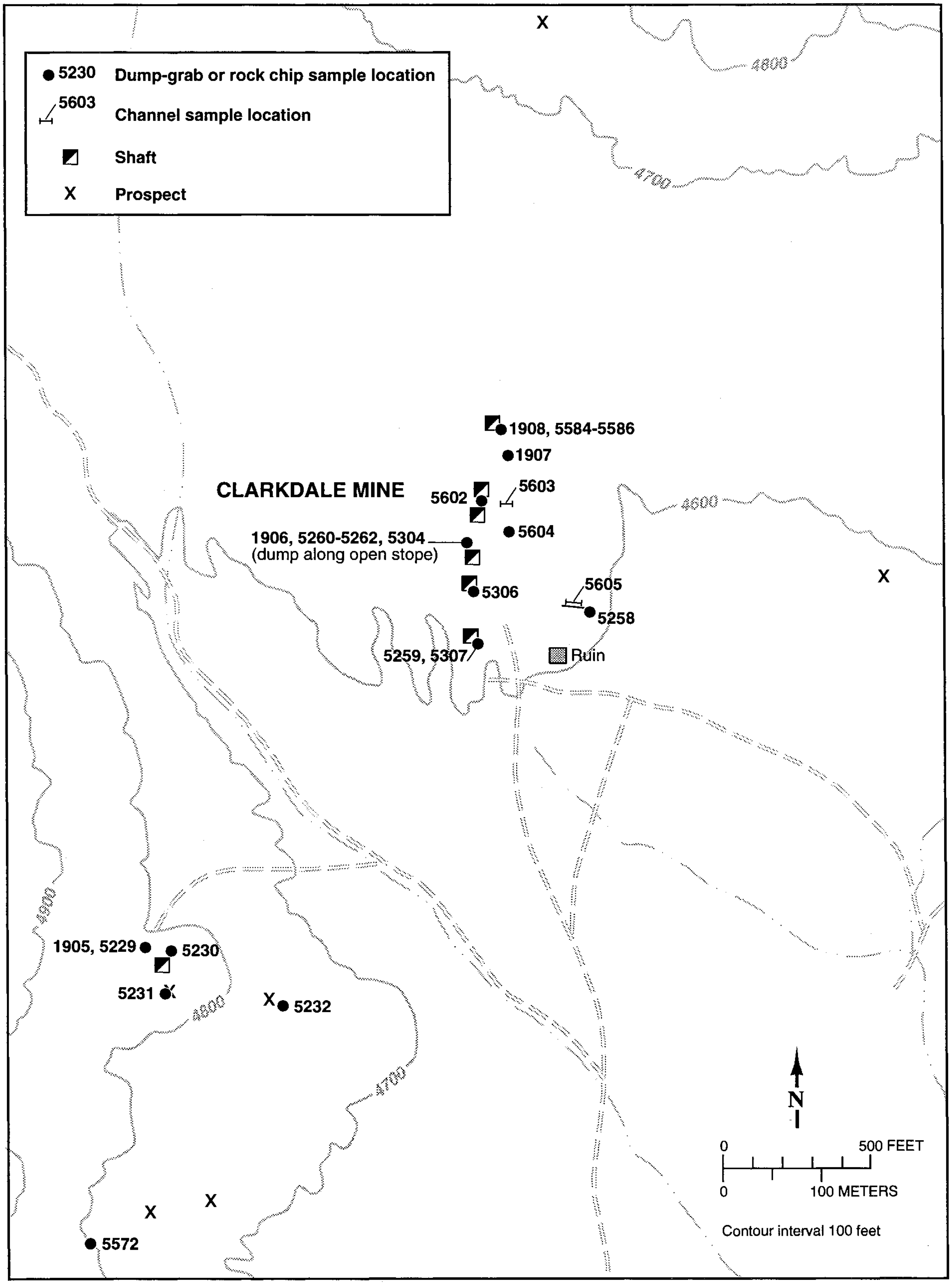


Figure 7-27 Sample location map of the Clarkdale Mine area, Section 3, T8S, R45E, Nye County, Nevada.

silica on fractures, and the partial to complete replacement of feldspar phenocrysts by adularia can be traced nearly to U.S. Highway 95. The ridge to the northwest of Tolicha Wash is composed of altered tuffs of the Timber Mountain Group that overlie or are intruded by a dome or plug of massively banded porphyritic rhyolite. The rhyolite, assigned by Minor and others (1993) to the rhyolite of Quartz Mountain (map unit Toq), is locally silicified and adularized.

Crosscutting and stratigraphic relations demonstrate that feldspar-stable alteration and the formation of the quartz+calcite veins in the district postdate 11.4 Ma, the age of the Ammonia Tanks Tuff, and are younger than the overlying volcanic conglomerate. If the porphyritic rhyolite at the Clarkdale Mine is indeed part of the rhyolite of Obsidian Butte (Minor and others, 1993), then vein formation is younger than about 8.8 Ma. Acid-sulfate alteration certainly is about 8.8 Ma or younger because the large flow-dome of the rhyolite of Obsidian Butte north of the Clarkdale Mine, and similar plugs and dikes southwest of the mine, are intensely altered to advanced argillic assemblages. The top of the large hill between the Clarkdale and Yellow Gold Mines is capped by about 10 m of flat-lying, completely unaltered ash-flow tuff of the 7.6-Ma Spearhead Member of the Stonewall Flat Tuff (fig. 7-25; Minor and others, 1993). This demonstrates that acid-sulfate type hydrothermal activity had ceased by 7.6 Ma.

Geochemistry

Analyses of specimens of veins and altered wall rocks from surface exposures, mine dumps and underground workings are given in appendix C. Crustiform-banded quartz+calcite vein material from dumps at the Clarkdale Mine contains as much as about 1 oz gold per ton, and samples containing between 0.03 to 0.15 oz gold per ton were obtained from veins southwest of the Clarkdale Mine, at the Yellow Gold Mine and south of the Yellow Gold Mine. Silver-to-gold ratios for specimens containing >0.100 ppm gold have a median value of about 7, not unlike ratios observed in other volcanic-hosted, gold-silver deposits in Nevada, such as Round Mountain (Sander and Einaudi, 1990), Rawhide (Black and others, 1991), and in the Bullfrog district (Castor and Weiss, 1992). Arsenic, antimony, thallium, and mercury concentrations are low, with maximum concentrations of 767 ppm, 8.8 ppm, 17 ppm and 17.1 ppm, respectively (appendix C). Base metals (copper, lead, zinc, and molybdenum) are also low. Beryllium concentrations are unusually high in specimens from veins in the district. Concentrations of beryllium are commonly >30 ppm, several specimens contained about 100 to 250 ppm beryllium, and a maximum of 518 ppm beryllium was determined for a sample from a narrow vein in the workings of the Yellow Gold Mine (appendix C; fig. 7-26). In the western United States elevated beryllium concentrations are typically associated with peraluminous granitic and volcanic rocks, and with topaz-type rhyolite domes and lavas (e.g., Christiansen and others, 1986, Burt and Sheridan, 1987; Barton, 1990; Barton and Trim, 1991). The presence of elevated beryllium in banded, epithermal-type quartz+calcite veins over wide areas is unusual, particularly as the Clarkdale district is situated in a region underlain by dominantly silicic volcanic rocks of subalkaline compositions.

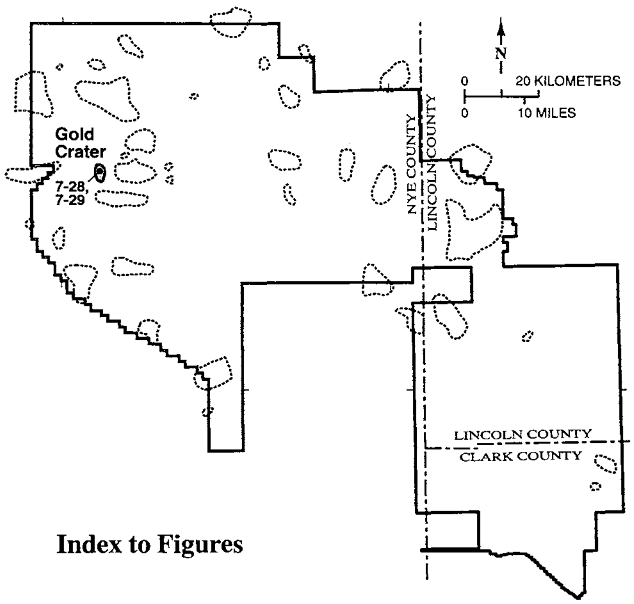
Identified Mineral Resources

There are no presently identified mineral resources in the district.

Mineral Resource Potential

In all, the hydrothermally altered rocks of the district comprise a northeast-trending zone of about 40 km^2, demonstrating that the hydrothermal system was of large aerial extent. The banded, crustiform nature of the quartz (± calcite ± barite) veins together with the feldspar-stable, illite-bearing near-vein wall-rock alteration assemblages, the presence of locally highly elevated gold, silver, mercury, and thallium, and the low concentrations of base metals, antimony and arsenic, indicate that the Clarkdale district is an example of the low-base-metal type of epithermal, adularia-sericite (low-sulfidation) precious-metal district. The narrow vein widths, together with data from samples collected from the surface and underground workings indicate that bulk-mineable, currently economic deposits are not presently exposed in the district. However, there has been little or no systematic drilling in the district, a number of faults and structural zones remain unexplored, and the district would likely attract considerable exploration drilling for bonanza-veins and disseminated deposits if it were open to the public. Additional consideration should be given to the advanced argillic alteration, centered on the dome and small dikes and plugs of the rhyolite of Obsidian Butte, which overprints and therefore postdates the feldspar-stable assemblages. The formation of the steam-heated type advanced argillic assemblages is reasonably interpreted as due to: 1) a drop in the water table elevation of a boiling, near-neutral hydrothermal system (i.e., a telescoped adularia-sericite type system), and/or 2) major, near-surface degassing and disproportionation of SO_2 during and after intrusions of the magmas of the rhyolite of Obsidian Butte, into and above(?) a shallow, near-neutral (adularia-sericite type) hydrothermal system. If this is the case, and in view of the presence of precious metals in the veins, potential exists for relatively shallow (<1 km) enargite-type (high-sulfidation) precious-metal deposits.

A high potential, certainty level C, is estimated for small-tonnage, bonanza-vein gold-silver deposits in the Clarkdale-Yellow Gold Mine area. A moderate potential, certainty level B, is estimated for bulk-mineable gold-silver deposits and for high-sulfidation precious-metal deposits in the vicinity of the dome, dikes, and plugs of unit Tyip where advanced argillic assemblages are present.



7.3.3.2 Gold Crater District

Location

The Gold Crater mining district is a 2.4 by 1.0 km area of low hills of altered volcanic rock with scattered shafts and prospects about 40 km southeast of Goldfield. It is about 6 km from the Jamestown mining district to the east, and may occupy the same general zone of altered and mineralized volcanic rock as that district.

History of Discovery, Exploration, and Mining

Mining activity began in Gold Crater in 1904 shortly after gold discoveries were made on Pahute Mesa (Hall, 1981; Ball, 1907; Kral, 1951). By September 1904, a townsite had been laid out, lots were sold, and there were 200 miners in the camp. The camp was empty by winter of 1904 and only a few leasers returned in 1905 to work the claims (Hall, 1981). Newspaper reports painted a more favorable picture of the camp: the Goldfield Weekly News, 7/14/1905, reported that there was "something doing" on Billy Coyle's Gold Crater claims and the Tonopah Times Bonanza 7/22/1905 reported that Bramhall, Elliott, and Duncan (leasers on the Curtis and Ridge Group at Gold Crater) had hit a $700 per ton ledge at the bottom of a 65-foot (20 m) shaft, and that six leasers had been taking out shipping ore for some time. There is no USBM record of this production. A 1907 news report stated that J. H. Schell had acquired a half interest in a property half way between Cactus Springs and Stonewall, "near the Schwab-McKane Group" which indicates continued activity in the Gold Crater area. Three claims located in 1904 at Gold Crater were patented in 1908, after which interest in the district lapsed.

Activity in the district resumed in 1913, when lessees produced 4 tons of gold-silver ore (USGS, 1913; USBM records, NBMG files). In 1914, a news clipping reported that the Gold Crater Consolidated Mining Co. had granted a lease to Charles Orr, who was to begin mining soon, with plans to install a 5-stamp mill. The same year, The Gold Prince Mining and Leasing Co. acquired the defunct Gold Crater Construction and Mining Co. and built a 25-ton amalgamation and concentration mill and produced a total of 120 tons of ore, reported by USBM in 1916 (Hall, 1981; USGS, 1916, Weed, 1916). The property continued to be listed as an active mine through 1918, but was listed as dead or idle in 1920 through 1924 (Weed, 1920, 1922, 1924). A geologic report on the Gold Crater Group by F. C. Black in 1919 describes the veins and workings at that time, when the owner, J. H. Forman was attempting to market the property to a mining company. Burgess (1924) briefly describes a small prospect (the roadside prospect) on the Gold Crater-Tolicha road, included in the Gold Crater district, where about a ton of sacked lead-silver ore was lying by the road near an 8-foot (2.4 m) deep cut, but there was no ongoing mining activity in the district at that time.

No new activity was reported in the district until 1934, when USBM smelter records show 40 tons of ore produced from the Waterloo Mine in the Gold Crater district, by Fred Schultz, who had recently been mining the Landmark Group in Tolicha (Goldfield News & Weekly Tribune, 1931). This mining activity yielded 27 oz gold and 583 oz silver, but appears to have been a short-lived venture, as no more shipments were reported from the property. Fifteen years later, mining was revived in the Gold Crater district with shipments of both gold ore and lead ore from the Gold Hill Mine at Gold Crater by Pius Kaelin and John Koshi in 1949 and in 1953 (USBM records, NBMG files). It is possible that more ore was produced at this time but was not recorded, as the Fuetsch brothers (Ed and Carl, Jr., personal commun., 1995) recall Pius Kaelin working the patented ground at Gold Crater for a number of years in the 1950s, and Kral (1951) reported that Kaelin had been working the patented claims for several years and had set up a small stamp mill at Stonewall Spring to treat the ore. A historical site evaluation in 1977 (NBMG files) reports that a 42-foot (12.8 m) high headframe and a wooden L-shaped building were still standing at Gold Crater at that time. The location of the Gold Hill Mine from which Kaelin produced the lead ore in the district is uncertain, but may be the shaft at sample site 5102 (photo 7-29), where a dump sample from this study yielded lead values of 15,228 ppm, although no lead minerals were observed on the dump during the field examination.

Total production from the Gold Crater district as recorded by USBM is 188 tons of ore yielding 82 oz gold, 2,722 oz

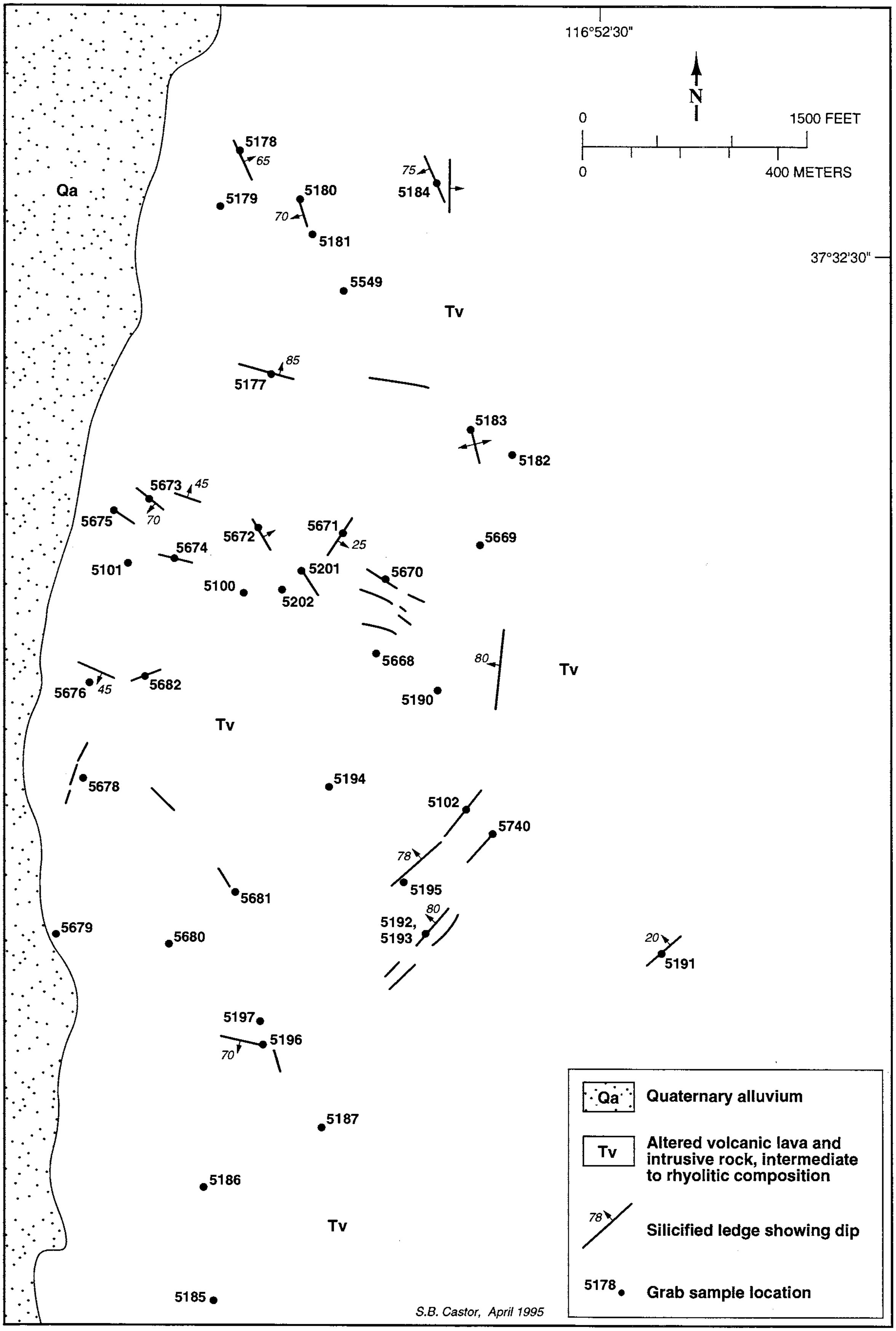


Figure 7-28 Sketch map of the Gold Crater district, Nye County, Nevada.

silver, and 7,300 pounds of lead. There was, however, undoubtedly additional production of gold-silver ore that was not recorded in the early days of the camp between 1904 and 1913.

Geologic Setting and Mineral Deposits

The Gold Crater district is mostly underlain by altered volcanic rock that appears to have originally been lava or intrusive rock of intermediate to rhyolitic composition. Ekren and others (1971) mapped rock exposed in the Gold Crater district as quartz latite. Relatively unaltered rock in the south central part of the district (near sample site 5680, fig. 7-28) was found to contain abundant potash feldspar phenocrysts up to 1 cm long and common rounded quartz phenocrysts up to 5 mm in diameter along with smaller biotite and plagioclase phenocrysts. Amphibole phenocrysts may also have been present but are now altered. On the basis of the presence of quartz phenocrysts of similar size, much of the altered rock in the central part of the district was originally of this rock type. However, quartz phenocrysts in samples from peripheral parts of the district are small and sparse or lacking entirely, indicating the presence of other rock types. Altered rhyolitic ash-flow tuff that has been tentatively identified as the tuff of Antelope Springs occurs in the southern part of the district. Minor amounts of altered bedded tuff and tuffaceous sedimentary rock were found in places (sample sites 5101 and 5182), and altered conglomerate occurs at sample site 5194. Andesitic intrusive rock was identified at sample site 5101 (fig. 7-28).

Regardless of its original lithology, altered rock in the Gold Crater district is mainly nonresistant white to pale green or tan argillized rock with local resistant ledges of strongly silicified rock. Many of the silicified ledges strike west-northwest, but the district contains ledges with other orientations that form a crudely circular pattern (fig. 7-28) that may have given the district its name. Most of the altered rock is composed of kaolinite + silica ± alunite. The alunite is very fine-grained in most samples and difficult to identify in the field. It was not found to occur commonly in patches of relatively coarsely crystalline material as it does in the Goldfield and Jamestown mining districts. However, it occurs rarely as crystals up to 0.5 mm in diameter in samples of silicified rock and breccia from prospect and mine dumps. Silicified rock in the Gold Crater district is composed of finely granular quartz with some cavities that are lined with finely drusy quartz. Rock that contains abundant iron and manganese oxide minerals is commonly found on dumps, and gossan is present on a few dumps. Tiny cubes of pyrite and limonite after pyrite occur in most silicified samples.

Geochemistry

Samples of silicified and argillized rock and breccia from outcrops and mine and prospect dumps in the Gold Crater district contain up to 138 ppm (4.4 oz per ton) silver and 8.7 ppm (0.28 oz per ton) gold. Out of 55 samples, 12 contain more than 10 ppm silver and 9 contain 1 ppm or more gold. Other elements that occur in elevated amounts in Gold Crater samples are arsenic, barium, bismuth, cadmium, copper, mercury, molybdenum, lead, antimony, selenium, tin, tellurium, thallium, and zinc. Gold-rich samples (samples with 1 ppm or more gold) from the Gold Crater district are mainly from locations along a peripheral zone of silicified ledges; only two gold-rich samples were collected from the interior of the district (figs. 7-28 and 7-29). The gold-rich samples are generally also high in bismuth (fig. 7-29). Samples with elevated copper and as are from an area in the north central part of the district, while lead occurs in elevated amounts in scattered samples (fig. 7-29). Tin contents of over 30 ppm are restricted to samples from the northern part of the peripheral zone of gold and bismuth enrichment (fig. 7-29).

Some samples with high metal contents contain pyrite, barite, base metal sulfides, enargite group sulfides, and other sulfide minerals. Sample 5549, which contains 138 ppm silver, 7.8 ppm gold, and 1.5 percent arsenic, includes pieces of massive pyrite with tiny inclusions of galena, sphalerite, chalcopyrite, and barite. It also contains relatively coarse quartz with visible pyrite and enargite as well as tiny grains (<20 microns) of copper-arsenic-antimony sulfide, galena, and chalcopyrite. This rock also contains tiny (<10 microns) grains of copper-tin sulfide with some zinc and iron, possibly zinc-bearing stannite (copper-iron-tin sulfide), or kuramite (copper-tin sulfide) with iron and zinc partially substituting for copper. Arsenic is also present in this sample as the secondary mineral scorodite. Nearby sample 5181 includes silicified rock with iron oxide, scorodite, barite, and iodargyrite (silver iodide) and breccia cemented with iron-oxide that contains tiny grains of native gold.

Sample 5179, collected from a northwest-trending silicified ledge about 300 m from sample site 5549 (fig. 7-28), consists of tan silicified volcanic rock with small patches of sulfide. Sulfide phases identified in this rock are mainly pyrite and enargite with minor amounts of cinnabar, chalcocite, and a mineral tentatively identified as mckinstryite ([copper-silver sulfide) on the basis of SEM/EDX analysis. Textural relationships suggest that original pyrite and possible marcasite were surrounded and partially replaced by enargite that is intergrown with cinnabar, chalcocite, and mckinstryite(?).

Altered and mineralized rock at sample locality 5182 (fig. 7-28) is different from other rock in the Gold Crater district. Here, volcanogenic sedimentary rocks with fine layering are replaced by calcite and potash feldspar and cut by quartz-calcite-barite veinlets in a 1-m-wide zone of brecciated and limonitic rock that resembles travertine and appears to have

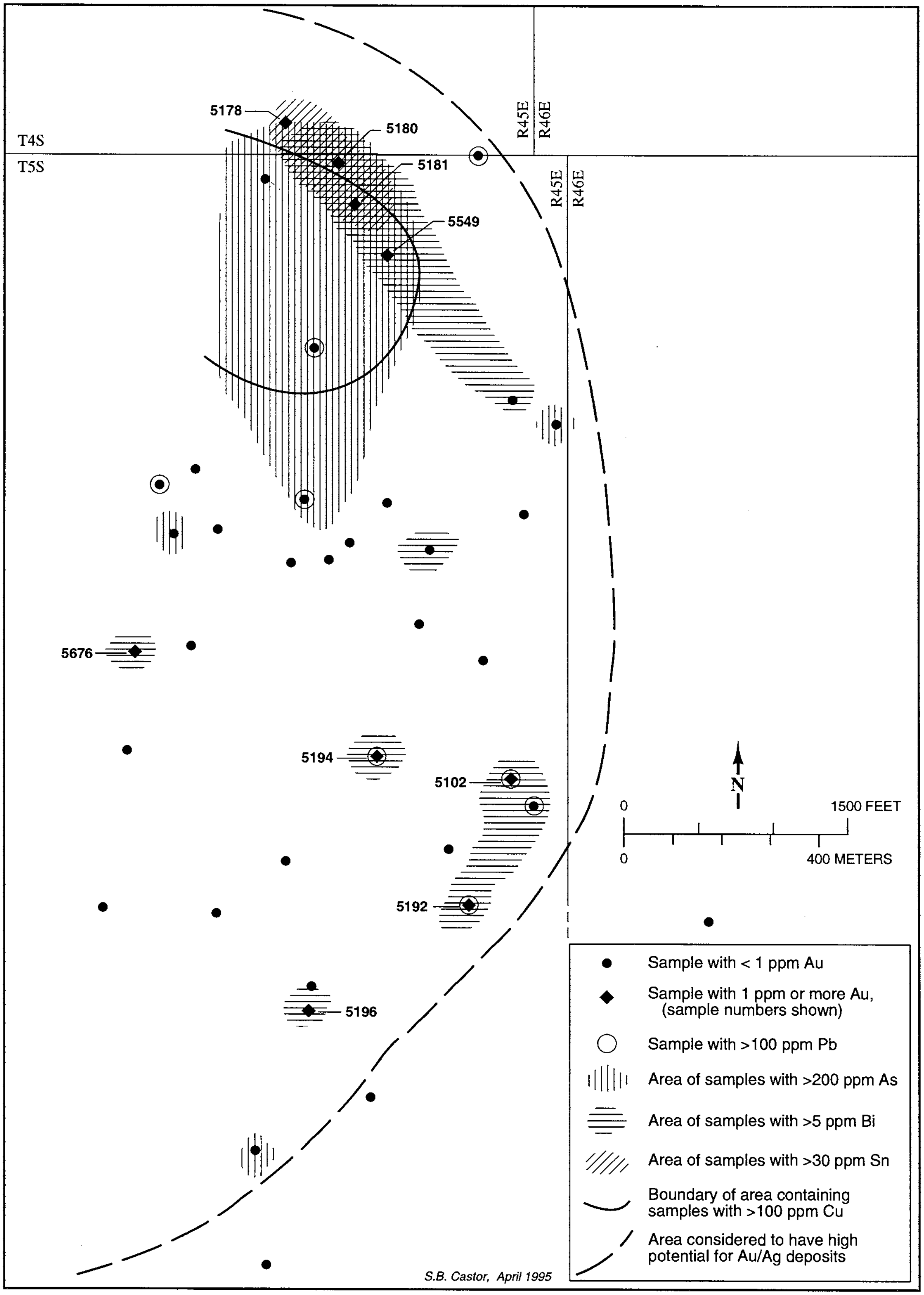


Figure 7-29 Geochemical pattern map of the Gold Crater district, Nye County, Nevada.

attitudes similar to nearby silicified ledges, at strike N10°W and dip 40°NE

A few exposures of hydrothermally altered volcanic rocks are present in a poorly defined area that extends eastward from the Gold Crater district toward the Jamestown mining district. This area, which is covered by Quaternary alluvium and late Miocene volcanic rocks that postdate mineralization, contains a single area of significant prospecting about 300 m in diameter known historically as the Adelaide district (Goldfield News, April-May 1908). Workings in this area consist of shafts and prospects with dumps that yielded samples with elevated silver and gold contents. Ruins at the site include a small mill with the remains of a shaking table, but little or no ore is believed to have been processed. Alteration in this area appears to be similar to that in the Gold Crater district; kaolinite, alunite, and quartz were identified by X-ray diffraction. Sample 5203, which contains 22 ppm silver, 0.5 ppm gold, and 1.4 percent arsenic, along with elevated bismuth, copper, antimony, tin, tellurium, and thallium, was found to contain abundant scorodite and tiny, striated crystals of calaverite (gold telluride).

Identified Mineral Resources

There are no identified mineral resources in the Gold Crater district.

Mineral Resource Potential

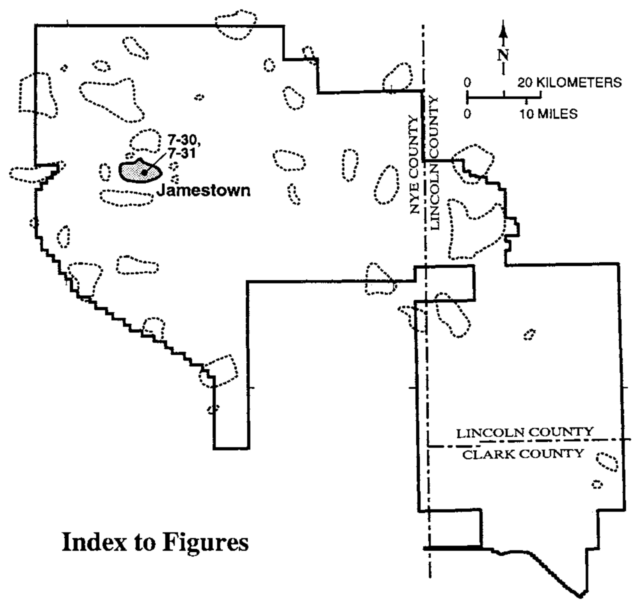
The Gold Crater district is considered to have high potential, certainty level C, for high sulfidation type gold-silver deposits. On the basis of the distribution of samples with high gold content and other trace metals (fig. 7-29), this potential seems to lie mainly in a narrow peripheral zone, which is similar to the situation in the Goldfield mining district (Ashley and Keith, 1976). However, because gold-rich samples were also collected from the interior of the Gold Crater district (samples 5194 and 5676, fig. 7-29), potential for gold-silver ore is also considered to be good. High potential for gold-silver deposits, certainty level B, is assumed to extend about 900 m to the west of the exposed area of mineralization in the Gold Crater district. Favorable rocks are postulated to occur in this area, which is mainly underlain by alluvium, following the assumption that the circular pattern of rock with high gold and associated metals continues under the alluvium.

The quartz-calcite veining and potash feldspar alteration that was found at the site of sample 5182 (fig. 7-29) is clearly dissimilar from the high-sulfidation alteration and mineralization that is predominant in the Gold Crater district. This type of mineralization occurs over a small area and, except for slightly elevated zinc, does not have elevated trace metal contents. It is considered to have little or no bearing on mineral potential in the Gold Crater district.

The area that lies between the Gold Crater and Jamestown districts is considered to have moderate potential, certainty level B, for gold-silver deposits of the high sulfidation type. Little work was done in this area because of the predominance of post-mineralization cover. Further exploration in this area, which contains a few scattered unexamined prospects in addition to the workings at Adelaide, would be required to determine its potential with more certainty.

Remote sensing analysis indicates that altered rocks similar to those in Gold Crater district are present about 5 km to the west in a tributary of Pack Rat Canyon. The presence of these altered rocks suggests that moderate potential for gold-silver deposits of the high sulfidation type extends 5 km westward from Gold Crater (fig. 5-2) under a relatively thin veneer of late Miocene volcanic rocks and Quaternary alluvium.

The area that has been identified as containing high and moderate potential for gold and silver deposits in the east-west zone that includes the Gold Crater and Jamestown districts is considered to have moderate potential, certainty level B, for porphyry copper-molybdenum deposits at depth (fig. 8-5).



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7.3.3.3 Jamestown District

Location

The Jamestown mining district is located in northern Pahute Mesa, a few kilometers northwest of Mount Helen (fig. 7-21), on the old Goldfield-Antelope Springs road. The area has been included in the Wellington mining district (Kral, 1951; Tingley, 1992), which is located in the southwest flank of the Cactus Range. The most important property is the Golden Chariot and Mohawk Group of six patented claims, on which are situated seven shafts about 30 to 100 m deep. These include the Golden Chariot Mine, where the remains of a collapsed wooden headframe are visible (fig. 7-30, photo 7-30). The Franz Hammel Mine is located adjacent to the Goldfield-Antelope Springs road about 1 km northwest of the Golden Chariot Mine (fig. 7-30) and reportedly consists of a 73-m shaft and lateral workings (Kral, 1951). A sturdy wooden headframe remains over the shaft and a small, wood-frame cabin in poor condition stands nearby (photo 7-31). Numerous shallow pits and cuts, most less than 5 m in maximum dimension, are scattered throughout both the Franz Hammel and Golden Chariot properties, and are widely present for as much as 2 km to the north and 4 km to the south and east of Jamestown.

History of Discovery, Exploration, and Mining

The original discovery in the district was made on the Mohawk Claim, located in June 1907. The Golden Chariot claims were located about the same time, amended in 1908, and were acquired by Carl Fuetsch, Sr. in about 1908 and have remained in the family until the present. The Fuetsch property currently consists of the Mohawk, Daisy, and Last Chance claims (patented July 1912); and the Golden Chariot No's 1-3 claims (patented October 1912). Jamestown had its own post office from June 1908 until August 1910 (Frickstad and Thrall, 1958) and reportedly had a short-lived newspaper (one issue) in 1908 (personal commun., Nevada Historical Society staff, 1995). Most of the mining in the district is believed to have taken place during the period of 1908-1912 in the area of the Golden Chariot Mine. Kral (1951) reported that a few tons of ore valued at about $200 per ton was shipped during this early period of mining activity. One shipment consisting of 2,129 pounds valued at $78 per ton is reported from the Golden Chariot Mine, probably in 1908 (NBMG files). There is, however, no official production from this district recorded by the USBM.

The 1918 Mines Handbook (Weed, 1918) listed the Golden Chariot Mining Co. as an active mining company with ore high in copper, gold, and silver to be shipped to a point 10 km south of Goldfield (Weed, 1918). Carper (1920) examined the Golden Chariot Mine and reported it unfavorable for further development and Weed (1920, 1921, 1924) listed the mine as idle in 1920 and 1922, presumably dead in 1924. The 1926 Mines Handbook (Weed, 1926) stated that in 1925 the Golden Chariot Mining Co. had been issued a permit to sell stock, but was listed as inactive again in 1931 (Weed, 1931). The Goldfield News and Weekly Tribune reported in October, 1931 that old-time Goldfield miners Pius Kaelin and Henry Steinegger had taken a lease and bond on the Golden Chariot Mine from brothers Carl and Joe Fuetsch, and were retimbering the old 320-foot (97.5 m) shaft in order to reach the rich ore in the workings on the 220-foot (67 m) level. By May 1932, they had dewatered the shaft to the 190-foot (58 m) level, but apparently never reached their goal, as reports of their activity at Jamestown ceased and Kaelin resurfaced in Tolicha with a lease on the Landmark claims there. The Goldfield News and Weekly Tribune, 1/10/1935, reported new mining activity noted in Jamestown district, and a 1936 press clipping (NBMG files) indicates that a leasing company was reopening the old Golden Chariot Mine, although the Fuetsch brothers remember this as just a stock promotion scheme that never resulted in any development on the property. A map of the underground workings was said to have been prepared by John Hogle in 1937-38. The Fuetsches recall several failed attempts in the 1920s and 1930s to attract sufficient capital to dewater and develop the workings.

At the Franz Hammel Mine the original claims were located by Franz Hammel in the late 1920s or early 1930s and most development work apparently took place in 1946-47 (Benson, 1947) at which time the property consisted of 26 unpatented lode mining claims, developed by a 240-foot (73 m) shaft with many lateral workings, and numerous shallow shafts. No evidence of ore was found at the surface at the Franz Hammel Mine during field examination, although Benson (1947) reported that a brecciated quartz vein containing free-milling gold was present in the workings. Rocks containing veins and/or disseminated ore minerals are now absent from the waste piles at and near the shaft.

Access to the Jamestown mines was first restricted by government in the early 1940s, but property owners regained access after the war and the Fuetsches have been negotiating renewable leases of their property to the Air Force since that time. The Fuetsch property now encompasses the original three Golden Chariot claims as well as the adjacent Mohawk, Daisy, and Last Chance patents. These claims were acquired by payment of back taxes to Nye County in 1967 after the death of the original owner, Engrace LaBarthe. There was a tentative plan by the AEC in the 1960s to mine low-grade copper ore using an underground nuclear explosion to fracture the rock, and the Golden Chariot Mine was targeted as a potential site for such a project, but nothing came of the plan (NBMG files). The formation of Fuetsch Nuclear Mines, Inc. by the owners dates from this period. Several government appraisals of the Golden Chariot Mine were done from the 1950s through the 1970s some of which contain geologic reports and assays of samples from the property. Two of these reports, Jones (1975) and McClung (1977), were obtained for review from the personal files of the Fuetsch family, Reno. The Jones (1975) document contains mostly title reports and some sampling information. It does, however, contain an excerpt from a mineral appraisal prepared by Otis A. Kittle in 1966. Commenting on the Golden Chariot property Kittle stated "The general area has productive capabilities upon accomplishment of further carefully planned exploratory effort." The Golden Chariot-Mohawk-Daisy claims are described by McClung (1977) as having "unproven mineral potential and can be categorized as attractive mineral exploration targets."

Present Investigation

Reconnaissance samples were collected from the dumps of the principal workings in the district during brief visits in July 1994. It was immediately evident that high-sulfidation type epithermal gold-silver (copper) ores had been intersected by workings of the Golden Chariot Mine, and that significant potential for precious-metal deposits could be present. Geologic mapping at a scale of 1:12,000 and collection of additional rock-chip samples was carried out in April and May, 1995, by S.I. Weiss and H.F. Bonham, Jr., primarily to determine the nature and extent of hydrothermal alteration assemblages and the surface distribution of elevated precious metals and indicator elements. Emphasis was directed toward the identification and geochemical evaluation of rocks having vuggy-silica texture, as these are most commonly the sites of economic precious-metal deposits in high-sulfidation type districts such as Goldfield in Nevada, Summitville in Colorado, and Julcani in Peru (e.g., Hayba and others, 1985; Bonham, 1988).

Geologic Setting and Mineral Deposits

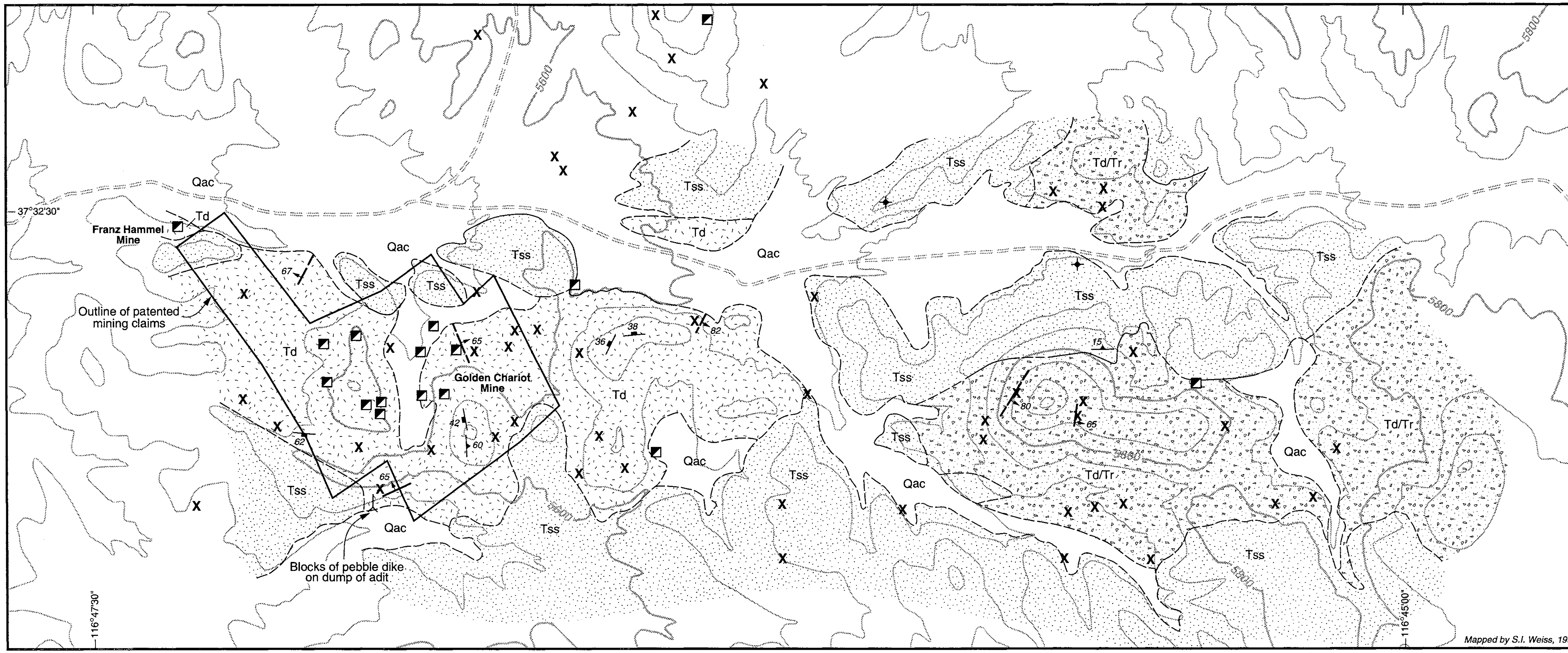
Nearly all of the mine workings in the Jamestown district are situated in hydrothermally altered volcanic rocks of intermediate to silicic compositions that underlie completely unaltered rhyolite ash-flow tuff of the 7.6-Ma Spearhead Member of the Stonewall Flat Tuff (figs. 7-30 and 7-31). The Spearhead Member ramps up on, pinches out against, and apparently did not cover hills composed of the altered rocks (photo 7-32). The Spearhead Member is essentially flat-lying and undeformed in the district and throughout northern Pahute Mesa, indicating that little tectonic activity has occurred in the area since late Miocene time.

The altered rocks consist of lavas, tuffs and shallow intrusive bodies assigned by Ekren and others (1971) to stratigraphic units coeval with and younger than the quartz-phenocryst bearing rhyolitic rocks of Mount Helen. However, stratigraphic relations between these rocks and with major units of ash-flow tuff such as the tuffs of Antelope Springs are difficult to ascertain on the basis of field relations in the area; their ages may range from Oligocene to late Miocene. Porphyritic textures and flow-banding are common. In most exposures from Gold Crater to north of Mount Helen these rocks have been thoroughly argillically altered to mixtures of kaolinite, illite, and small amounts of quartz. Unoxidized rocks observed on mine dumps from Gold Crater to east of Jamestown contain about 1-3 percent disseminated, fine-grained pyrite and little, if any, preserved or recrystallized feldspar. This suggests that the primary, hypogene alteration was of phyllic and argillic types, although some of the kaolinite in the oxidized rocks may be of supergene origin related to weathering of the pyrite.

In the Jamestown district, rocks altered to phyllic and argillic assemblages surround ledges and hills of resistant rocks composed of mixtures of quartz, alunite, kaolinite and illite (fig. 7-31). The topographically higher, most resistant rocks comprise northeast- to east-trending "ledges" composed almost entirely of vuggy-silica texture quartz (photo 7-33). Rocks composed of vuggy-silica texture quartz and abundant intergrown alunite form broader hills and border the vuggy-silica ledges (fig. 7-31). Individual alunite crystals are as much as 1 mm in maximum dimension. Both the alunite and quartz contain abundant vapor-rich fluid inclusions, indicating the presence of vapor as a major component of the hydrothermal fluids. The ledges and surrounding alunite-bearing rocks are interpreted as sites of intense hypogene acid-sulfate alteration of the magmatic-hydrothermal type of Rye (1993). Certain ledges east of the Golden Chariot Mine, near the sites of samples 5598, 5640, 5641, and 5642, are distinctly finer grained and locally chalcedonic in appearance, presumably due to late silica flooding.

Due to weathering, the quartz-alunite ledges are barren of sulfides. However, workings of the Golden Chariot Mine intersected vuggy-silica altered rocks containing several volume-percent of pyrite and locally abundant luzonite (identified by X-ray diffraction methods) and tetrahedrite. Microscopic grains of galena, chalcopyrite, covellite and sphalerite accompany the sulfosalt minerals. Pyrite and sulfosalts are present as disseminated granular clots, as stringers and irregular, dense to vuggy replacement bodies, and as drusy coatings and matrix between fragments of brecciated, quartz-pyrite ± sulfosalt rock. Primary rock textures such as flow banding and relict feldspar phenocryst sites remain visible in rocks that contain an estimated 5 to 30 volume-percent sulfides. Native gold comprises microscopic inclusions and fracture veinlets in the sulfosalt minerals.

Hills and ridges of hydrothermally altered rocks in the Jamestown district, and areas to the south and east, were incompletely buried by the completely unaltered Spearhead Member of the Stonewall Flat Tuff, demonstrating that alteration and mineralization are older than 7.6 Ma. An older limit on the timing of mineralization is difficult to estimate due to the poorly known stratigraphic relations and lack of radiometrically dated units of pre-Spearhead volcanic rocks in the Mount Helen-southwestern Cactus Range area (cf. Ekren and others, 1971). The acid-sulfate alteration and high-sulfidation ore mineralogy are closely similar to the alteration and ore mineralogy of the Goldfield district, 40 km to the northwest, where mineralization has been radiometrically dated at about 20 to 21 Ma (Ashley, 1990). A similar, or perhaps slightly younger age would seem reasonable for the Jamestown district.



All descriptions are modified from Ekren and others (1971) and Noble and others (1984).

Qac — **Quaternary and Recent alluvium and colluvium, undivided** Unconsolidated to poorly consolidated gravel, sand, and silt. Locally includes older (Pliocene?) alluvium.

Tss — **Miocene Spearhead Member of the Stonewall Flat Tuff** Nonwelded to densely welded subalkaline to peralkaline rhyolite ash-flow tuff.

Td — **Oligocene(?) and Miocene(?) hydrothermally altered, intermediate to silicic composition tuff and high-level intrusive bodies** Predominantly porphyritic with abundant phenocrysts of feldspar ± sparse quartz.

Td/Tr — **Oligocene(?) and Miocene(?) hydrothermally altered, porphyritic lava, tuff and intrusive bodies of intermediate to silicic composition** In part phenocryst-poor, commonly flow-banded. Age relations to Td unknown.

Lithologic contact dashed where approximately located

Fault showing dip, dashed where approximately located

Strike and dip of prominent joints

Strike and dip of inclined compaction foliation

Horizontal compaction foliation

N

0 1000 FEET

0 300 METERS

Figure 7-30 Geologic sketch map of the Jamestown district, Nye County, Nevada.

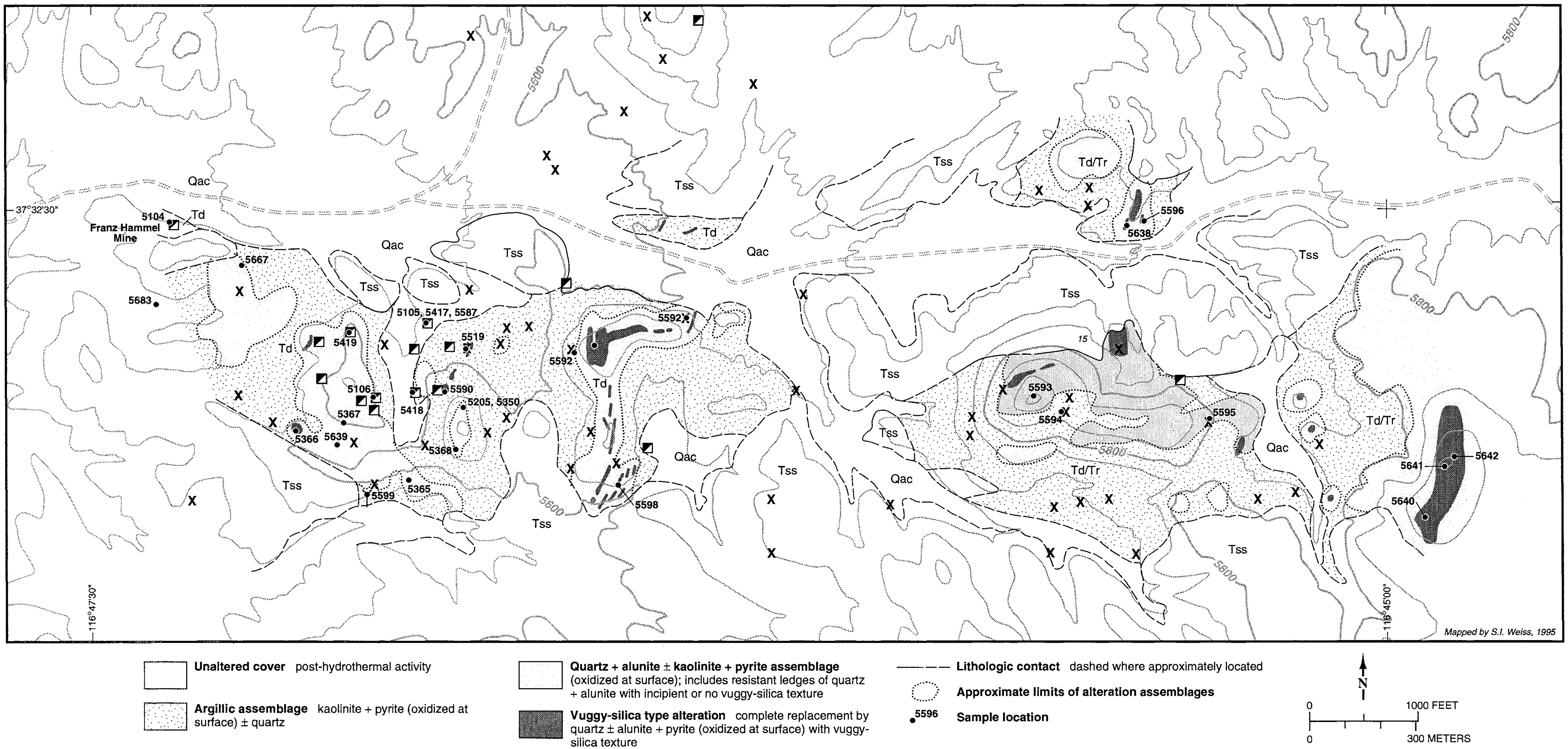


Figure 7-31 Sketch map showing location of geochemical samples and alteration assemblages in the vicinity of Jamestown, Nevada.

Geochemistry

Mineralized rocks from the Golden Chariot Mine and nearby shafts contain abundant copper, antimony, arsenic, lead, and mercury ± silver ± gold, as well as elevated bismuth, molybdenum, tellurium, thallium and, locally, tin (appendix C). Bismuth, tellurium, and tin concentrations as high as 116 ppm, 131 ppm and 777 ppm, respectively, were determined. This suite of elements is characteristic of high-sulfidation epithermal precious-metal deposits, worldwide, and is largely associated with the presence of abundant sulfosalt minerals such as luzonite, enargite and tetrahedrite, and small amounts of galena and sphalerite, ± Bismuthinite (e.g., Heald and others, 1987; Bonham, 1988). High-grade specimens contain as much as about 3.5 weight percent copper, 1.7 weight percent antimony and 0.07 to 0.3 oz gold per ton (appendix C). Silver-to-gold ratios are variable; for specimens with gold >0.5 ppm, silver-to-gold ratios range from 0.3 to 105, but are generally greater than 2. Higher gold and silver concentrations are in most cases associated with copper concentrations greater than about 50 ppm, but the closest correlation appears to be with antimony (appendix C). Manganese concentrations are low, typically <0.04 weight percent.

Gold, silver, arsenic, antimony, bismuth and tellurium concentrations decrease rapidly with distance from the Golden Chariot Mine, but significantly elevated concentrations of these elements are locally present in vuggy-silica rocks at the locations of samples 5350, 5365, and 5599 (fig. 7-31). Rocks composed of vuggy silica and of quartz + alunite in the ridge east of the Golden Chariot property locally contain highly elevated concentrations of gold, arsenic, antimony, mercury, and tellurium ± bismuth (samples 5594, 5595, 5596). Lead and copper in these samples are weakly elevated as well. Throughout the area east of the Golden Chariot Mine, resistant, topographically higher rocks having somewhat fine-grained vuggy-silica to chalcedonic textures contain strongly elevated concentrations of the volatile elements tellurium (in the range of 1 to 4 ppm) and mercury (in the range of 1 to 6 ppm). These rocks may represent distal, upper portions of two or three separate centers of acid-sulfate hydrothermal activity.

Hydrothermally altered rocks cropping out in the northwest and west flanks of Mount Helen, 1 to 4.5 km south and southeast of Jamestown locally contain strongly elevated concentrations of gold, arsenic, antimony, mercury, thallium, molybdenum, lead, and tellurium. For example, the second highest gold value from the Jamestown district (5.7 ppm gold) was determined in sample 5198 (appendix C), which was obtained from a silicified, pyritic fracture zone in volcanic rocks in the northwest flank of Mount Helen, about 4 km southeast of Jamestown.

Identified Mineral Resources

There are no identified mineral resources in the Jamestown district

Mineral Resource Potential

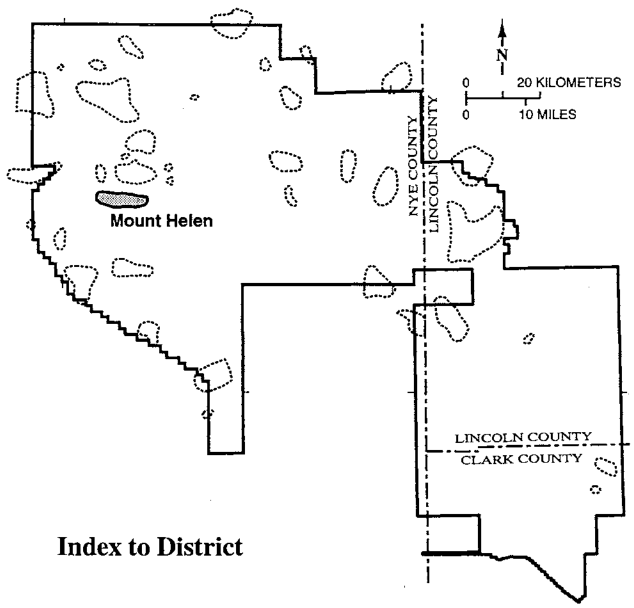
Most of the vuggy-silica quartz-alunite ledges in the Jamestown district have not been physically explored for mineralization. The relatively large size of the ledges and dispersion of elevated arsenic, antimony, tellurium, mercury, bismuth ± gold in areas adjacent to and east of Jamestown suggests significant potential for high-sulfidation type epithermal gold-silver deposits is present. The district would be highly attractive to commercial exploration for precious metals and drilling seems virtually assured if the area were open to the public. Only a thin veneer of 1 to about 50 m of ash-flow tuff of the Spearhead Member overlies the altered rocks in a large area surrounding the district and altered rocks are exposed in erosional windows as far west as the Gold Crater district. This long-recognized relationship (e.g., Anderson and others, 1965) suggests that potential exists in a wide area of northern Pahute Mesa for hydrothermal mineral deposits at shallow depths beneath the Spearhead Member. Argillic and phyllic alteration zones of such large aerial extent are a common characteristic of porphyry-type magmatic-hydrothermal districts. This, coupled with increasing geologic and isotopic evidence that high-sulfidation mineralization forms in the upper parts of and is genetically related to porphyry magmatic systems (e.g., Sillitoe, 1983, 1991; Rye, 1993), suggests there may be potential for porphyry-type copper-molybdenum and/or copper-gold deposits at depth in the area of northern Pahute Mesa between Mount Helen and Gold Crater. Although potential porphyry mineralization may lie at considerable depth (500-1000+ m), pre-Spearhead faulting may have brought deeply buried rocks to shallower depths in areas now covered by the Spearhead Member.

A moderate potential, certainty level B, is estimated for high-sulfidation epithermal precious-metal deposits in the area between Jamestown and Gold Crater. At and near Jamestown, a high potential, certainty level C, is estimated for high-sulfidation, epithermal precious-metal deposits. There is moderate potential, certainty level B for porphyry copper-molybdenum deposits at depth possibly <1 km over the entire area of argillic/phyllic alteration between Gold Crater and northern Mount Helen.

7.3.3.4 Mount Helen Area

Location

This area includes scattered outcrops of hydrothermally altered rocks located generally south and west of Mount Helen.



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History of Discovery, Exploration, and Mining

Mine workings in the area are limited to scattered, shallow prospect pits (<5 m in maximum dimension The small prospects presumably date from the time of activity in the nearby Jamestown and Gold Crater camps.

Geologic Setting and Mineral Deposits

Hydrothermally altered rocks largely assigned to the Tolicha Peak Tuff and to the tuffs of Antelope Springs (Ekren and others, 1971; Minor and others, 1993) crop out south and west of Mount Helen, respectively, in northern Pahute Mesa (fig. 7-21).

Altered Tolicha Peak Tuff south of Mount Helen is resistant due to numerous, closely spaced veins of chalcedonic quartz, drusy fine-grained quartz and limonitic hydrothermal breccia. Veins are largely along steeply dipping fractures trending N10°W and N30°E. Wall rocks consist of densely welded, phenocryst-poor ash-flow that has been bleached, silicified, and locally adularized. Samples containing veins of hydrothermal breccia cemented by quartz and limonite have slightly elevated concentrations of arsenic, antimony, and Ga (samples 5636 and 5637, appendix C).

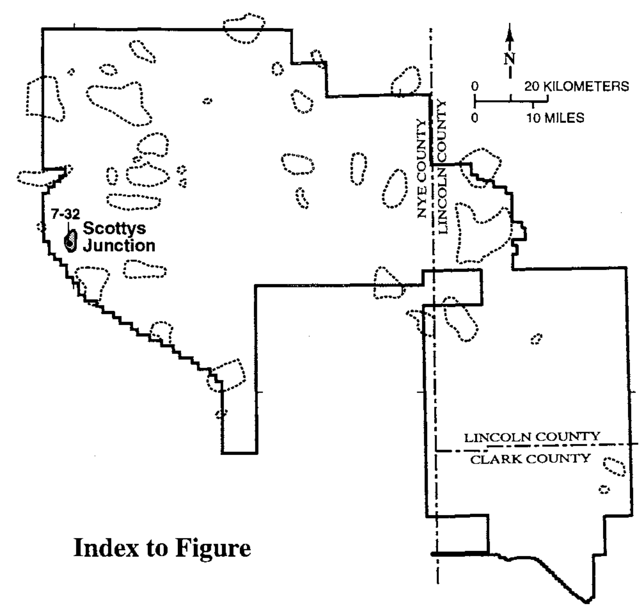
Resistant, limonite-stained altered rocks of the tuffs of Antelope Springs and porphyritic, phenocryst-rich, low-silica-rhyolite lavas form hills west and southwest of Mount Helen. Alteration includes partial to complete dissolution of feldspar phenocrysts, in part with replacement by fine-grained aggregates of illite and quartz ± kaolinite, veinlets of fine-grained quartz and hydrothermal breccia, and complete replacement of biotite and hornblende by illite-sericite. Traces of barite were observed in vugs representing relict feldspar phenocrysts in the altered tuffs of Antelope Springs between Mount Helen and Jamestown. Near Mount Helen the lavas are strongly albitized and locally contain disseminated pyrite. Anomalously high concentrations of K_2O reported by Ekren and others (1971) for lavas at an unknown location in Mount Helen in all probability reflect strong adularization. Sparse, steeply dipping veins of fine-grained, banded quartz+pyrite <2 cm in width are present along the top of the north-trending ridge located 8.5 km southwest of Mount Helen. Rocks containing quartz and/or quartz+pyrite veins are enriched in arsenic, mercury, and antimony, and contain elevated concentrations of molybdenum and thallium as well (appendix C). The style and mineralogy of the veins and alteration minerals, together with the geochemical data, are suggestive of epithermal conditions, and perhaps distal to deeper, porphyry-type magmatic-hydrothermal activity.

Identified Mineral Resources

There are no identified mineral resources in this area.

Mineral Resource Potential

Low to moderate potential, certainty level B, is estimated for low-sulfidation, epithermal, precious-metal deposits in areas of hydrothermally altered rocks west and southwest of Mount Helen.



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7.3.3.5 Scottys Junction Area

Northeast of Scottys Junction

Location

This area includes about 1.2 km^2 in the western escarpment of Pahute Mesa, along the east edge of Sarcobatus Flat (fig. 7-21).

History of Discovery, Exploration, and Mining

Traces of a jeep trail, bulldozer scrapes, and claim monuments possibly dating from the 1940s are present, but no mine workings were observed.

Present Investigation

Brief reconnaissance mapping and the collection of surface rock-chip samples were carried out in December 1994 by S. I. Weiss.

Geologic Setting and Mineral Deposits

Hydrothermally altered rhyolite ash-flow tuff of the Tolicha Peak Tuff and underlying porphyritic andesite are exposed in the western escarpment of Pahute Mesa.

Alteration appears to be associated with steeply dipping normal faults that strike N20°E to N30°W and commonly contain finely crustiform-banded veins of calcite ± chalcedonic quartz, as much as 1.5 m wide (fig. 7-32). A poorly exposed zone of silicification and adularization within densely welded Tolicha Peak Tuff lies adjacent to, and may underlie, a more extensive area of carbonatization, abundant calcite veins, reddish-orange iron oxide staining, and irregular veins and bodies of hydrothermal breccia within gently dipping rocks of the Tolicha Peak Tuff. The veins and bodies of hydrothermal breccia are cemented by mixtures of ferruginous calcite, iron oxides, and silica. Calcite fills porosity in the groundmass as well as lithophysal cavities of the ash-flow tuff and is sufficiently abundant to be visible as a blue-white color anomaly on Landsat Thematic Mapper (TM) imagery (fig. 5-2).

Calcite veins and hydrothermal breccia in the area contain elevated concentrations of Ga, mercury, molybdenum, antimony, and tungsten (appendix C). Within the area of intense carbonatization a vein of hematite and silica about 0.5 m wide crops out along a steeply west-dipping fault (site 5240, fig. 7-32). Sample 5240, taken across this vein, contains 21.5 weight percent iron, 1,245 ppm arsenic, 2.8 ppm bismuth, 2.07 ppm mercury, 468 ppm molybdenum, 114 ppm antimony, and 16 ppm tungsten (appendix C), suggestive of chemical enrichments formed in distal portions of porphyry-type magmatic-hydrothermal systems.

Identified Mineral Resources

There are no identified mineral resources in this area

Mineral Resource Potential

The overall geochemical signature of the veins and hydrothermal breccia, the finely banded nature of the veins, and the wall-rock alteration dominated by calcite and adularia suggest that the alteration formed at relatively shallow depths in the upper part of a low-sulfidation type of epithermal system. Therefore, moderate potential, certainty level B, is estimated for shallow, low sulfidation epithermal precious-metal deposits in this area, and a moderate potential, certainty level B, for porphyry copper-molybdenum deposits at greater depths.

The hydrothermally altered rocks are overlain successively by unaltered rhyolite ash-flow and bedded tuffs, and both ash-flow units of the Stonewall Flat Tuff. The timing of hydrothermal activity is therefore bracketed between 14 Ma, the age of the host Tolicha Peak Tuff (Weiss and others, 1993), and 7.5 Ma, the age of the lower unit (Spearhead Member) of the Stonewall Flat Tuff (Hausback and others, 1990).

About 4 km northwest of sample site 5240, hydrothermally altered, interbedded limestone, chert, and quartzite of pre-Cenozoic age, and overlying altered rhyolitic pyroclastic rocks of Tertiary age crop out beneath unaltered tuffs of the Spearhead Member of the Stonewall Flat Tuff. The pre-Cenozoic sedimentary rocks are tentatively assigned to the Cambrian Emigrant Formation (Weiss, 1987). The sedimentary rocks are strongly iron stained and locally strongly silicified. Nearby overlying volcanic rocks have undergone argillic alteration. Identified resources are not present. Two specimens of the Emigrant Formation obtained from this alteration area were analyzed for the Characterization data set (appendix A, samples GSC-160 and GSC-183). Both specimens contain significantly elevated mercury (0.645 ppm and 0.207 ppm, respectively).

East of Scottys Junction

Location

This area includes scattered outcrops of hydrothermally-altered rocks exposed about 6 km east of Scottys Junction.

History of Discovery, Exploration, and Mining

No mine workings were observed in this area.

Geologic Setting and Mineral Deposits

Rocks exposed in this area include a thick sequence of hydrothermally altered, thinly interbedded, initially glassy nonwelded ash-flow tuff and pyroclastic surge deposits. Assigned to the Tolicha Peak Tuff by Minor and others (1993), the altered rocks are composed of mixtures of adularia, calcite, fine-grained silica, zeolite, and illite-smectite, are cut by numerous thin veins of chalcedony and very fine-grained quartz, and are visible as a distinct color anomaly in

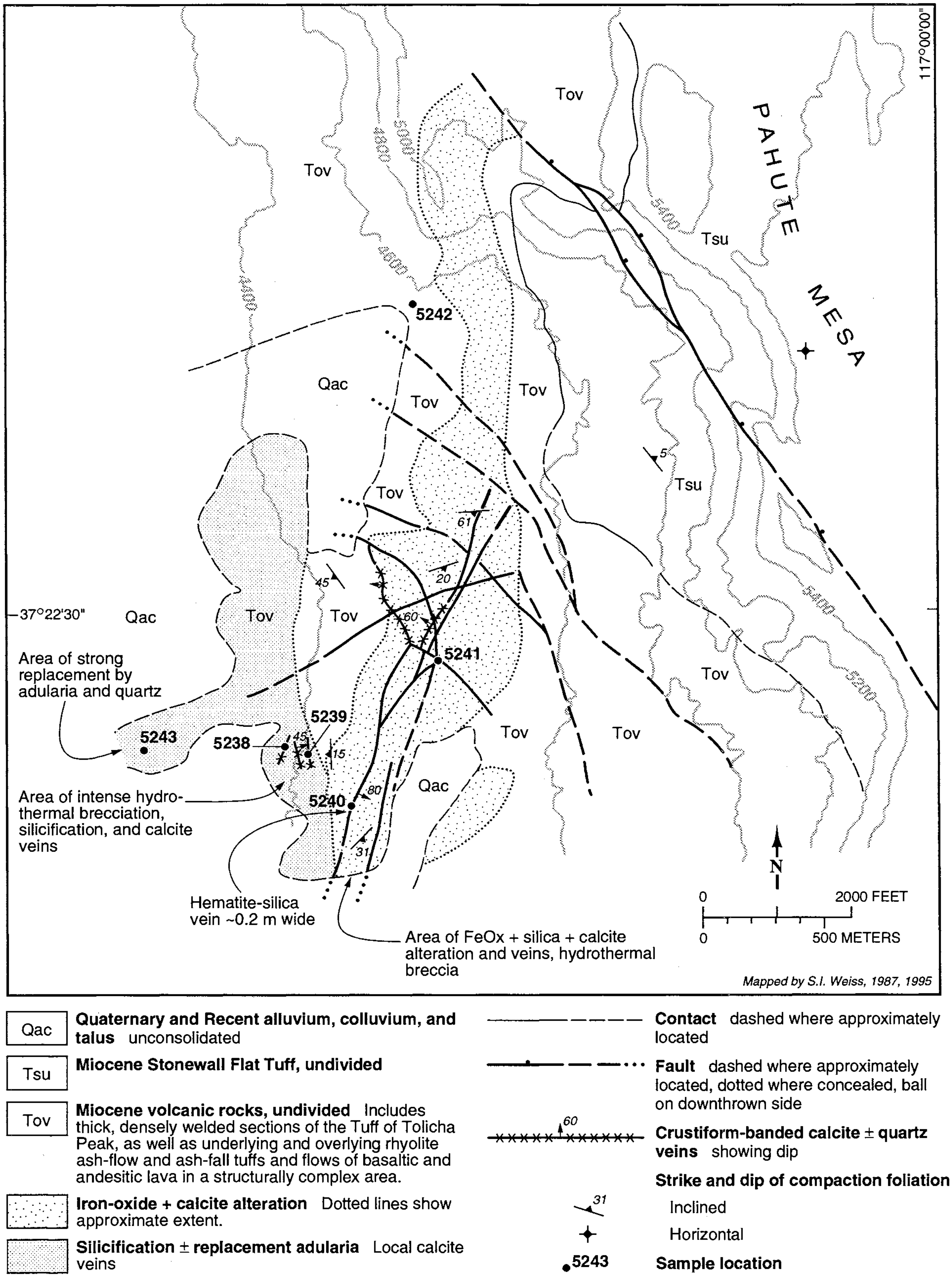


Figure 7-32 Simplified geologic map of the Scottys Junction area.

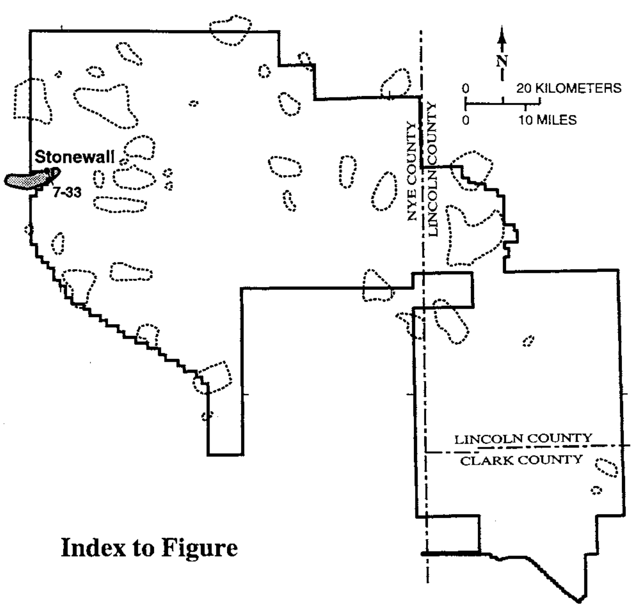
TM imagery (fig. 5-2). The style and mineralogy of the alteration is consistent with a shallow and/or distal part of an epithermal-type system.

Identified Mineral Resources

No mineral resources have been identified.

Mineral Resource Potential

Low potential, certainty level B, is estimated for low-sulfidation epithermal precious-metal deposits in this area.



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7.3.3.6 Stonewall District

Location

The Stonewall Mountain district is situated in northern Stonewall Mountain, adjacent to the western boundary of the NAFR, at the northwest periphery of Pahute Mesa. The eastern part of the district, in the vicinity of Stonewall Spring, straddles the NAFR boundary and is developed by several shallow pits and cuts, three adits <15 m in length and two shafts estimated to be <60 m in depth. The western part of the district lies entirely outside of the NAFR and is developed by one adit reported to be 1.6 km in length, five adits estimated to be <90 m in length; one 75-m shaft and two shafts probably <30 m in depth.

History of Discovery, Exploration, and Mining

Quartz veins near Stonewall Spring were reportedly known as early as 1870, but the discovery of gold there was credited to Billy O'Brien, who brought some rich ore into Goldfield in 1904, prompting a small rush of prospectors out to Stonewall Mountain (The Goldfield News, 8/8/1908). Many claims were staked in the area over the next few years in both the western part (covered by the Golden Dawn claims in 1908) and the eastern part (Houston and Stancher's claims, Magnolia Group, and C. G. Noble's claims) (The Goldfield News, 8/8/1908). Ball mentioned prospecting activity on quartz veins at Stonewall Springs in both his 1906 and 1907 reports. The Stonewall King Mining Co.'s claims in the western part of the district were located in 1906, 1909, and 1910, and were patented in 1912, and small shipments of hand-sorted silver-gold ore were made in 1911, 1915, and 1916, probably from the Stonewall King Mine (Lincoln, 1923; USBM records, NBMG files; USGS, 1911; NBMG files; Cornwall, 1972). An adit 1.6 km long, known as the Yellow Tiger or Sterlog (Sterlag) tunnel, was driven by the Yellow Tiger Consolidated Mining Co. in the 1920s to intercept the workings of the Stonewall King Mine (The Goldfield News and Weekly Tribune, 8/6/1921, 1/1/1926, 4/30/1926; Weed, 1922; 1926). Weed (1926) describes ore reserves at the Yellow Tiger estimated as 10,000 tons blocked out averaging 16 oz silver per ton and 0.06 oz gold per ton. The ore was apparently never mined, and Rand and Sturgis (1931) reported that operations had been suspended in 1927 pending a more favorable price for silver. Since closure of the NAFR, exploration activity has been confined to the portion of the Stonewall district lying outside the NAFR boundary, where several mining companies have conducted precious metals exploration programs until the present (The Mining Record, 3/21/1984; NBMG files).

Previous Investigations

Previous investigators have recognized that the Stonewall district is situated within a large area of hydrothermally altered rhyolitic welded ash-flow tuffs, silicic lavas, and monzonitic and trachytic intrusive rocks which comprise the eroded core of the subalkaline to peralkaline, 7.5-Ma Stonewall Mountain volcanic center (Spurr, 1903; Foley, 1978; Weiss, 1987; Weiss and Noble, 1989). For this report, collection of surface samples and reconnaissance geologic mapping were carried out by S. I. Weiss in May 1995.

Geologic Setting and Mineral Deposits

The eastern part of the district, in the vicinity of Stonewall Spring (fig. 7-33), is underlain largely by intracaldera welded rhyolite ash-flow tuffs and silicic resurgent intrusions, which have been hydrothermally altered to propylitic mineral assemblages including quartz, adularia, albite, chlorite, illite, epidote, pyrite, and calcite. A spectacular, east-northeast-striking, largely north-dipping system of quartz veins extends for about 3 km along splays of the prominent, range-bounding normal fault (fig. 7-33, photo 7-34). The veins are as much as 5 m wide and consist of delicately banded, crustiform and drusy comb quartz with locally abundant boxwork texture after bladed and tabular calcite.

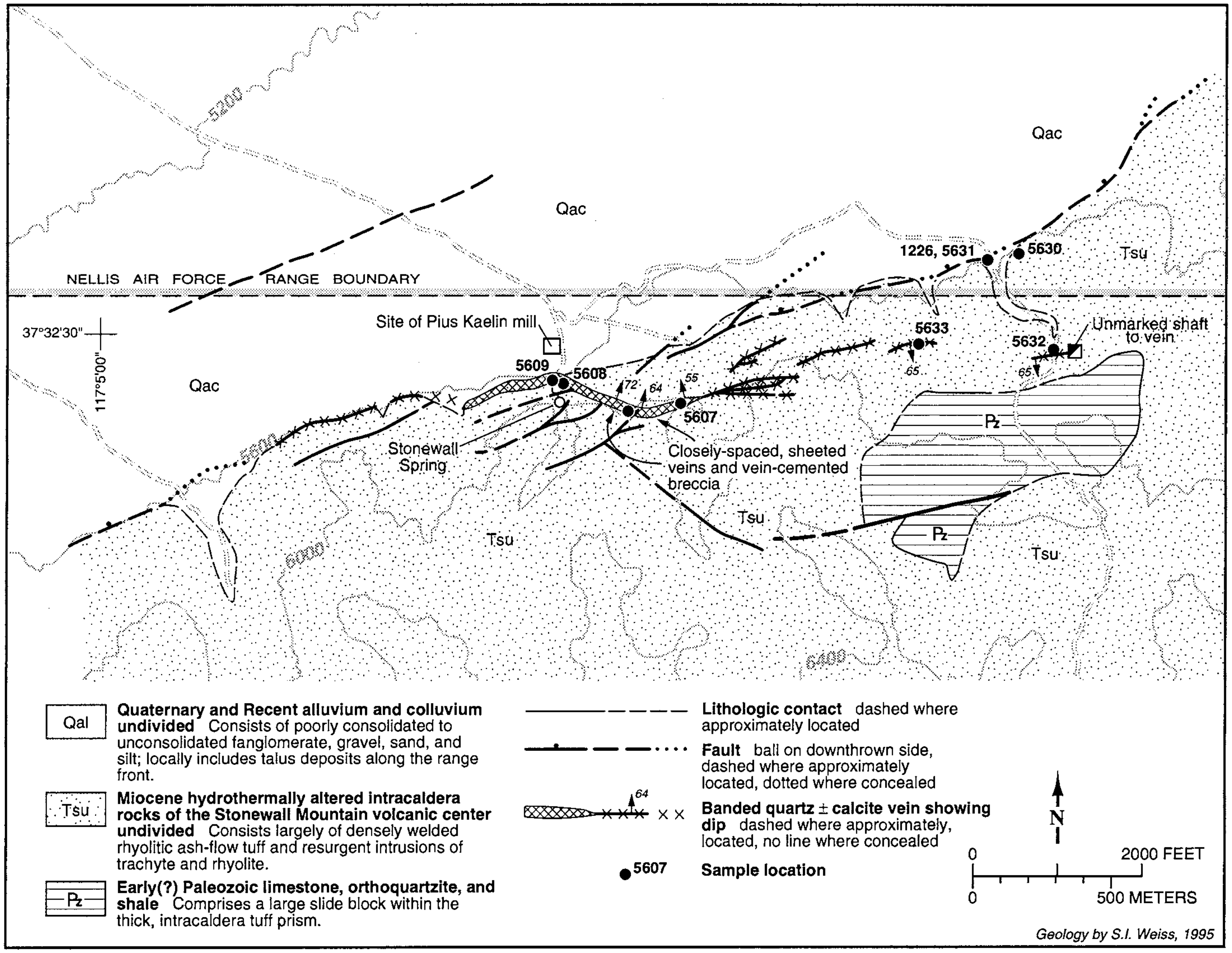


Figure 7-33 Sketch map of the Stonewall Spring vein system, northern Stonewall Mountain, Nye County, Nevada.

Much of the vein system comprises zones of up to about 15 m in width of closely spaced, anastomosing and subparallel veins and cockade-crustified breccia. Fragments of banded quartz overgrown by later stages of quartz are common, indicating that repeated episodes of brecciation and fracturing occurred during deposition of the veins. Near Stonewall Spring the veins dip about 60°N and project beneath the NAFR boundary at depth. East of the spring the dips of the veins increase to subvertical and become south-dipping near the eastern limit of their surface exposure (fig. 7-33). Wall rocks are strongly adularized, silicified, and pyritized for at least several meters away from the vein margins. The veins are thoroughly oxidized in surface exposures and no ore minerals have been identified, although surface samples from the veins locally contain 105 ppm silver and 0.554 ppm gold (appendix C).

Chemical data from surface rock-chip samples show that the veins contain highly elevated, but currently subeconomic quantities of silver and gold, with silver contents 3 to 4 orders of magnitude greater than gold contents (appendix C). Concentrations of the base metals and the indicator elements arsenic, antimony, mercury, tellurium, and thallium are low, even in samples containing abundant silver. Tin and selenium are low as well. Elevated bismuth (1.2 ppm) and molybdenum (up to 49 ppm) are present locally. In view of the low copper, arsenic, and selenium concentrations, silver presumably was originally deposited as silver sulfide, although greater amounts of selenium may have been present prior to weathering.

The western portion of the Stonewall district lies well outside of the NAFR boundary and was examined only briefly for this report. Numerous narrow quartz-calcite veins similar to those of the Stonewall Spring area fill steeply dipping northeast-, north-, and northwest-trending fractures and faults within a large monzonite to trachyte stock and welded tuffs in northwestern Stonewall Mountain. The Yellow Tiger Adit (Sterlog tunnel) was driven to intercept a northwest-striking fissure vein of this type within the Stonewall King Mine. Narrow zones of calc-silicate alteration, locally including sparse grossular garnet, are present along contacts between the stock and a large body of sedimentary rocks considered by Cornwall (1972) and Foley (1978) to belong to the Wyman Formation and to the Reed Dolomite. The intrusive and volcanic rocks are propylitically altered, locally silicified and adularized, and contain disseminated pyrite where unoxidized.

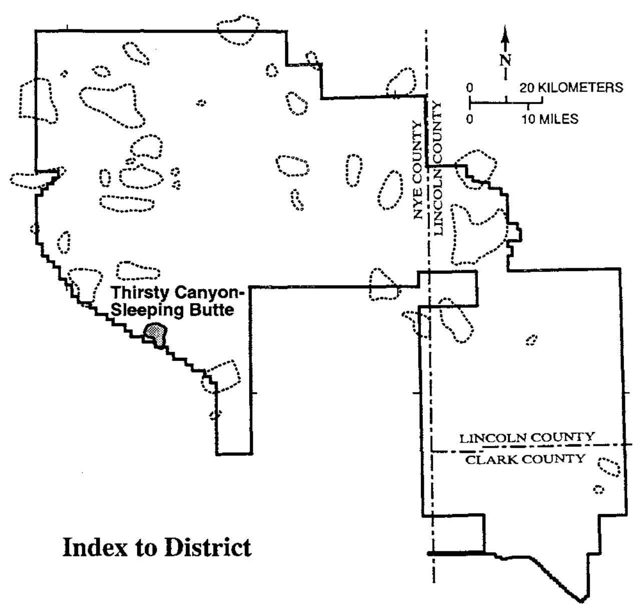
Identified Mineral Resources

There are presently no identified reserves in the NAFR portion of the Stonewall district.

Mineral Resource Potential

The style, texture, mineralogy, and trace-element contents of the veins in the eastern part of the district, along with the wall-rock alteration mineralogy and overall geologic setting suggest that the Stonewall Spring vein system represents a relatively shallow part of a low-sulfidation (adularia-sericite), epithermal, precious-metal system of the low-base-metal type. This vein system is unusually silver-rich in comparison to the generally gold-rich nature of other low indicator-element, low-base-metal epithermal precious-metal systems situated in silicic volcanic terranes (e.g., Bullfrog and Rawhide in Nevada, and Castle Mountains in California).

High potential, certainty level C, is estimated for small-tonnage, bonanza-vein-type, low-base-metal, epithermal silver-gold deposits at depth in the Stonewall Spring vein system, and moderate potential, certainty level B, for stockwork-disseminated silver-gold deposits of the low-base-metal, low-sulfidation-type at depth near the vein system.



<u>7.3.3.7 Thirsty Canyon-Sleeping Butte Area</u>

Location

Numerous prospect pits (<5 m in maximum dimension) and several shallow shafts (25 m in depth) are scattered in the Thirsty Canyon SW, Thirsty Canyon NW and Springdale NE 7.5' Quadrangles, and in part are associated with hydrothermally altered volcanic rocks in the vicinity of Sleeping Butte (fig. 7-21).

History of Discovery, Exploration, and Mining

Nothing is known of the history of prospecting in this area.

Geologic Setting and Mineral Deposits

Alteration consists of partial replacement of plagioclase phenocrysts by adularia ± chalcedony and local weak silicification within welded rhyolite ash-flow tuffs of the tuff of Sleeping Butte, and underlying, unnamed, densely welded rhyolite ash-flow units. Bedded glassy tuffs and interbedded volcanic siltstone and sandstone overlying the tuff of Sleeping Butte are locally replaced by fine-grained, originally opaline(?) silica. Sparse, drusy fluorite is locally present with quartz and calcite veinlets southwest of Sleeping Butte in highly fractured and sheared rhyolite lava assigned by Minor and others (1993) to the rhyolite of Quartz Mountain. The fluorite-bearing rhyolite contains elevated, but subeconomic, concentrations of arsenic, bismuth, gallium, molybdenum, tellurium, and thallium, and 0.023 ppm gold (sample 5450, appendix C). Similar concentrations of one or more of these elements were determined in samples of the silicified volcanic-sedimentary rock and of weakly altered ash-flow tuff (appendix C). The weak alteration and presence of elevated, but nevertheless low, concentrations of arsenic, antimony, bismuth, molybdenum, tellurium, and thallium are suggestive of the distal or shallow portions of an epithermal-type volcanic-hosted hydrothermal system.

Identified Mineral Resources

No mineral resources have been identified in the area.

Mineral Resource Potential

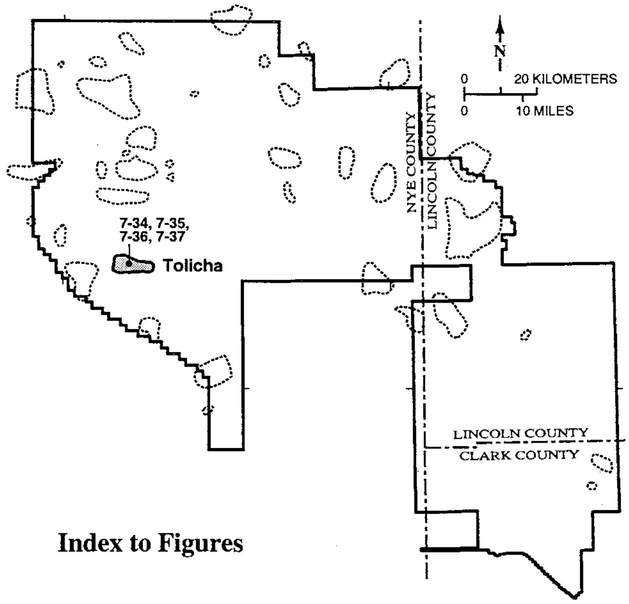
Low potential, certainty level B, is estimated for low-sulfidation, epithermal, precious-metal deposits in the Thirsty Canyon-Sleeping Butte area.

7.3.3.8 Tolicha District

The Tolicha mining district includes three subdistricts, west Tolicha, central Tolicha, and Quartz Mountain (fig. 7-34) that lie an east-trending zone about 10 km long and 1.6 km wide to the north of Tolicha Peak and Quartz Mountain. In the past, the Clarkdale mining district, which lies about 6 km to the west, has been included in the Tolicha district, but in this report it is considered separately.

History of Discovery, Exploration, and Mining

Gold was discovered and the first locations were made in both Tolicha and Quartz Mountain subdistricts (fig. 7-34).in 1905 (Carper, 1921; Lincoln, 1923; Hall, 1981) and a claim location notice found in the main Tolicha district during this study corroborates prospecting in that the area at least as early as July, 1907. The Quartz Mountain subdistrict appears to have been the site of the earliest mining activity, and was a well-established camp at the time of Ball's report in 1907. Carper (1921) stated that claims in the main



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Tolicha district were located by Ed "Jumbo" Yeiser and Jack Jordan in 1905 and worked by them from 1905 to 1909. Because water is scarce in the area, some of the ore was milled near Monte Cristo Spring about 3 km west-northwest of the main Tolicha district as evidenced by the presence of tailings, an ore stockpile and mill foundation noted at the site during this investigation; Monte Cristo was an early name for the district. Ball (1907) described prospects on veins in altered rhyolite near Monte Cristo Spring; he did not visit the Quartz Mountain camp, but mentions it as being similar to Monte Cristo Spring area. USBM production records show production of copper-silver-gold ore from a Monte Cristo district in Nye County in 1909 and 1919. This information is suspect, however, as there is no copper known to be present in the Tolicha district. The earliest definitive report found on mining activity in the district was a geologic report by J. A. Burgess (1910) on the I. G. Southey property of 10 claims and a fraction at Quartz Mountain (NBMG file 253, item 2) prepared for the Tonopah Mining Co.. A 1914 press clipping states that a tramway and mill had been completed at Monte Cristo in Nye County, and 25 to 30 tons per day of ore were being treated; it is not known if this is the same area now included in the Tolicha or Quartz Mountain subdistricts. A 1917 report on the Golden Age Group of seven claims at the head of Monte Cristo Canyon, owned by L. J. Webber, described a well and spring serving two shafts and crosscuts (Webber. 1917).

Jack Jordan and "Jumbo" Yeiser, who made some of the earliest locations in the district, made a discovery of rich ore at Tolicha in 1917 and located the Landmark and adjacent Life Preserver claims, prompting a short-lived boom in the district (Lincoln, 1923). That year, an option was taken on the Life Preserver claims by George Wingfield and Kendall

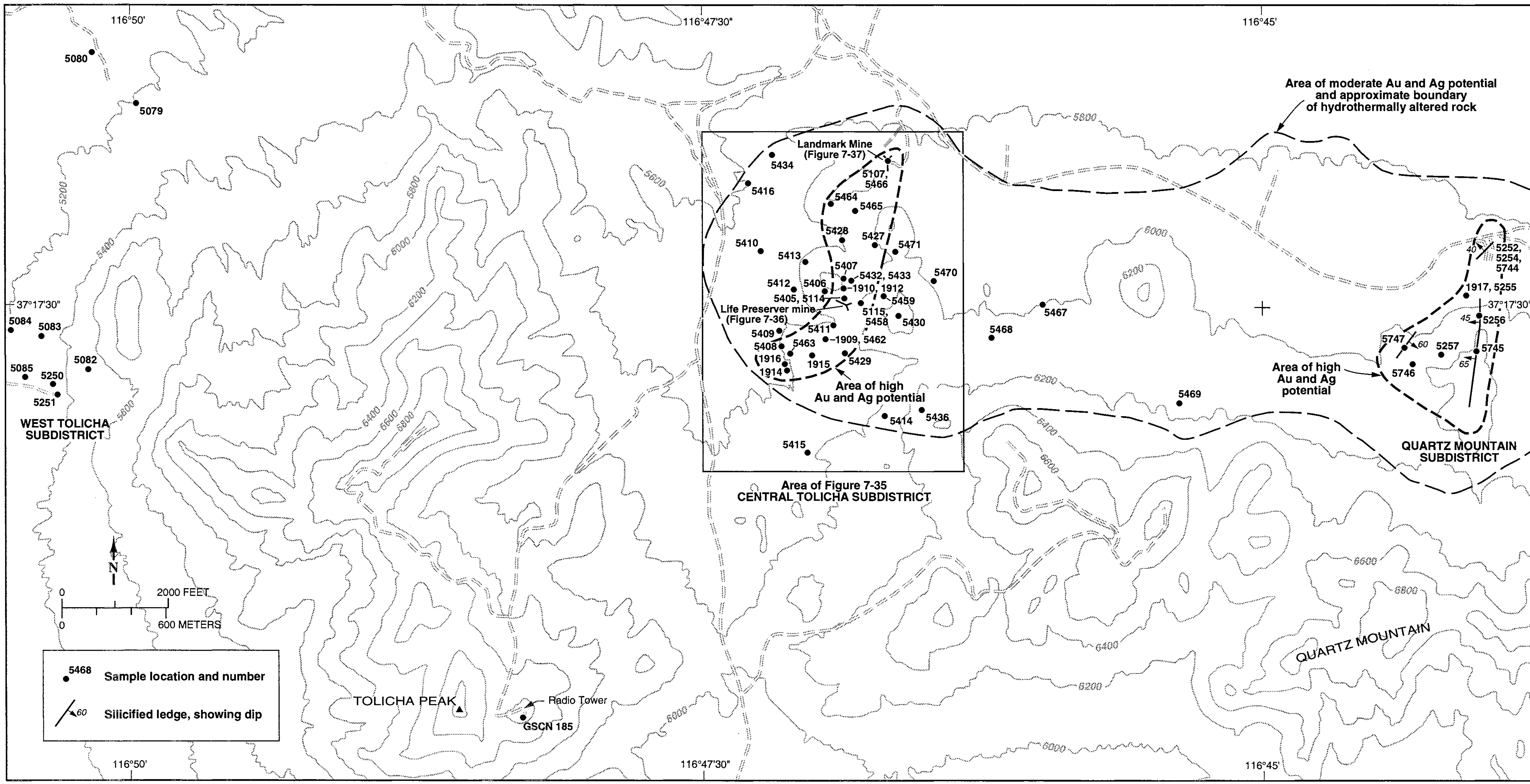


Figure 7-34 Sample location map of the Tolicha district showing altered areas and mineral potential, Nye County, Nevada.

who financed 300 feet (91 m) of development work in short tunnels and shallow shafts on the Life Preserver claims (Hall, 1981; Lincoln, 1923) but lost interest when no ore was found. A later report Holland (1923) suggests that Wingfield's work was progressing in the wrong direction to intersect the vein. After Wingfield and associates dropped the property, it was leased and worked by E. Harney (Harvey), who installed a small Gibson mill to treat the ore at Vignola (or Vignora) Spring, 6 km southwest of the claims (location of this spring is unknown), but this lease was canceled in 1920 due to failure by lessee to perform sufficient work (Hall, 1981, Carper, 1921).

The Tolicha district was active in 1923 when Tonopah Mine accountant and prospector Herman Albert (1967) chronicled his part in mining activity there. Albert secured financial backing from Charles Knox and J. W. Gerard to develop the Landmark claims. He obtained a compressor and hoist for use at the workings from the Lucky Boy Mine near Hawthorne, set up a cookhouse complete with cook, and extended the shaft and drifts, but failed to reach any rich ore before another payment was due, whereupon the property was dropped. A townsite was surveyed at Tolicha in 1923, as were several claim groups (NBMG files). Lincoln (1923) reported activity at both Tolicha and Quartz Mountain that year, and the USGS reported ore shipments to California and to Tonopah, (USGS, 1923), and a geologic report on the Landmark property by L. F. S. Holland (1923) described four veins carrying good ore, and details the returns on two carloads of high-grade ore shipped from the property. The USBM reported 114 tons of ore shipped in that year, yielding 236 oz gold and 421 oz silver. Nevertheless, by the end of the year, a local newspaper described Tolicha as a "flash in the pan" when Knox abandoned the Landmark Group (Goldfield News and Weekly Tribune, Nov., 1923). No one was present at the claims in 1924 when visited by J. A. Burgess and J. Thorn, who examined the workings and mapped the underground geology, but gave an unfavorable report on the property's value to USSRM Co. (Burgess, 1924). Hall (1981) reported that the Landmark Group continued to be worked until 1926 when it was purchased by J. A. Logan and H. L. Gilbert who abandoned it in 1927, but there is no official production recorded for this period.

The main Tolicha district got a new lease on life in 1929, when 40 tons of ore containing 27 oz gold and 40 oz silver was shipped from the Landmark Group (USBM). Goldfield News and Weekly Tribune articles from 1930 through 1931 chronicle the discovery and subsequent mining of a rich pocket of ore on the Landmark Claim by 60-year old John Weaver, under a lease from the owner, Nick Abelman of Reno. After several regular shipments of ore bearing 1-2 oz gold and 2-3 oz silver per ton were made (USBM records) Weaver's lease and bond were taken over by T. F. Cole of Pasadena, California, who put six men to work on the claims, including Ed "Jumbo" Yeiser, Ivy Southey, and Fred Schultz, some of the original prospectors in the area. Regular shipments of rich ore continued for several months, with a report that a machinery plant (for concentrating the ore?) had been installed at "Yellowgold, formerly the old camp of Trapman" (not to be confused with Trappman's Camp in the Trappman Hills, but possibly named for the same original prospector). This was probably the Yellow Gold Mine area discovered by John "Curly" Carr in 1931, south of Clarkdale in Tolicha Wash. With weekly news reports of new veins, widening veins with depth and richer ore at Tolicha, Abelman was reported to have optioned both the Landmark and Life Preserver claims to an Idaho syndicate in April, 1932 after which newspaper reports of the property's productivity ceased for a time, partly due to its being overshadowed by the new discoveries to the southwest at Clarkdale and Yellow Gold (again described as the old Trapman property, Goldfield News and Weekly Tribune, 5/20/32).

Weaver continued shipping ore from the Landmark Group in 1932 (USBM production records) and the Goldfield News and Weekly Tribune reported that the Life Preserver claims had been leased to Pius Kaelin of Goldfield, who had earlier developed and mined the patented claims at Gold Crater. By September, 1933, Kaelin was reported to have installed a small mill at Tolicha to concentrate the ore, and he made shipments in 1934, 1935, and 1936, most of the ore mined from the Landmark, but at least one carload from the Life Preserver claims (USBM; Goldfield News and Weekly Tribune 4/27/34). Also in 1935 and 1936, several shipments of ore were produced from H. B. Willbourn's lease on the Only Chance claims at Tolicha, formerly owned by I.G.M. Southey (Goldfield News and Weekly Tribune 10/25/35, 11/29/35, 1/17/36; USBM records). Although Hall (1981) reports that the Landmark Mine was worked until the 1940s, USBM recorded no more shipments from Tolicha except a single carload of 25 tons shipped by L. J. Bacoccina in 1940 from the Landmark Mine, with no subsequent production. Hall (1981) reports that the mine equipment was dismantled for salvage and that a single building remained standing at the time of incorporation into the Bombing Range in 1950.

Total production from the Tolicha district, according to USBM production records was 604 tons of ore containing 674 oz gold and 955 oz silver. In addition to this production, local newspaper articles give detailed accounts of at least 387 additional tons of ore shipped from Tolicha between 1931 and 1935 which would have yielded about 1,454 more oz gold and 800 more oz silver, based on grades of ore reported and metal prices during that time period. Thus, total estimated production from Tolicha is 991 tons ore containing 1,345 oz gold and 12,409 oz silver (table 7-7). In addition to this, records show 90 tons of ore containing 3 oz gold, 270 oz silver and 26,210 pounds of copper were produced from the Monte Cristo district in Nye County (as distinguished from the Monte Cristo district of Esmeralda

Table 7-7. Tolicha district production.

Year	Tons Ore	Gold (ounces)	Silver (ounces)
	Tolicha Main District		
1923	114	236	421
1929	40	27	40
1930	19	31	50
1931	128	249	492
1932	135	232	454
1933	87	92	126
1934	240	353	715
1935	99	52	19
1936	104	65	74
1940	25	8	18
Total	**991**	**1,345**	**2,409**

County) in 1909 and 1919. There is no evidence, however, that copper was produced from the Tolicha district.

Geologic Setting and Mineral Deposits

Mineralization and accompanying hydrothermal alteration in the Tolicha district are hosted in rock that has been mapped as the rhyolite of Quartz Mountain (Noble and Christiansen, 1968; Minor and others, 1993), which consists mostly of rhyolite lava and associated tuffs. Rhyolite lava from this unit has been tentatively correlated with the 14.0 Ma lava of Tram Ridge (Minor and others, 1993). The Tolicha Peak Tuff (Noble and Christiansen, 1968), a crystal-poor ash-flow unit, underlies the rhyolite of Quartz Mountain to the south of the Tolicha district. The Tolicha Peak Tuff and tuffaceous beds in the rhyolite of Quartz Mountain dip moderately to the northwest in and around the Tolicha mining district. These units are overlain by shallowly eastward-dipping ash-flow sheets of the 11.45 - 11.6 Ma Timber Mountain Group (Sawyer and others, 1994) between the central and west Tolicha subdistricts.

In the central Tolicha subdistrict, the rhyolite of Quartz Mountain consists of a lower unit of bedded and nonwelded ash-flow tuff that contains sparse to abundant fragments of rhyolite flow rock, and an upper unit of nonwelded ash-flow tuff with abundant fragments of spherulitic rhyolite. Between these two units is a unit composed of a flow dome and related tuffs that consist mainly of hydrothermally altered spherulitic rhyolite with silicified zones that contain all of the known mineralized rock in the district (fig. 7-35).

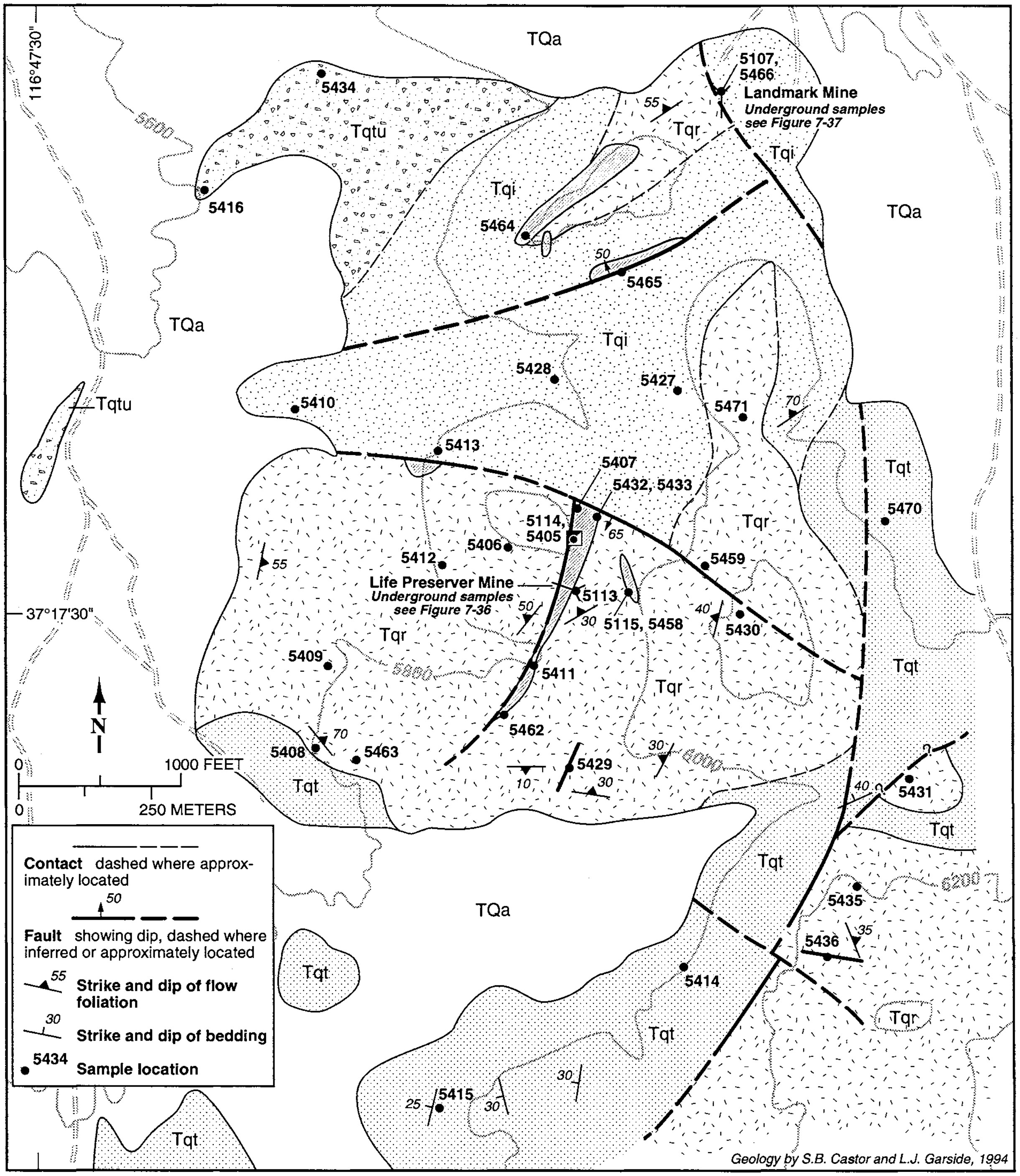
Precious-metal mineralization in the central Tolicha subdistrict, the most productive and thoroughly prospected of the three subdistricts, occurred in quartz veins, silicified breccia, and fault breccia and gouge. In the Life Preserver Mine area, samples that contain more than 100 ppb gold were collected along a northeast-striking zone about 760 m long that includes a strongly silicified exposure about 490 m long. From this exposure, the most highly mineralized samples of district were collected. This zone is cut off to the north by a northwest-striking, steeply south-dipping fault (fig. 7-35). In the main adit of the Life Preserver Mine (fig. 7-36, photo 7-35), two chip samples taken from the breast for about 6 m across this strongly silicified zone (samples 5421 and 5423) contain an average of 9.5 ppm gold (0.3 oz per ton). A select sample of pulverized rock (sample 5460) collected from an irregular, low-angle fault in this zone contains 293 ppm (9.4 oz per ton) gold. Rock in this mineralized zone is highly radioactive, and sample 5460 contains 4700 ppm thorium. A northwest-striking fault that dips 55° east seems to form the western boundary of this radioactive mineralized zone. A northeasterly drift along this fault is caved, but probably connects with inclined shafts to the north of the adit that yielded samples of silicified breccia that contain 1.7 ppm (0.05 oz per ton) gold over a 3 m width (sample 5405) and 5.45 ppm (0.18 oz per ton) gold over a 2.5 m width (sample 5407). Samples from 1-m-thick north- to northwest-striking quartz veins from the mineralized area near the Life Preserver adit contain 0.98 and 21.4 ppm gold (0.03 and 0.69 oz per ton).

At the Landmark Mine, which is about 1 km northeast of the Life Preserver adit, the workings are inaccessible. Select samples of pyritic vein and silicified rock from the major dump contain 5.23 ppm (0.17 oz per ton) and 12.1 ppm (0.39 oz per ton) gold (samples 5107 and 5466). On the basis of an unpublished report (Carper, 1921), samples collected underground at the Landmark Mine delineated a 20-m-long, 3-m-wide northwest-striking vein segment containing 0.05-0.72 oz gold per ton and averaging 0.26 oz gold per ton (fig. 7-37).

Precious-metal mineralization in the central Tolicha subdistrict is found in discrete steeply dipping quartz veins as much as 1 m thick, in brecciated and silicified zones as much as 6 m thick, and in crushed or pulverized rock along faults. The quartz vein material ranges from massive white rock to delicately crustiform banded gray to white rock. Bands in the veins consist of chalcedony, fine granular quartz, fine comb quartz, quartz that has replaced carbonate, and microcrystalline adularia.

Veins at the Landmark property have been described as a mixture of "quartz, talc (probably clay), and crushed rhyolite" (Carper, 1921). According to Kral (1951), the Landmark ore was mined from an area of silicified brecciated zones in and along a N20°E-striking shear zone reported to be nearly 1.6 km long.

Vein samples from the Life Preserver Mine contain minor limonite, specular hematite, and rare sulfides and electrum.

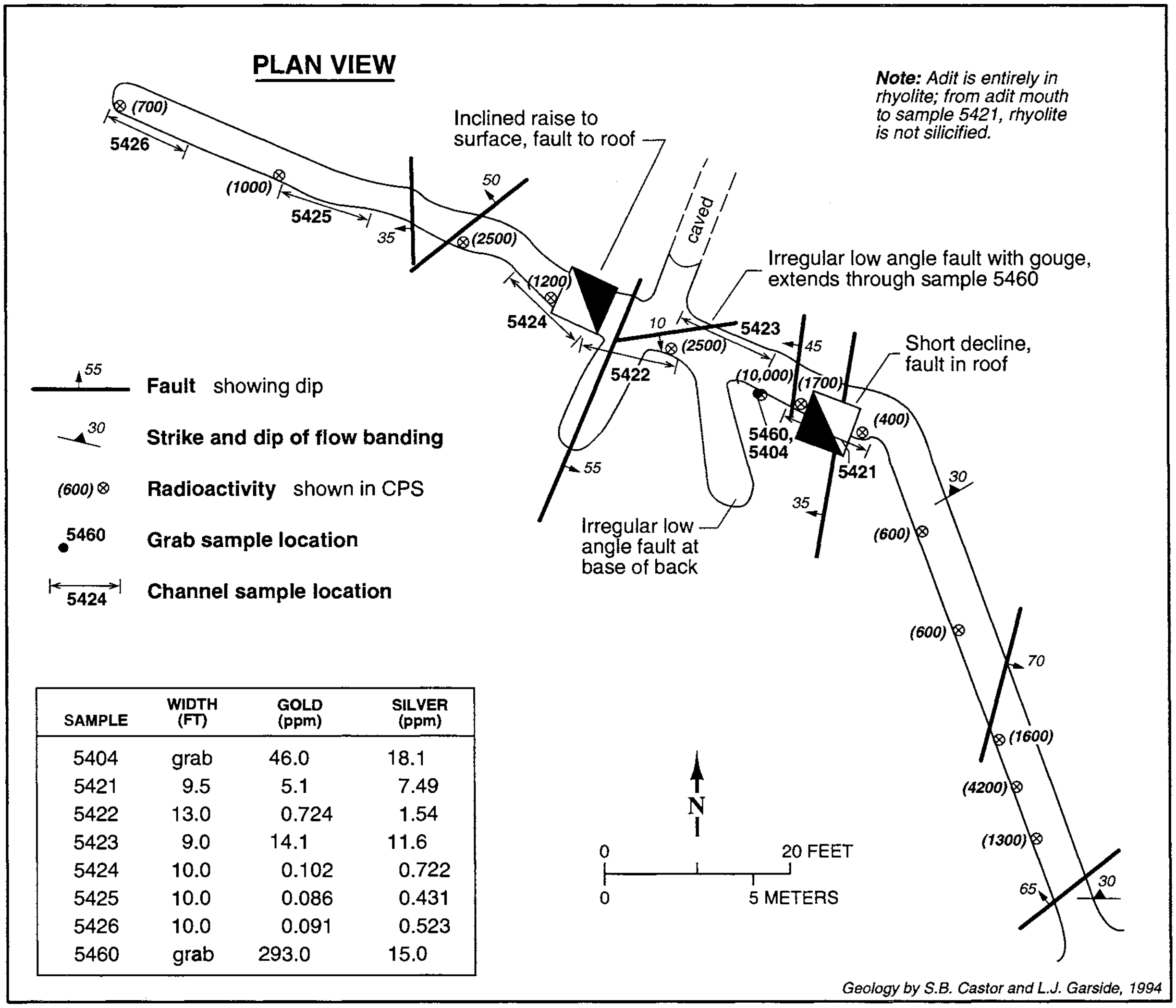


TQa	**Alluvium** includes Quaternary gravels and gravel terraces of possible Tertiary age
	Strongly silicified volcanic rock with local quartz veins

Rhyolite of Quartz Mountain

Tqtu	Nonwelded ash-flow tuff with abundant spherulitic rhyolite lithics and abundant phenocrysts (quartz, potash feldspar, and plagioclase). Locally hydrothermally altered.
Tqi	Mostly welded ignimbrite with sparse to abundant lithic fragments, abundant phenocrysts (quartz, potash feldspar, plagioclase, biotite, and hornblende), and trace monazite. Unit uncludes some phenocryst-rich spherulitic rhyolite flow rock. Generally hydrothermally altered.
Tqr	Rhyolite flow-rock, commonly flow-banded and autobrecciated. Generally spherulitic with moderately abundant phenocrysts (quartz, potash feldspar, plagioclase, biotite, and hornblende). Trace monazite and zircon. Generally hydrothermally altered.
Tqt	Bedded tuff and nonwelded ash-flow tuff with sparse to abundant rhyolitic lithic fragments. Sparse to abundant phenocrysts (quartz, feldspar, and biotite). Locally hydrothermally altered.

Figure 7-35 Geologic map of the central part of the Tolicha district, Nye County, Nevada.



SAMPLE	WIDTH (FT)	GOLD (ppm)	SILVER (ppm)
5404	grab	46.0	18.1
5421	9.5	5.1	7.49
5422	13.0	0.724	1.54
5423	9.0	14.1	11.6
5424	10.0	0.102	0.722
5425	10.0	0.086	0.431
5426	10.0	0.091	0.523
5460	grab	293.0	15.0

Figure 7-36 Geologic map of the Life Preserver Mine, Tolicha district, Nye County, Nevada.

On the basis of SEM analysis, vein sample 5113 was found to contain limonite, electrum, acanthite, and the rare gold-silver sulfide uytenbogaardtite. The electrum in this sample contains about 50 percent gold and 50 percent silver and occurs mainly as tiny particles in quartz and in limonite that probably replaced pyrite. Pyrite, barite, galena, acanthite, and electrum occur in a N10°W, 40°NE vein that is exposed in a prospect east of the Life Preserver Mine (sample site 5458). Electrum in this sample is compositionally similar to that in sample 5113.

Silicified breccia in the central Tolicha subdistrict ranges from light gray or brownish gray rock that contains little or no sulfide or iron oxide minerals, to dark gray sulfide-rich rock or reddish-brown rock with abundant iron oxide. Chalcedonic breccia from the Landmark Mine (sample 5107) was found to contain pyrite with traces of galena. Highly mineralized gouge from the Life Preserver Mine (sample 5460) contains quartz, adularia, illite, barite, electrum, and thorium-calcium-titanium-rare earth element silico-phosphate (cheralite?). The electrum, which occurs as irregular spherical particles up to 0.1 mm in diameter, has variable compositions; SEM/EDX analyses of four particles gave a range of 65 to 98 weight percent gold.

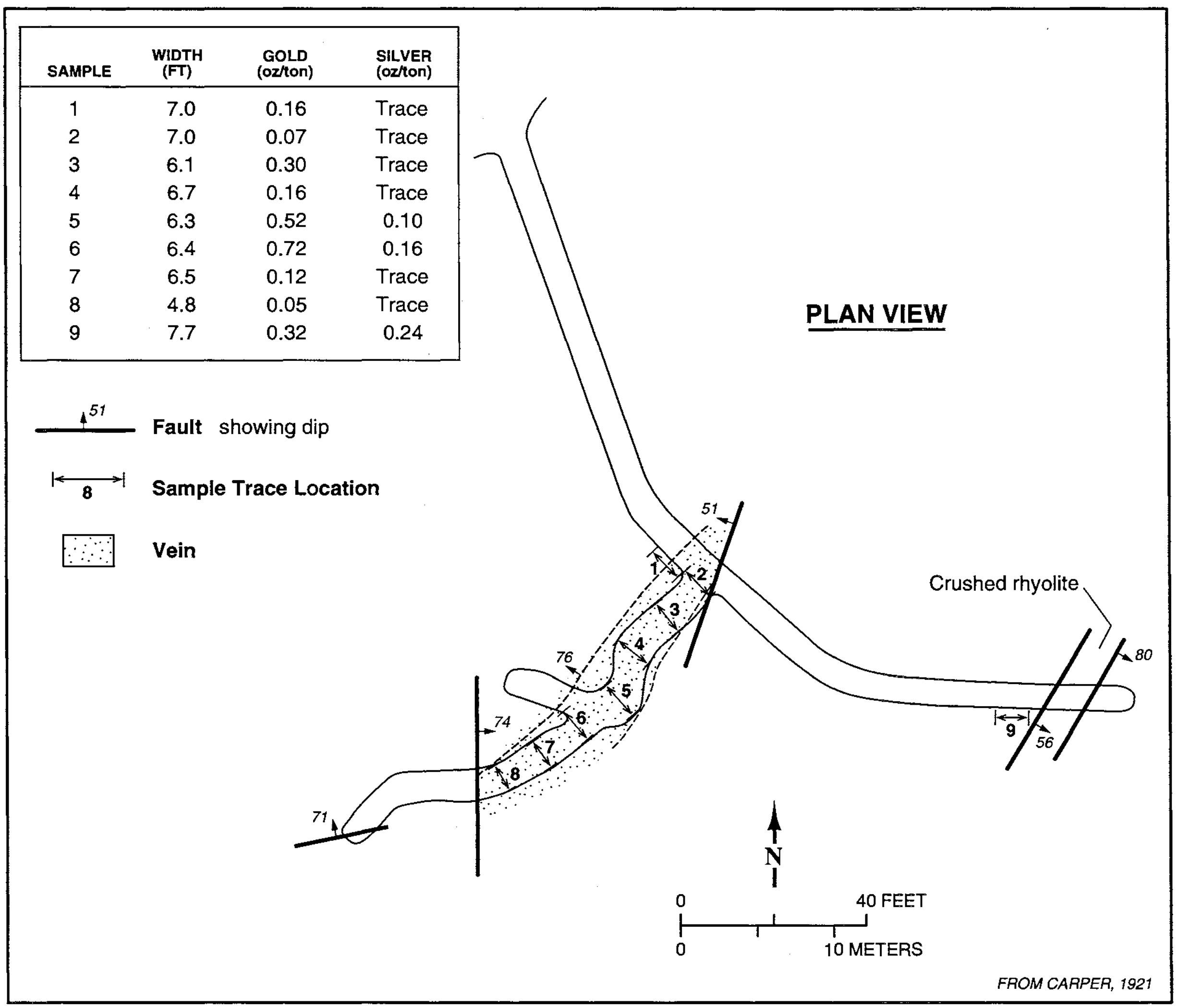
Hydrothermal alteration in the central Tolicha and Quartz Mountain subdistricts includes strongly silicified and adularized rock and argillic rock. The most abundant clay mineral is illite. Hydrothermally altered lava rock and tuff of the rhyolite of Quartz Mountain underlies an area about 1.6 km across in the central Tolicha subdistrict, and extends eastward in a 1.6-km-wide zone that includes the Quartz Mountain subdistrict. In addition, small areas of silicified hydrothermal breccia were noted in this area.

Precious-metal mineralization in the Quartz Mountain subdistrict is mainly along a N10°E, 60°NW to 90°-dipping zone of silicified rhyolite (fig. 7-34, photo 7-36) that is similar to silicified rock in the central Tolicha subdistrict. This silicified zone contains sheeted to stockwork quartz veins and veinlets with carbonate replacement textures, and possibly adularia. Several generations of quartz veins are present. Host rocks include altered silicic lava and ash-flow tuff. Dumps at shafts near the north end of this zone yielded samples that contain as much as 5.7 ppm (0.18 oz per ton) gold. At the northernmost workings (sample site 5252) there was some stoping along a N80°E-trending, 40°NW-dipping quartz vein and stockwork zone that has crustiform layering and lamellar carbonate replacement texture.

Rock containing 4 ppm (0.13 oz per ton) gold (sample 5474) was collected from a dump at an inclined shaft about 500 m to the west of the silicified zone (fig. 7-34). These workings explored a northeast-striking zone of silica recemented breccia with abundant iron and manganese oxide minerals. According to Kral (1951), development in the 1930s was done on a 2- to 3-foot (0.6- to 0.9-m)-wide vein that dips 50°NW. This may refer to the site of sample 5474 or to the site of sample 5252 mentioned above.

Rock from the Quartz Mountain subdistrict that has high gold content generally consists of breccia composed of angular silicified clasts cemented by iron oxide. However, one sample (5253) contains subparallel banded chalcedony and comb quartz veins that are as much as 1 cm thick. Careful examination of samples from the Quartz Mountain subdistrict failed to reveal any sulfide or native precious metal, although specular hematite was identified. As in the central Tolicha subdistrict, alteration includes silicification, adularization, and argillization.

The west Tolicha subdistrict contains only a few small prospect pits in hematitic and limonitic argillized rock along northeast-striking, vertical to moderately east-dipping faults in tuff that has been mapped as rhyolite of Quartz Mountain (Minor and others, 1993). No quartz veins were found, although some silicified rock occurs along the faults. Five samples were collected from the west Tolicha subdistrict and none were found to contain more than 0.006 ppm gold or 0.023 ppm silver.



SAMPLE	WIDTH (FT)	GOLD (oz/ton)	SILVER (oz/ton)
1	7.0	0.16	Trace
2	7.0	0.07	Trace
3	6.1	0.30	Trace
4	6.7	0.16	Trace
5	6.3	0.52	0.10
6	6.4	0.72	0.16
7	6.5	0.12	Trace
8	4.8	0.05	Trace
9	7.7	0.32	0.24

Figure 7-37 Landmark adit plan map.

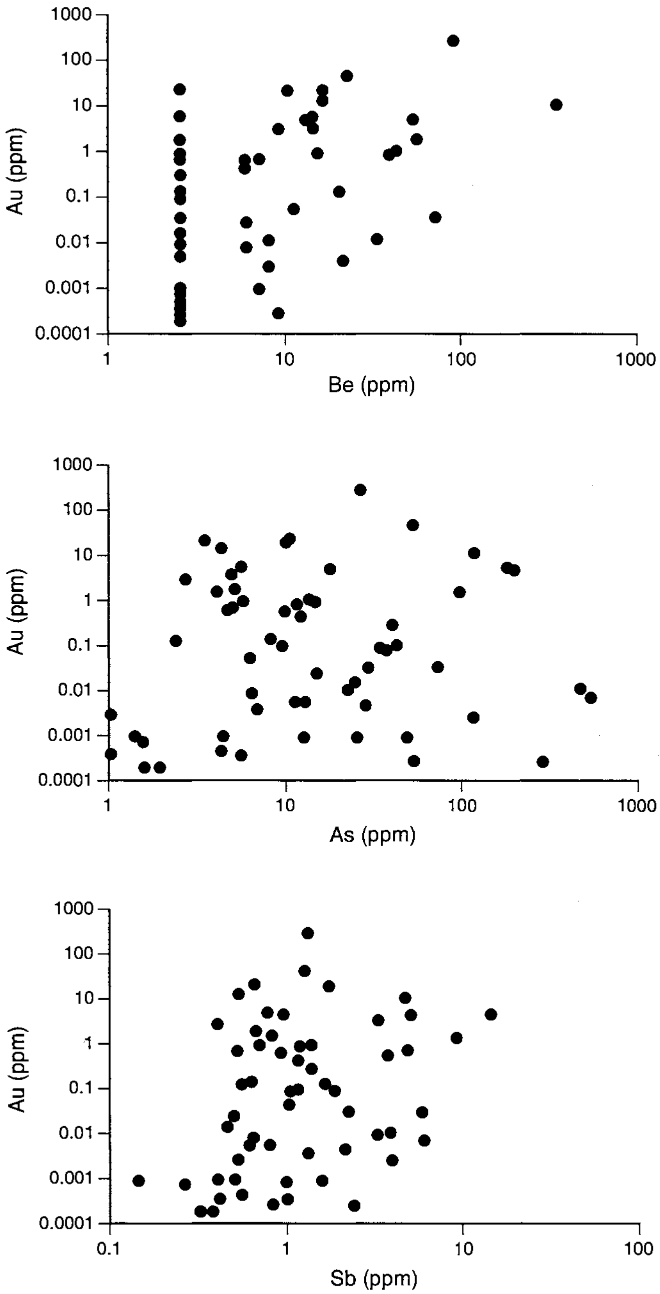


Figure 7-38 Plots of Au/Be, Au/As, and Au/Sb geochemical samples from the Tolicha mining district, Nye County, Nevada.

Geochemistry

Rocks in the Tolicha mining district that contain high gold contents (>1 ppm) are also enriched in silver (>2 ppm), with the median gold-to-silver ratio at 0.63. Samples that are enriched in gold generally have anomalously high beryllium (fig. 7-38), which is surprising because beryllium is not typically associated with gold. The highest beryllium reported, 350 ppm, is in a sample of quartz vein and sulfide-rich breccia from the dump of the Landmark Mine. No beryllium minerals have been identified in samples from the Tolicha district. Thorium, another element that is not generally found with gold, is enriched in samples from the gold-rich zone in the Life Preserver adit. A sample that was collected from the area with the highest radioactivity in the Life Preserver adit (fig. 7-36), is extremely enriched in thorium, at nearly 0.5 percent, and also enriched in beryllium, heavy rare earth elements, yttrium, and tungsten (sample 5460).

Arsenic, antimony, mercury, and molybdenum, elements that are commonly associated with precious metal deposits, are also present at elevated levels locally in the Tolicha district. Arsenic values do not correlate well with high gold contents in the Tolicha district (fig. 7-38). Arsenic is present in amounts in excess of 200 ppm in samples from the central Tolicha subdistrict, but these samples do not have high gold contents and are located in an area that is northeast of the mineralized area at the Life Preserver Mine and south of the Landmark Mine (samples 5465, 5470, and 5471, fig. 7-34). Antimony shows better correlation with high gold content than arsenic (fig. 7-38), and gold-rich samples from the Landmark Mine and the Quartz Hill subdistrict have relatively high antimony contents. However, antimony is only moderately elevated in gold-rich samples from the Life Preserver Mine. Although mercury is present at relatively low levels for epithermal precious metal deposits (2 ppm or less), it correlates positively with precious metal contents in the Tolicha district. Molybdenum is also locally enriched in mineralized rock in the Tolicha district, occurring in amounts as high as 279 ppm in gold-rich breccia from the Quartz Mountain subdistrict. Rock from in and near the southern part of the gold-bearing silicified zone in the Life Preserver area contains more than 50 ppm molybdenum (samples 5411, 5429, and 5463; fig. 7-36).

Identified Mineral Resources

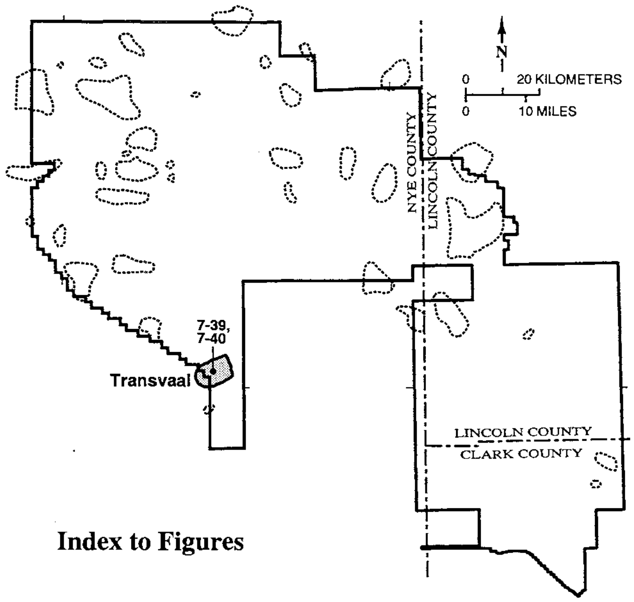
There are no identified mineral resources in the Tolicha district.

Mineral Resource Potential

The central Tolicha and Quartz Mountain subdistricts are considered to have high potential, certainty level C, for economic gold and silver deposits of the low base metal, low sulfidation type. Exploration for such deposits would probably be most fruitful in the Landmark and Life Preserver Mine areas, and previously prospected areas in the Quartz Mountain subdistrict.

The large area of hydrothermally altered rock that includes the central Tolicha and Quartz Mountain subdistricts (fig. 7-34) is considered to have moderate potential, certainty level B, for disseminated and vein-hosted gold and silver deposits. This area includes some ground that is covered by alluvium.

The Tolicha district may also have potential for by-product production of beryllium from gold and silver ores. However, the recovery and production of this strategic metal is highly specialized and it is unlikely that production from the Tolicha district would be feasible under current conditions.



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7.3.3.9 Transvaal District

Location

The Transvaal mining district is situated within and adjacent to the southwestern boundary of the NAFR, southwest of Timber Mountain (fig. 7-21).

History of Discovery, Exploration, and Mining

Initial discoveries in March 1906 led to a rapid but short-lived boom that included the construction of a tent city known as Transvaal. The population reached quickly reached a maximum of 700 persons and two newspapers began operations, but by late May of the same year the site was completely abandoned (Hall, 1981). Numerous adits, shallow shafts, and prospect pits are present in the district. However, due to a lack of evidence for ores of any kind, it is inferred that little or no production came from the district.

Geologic Setting and Mineral Deposits

The bedrock geology of the area has been described by Byers and others (1976). Workings in the district are broadly, but not exclusively, associated with faults and hydrothermally altered volcanic rocks near the margin of the Timber Mountain caldera, which formed during the eruption of the Ammonia Tanks Tuff (Byers and others, 1989; Noble and others, 1991). The nature and timing of hydrothermal activity in the district are briefly discussed by Jackson (1988), Weiss and others (1995), and Weiss (1996).

Hydrothermally altered rocks that crop out in the southwest flank of Timber Mountain, near Buttonhook Wash, are included in the Transvaal Hills district for the purpose of this report.

A simplified geologic map of the area and a diagram showing sample locations and alteration assemblages are given in figure 7-39 and figure 7-40, respectively. The approximate distribution of hydrothermally altered rocks (fig. 7-40) was determined in the field by S. I. Weiss using color aerial photographs during December 1994 and April 1995, supplemented with standard X-ray diffraction and optical microscopic methods. The main part of the district is located east and southeast of the site of Transvaal (fig. 7-40) and is situated largely within intracaldera-facies ash-flow tuffs and landslide deposits of the Rainier Mesa Tuff, and overlying outflow-facies of the Ammonia Tanks Tuff and tuff of Cutoff Road (Byers and others, 1976). A large area of acid-sulfate alteration characterized by porous, fine-grained mixtures of kaolinite, alunite, quartz, opal, and iron-oxides ± calcite ± dolomite, and inferred to be of the steam-heated type (Rye, 1993), is centered about 1.6 km east of the Transvaal site (fig. 7-40). This alteration assemblage grades abruptly westward into a large area of weak argillic alteration containing narrow zones of silicification and adularization along fault surfaces. In the northern part of the district the area of argillic alteration is bordered by areas of zeolitic alteration within ash-flow units of the Timber Mountain Group. The zeolitic alteration is characterized by the presence of abundant thin veins and fracture coatings of coarsely crystalline stilbite and smaller amounts of water-clear alunite (confirmed by X-ray diffraction studies). Alunite from the northern part of the district has given a potassium-argon age of 9.9±0.4 Ma (Jackson, 1988; McKee and Bergquist, 1993). Based on this age determination and stratigraphic relations, hydrothermal activity took place coeval with, or as much as about 0.5 Ma after, the latter stages of post-collapse volcanism that occurred within the moat, peripheral to, and west of the Timber Mountain II caldera (Noble and others, 1991; Weiss and others, 1995).

The principal workings of the district are located about 0.6 km southeast of Transvaal site (fig. 7-40), and consist of a shaft, estimated to be less than 100 m in depth, and a nearby adit. Most workings in the main and northern parts of the district are along steeply dipping, north- to northeast-striking normal faults, mainly within areas of argillic and zeolitic alteration. Innumerable shallow pits, cuts and short adits are also associated with areas of distinctive, reddish-orange iron-oxide staining common in tabular bodies of clast- and matrix-supported landslide breccia that interfinger with the Rainier Mesa Tuff.

Geochemistry

Geochemical data from the district show that rocks that have undergone acid-sulfate alteration contain elevated,

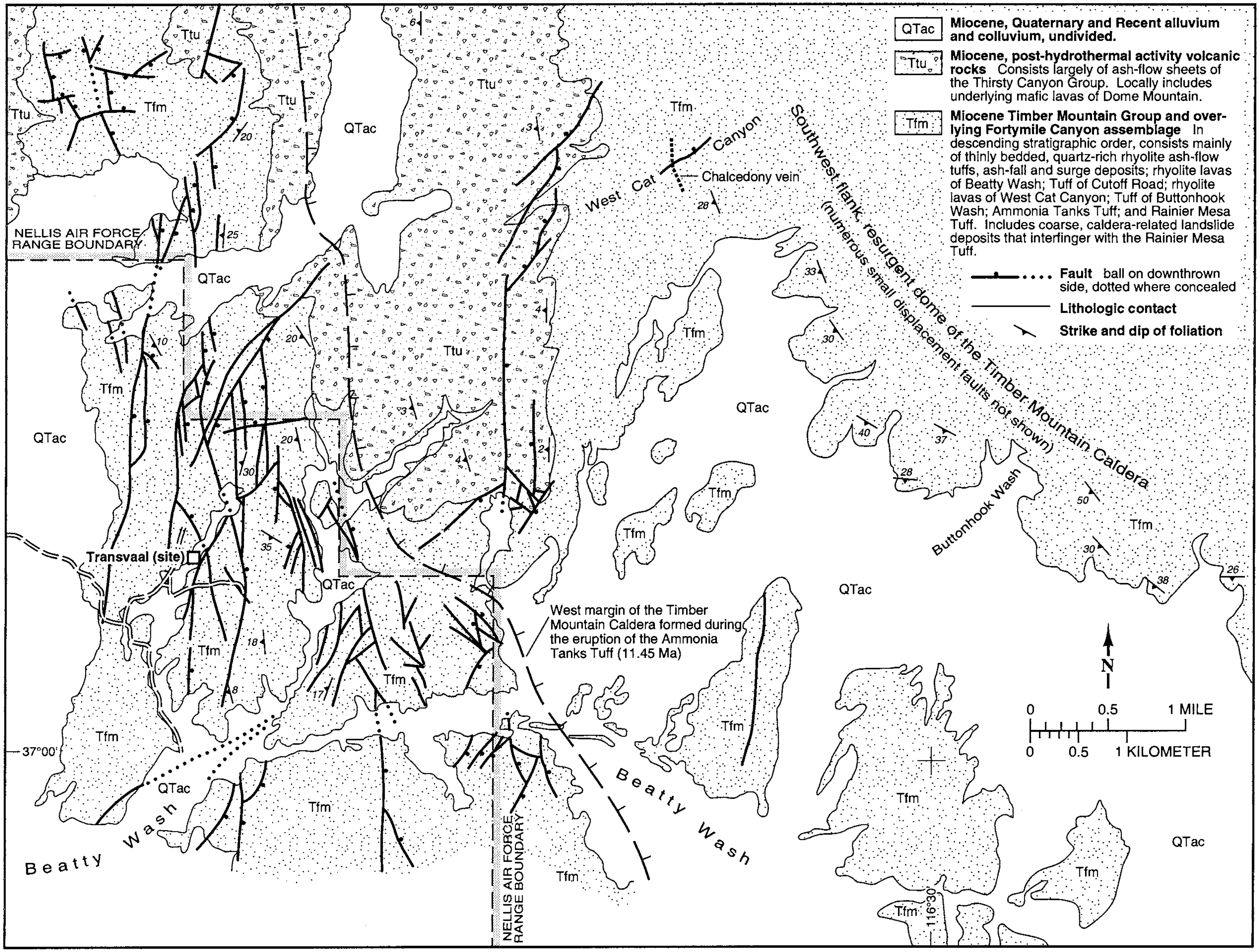


Figure 7-39 Generalized geologic map of the Transvaal Hills area, Nye County, Nevada (modified from Byers and others, 1976).

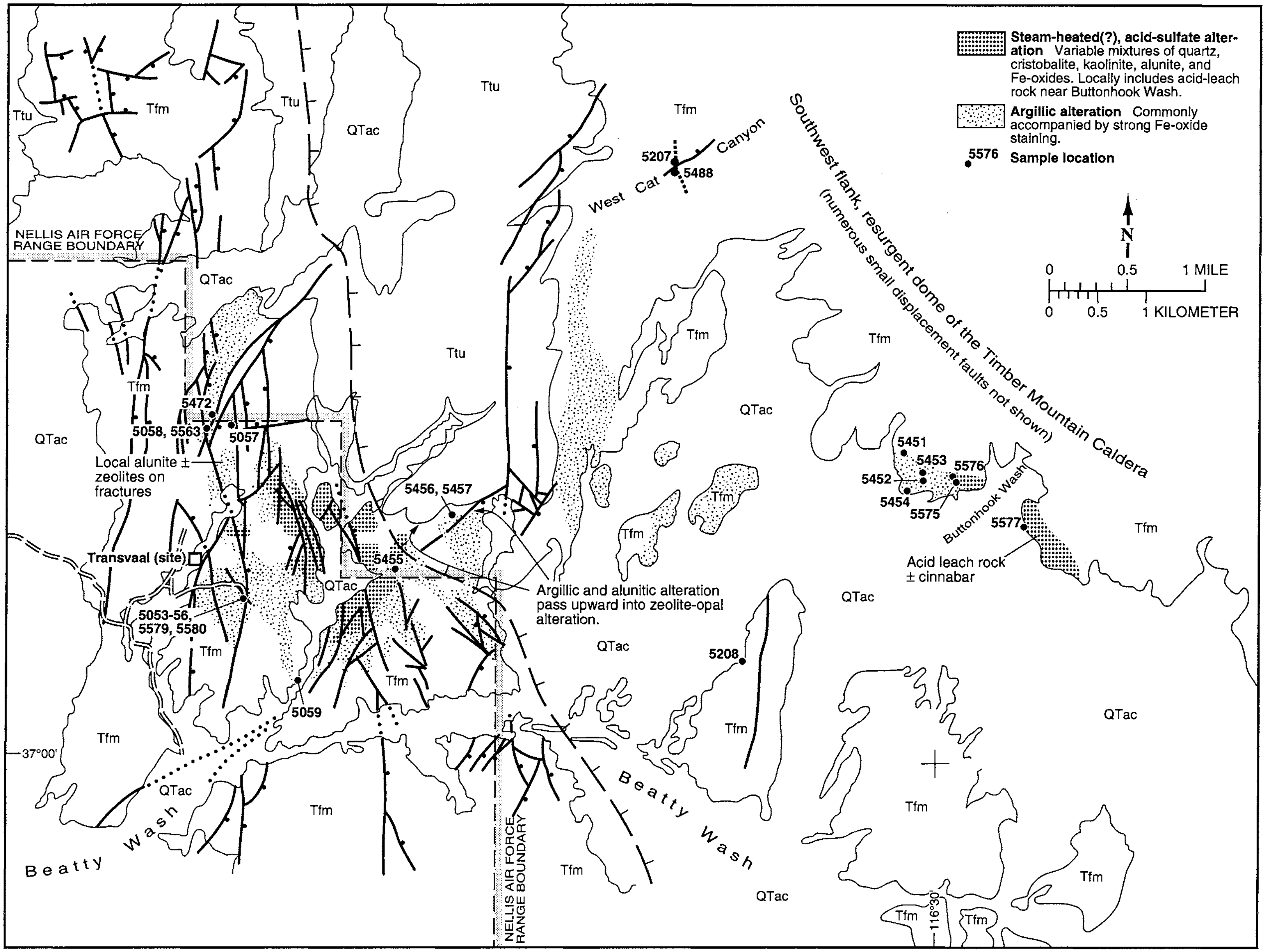


Figure 7-40 Sketch map showing sample locations and approximate distribution of hydrothemally altered rock in the Transvaal Hills area, Nye County, Nevada.

but generally low concentrations of mercury, ± bismuth ± thallium ± tellurium ± arsenic ± molybdenum (appendix C). Filmy cinnabar is locally present in acid-leached rock along the southwest flank of Timber Mountain near Buttonhook Wash (fig. 7-39). In contrast, silicified and partially adularized rocks along faults within areas of argillic alteration, such as in the area of the principal shaft southeast of Transvaal site, contain weakly elevated gold (e.g., 0.015 ppm to 0.031 ppm) and mercury ± bismuth ± molybdenum ± thallium ±tin(?) (appendix C). The maximum arsenic and antimony concentrations from the area of the principal shaft (53 ppm and 2.1 ppm, respectively) are low (appendix C). Samples from similar rocks at prospect workings in the northern part of the district contain only very weakly elevated concentrations of mercury.

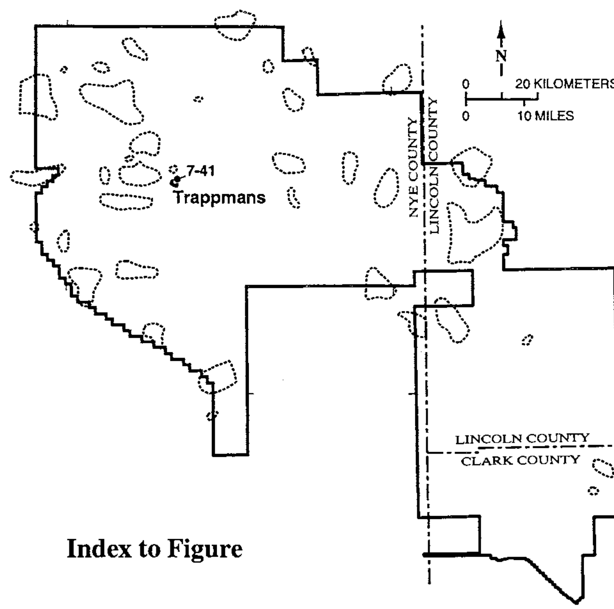
No evidence of ores of any type was observed on the dumps of, or within, the shallow workings in the district. The geochemical data, together with the nature of the alteration exposed in the district, are consistent with that of a shallow, largely vapor-dominated portion of an epithermal-type hydrothermal system. Large volumes of acid-sulfate altered rock, entirely barren of precious metals, may form as the result of condensation and oxidation of hydrogen sulfide-bearing water vapor above a boiling hydrothermal reservoir (e.g., Schoen and others,1974), and may locally contain economic amounts of amounts of cinnabar and/or native mercury, such as at Sulphur Bank in California (White and Roberson, 1962).

Identified Mineral Resources

There are no identified mineral resources in this area.

Mineral Resource Potential

Moderate potential, certainty level C, is estimated for hot-spring-type mercury deposits in the areas of advanced argillic (acid-sulfate) alteration at Buttonhook Wash and the Transvaal Hills. The presence of low-level gold concentrations in certain samples (e.g., samples 5053 and 5055) and adularia along faults in the argillic zones indicates that water-saturated conditions existed peripheral to the vapor-dominated part of the system and that potential may exist at depth for precious-metal deposits of either the adulari-asericite type, or the high-sulfidation type. Potential deposits could have formed at or below the depth of the water table at the time of hydrothermal activity. Such depths may be hundreds of meters below the present surface, suggesting that the potential for economic precious-metal deposits is low. Therefore, low potential, certainty level B, is estimated for shallow high-grade or bulk-mineable, epithermal precious-metal deposits of the low-sulfidation type.



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7.3.3.10 Trappmans Camp

Location

Trappmans Camp is located in T5S, R47E in the Trappman Hills.

History of Discovery, Exploration, and Mining

The ore deposits were discovered in June 1904 by Hermann Trappman and John Gabbard (Ball, 1907). The district was active in 1905 at the time of Ball's visit. A group of five claims (Bonanza, Red Boy, Jimmie Burns, Dutchman, and Portland) was located in 1904 by the Trappman Mining Co. and surveyed for patent in 1909, but was not patented (fig. 7-41). The only production recorded for the district was 1 ton of ore in 1908 by the Trappman Mining Co.; it contained 1 oz of gold and 69 oz of silver. According to Kral (1951), there has been no activity in the district since the early days. There are a number of shafts, several adits, and one old cabin in the district.

Geologic Setting and Mineral Deposits

The southern two-thirds of the Trappman Hills is composed of coarse-grained, somewhat gneissic, granite with numerous inclusions and small pendants of schist and hornfels. Ekren and others (1971), thought that the granite was of Precambrian age, but McKee (1973) obtained a potassium-argon age of 14.0±0.5 Ma on muscovite from a muscovite schist at Trappmans and concluded that the Trappman Hills form a metamorphic core complex. The muscovite age is clearly reset and much too young. The actual age of the granite and metamorphic rocks is unknown; the granite

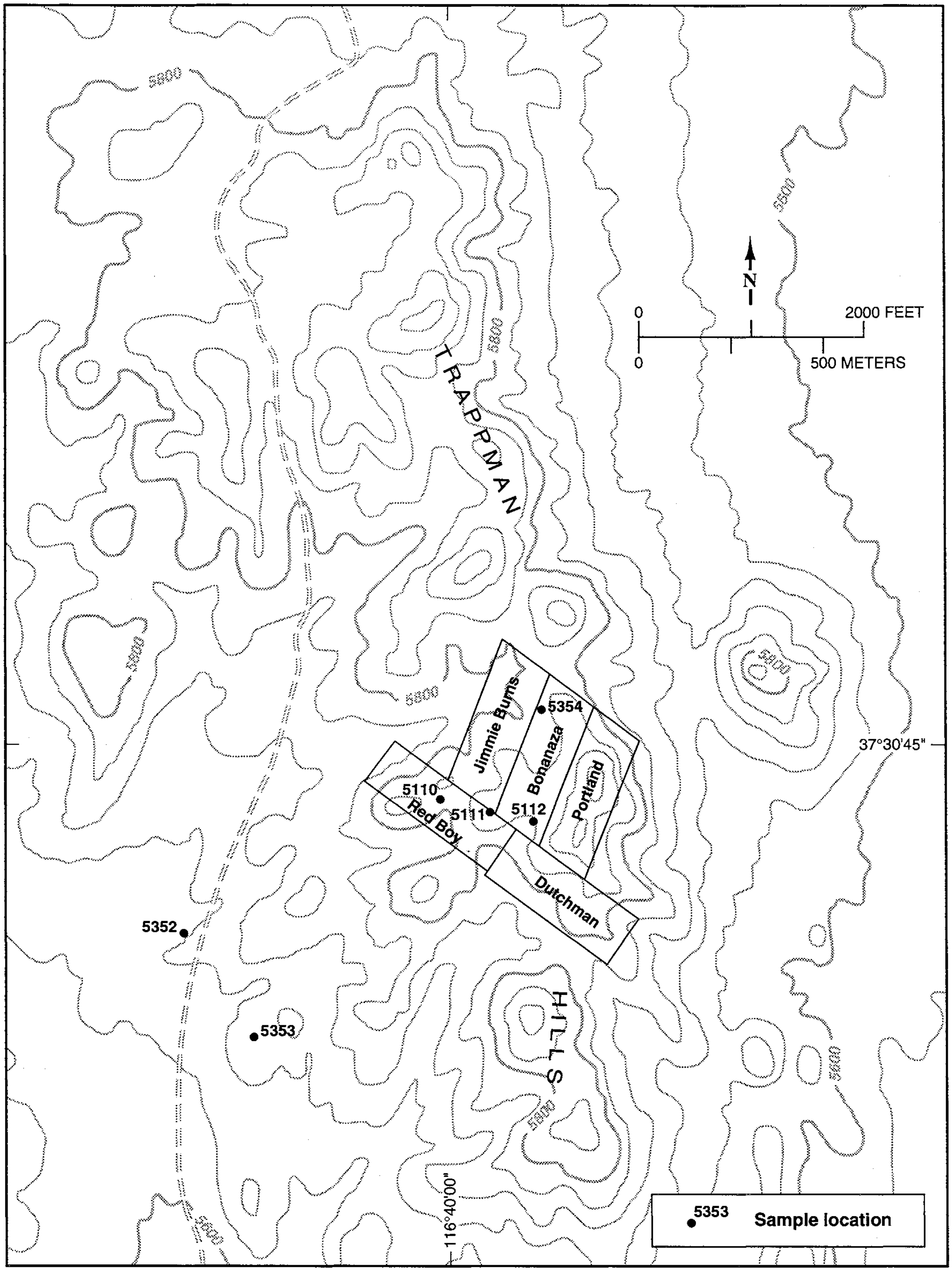


Figure 7-41 Sample location map showing outline of unpatented mining claim group, Trappman Hills, Nye County, Nevada.

could be Mesozoic, the metamorphic rocks could be late Proterozoic or Paleozoic. While the granite in the Trappman Hills is crudely foliated, there is no conclusive evidence that the area is a metamorphic core complex. There is no evidence in the Trappman Hills for a low-angle detachment fault and the Tertiary volcanic rocks in the hills are gently dipping. Ekren and others (1971) showed a low-angle normal fault in the Gabbard Hills a few kilometers east of Trappmans, but its relationship to the Trappman Hills is not clear.

The granite is intruded by several prominent, near vertical, rhyolite porphyry dikes. It is in fault and depositional(?) contact with the tuffs of Antelope Springs and is overlain unconformably by the Spearhead Member of the Stonewall Flat Tuff.

There are at least two generations of vein quartz in the district, an early phase of white crystalline "bull" quartz and a later group of granular, coarse quartz veins with locally abundant metal oxide phases. A sample of the barren early quartz (5111) contained anomalous arsenic, and antimony, and weakly anomalous nickel, tungsten, vanadium, and zinc. Five samples from the later group of veins 5110, 5112, 5352, 5353, and 5354 are strongly anomalous in silver (7.5, 4.4, 1.6, 2.7 and 106 oz per ton) and anomalous in gold (0.313, 0.389, 0.056, 2.29, and 0.777 ppm) (fig. 7-41). All five samples are strongly anomalous in lead, up to 1.5 percent, arsenic, up to 0.6 percent, antimony, up to 0.48 percent and are anomalous in selenium, copper, cadmium, mercury, and zinc. Three samples were anomalous in bismuth and tungsten, one sample was anomalous in tellurium and one sample had 1,300 ppm Br. The mineralized veins cut coarse-grained granite and are surrounded by envelopes of kaolinized granite up to 10 m wide. The veins range up to 1 m thick, but are typically about 40 to 50 cm thick. Numerous shallow shafts, several adits, and numerous prospect pits have been dug on the veins. The veins belong to the polymetallic type.

Identified Mineral Resources

There are no identified mineral resources in this district.

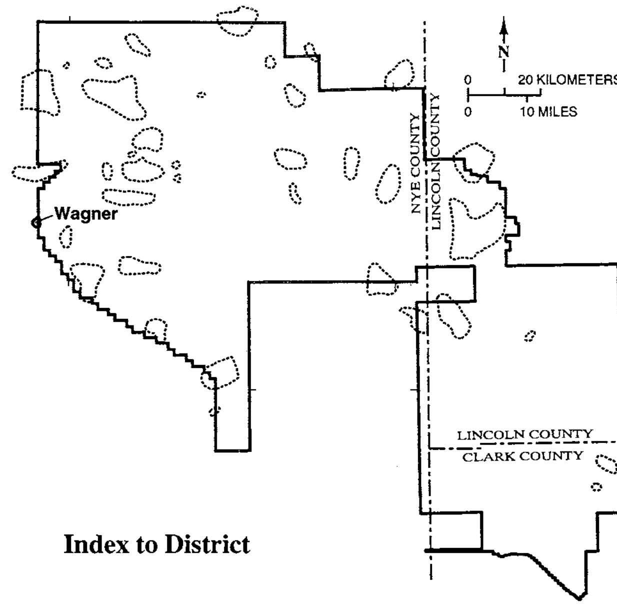
Mineral Resource Potential

Trappmans Camp has moderate mineral potential, certainty level C, for the occurrence of a small tonnage (a few thousand tons) of lead-rich, silver-gold ore.

7.3.3.11 Wagner District

Location

The Wagner district is located in section 24, T6S, R43E, and in section 19, T6S, R44E (unsurveyed). Most of the claims



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in the district lie just to the west of the NAFR, but a portion of the Ish patented claim straddles the NAFR boundary.

History of Discovery, Exploration, and Mining

The 18 claims of the Wagner (Ish) Group were located in 1903 and 1904 by Frank M. Ish of Goldfield, who had sunk two 100-foot (30 m) shafts on the property by October 1906 (The Goldfield News, 10/3/1906). Ore material from one of the shafts was said to assay 10-13 percent copper, and $5.00 to $8.00 in gold, and material found during assessment work on the Ish Group ran 20 percent copper, and $15.00 in gold. There were plans to ship ore from the property in 1906, but there is no record of any production at that time. The Wingfield interests sank the main shaft, 453 feet (138 m) deep, as well as a circular shaft 100 feet (30 m) deep about a year or so prior to 1912, the year in which the claims were patented under the ownership of the Wagner Copper Co. (USSRM Co. report, NBMG files; BLM Mineral Survey).

The property was drilled by Gulf Resources and subsequently by BHP in the early 1990s. Reportedly some of the BHP holes were as deep as 425 m.

Geologic Setting and Mineral Deposits

The geology of the Wagner district is not shown correctly on either the geologic map of Nevada (Stewart and Carlson, 1978) or on the geologic map of southern Nye County (Cornwall, 1972). Both maps show the area occupied by the Wagner district as consisting entirely of silicic ash-flow tuffs. In fact, the main rock type in the district is the Wood Canyon Formation of Late Proterozoic and Early Cambrian age. The Wagner district, adjacent to NAFR, was examined by J. V. Tingley and H. F. Bonham, Jr. in 1993. The area on NAFR immediately adjacent to the district was examined by S. I. Weiss in 1995. The Wood Canyon Formation in the Wagner area, consists of a thick (>500 m) sequence of shale, quartzite, and some intercalated limestone. The Wood Canyon Formation is intruded by an andesite plug and is unconformably overlain by silicic tuffs.

Mineralization in the Wagner district is confined to the Wood Canyon Formation; the Tertiary volcanic rocks are unaltered. Drilling conducted in the district by Gulf Resources and BHP was apparently done in a search for a buried porphyry copper system.

Mineralization in the district occurs in brecciated quartzite, in silicified, brecciated shale, and in one locality, in kaolinized shale. Sample 4170 (appendix C), collected from the dump of the northernmost shaft in the district, consisted of hematite-stained, brecciated quartzite cemented with clear, crystalline quartz, malachite, chrysocolla and azurite. The sample contained 3,362 ppm copper, and had anomalous arsenic, bismuth, nickel, cadmium, mercury, antimony, and zinc. Sample 4171 (appendix C) was collected from an outcrop of silicified, brecciated shale and quartzite. The breccia zone contained abundant iron oxides, was cemented with quartz and calcite, and had abundant conichalcite (copper arsenate), and lesser amounts of chrysocolla and malachite. The sample had 1 ppm silver, 3,591 ppm arsenic, 1.5 percent copper, was strongly anomalous in bismuth, mercury, and antimony, and was anomalous in cadmium, cobalt, molybdenum, nickel, lead, zinc, selenium, tellurium, uranium, and tungsten. Sample 4172 (appendix C) was collected from the dump of the main shaft. The sample is greenish shale, with worm-tube casts. The shale has clots of specular hematite and calcite, and is cut by quartz and sulfide veinlets. The sulfide is mainly chalcopyrite. Sample 4172 contained anomalous bismuth, copper, cobalt, nickel, vanadium, tungsten, and zinc. Sample 4173 (appendix C) was collected from prospect pit in the southern part of the district. The sample is strongly silicified shale, with some intercalated quartzite. The sample contained oxidized pyrite, chalcocite(?), chrysocolla, and manganese oxides. Sample 4173 contained 35 ppm silver and 1.42 ppm gold and 2.3 percent copper. It is strongly anomalous in arsenic, bismuth, cadmium, cobalt, mercury, nickel, selenium, tin, tellurium, and thallium. It is anomalous in lead, molybdenum, antimony, uranium and zinc. Sample 4174 was also collected from the vicinity of a shaft in the southern part of the Wagner district. The sample consists of quartzite and kaolinized shale. Lenses and veinlets of malachite, azurite, chrysocolla, and melaconite are present. Sample 4174 contained 2 ppm silver, 0.77 ppm gold and 2.5 percent copper. It is anomalous in barium, bismuth, antimony, and selenium, and strongly anomalous in tellurium, thallium, and mercury.

The anomalous suite of elements present in the samples, and the character of the mineralization (stockwork veinlets, silicified breccias in shale, quartzite, and minor carbonate replacement) characterize Wagner as a polymetallic replacement deposit, probably related to a copper porphyry. Apparently no igneous porphyry was found in the deep drill holes of BHP, but their drilling may not have been deep enough or in the wrong locality. Interesting aspects of the metal suite present at Wagner are the anomalous cobalt and nickel and the highly anomalous amounts of mercury and thallium present in several samples. Gold and silver are anomalous in two samples, but in amounts too low to be of economic interest.

The main interest in the Wagner district, for the present study, was in attempting to ascertain whether the mineralization in the older sedimentary rocks extended under a post mineral cover of Tertiary volcanic rocks onto the NAFR. S. I. Weiss examined the Tertiary volcanic rocks and the geology in the NAFR, immediately adjacent to Wagner, and concluded that the mineralization did not extend eastward onto the NAFR. He found that the mineralized sedimentary rocks of the Wood Canyon Formation were cut off at the NAFR boundary by a large unaltered flow-dome of andesite.

Identified Mineral Resources

There are no identified mineral resources in the portion of the Wagner district within the NAFR.

Mineral Resource Potential

The Wagner district is assigned a high mineral resource potential, certainty level C, for the occurrence of a limited tonnage of mixed oxide and sulfide copper ore and moderate resource potential, certainty level B, for the occurrence of a buried porphyry copper deposit. Low mineral resource potential, certainty level C, is assigned to that portion of the NAFR adjoining the Wagner district.

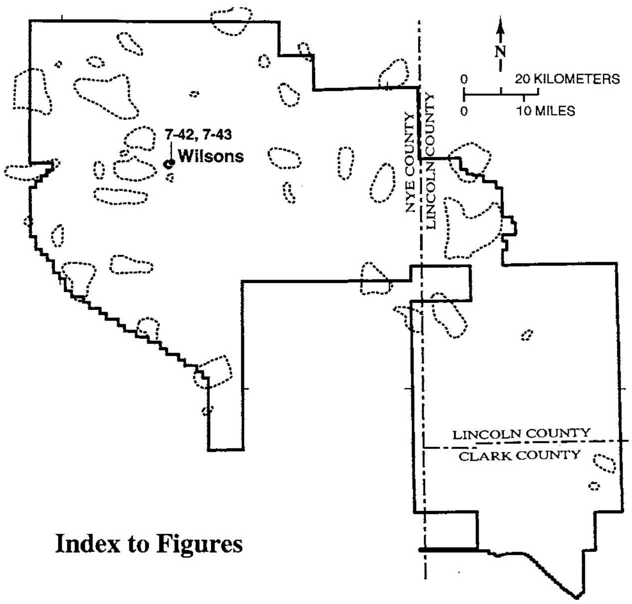
7.3.3.12 Wilsons District

Location

The Wilsons mining district, also known as Wilsons Camp, is located about 6 km northeast of Mount Helen, at the north end of the Trappman Hills (fig. 7-42).

History of Discovery, Exploration, and Mining

Discoveries were reportedly made in 1904 (Ball, 1906) and small-scale mining in the district may have continued intermittently in the 1930s and early 1940s (Kral, 1951; Ekren and others, 1971). The principal workings are situated in an east- to northeast-trending ridge and consist of two adits, each estimated to be <100 m long, a shaft estimated to be <50 m deep, and numerous shallow cuts and pits, all <10 m in maximum dimension. Another shaft, estimated to be



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<25 m deep, as well as several shallow cuts, are located about 800 m south of the northern adits (fig. 7-42).

The main workings of the district are within a group of 13 claims (Red Top-Multnomah Group) located in 1907 by the Cactus Peak Mining Co., which were surveyed for patent in 1907 but were not patented. At that time, the claims were developed by 11 shafts and an inclined shaft both with drifts, as well as two tunnels and numerous cuts and trenches (BLM mineral survey records). The workings described by Kral (1951) roughly match those found at Wilsons Camp, and are probably the same. USBM production records show 15 tons of ore shipped from Wilsons district in 1933, yielding 0.15 oz gold, 527 oz silver, 105 pounds of copper, and 993 pounds of lead. Lead minerals were not noted on the dumps of any of the workings visited. No other production was recorded for the district, although it is likely that small amounts of hand-sorted ore were produced in the early days of the camp.

Geologic Setting and Mineral Deposits

The workings primarily explored individual quartz+calcite veins of a spectacular, northeast-striking, sheeted and subparallel vein system, which crops out over a distance of nearly 1,220 m along strike (fig. 7-43, photo 7-37). The hard, resistant nature of the veins and adjacent, hydrothermally altered wall rocks are responsible for the northeast-trending form of the ridge in which most of the workings are located. Individual veins dip steeply northwest and southeast, vary from <1 cm to about 1.5 m in width, and consist of banded, locally crustiform, comb-textured clear quartz and brown to milky calcite (fig. 7-43).

Many of the veins contain open cavities lined with drusy quartz crystals as much as 4 cm long. Traces of chrysocolla(?) or other copper-oxide minerals are present locally. Crystals of adularia line fractures in altered wall rocks near quartz veins in the vicinity of sample sites 5109 and 5742 (fig. 7-43).

Wall rocks consist largely of gently east-dipping, partially to densely welded, rhyolite ash-flow tuff and interbedded waterlaid tuffs and sandstone collectively assigned to the tuffs of Antelope Springs (Ekren and others, 1971) The tuffs overlie, or are intruded by, porphyritic hornblende-biotite andesite or dacite (fig. 7-43). Narrow, north-trending dikes of hornblende-bearing andesite intrude the tuffs and are cut by the veins. In the southern part of the district east-northeast-trending quartz+calcite veins formed in fractures within an elongate plug of flow-banded rhyolite. All of the rock units in the district have undergone pervasive hydrothermal alteration to mixtures of variable proportions of hydrothermal quartz, albite, adularia, illite-smectite, illite-sericite, calcite, epidote, and chlorite. Disseminated, anhedral to subhedral grains of pyrite, in concentrations of as much as about 1 percent, were ubiquitous prior to weathering and are undoubtedly present at depth, below the level of oxidation. These mixtures are most reasonably interpreted as propylitic alteration assemblages. Resistant, topographically higher rocks, proximal to the veins, contain more abundant veinlets and porosity infillings of quartz, and relatively small proportions of illite and calcite. Topographically lower rocks, distal to the veins, are much less resistant, having been altered to mixtures rich in calcite, illite-smectite, and chlorite.

Veins and wall rocks exposed in outcrops and on the dumps in the district are entirely oxidized and no sulfide ore minerals were observed. Nevertheless, chemical analyses of samples from the veins show that substantial, but currently subeconomic quantities of silver and gold are locally present in the veins (appendix C). Chip samples across 1- to 2-m-wide veins near the topographically highest part of the system contained on the order of 1+ oz silver per ton. Dump-grab samples from the main adit and the two shafts contained 10 to 20+ oz silver per ton. In general, the veins are dominated by silver, with only modest concentrations of copper, lead and zinc. Gold correlates well with silver (fig. 7-44), but silver-to-gold ratios are high. For samples containing greater than 0.5 oz silver per ton, a median silver-to-gold ratio of 473 is calculated. Arsenic, antimony, mercury, and thallium concentrations are low in view of the elevated silver concentrations. Significant amounts of tellurium are present; all samples contained >1 ppm tellurium, with a maximum concentration of 332 ppm determined for sample 5108 (appendix C). There is an indication that bismuth, mercury, and molybdenum are most abundant in the southern part of the district. The highest concentrations of bismuth (638 ppm), mercury (2.44 ppm), molybdenum (83 ppm), and lead (1,113 ppm) were determined for sample 5351 (appendix C) from the vein hosted by the rhyolite plug in the southern part of the district.

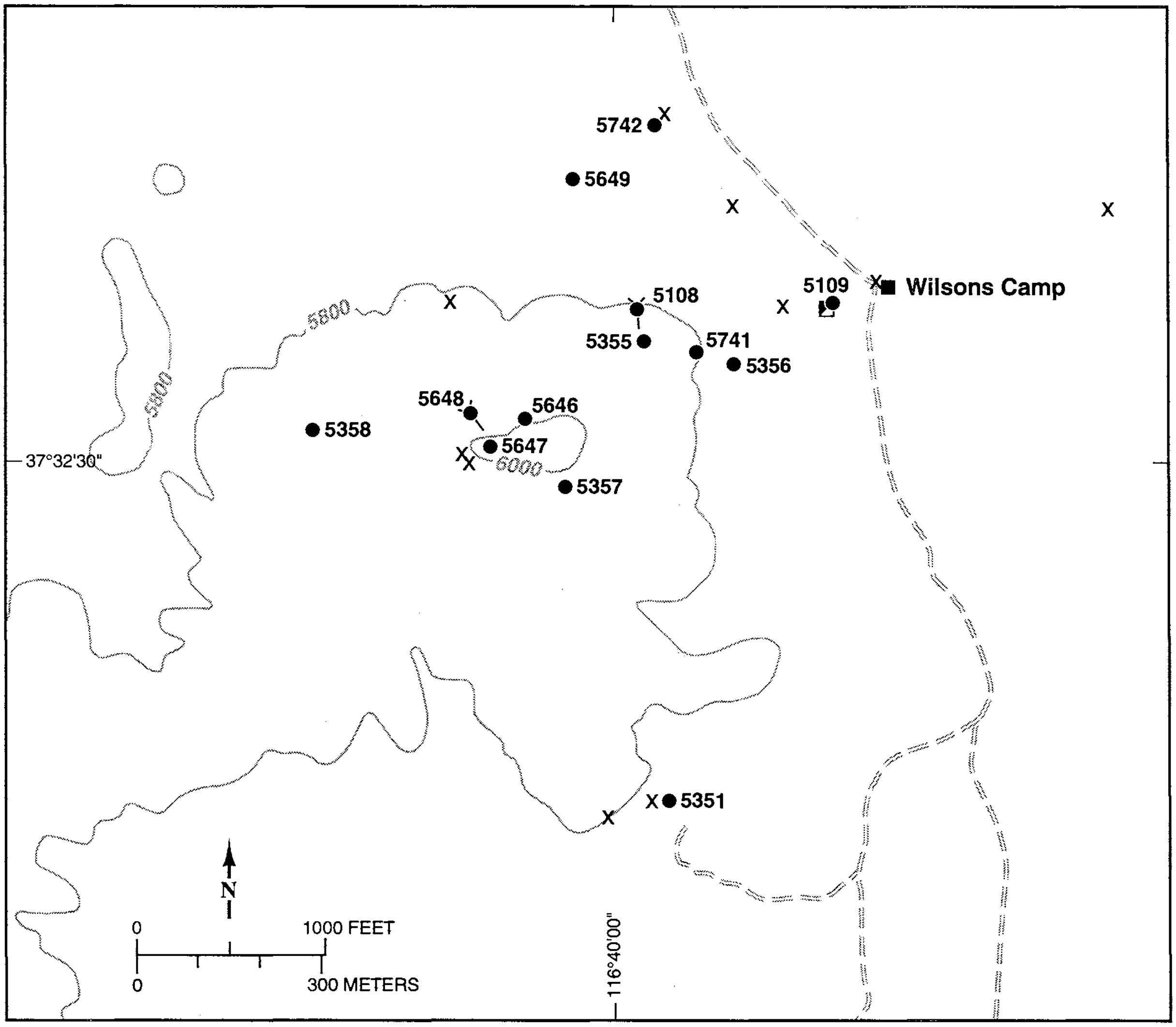


Figure 7-42 Sample locations, Wilsons Camp and vicinity, Nye County, Nevada.

Identified Mineral Resource

Identified mineral resources are not presently known in the district.

Mineral Resource Potential

Based on the banded, commonly vuggy nature of the veins, together with the propylitic wall-rock alteration assemblages, local adularia along fractures, and the geochemical data, the veins of the Wilsons district are interpreted as a classic example of an epithermal precious-metals-bearing fissure-vein system of the low-sulfidation (adularia-sericite) type. The large lateral and substantial vertical extent of the veins exposed at the surface, coupled with the presence of significant concentrations of silver and gold, are highly favorable criteria in present-day exploration for economic mineral deposits and suggest economic deposits may be present. The highest silver and gold concentrations were determined in samples from the northern margin and east end of the main sheeted vein zone, and from the vein hosted by the rhyolite plug in the southern part of the district, suggesting an erratic spatial distribution of the higher precious-metal grades. Such erratic grades are typical of vein deposits in general, including low-sulfidation epithermal precious-metal deposits. Detailed mapping and geochemical surveys, followed by a program of reverse-circulation rotary drilling, are required to further assess the potential for economic mineral resources.

Based on the available data, the Wilsons vein system would be highly attractive to present-day explorationists seeking

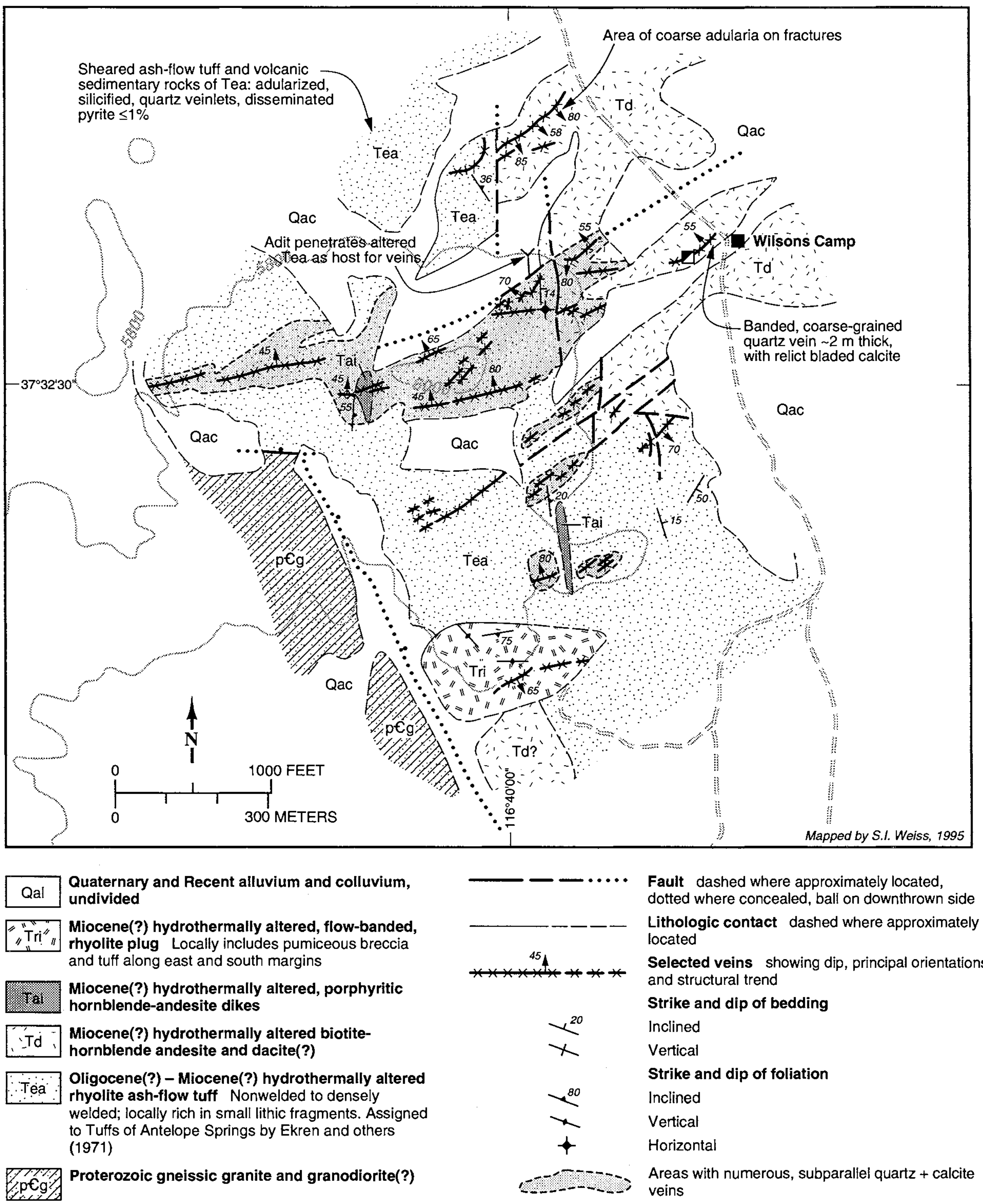


Figure 7-43 Geologic map of the Wilsons Camp quartz-calcite vein zone, Nye County, Nevada.

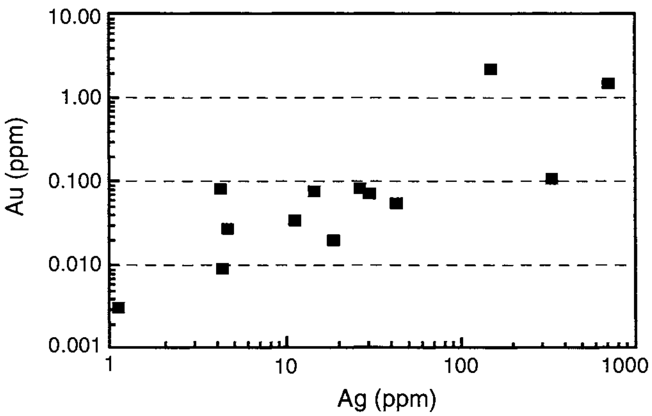


Figure 7-44 Plot of Ag/Au for specimens from the Wilsons Camp vein system, Nye County, Nevada.

precious-metal resources. Therefore, an estimate of high potential, certainty level C, is estimated for low-sulfidation-type, epithermal, precious-metal deposits at Wilsons Camp.

7.3.4 Yucca Mountain

Location

Sample 5815 was collected from an area of sinter and silicified sandstone and siltstone in section 36, T11S, R48E, approximately 200 m west of the NAFR boundary on Yucca Mountain.

Geologic Setting and Mineral Deposits

A distinct zone of sinter and silicified sediments is present at sample locality 5815. The sinter and silicified zones are intercalated in a sequence of ash-flow tuffs. The sinter occurs in thin ash-flow tuffs, bedded tuffs and sediments above the Tram member of the Crater Flat Tuff, is overlain by unaltered ash-flow tuff of the Bullfrog Member of the Crater Flat Tuff, and is faulted against the Topopah Spring Member of the Paintbrush Tuff (Weiss and others, 1993). The sinter and silicified zone range from 0.25 to 1 m thick and extend for several hundred meters along strike. The sinter zone overlies 8 m of poorly welded ash flow, which in turn overlies 1 m of silicified sandstone and conglomerate. The base of the ash flow above the sediments is variably silicified. The sinter is distinctly banded and is locally brecciated. The bands are 1-10 cm thick and are red, black, or gray. The sinter is composed of chalcedony. Some drusy quartz occurs in cavities. Dehydration cracks and fossil reeds are locally present. The sample collected was a composite sample of sinter and silicified sediments. No anomalous metal values were present in the sample. There is no evidence that the sinter or silicified sediments extends into the NAFR.

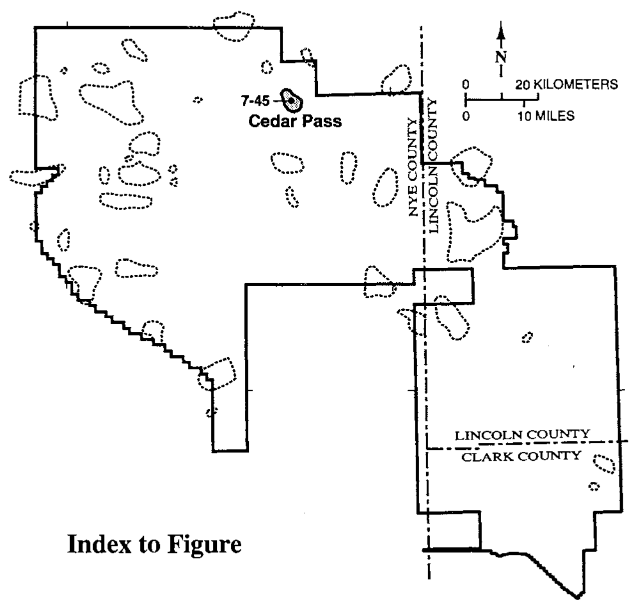
Identified Mineral Resources

There are no known identified mineral resources in this area.

Mineral Resource Potential

The area is assigned a low mineral potential for metallic mineral deposits down to 1 km below the present surface, certainty level C, based upon the lack of anomalous metal values in sample 5815 and the lack of any alteration in the volcanic rocks on NAFR.

7.3.5 Kawich Range



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7.3.5.1 Cedar Pass Area

Location

The Cedar Pass area is located in T2S, R51E on the east slope of the Kawich Range. The area of interest is located within the Cedar Pass 7.5′ Quadrangle. It is not within a known mining district.

History of Discovery, Exploration, and Mining

Several prospect pits and three shallow shafts are located within a northwest trending area of hydrothermal alteration in dacite and ash-flow tuffs (Rogers and others, 1967). The prospects were probably active during the early boom years at Silverbow and Gold Reed, 1904-05, when the Kawich Range was being heavily prospected. Hall (1981) described Cedar Spring, located about 3 km east of Cedar Pass, as a small silver camp that was active about the turn of the century but was inactive by 1910 and had no recorded production. A 1934 news article (Goldfield News and Weekly

Tribune 12/28/34) reported the discovery of a rich gold vein 0.6 to 3.6 m wide, located about 13 km north of Kawich (Gold Reed) and 14 km south of Cedar Springs, which Jack Degman, an earlier prospector at Gold Reed, had opened to a depth of 9 m. Although the exact location of this prospect was not identified during this study, the news article indicates that there was ongoing prospecting in this part of the Kawich Range at least into the 1930s.

Geologic Setting and Mineral Deposits

The hydrothermally altered area at Cedar Pass is located within dacite and the tuff of the Kawich Range (Rogers and others, 1967). All of the prospects except one, that were found and examined during this study, occur within altered ash-flow tuff, which has been mapped by Rogers and others (1967) as tuff of the Kawich Range. The altered area is located adjacent to the eastern margin of the Cathedral Ridge caldera of Rogers and others (1967) (fig. 7-45). The intracaldera rocks, the tuff of Cathedral Ridge, are unaltered and apparently postdate the hydrothermal alteration event.

Sample 5126 was taken from the dump of a shaft located on strongly silicified dacite porphyry. The silicified zone is a pod about 8 m in diameter and consists of multiply brecciated and veined, fine-grained quartz, with abundant goethite and hematite (photo 7-38). Some bright red jasper is present, as well as some fine-grained pyrite. The sample was anomalous in as and tungsten, but contained no gold or silver.

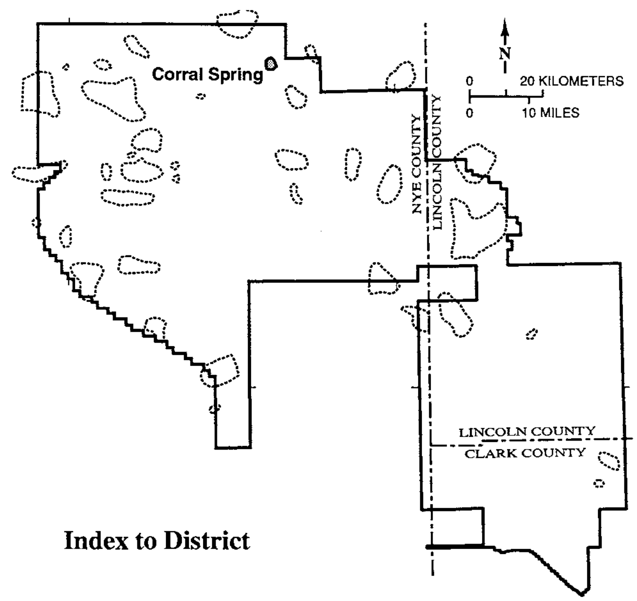
Samples 5707 and 5708 were collected from road cuts on the Cedar Peak road. The samples were taken from bleached and altered zones in lithic-rich welded ash-flow tuff, cut by hairline veinlets and clots of quartz and quartz crystals in vugs. Biotite is altered to illite(?) and the feldspars are chalky. Sample 5707 contained 16.6 ppm silver, 32.8 ppm arsenic, and 0.127 ppm gold. Sample 5708 was not anomalous. Sample 5709 was collected from a pit on argillically altered ash-flow tuff cut by iron oxide stained fractures lined with drusy quartz crystals. It contained 5.14 ppm silver, 74.3 ppm arsenic, 55 ppb gold, and 68 ppm molybdenum. Sample 5710 was collected from the dump of a shallow (5-7 m) shaft sunk in silicified welded ash-flow tuff. A 30 to 60-cm-wide fracture zone is exposed in the shaft. Abundant drusy quartz occurs within the fracture zone. The sample contained 1.05 ppm silver, 213 ppm arsenic, 0.112 ppm gold, and slightly anomalous tungsten and molybdenum.

Identified Mineral Resources

There are no identified mineral resources in the Cedar Pass area.

Mineral Resource Potential

The alteration and mineralization in the Cedar Pass area is of low-sulfidation type, with low base metals, but anomalous as. The extensive area of hydrothermal alteration in the Cedar Pass area, coupled with the occurrence of anomalous silver, arsenic, gold, tungsten and molybdenum in samples from the area, indicate that it should be classified as having moderate resource potential, certainty level B, for the occurrence of low-sulfidation silver-gold deposits and moderate potential, certainty level B, for the occurrence of deep molybdenum porphyry mineralization.



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7.3.5.2 Corral Spring Area

Location

The Corral Spring Prospect is located in the central Kawich Range about 1 km north of Corral Spring.

History of Discovery, Exploration, and Mining

This area was probably first prospected about 1904-05, when most of the Kawich Range saw extensive exploration activity following the rushes to Silverbow and Gold Reed.

Geologic Setting and Mineral Deposits

Bedrock in the area near Corral Spring consists predominantly of porphyritic rhyolite, locally intruding the tuff of White Blotch Spring, (Ekren and others, 1971). A large area of the tuff and rhyolite is weakly propylitized. Samples 5144 and 5145 were collected from prospects located on narrow quartz veins cutting silicified and argillized rhyolite (photo 7-39). Sample 5144 was collected from a N20°W-

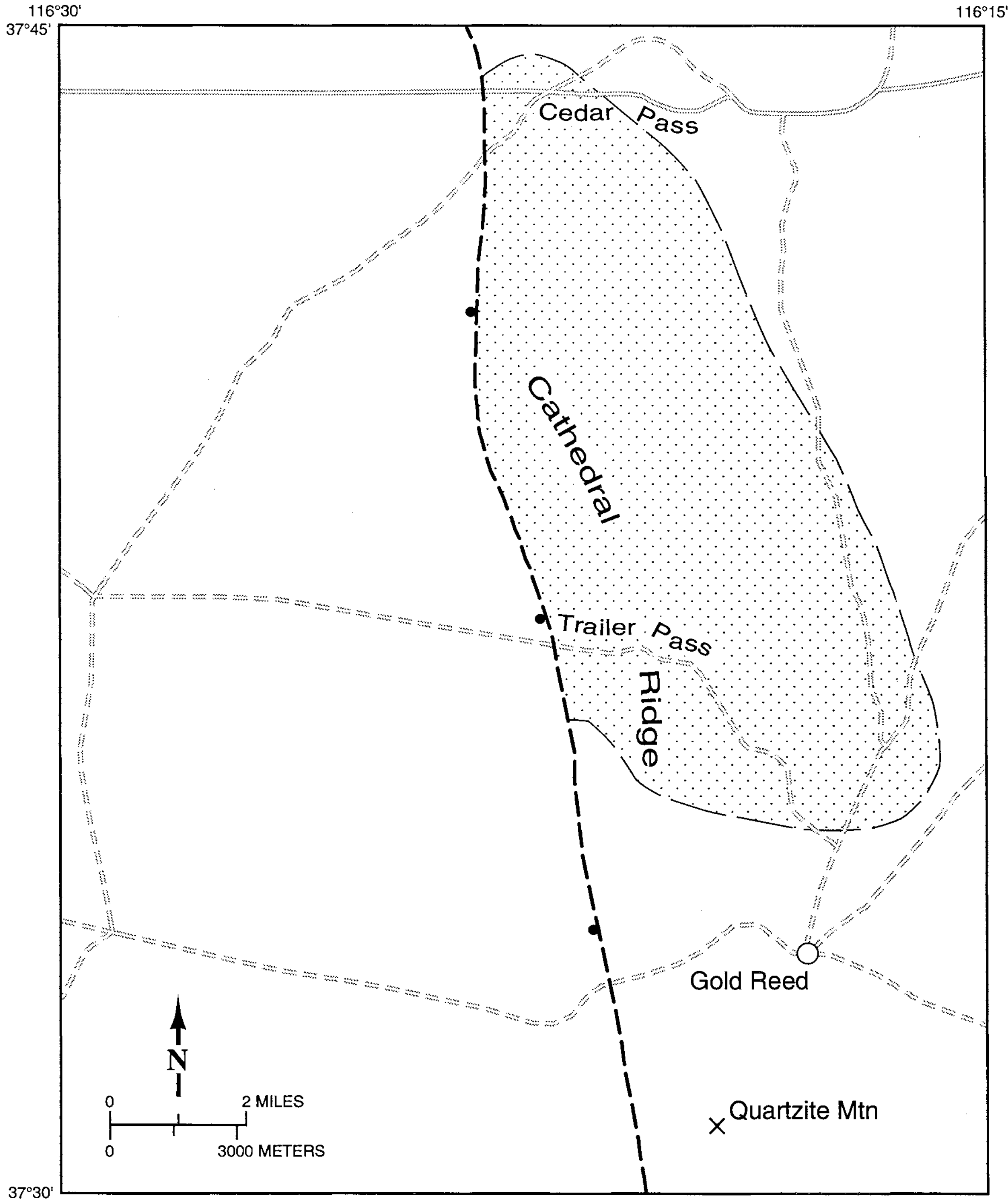


Figure 7-45 Map showing the approximate location of the Cathedral Ridge caldera (stippled), Kawich Range.

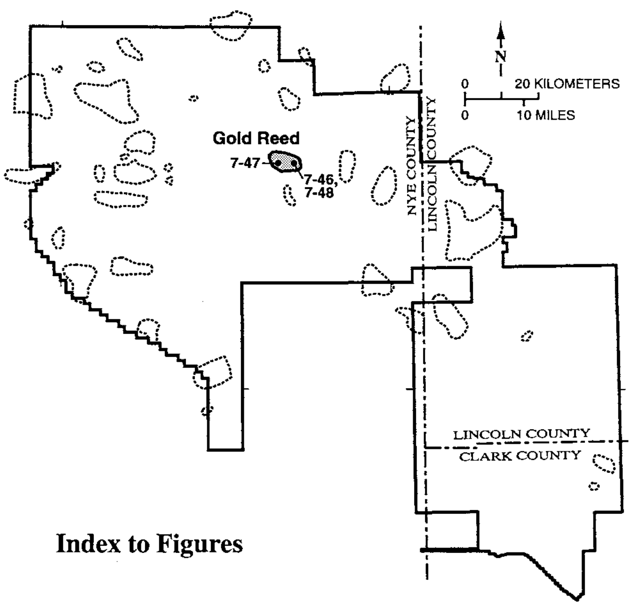
trending vuggy quartz vein in a 0.5 m wide shear zone. The sample contained 0.003 ppm gold and 24 ppm molybdenum. A 3-m-deep pit had been dug on this vein. Sample 5145 was taken from a 0.3-m-wide, north-trending, vuggy quartz vein. A 16-m-deep shaft was located at this locality. Specks of visible gold and iron oxide after pyrite could be seen in vein quartz from this locality. Sample 5145 contained 5.39 ppm silver, 26 ppm arsenic, 0.061 ppm gold, and 65.3 ppm molybdenum. Clearly, the sample assayed did not contain any of the visible gold observed in vein quartz at this locality. The vein quartz is banded and crustiform and the prospect can be classified as low-sulfidation gold-silver, with low base metals and low arsenic-antimony.

Identified Mineral Resources

There are no identified mineral resources in the Corral Spring area.

Mineral Resource Potential

The occurrence of visible gold in vein quartz within a large area of propylitized rock indicates that the Corral Springs area has moderate resource potential, certainty level B, for gold-silver mineralization.



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7.3.5.3 Gold Reed District

Location

The Gold Reed district is located in the on the east side of the southern Kawich Range in T4S, R51E, approximately 8 km south of Trailer Pass and about 4 km north-northeast of the summit of Quartzite Mountain. All of the significant mine workings and hydrothermally altered rocks at the main Gold Reed camp are located in area of about 1 km^2 (fig. 7-46, photo 7-40). There is another area of hydrothermally altered rock on the west side of Gold Reed Pass, with numerous prospects, but no producing mines, known as the Bristol Group (fig. 7-47) (Anaconda collection, 34316, 1942).

History of Discovery, Exploration, and Mining

The first locations were made in December 1904 by O.K. Reed and Ed Slavin on an outcrop with large (up to 2.5 cm diameter) flakes of gold. The discovery precipitated a rush of several hundred men to the site in early 1905 (Ball, 1907). By spring of 1905, the town of Gold Reed (or Kawich, as it was also called) supported four stores, eight saloons, two lodging houses, two restaurants, and a sporadic stage service from Tonopah as well a post office which operated until 1908 (The Rhyolite Herald, 5/12/1905; Frickstad and Thrall, 1958). Water was non-existent at the site, and had to be shipped in at the rate of $8.00 a barrel from Cliff Spring in the Belted Range 20 km to the east. Most of the prospectors found that the best showings in the camp were already covered by the 26 claims held by Reed's Gold Reed Mining Co., on which 53 leases were given. Most of the rich surface ore did not persist at depth, and the camp was nearly deserted by the end of 1905. When Ball (1907) visited the camp in summer of 1905, there were ten miners at work on the claims, two shafts had been sunk, and several thousand feet of drifting had been done. He described the veins in the three main mines of the district at that time: the Gold Reed, the Chief Kawich, and the Diamond No. 2, all held by Reed. A rich new strike in the district was reported by the Goldfield Gossip in May 1907, but nothing came of it and the camp was almost deserted by 1908, when the postmaster was one of only three residents left in the town (The Goldfield News, 4/13/1908; Hall, 1981). The claim group of the Gold Reed Mining Co. covering the original discovery site was surveyed for patent in 1909, but was never patented. USBM recorded placer production from the district in 1921, and lode production in 1927, but the provenance of the ore is unknown. In 1940, Albert and Robert Martel are reported to have reopened the Gold Reed Mine shaft and deepened it to 300 feet (91 m) without finding any ore (Hall, 1981), but USBM reported production of 33 tons of ore from the Gold Reed and Horseshoe Mines in the district in 1941, by Austin Tubbs of Lovelock. Only a few foundations remain at the town site.

USBM records credit the district with production of 335 tons of ore yielding 216.58 oz gold and 475 oz silver resulting from mining activity in 1910-12, 1921, 1927, and 1941, although there was certainly some high-grade ore taken out in the first year, 1904-05, that was unrecorded.

Geologic Setting and Mineral Deposits

Ball (1907) reported coarse visible gold in limonite-stained phenocryst casts of silicified monzonite porphyry in outcrops at the site of the Gold Reed Mine, and that the gold values decreased with depth. He reported that gold could be panned from other silicified outcrops in the district, but it was not visible to the unaided eye. The only sulfide mentioned by Ball is pyrite, which he stated had low gold assays. The workings in the district are almost entirely shafts and shallow prospect pits. None of the shafts are accessible.

The main rock type in the district is porphyritic dacite, which where fresh, contains phenocrysts of plagioclase, biotite, hornblende, pyroxene, and quartz. The dacites are overlain and are in fault contact with the tuff of Cathedral Ridge (Fraction Tuff of Rogers and others, 1967, and Ekren and others, 1971) and olivine basalt. The dacites are in fault contact with, and overly the Monotony Tuff (Rogers and others 1967). According to Ekren and others (1971) and figure 7-45 (from Rogers and others, 1967), the district is located a few kilometers to the south of the southern margin of their Cathedral Ridge caldera. Most of the hydrothermal alteration occurs within the dacite, but small areas of the tuff of Cathedral Ridge are altered adjacent to the dacite. The generalized area of hydrothermal alteration at Gold Reed and the Bristol Group is shown on figure 7-47 (from Rogers and others, 1967).

The Gold Reed district is of high-sulfidation type. The main mine workings and prospects are located on or adjacent to quartz-alunite ledges, which trend N30°-60°W. The ledges are in sharp contact with strongly argillized dacite, which grades outward into propylitized rock. The main production in the district came from the Gold Reed Mine, which is located on a 10-m-wide, N60°W-trending quartz-alunite ledge. According to Ball (1907), the main shafts are 150 feet (46 m) in depth with extensive drifts. Data from the Anaconda collection 34316, dated 1942, indicates that the main shaft was subsequently deepened to 300 feet (91 m).

Thirty-seven samples were collected from dumps, prospect pits, and outcrops during the course of the present investigation (appendix C; fig. 7-46). Only three samples from the main district contained anomalous gold (0.5 ppm gold or higher). Sample 5121 from the main shaft contained 1.57 ppm gold, and samples from nearby shafts contained 0.507 (sample 5122), and 0.961 ppm gold (sample 5718). Five samples contained between 0.17 and 0.4 ppm gold (samples 5719, 5722, 5724, 5805, and 5806). Silver was not present in anomalous amounts (1 ppm or greater) in any samples. Elements present in anomalous amounts in a number of samples from Gold Reed (appendix C) include mercury, arsenic, antimony, barium, strontium, tellurium, selenium, and vanadium. A few samples contained anomalous zinc. Titanium dioxide was slightly elevated in a few samples. Three samples contained anomalous bismuth. The geochemical suite at Gold Reed is somewhat analogous to that at Paradise Peak, Nevada with the exception of silver, which was an important constituent of the ore at Paradise but is only weakly anomalous at Gold Reed.

Samples from the hydrothermally altered dacite in the area of the Bristol Group on the west side of Gold Reed Pass (fig. 7-47) contained no anomalous silver but one sample contained strongly anomalous gold (1.94 ppm, sample 5655). One sample, 5660, contained 0.238 ppm gold. A few samples from this area were anomalous in tungsten, barium, strontium, mercury, tellurium, selenium, and vanadium.

The Anaconda Copper Mining Co. examined and sampled the Gold Reed district including the Bristol Group (fig. 7-48) and the Cowpuncher Group in 1931 (Anaconda collection 34316, 1942). They collected 89 samples from dumps, pits, and outcrops and assayed them for gold, silver, and mercury (tables 7-8 and 7-9). Three samples from the dump of the main Gold Reed shaft contained 11.02, 1.82 and 2.96 oz gold per ton. Six other samples assayed from 0.150 to 2.05 oz gold per ton. Only one sample contained more than 1 oz silver. A few samples contained anomalous mercury. Most of the other samples assayed from a trace to 2 ppm gold, a few samples contained over 4 ppm gold.

Twelve samples taken by Anaconda from the Bristol Group assayed from 1 ppm to 5 ppm gold, most samples did not contain more than a trace of gold. None contained as much as 1 oz silver per ton, most of the samples were anomalous in mercury.

Results of sampling done for this project and sampling done be Anaconda are comparable. A few of the Anaconda samples from Gold Reed contained much higher gold values than any of the project samples, but most of the Anaconda samples contained only weakly anomalous gold. Silver and mercury assays results of both groups are very similar. The results of current sampling from the Bristol Group are very close to the assays obtained from the Anaconda sampling program.

Identified Mineral Resources

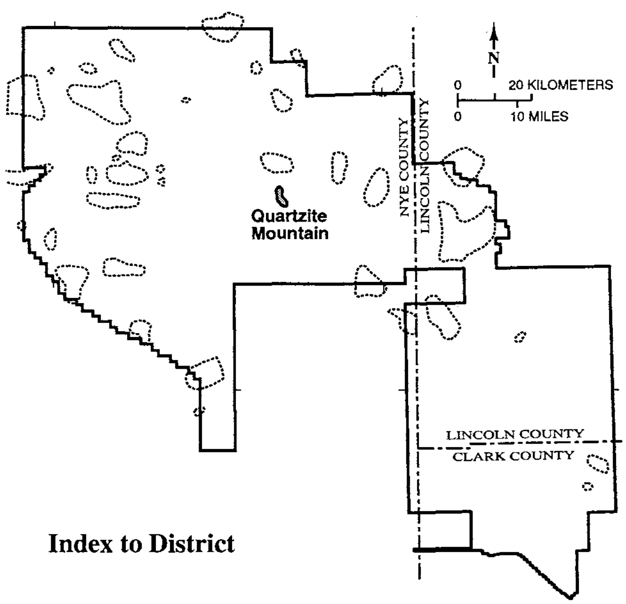
There are no identified mineral resources in the Gold Reed district.

Mineral Resource Potential

The Gold Reed district is assigned an overall moderate mineral resource potential, certainty level C. This assessment is based upon the relatively limited areal extent of hydrothermal alteration, particularly for a high-sulfidation system and the small number of samples from silicified ledges that contained 1 ppm gold or more. The occurrence of some very high-grade gold based upon data from Ball (1907) and the Anaconda sampling suggests a high potential, certainty level C, exists for developing a small tonnage of hand-sorted, direct-shipping gold ore. The occurrence of low-level anomalous gold in a number of silicified ledges at Gold Reed suggests a moderate potential, certainty level B, for developing a bulk-mineable gold orebody.

The Bristol Group area is assigned a moderate gold-silver resource potential, certainty level C, based upon the widespread occurrence of anomalous mercury, and some low-level anomalous gold and tellurium. The anomalous mercury suggests that the mineralization in the Bristol area is shallower than at Gold Reed and that there may be some increased potential for better grade gold mineralization at depth. This area also has a low resource potential, certainty level C, for mercury.

There is a general consensus (Sillitoe, 1991; Hedenquist and Lowenstern, 1994) that high-sulfidation systems are the high-level expression of porphyry intrusions at depth. These porphyry intrusions may contain associated copper-molybdenum or copper-gold mineralization. Therefore, there is moderate potential, certainty level B, in the Gold Reed area for porphyry-style mineralization at depth. Minimum depths for such buried intrusions are probably 500 to 1,000 m.



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7.3.5.4 Quartzite Mountain Area

Location

The area herein referred to as Quartzite Mountain is located in the southern Kawich Range about 10 km south of the old camp of Gold Reed. The prospects are south of Quartzite Mountain on the east flank of Saucer Mesa.

This area was included in the Kawich district by Ball (1907). For the purpose of this report, the large Kawich district is divided into several areas; Quartzite Mountain is the southernmost of these. Gold Reed, the closest of the other Kawich areas, is about 10 km to the north.

History of Discovery, Exploration, and Mining

There is little record of mining activity in the Quartzite Mountain area. Prospecting here probably began about 1904, contemporaneous with activity to the north at Gold Reed. Ball (1907) mentioned that there were prospects in the area when he visited in 1906. None of the workings are extensive and most appear to have been abandoned soon after the original flurry of activity. There is no record of production from this area.

Present Investigation

Prospects in the Quartzite Mountain area were examined and sampled in September 1995.

Geologic Setting

The low foothills containing the prospects in this area are underlain by thin-bedded quartzite and mottled green and reddish shale of the Precambrian Wood Canyon Formation. Saucer Mesa, to the west, is covered by ash-flow tuff of the Tertiary Belted Range Tuff. East of the Precambrian outcrops, rhyodacite lavas crop out in a series of isolated knobs and hills (Ekren and others, 1971).

The Precambrian rocks are cut by numerous faults that trend east to northeast and northwest. The contacts with the adjacent volcanic rocks to the east, west, and south are almost wholly fault contacts, and some of these faults have displacements of a hundred or more meters (Ekren and others, 1971).

Mineral Deposits

There is no evidence of significant mineralization in the Quartzite Mountain area. Prospects expose rubbly, hematite-stained breccia zones along steep faults and bedding planes in the quartzite and shale. The structures strike northwest to north and some have vein quartz up to 1.5 m thick along them. The quartz is white "bull" quartz, and is brecciated and recemented with quartz. Other than iron- and manganese-oxides, no metallic minerals were identified in samples collected from these prospects.

Samples taken in this area were uniformly low in all metallic elements except mercury. Elevated mercury values occur in samples collected from the three northern prospects examined (samples 5727, 5728, 5729, appendix C).

Identified Mineral Resources

There are no identified mineral resources in the Quartzite Mountain area.

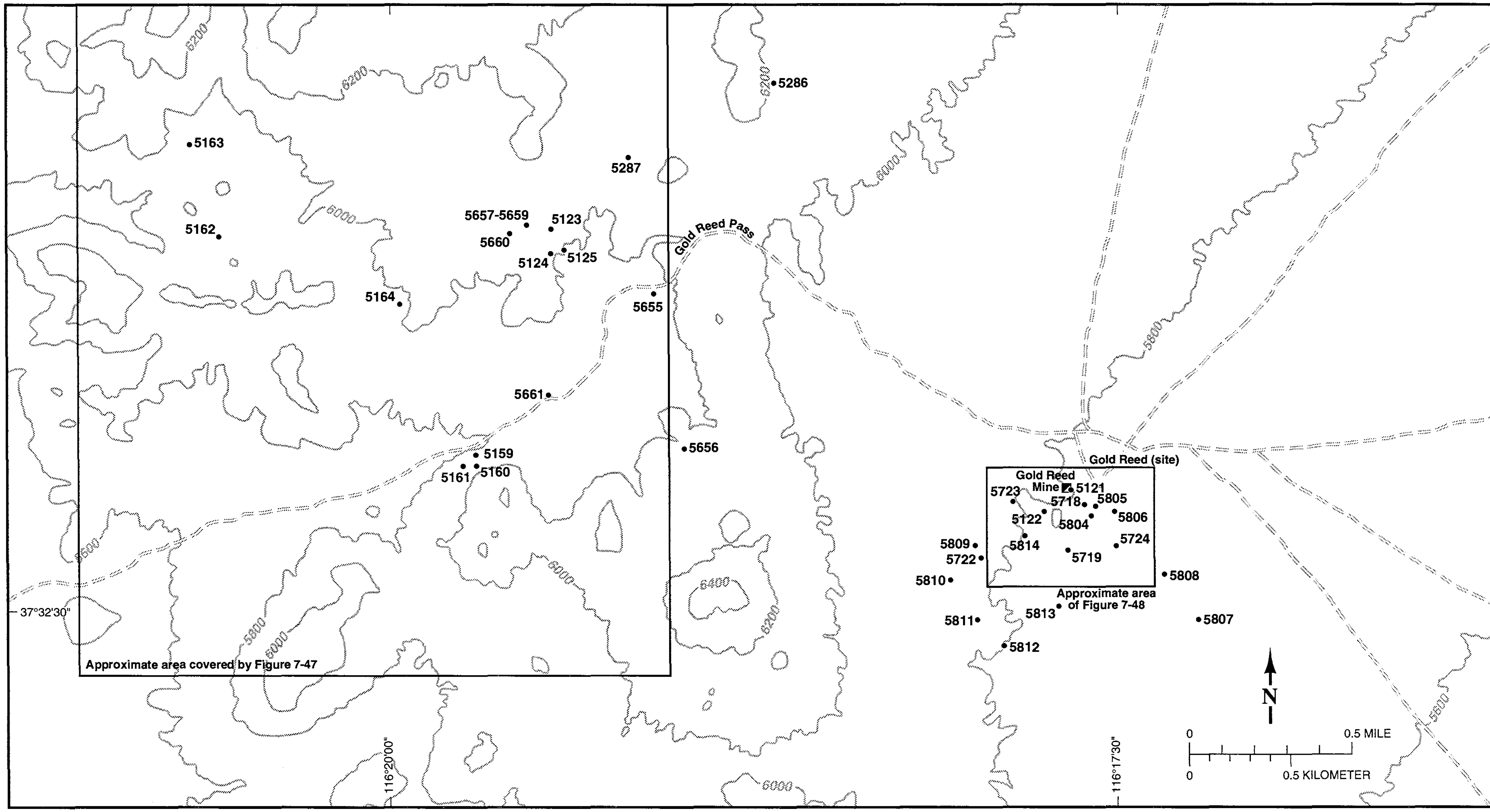


Figure 7-46 Sample locations, Gold Reed district, Nye County, Nevada

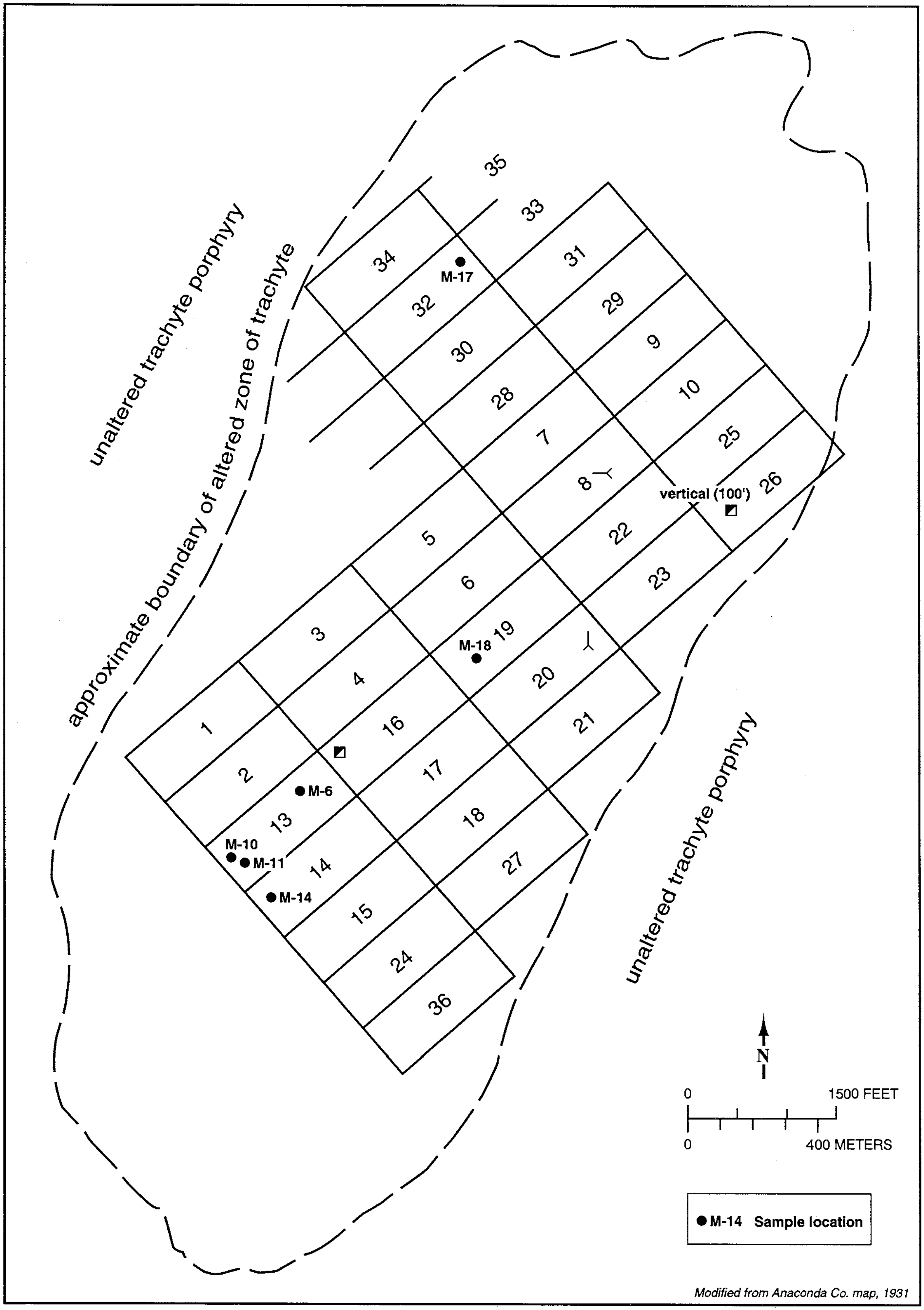


Figure 7-47 Bristol claim group, Sections 30 and 31, T4S, R51E (approx.), Gold Reed district, Nye County, Nevada.

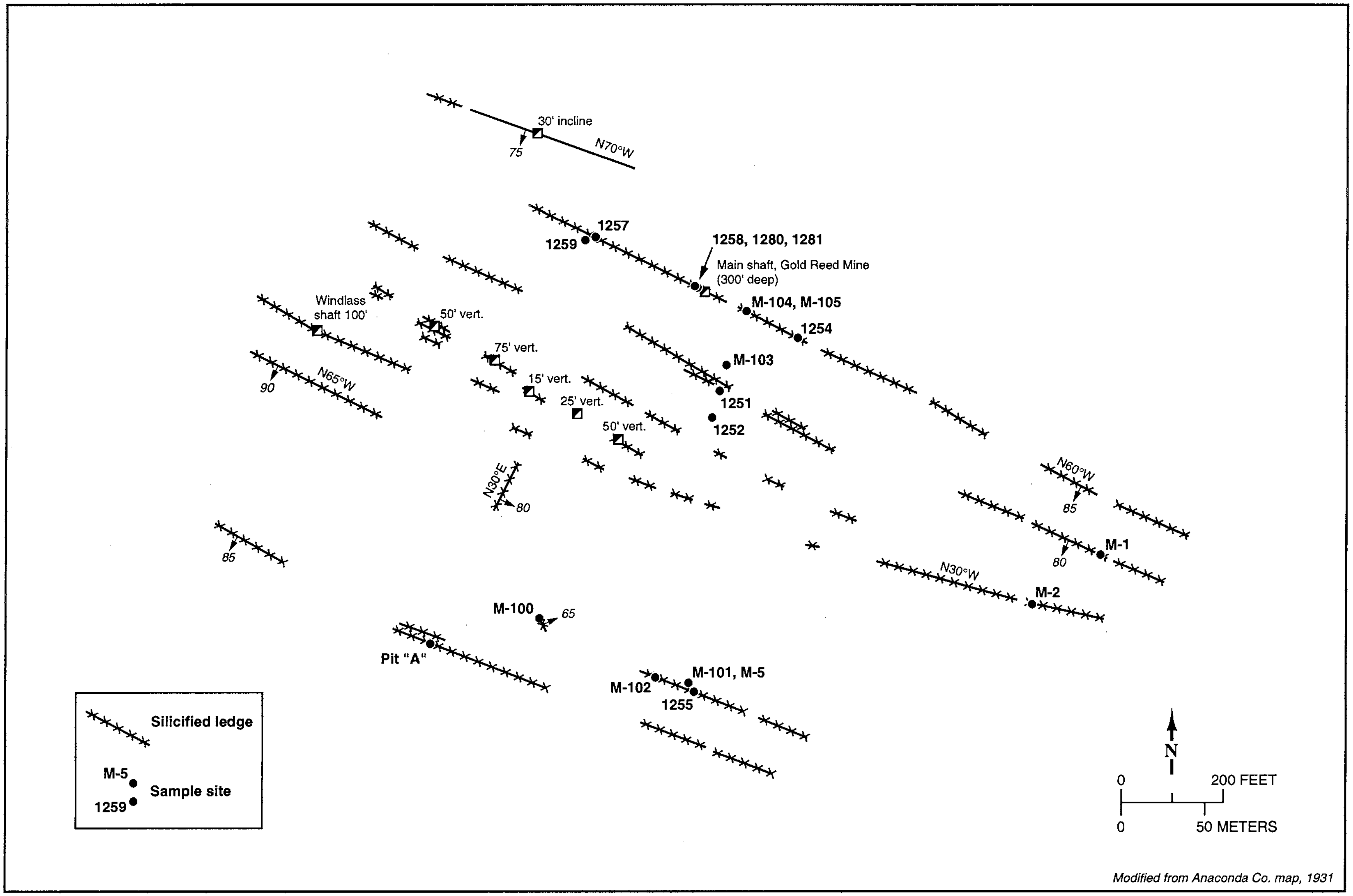


Figure 7-48 Sketch map of Cowpuncher group, Sections 32 and 33, T4S, R51E, Gold Reed Mine area, Gold Reed district, Nye County, Nevada.

Table 7-8. Sample descriptions and analyses, Bristol Claim Group, Gold Reed district (samples collected in 1931, Anaconda Co.).

Sample No.	Gold (oz/ton)	Silver (oz/ton)	Mercury (lbs/ton)	Description
M-6	none	none	0.03	Bristol #13 yellow cut
M-7	none	none	0.04	Bristol #13-Pile of brilliant red material
M-8	Tr.	None	0.02	Bristol #13 Brown outcrop
M-9	none	none	0.04	Bristol #13 Yellow out 30′ long
M-10	none	none	0.02	Bristol #13 Siliceous ledge East-west strike.
M-11	none	none	0.05	Bristol #13 15′ cut soft
M-13	none	none	0.03	Bristol #14 Siliceous reef
M-14	none	none	none	Bristol #14 Yellow cut 15′
M-15	none	none	none	Bristol #14 Gray quartz.
M-16	none	none	Tr.	Bristol #30 solid dark red
M-17	none	none	Tr.	Bristol #32 Placer sand
M-18	none	none	Tr.	Bristol #32 Siliceous ledge
1261	0.13	0.01		0.52 Bristol #2 sacked ore
1263	0.01			Brown iron rhyolite 8′ ledge outcrop Bristol #6
1265	Tr.	Tr.	0.3	Bristol #14, 5′ ledge.
1266	0.1	0.01		Bristol #14, 8′ ledge quartz
1267	Tr.	Tr.		Bristol #6 yellow iron quartz, 10' ledge
1268	Tr.	Tr.	0.1	Bristol #4, soft yellow iron and talc with gypsum (see sample 1294)
1269	Tr.	Tr.	0.28	Bristol #2, 285′ tunnel x-cut face
1270	0.04	0.005	0.09	Bristol #2, 285′ tunnel face
1271	—	—	0.17	Bristol #2- mg. ledge white talc
1272	0.16	0.02	0.09	Bristol #2- mg. ledge red rock. several 8″ streaks through ledge
1273	0.01	—	1.41	Bristol #2. Pile of quartz lower pile
1274	none	none	0.28	Sand Bristol #34
1275	0.06	0.01		Bristol #3 ledge
1276	none	none	0.094	Location mountain Bristol #2
1277	0.19	0.01	0.23	Bristol #1
1278	0.005	0.01	0.23	Bristol #2 dump
1279	0.025	0.015	0.33	Bristol #4 ledge in wash
1282	none	none		Bristol #10 white talc (Black metal)
1283	0.12	0.005	1.89	Bristol #2 dump pile mg. ledge
1284	0.13	0.015	0.85	Bristol #2 lower muck pile
1285	0.03	0.01		Bristol #26 muck pile of shaft
1286	none	none		Bristol #26 muck pile of shaft
1287	none	none		Bristol #26 3rd muck pile of shaft
1288	0.02	none		Bristol #26 pyrite
1289	none	none	0.33	Bristol #34 sand from wash
1290	0.15	none	0.28	Bristol #2 monument dumps east 150′
1291	0.12	0.42	0.23	Bristol #2
1293				Bristol #4 chips from 20′ siliceous dike, N70°E 85°S dip
1294			0.12	Bristol #4 Pit in altered porphyry-broken- much gypsum. See #1268
1295			0.1	Bristol #3- 4′ × 10′ pit in altered porphyry, greenish clay
1296	Tr.		—	Bristol # 5 Furnace lining 200′ N from E cor. 50′ × 100′
1297	Tr.		0.12	Bristol #5 3′ siliceous outcrop 50′ long N 60 E-400′ NE #3 altered porphyry
1298				Bristol #5 1/4″-1/2″ veinlets red material in white altered porphyry-300' N, 30' E 1297
1299			0.1	700' W. of #5. 8′ siliceous dike-altered porphyry- 400' outcrop
1300	—	Tr.	0.06	Bristol #30 SW end of claim- very red siliceous altered porphyry
1301	0.03		0.07	Bristol # 30. Siliceous iron stained rock under quartz cliff
1302	Tr.	Tr.	0.1	Bristol #29 4′ × 10′ pit altered porphyry
1303	Tr.			Bristol # 9 Altered porphyry float- iron stain on hillside
1304	Tr.		0.07	East of Bristol #23 Iron mass 600′ south of vertical shaft on #26
1305	Tr.		—	Bristol #20 Tunnel in altered porphyry on N10°W slip
1306	0.04	Tr.	0.12	Bristol #19 (?) Red siliceous altered porphyry. Large irregular mass cut by sharp gully
1307				Bristol #16, grab from dump, 50′ incline on N50°E 75°NW dip, 3′ silicified fissure, iron stained
	0.18	none	3.02	Bristol #2 Sacked ore at small tunnel
	0.44	none	0.53	Bristol #2 Sacked ore at small tunnel
	0.06	none	Tr.	Bristol #2
	none	none	0.02	Bristol #3, E-W vein
	Tr.	none	none	Bristol #12-Brown jasper

Table 7-9. Sample descriptions and analyses, Cowpuncher claims, Gold Reed district (samples taken in 1931, Anaconda Co.).

Sample No.	Gold (oz/ton)	Silver (oz/ton)	Mercury (lbs/ton)	Description
M-1	0.02	0.2		Tripod shaft- bottom of shaft 4′
M-2	2.05	0.3		Selected quartz from dump
M-2	0.03	none		Tripod shaft west crosscut 4′
M-5	none	none		Dark colored surface pile
	0.05	none		Mn. from Tripod Shaft-Kawich
M-100	0.47	none		Grab from dumps, black brecciated siliceous ore, 300′ N65°W from Tripod
M-101	0.07	none		Grab around dump Tripod shaft
M-102	0.03	none		Grab from small dump- 5′ pit 75′ NW of Tripod
M-103	Tr.	none		Grab from dumps- 10′ pit 150′ S of main shaft on E-W fissure
M-104	0.15	none		Grab from main dump 50# made up of 1# lots taken at intervals around edge of dump
M-105	0.05	0.4		Grab, siliceous material from main dump probably from 300 level
M-105A	0.04	none		White soft material from Sample 105
M-105B	0.35	Tr.		Fines from sample 105
1251	0.01	0.19	0.09	8' pit face 200′ S of 310′ Kawich shaft
1252	—	—	0.1	Pit face 250′ S of 310′ Kawich shaft
1253	—	—	0.09	Dump from 1252 pit
1254	1.1	0.01		Muck pile from 8' pit 200′ S70°E from 310′ Kawich
1255	0.09	0.27		18″ streak talc down 15′ in Tripod shaft, Kawich
1257	0.44	0.02		4′ ledge sample 250′ N65°W from 310′ Kawich shaft
1258	2.96	0.08		Grab muck pile 310′ Kawich shaft
1259	4.26	0.04		Grab sample from pit 250′ N65°W to 310′ Kawich shaft
Dump	0.07	none		Dump sample Pile A
	Tr.	none		White clay in tunnel 50′
	Tr.	none		Yellow talc in tunnel 50′
	0.12	none		Chinese talc 100' level
	0.02	none		Porphyry N end 50′ level
1264	Tr.	Tr.		Talc pyrite sample from 310′ Kawich shaft
1280	1.82	0.28		Kawich 300′ shaft pile sample
1281	11.02	4.82		Kawich 300′ shaft pile sample on boards
1308	0.03	Tr.		Specimen of ssiliceous porphyry with pyrite from 300 level, Kawich 300′ shaft

Mineral Resource Potential

There is low potential, certainty level C, for the development of precious metal mineral resources in this area.

7.3.5.5 Reveille Valley Area

Location

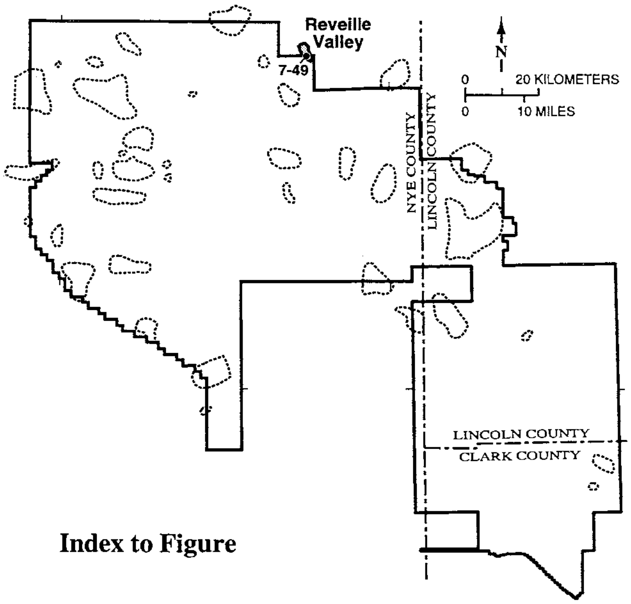
The Reveille Valley area is located in T1S and T2S, R51E, on the north-central boundary of the NAFR. It is located on the Reveille Peak and Georges Water 7.5′ Quadrangles. The main area of hydrothermally altered rock is located in Reveille Valley, north of the NAFR boundary.

History of Discovery, Exploration, and Mining

A shallow prospect pit located in the center of the altered area north of the NAFR boundary is evidence of historic prospecting activity, but there is no record of when this activity took place. The altered area has been the site of exploration by several mining companies over the last 15 years, most recently by Kennecott Exploration who held claims in the area in 1995 and conducted exploration drilling.

Geologic Setting and Mineral Deposits

The altered area south of the NAFR boundary occurs in opalized rhyodacite porphyry (fig. 7-49), which grades into



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and is overlain by fresh rhyodacite flows. The rhyodacite contains phenocrysts of plagioclase, quartz, biotite, hornblende and pyroxene in a fine-grained matrix. The rhyodacite outcrops are surrounded by alluvium. Young basalt flows occur nearby and altered ash-flow tuff is present just north of the NAFR boundary. The basalt undoubtedly overlies the tuff and rhyodacite, the rhyodacite probably intrudes and overlies the tuff. The largest exposed area of hydrothermally altered rock occurs just to the north of the NAFR boundary in the area claimed by Kennecott Exploration. There, the predominant rock type is welded ash-flow tuff, which outcrops on several small hills and in dry washes. The tuff outcrops are on a pediment surface and are surrounded by Quaternary alluvium. Several rotary drill holes, collared in alluvium, penetrated altered ash-flow tuff at depths of 20 to 30 m as evidenced by drill cuttings.

The main area of alteration on the Kennecott ground outcrops intermittently over an area of about 2 km^2 and extends an unknown distance further under alluvial cover. Three samples were taken from surface outcrops of altered rock in this area. The altered tuff has been variably argillized and silicified. Strongly silicified ledges grade outward into quartz-kaolin alteration and into areas of opalized tuff. The alteration is of high-sulfidation type. Sample 5139 contained 38.3 ppm arsenic, 797 ppm barium, and 76 ppm vanadium, sample 5150 had 80.7 ppm arsenic, 21 ppm molybdenum, 11 ppm antimony, and 2.49 ppm selenium. The samples were not anomalous in gold or silver. According to Thomas Callicrate (personal commun.), geologist for Kennecott Exploration, several of their drill holes had highly anomalous amounts of gold and base metals.

A crudely circular area of opalized rhyodacite about 500 m in diameter, is present on the NAFR boundary; the opalized rhyodacite is overlain by fresh rhyodacite lava and also extends laterally into fresh rock (fig. 7-49). Three samples (5140, 5141, and 5721) were taken in this area. The opalized rock is variably brecciated and ranges from white to red, buff and brown. Sample 5140 contained 154 ppm arsenic, 2,033 ppm barium, and 112 ppm vanadium; sample 5721 contained 94.4 ppm arsenic, 1,426 ppm barium, 70 ppm cobalt, 16.3 ppm antimony, 4.09 ppm thallium, and 190 ppm vanadium; and sample 5141 had 217 ppm arsenic, 2,358 ppm barium, 6.62 ppm antimony, and 91 ppm vanadium. The samples contained only trace amounts of gold and silver.

Identified Mineral Resources

There are no identified mineral resources in the portion of the Reveille Valley area within the NAFR.

Mineral Resource Potential

The altered area in the NAFR has the characteristics of high-level alteration in a high-sulfidation system, abundant opaline alteration, which reflects low-temperature fluids, and highly anomalous barium. Arsenic, antimony, and thallium are also anomalous. The geochemical anomalies are quite similar to those to the north in the area claimed by Kennecott Exploration, which is known to contain potentially economic mineralization in drill holes. For these reasons the portion of the Reveille Valley area in NAFR is assigned a moderate resource potential for precious metals, certainty level B.

7.3.5.6 Silverbow District

Location

The Silverbow mining district is located 85 km east of Tonopah, on the southwest flank of the Kawich Range near the northern boundary of the NAFR (fig. 7-1). A small townsite known as Silverbow is situated along Breen Creek less than 1 km north of the NAFR boundary. Principal workings in the district are associated with the Hillside Mine and the Catlin claim group 3 to 4 km northeast of the townsite of Silverbow, and with the Blue Horse Mine 1.4 to 2 km east of the townsite (fig. 7-50).

The Hillside Mine contains the most extensive underground workings in the district, consisting of several hundred meters of adits, drifts, raises, and narrow stopes on at least three levels, and probably was the site of the most recent mining activity (see below). Workings of the Hillside Mine are presently accessible and blasting materials remain in place on at least one face.

Several shallow shafts, drifts, crosscuts and stopes of 30 m or less in maximum dimension comprise the Catlin Mine,

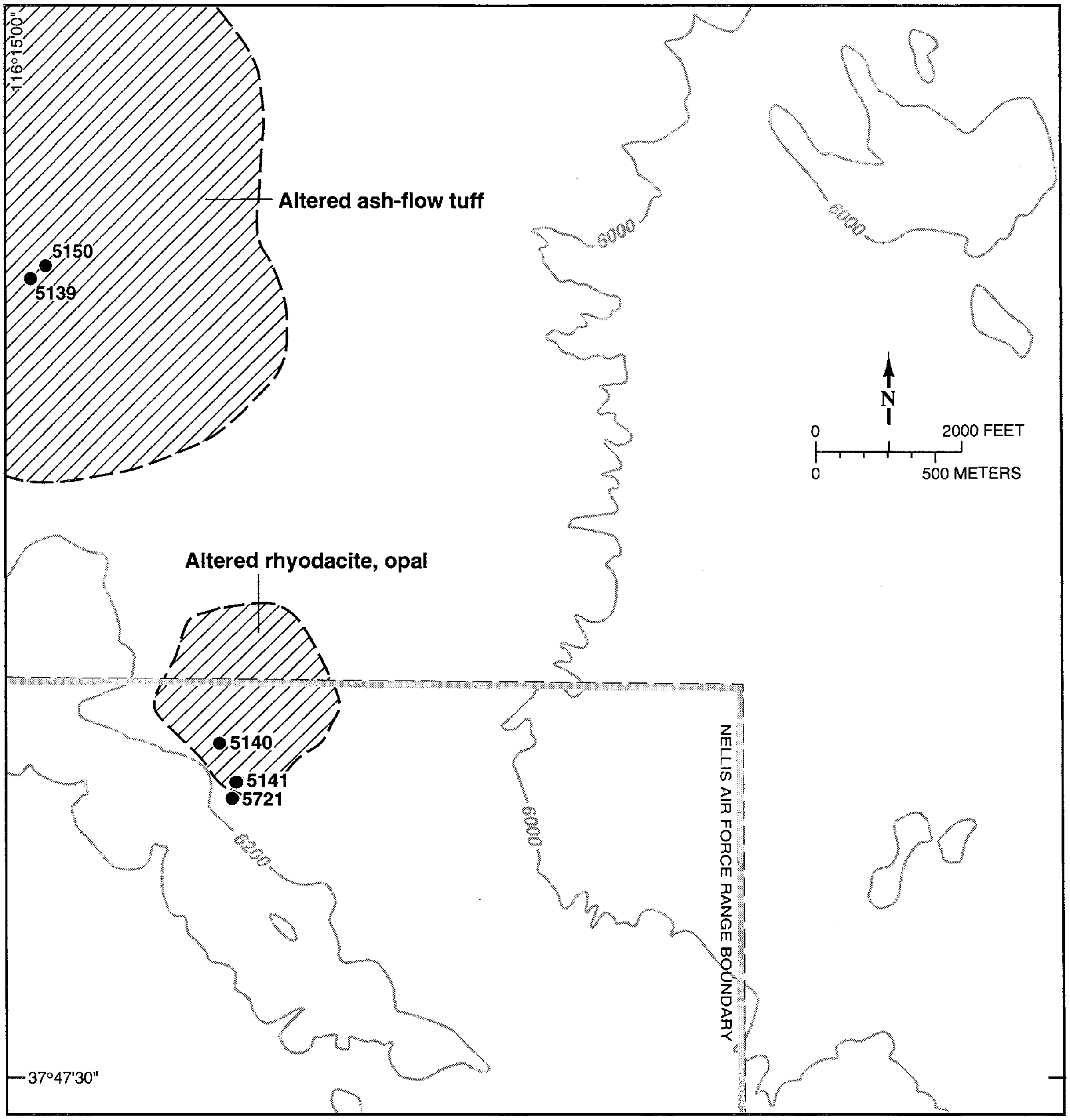


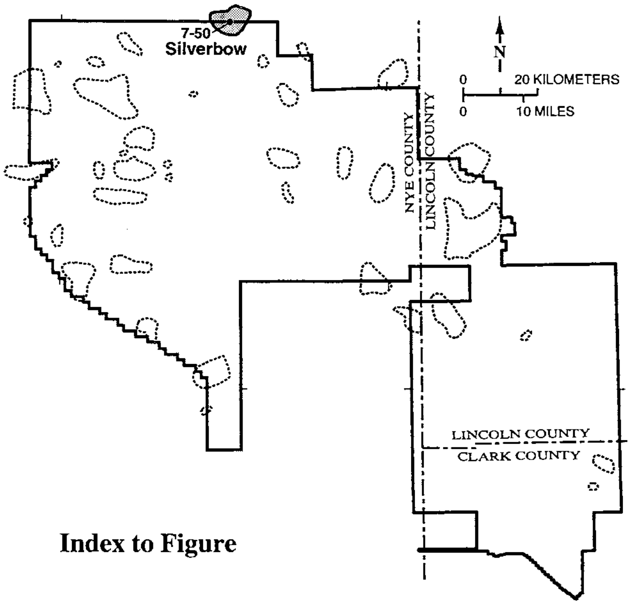
Figure 7-49 Sample locations and alteration in the Reveille Valley area, Nye County, Nevada.

about 1 km west of the Hillside Mine. The Blue Horse Mine includes a shaft of about 30 m in depth, an adit of about 100 m in length and several shallow cuts. Narrow stopes are open to the surface over a distance of about 100 m. Several adits and shallow shafts are situated in the ridge east of the Blue Horse Mine.

Outlying areas of the Silverbow district include numerous shallow pits, cuts and shafts in the hills east, south and southwest of Nixon Peak, and between Breen Creek and Stinking Spring, southwest of the townsite of Silverbow (fig. 7-50). Most of these workings are cuts and pits less than 2 m in depth, and all are probably less than 15 m in maximum dimension.

History of Discovery, Exploration, and Mining

Although Ball (1907) and Paher (1970) both report that the first discoveries at Silverbow occurred in November 1904, the Silver Glance claims were reportedly located by Ed Clifford about 1900-01, which would make them the earliest locations in the district (Kral, 1951). At any rate, a rush to Silverbow occurred in late 1904, and a map of the district from that year shows a townsite and many claim groups located both south and north of what would later become the NAFR boundary (Paher, 1970). Much of the interest in the district was no doubt precipitated by George Wingfield and George Nixon, mining magnates of the time, who staked claims and platted the townsite at Silverbow. Silverbow,



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"The Bow," or "Silverbow Country" as it was called in the Goldfield and Tonopah newspapers of the time, was by 1905 the largest mining camp in eastern Nye County.

The first ore shipment of 20 tons made from the Catlin Mine in 1906 was reported to carry about $100 per ton in gold and $40 per ton in silver. Recorded shipments made later that year included 3 tons of ore from the Silverbow Mine carrying 100 oz gold and 900 oz silver and 2 tons of ore from the Lucky Boy Mine carrying 60 oz gold and 240 oz silver. Several small mills were operating on various properties in the first few years, and news reports of ore shipped from the mines far exceed that recorded by the USBM (Goldfield Weekly News, 7/14/1905, 7/21/1906; Tonopah Bonanza, 7/28/1906, 9/15/1906, 11/24/1906; Goldfield Gossip, 2/2/1907, 4/20/1907,) Despite the exodus of most of the boomtown prospectors from Silverbow after the first year or two, USBM smelter records and USGS annual reports show continuous yearly production at several mines from 1906 through 1914, with the gold content of the ore dropping off sharply after 1908. Much of the early production came from the Catlin Mine, Silverbow Belle (Gift) Mine, Silverbow Mining Co., and Nevada Silverbow Mining Co.

There appears to have been a lull in mining activity at Silverbow for a few years between 1914 and 1920, after which a sizable amount of production was made from the Blue Horse Mine for two years (USBM, NBMG records; USGS, 1920, 1921), with the ore once again showing the high gold values of the early years. The mine closed in 1921, although one ton of ore was credited to it in 1923. No production was recorded between 1923 and 1928, although Kral (1951) reported that 50 people were working Silverbow following a small strike in 1926. Beginning in 1927, H. H. Leighton, a mining engineer from the Bellehelen Mine, acquired and consolidated several properties at Silverbow and raised capital to construct a 50 ton-per-day oil flotation plant to treat the ore (Goldfield News and Weekly Tribune, 11/17/28; Kral, 1951; Weed, 1931). The claims he secured were the Catlin Group, Belmont Group, and Shield and McGonagill Group, one of which must have encompassed the Blue Horse Mine area, as Kral places the plant operations at the Blue Horse Mine.

A test run of the mill was conducted in November 1928 before the plant was mothballed for the winter, and plans were made to mill ore in the spring, after the 15,000-foot (4.6 km) long spring-fed water pipeline to the mill thawed out. Silver Bow Consolidated Mining Co., under Leighton, mined the several claim groups and treated 25-30 tons per day in the new plant, with the whole operation employing 11 men (Weed, 1931). This may be the same production reported by USBM from 1929 to 1931, credited to a Shields of the Silverbow Mining Co.. The fate of Leighton's operation is unknown, but after its production ceased in 1931, leasers continued to produce healthy amounts of ore in the mid-1930s from several mines: the Single Jack Mine in 1932, 1934 and 1936, the Junkee Mine in 1933, and the Blue Horse in 1934.

The USBM reported no production from the Silverbow mines from 1937 to 1939, but mining activity picked up again in 1940. Production was recorded for several years from the Hillside & Stone Cabin groups, the Catlin Mine, and the Silver Glance claims by various workers through 1947. Kral did not note any active mines in Silverbow in 1951 and the only post-1947 production recorded by USBM was a single shipment of 15 tons by the Sugarbowl Mining Co. from the Johnnie Mine in Silverbow in 1955. Cornwall and Norberg (1978) reported that several mines in the Silverbow district were reopened in 1964 by the Tickabo Mining and Milling Co., but no production from this venture was recorded.

Several major mining companies have investigated the Silverbow district from the 1960s through the present in attempts to identify sufficient tonnage and grade of ore to warrant development of a viable precious metals mining operation.

Since the early 1960s there have been at least four programs of exploratory drilling carried out in the district. A total of 17 core and rotary drill holes mainly less than 100 m in depth were completed by the Browne Group in the gulch west of the townsite in the 1960s. Amoco Minerals Co. completed 4-6(?) rotary drill holes north of the townsite and near the Hillside Mine in 1983-1984. Later in the 1980s several rotary holes were drilled by NERCO into a low ridge 0.5 km east of the Hillside Mine. In late 1993(?)-early 1994 the Phelps-Dodge Mining Co. carried out a program of reverse-circulation rotary drilling in the ridge west of the townsite. All of these programs were directed at finding bulk-mineable precious-metal deposits at shallow depths and the drill holes were not designed to explore the known veins in the district. It is believed that in each case, insufficient evidence for bulk-mineable resources was found to justify further drilling.

Silverbow has been one of the most consistent ore-producing districts in the study area. Ore has been shipped annually from the district from 1906 through 1955 with only a few short gaps of no recorded production. Total production from the Silverbow district as calculated from USBM records, and NBMG files is 3,246 tons of ore yielding 8,709 oz gold and 90,570 oz silver. Taking into consideration that some ore shipments were unrecorded, total district production probably exceeded 10,000 oz gold and 100,000 oz silver.

Previous Investigations

Summary descriptions of the Silverbow district have been given by Ball (1906, 1907), Kral (1951) and Ekren and others, 1971. Additional, very cursory reports have been given by Cornwall (1972), and Cornwall and Norberg (1978).

Present Investigation

For this report the district was visited briefly in July 1994 and April and May 1995 by J. V. Tingley, H. F. Bonham, Jr., S. I. Weiss and V. Calloway. Specimens of ores and hydrothermally altered country rocks were collected to evaluate the concentrations and aerial extent of the precious metals and other trace elements, and to better determine the mineral assemblages and extent of hydrothermally altered rocks in the district. Maps of claims and underground workings in the district from the files of the NBMG dating from prior to 1940 were examined, as well as newspaper and other historical records.

Geologic Setting

The Silverbow district is situated adjacent to Cactus Flat within hydrothermally altered rhyolite ash-flow tuffs and porphyritic intrusions near the topographic margin of the northern Kawich Range caldera. Areas north and east of the Silverbow townsite are within the Kawich caldera (Stewart and Carlson, 1976; Best and others, 1993) and are underlain by a thick (1+ km), intracaldera-facies unit of densely welded, phenocryst-rich rhyolite ash-flow tuff containing abundant large quartz phenocrysts and sparse lithic fragments. These tuffs, formerly included in the tuff of White Blotch Spring (Ekren and others, 1971), comprise the intracaldera tuff prism of the 22.6-Ma Pahranagat Formation (Best and others, 1995). Southeast, south, and west of the townsite the district is underlain by a thick, gently south-dipping unit of partially to densely welded rhyolite ash-flow tuff. This unit, assigned to the Fraction Tuff by Ekren and others (1971), contains fewer and generally smaller phenocrysts than are present in the Pahranagat Formation, including ubiquitous, abundant phenocrysts of sphene. The two cooling units of the "true" Fraction Tuff, properly defined in the Tonopah district to the west lack abundant phenocrysts of sphene (Bonham and Garside, 1979), demonstrating that this unit is not correlative (cf. Ekren and others, 1971). Instead, this unit more likely comprises the outflow-sheet equivalent to the intracaldera tuff of Cathedral Ridge, which has been dated at 18.3 Ma and contains very abundant sphene (Ekren and others, 1971; Best and others, 1989, 1993).

The ash-flow tuff units at Silverbow are intruded and overlain by several west-northwest- and north-northwest-trending dikes, plugs and domes of porphyritic rhyolite of two distinct varieties: 1) coarsely porphyritic and containing abundant feldspar phenocrysts as much as 1 cm in length, and 2) finely porphyritic, commonly finely flow banded, containing only about 5 percent small phenocrysts of feldspar and anhedral quartz <2 mm in maximum dimension. Both types have undergone pervasive hydrothermal alteration. In addition, small, weakly altered intrusive bodies of dark-colored, hornblende-biotite dacite crop out near the Blue Horse Mine.

Mineral Deposits

Mining in the district has been focused on two systems of east-west to northwest and north-striking, steeply dipping quartz veins (photo 7-41). The veins are as much as 3 m wide near the surface and are composed of fine-grained to medium-grained comb quartz and lesser granular quartz and adularia. Finely banded, commonly crustified and drusy textures are well developed. The northern vein system, worked at the Catlin and Hillside Mines and east of the Hillside Mine, formed in faults cutting mainly dense intracaldera Pahranagat Formation. Veins at the Blue Horse Mine fill faults and fractures cutting welded ash-flow tuff and porphyritic rhyolite dikes and plugs. Textures interpreted as evidence for hydrothermal brecciation are locally present. Based on reconnaissance observations, the veins formed along a system of faults that separate the Pahranagat Formation to the north from the tuff of Cathedral Ridge to the south. These faults also localized many of the rhyolite intrusions.

Stephanite, ruby silver, cerargyrite, and electrum have been considered to be the principal ore minerals of the Catlin, Hillside and Blue Horse Mines (e.g., Ball, 1907). Scanning-electron microscope and reflected-light optical examinations of specimens from outcrops and mine dumps indicate the presence of considerable amounts of acanthite, arsenopyrite and native silver as well, and minor to trace quantities of aguilarite, chalcopyrite, and pyrrhotite. The ore minerals are commonly associated with pyrite in irregular, granular aggregates and disseminated grains interstitial to

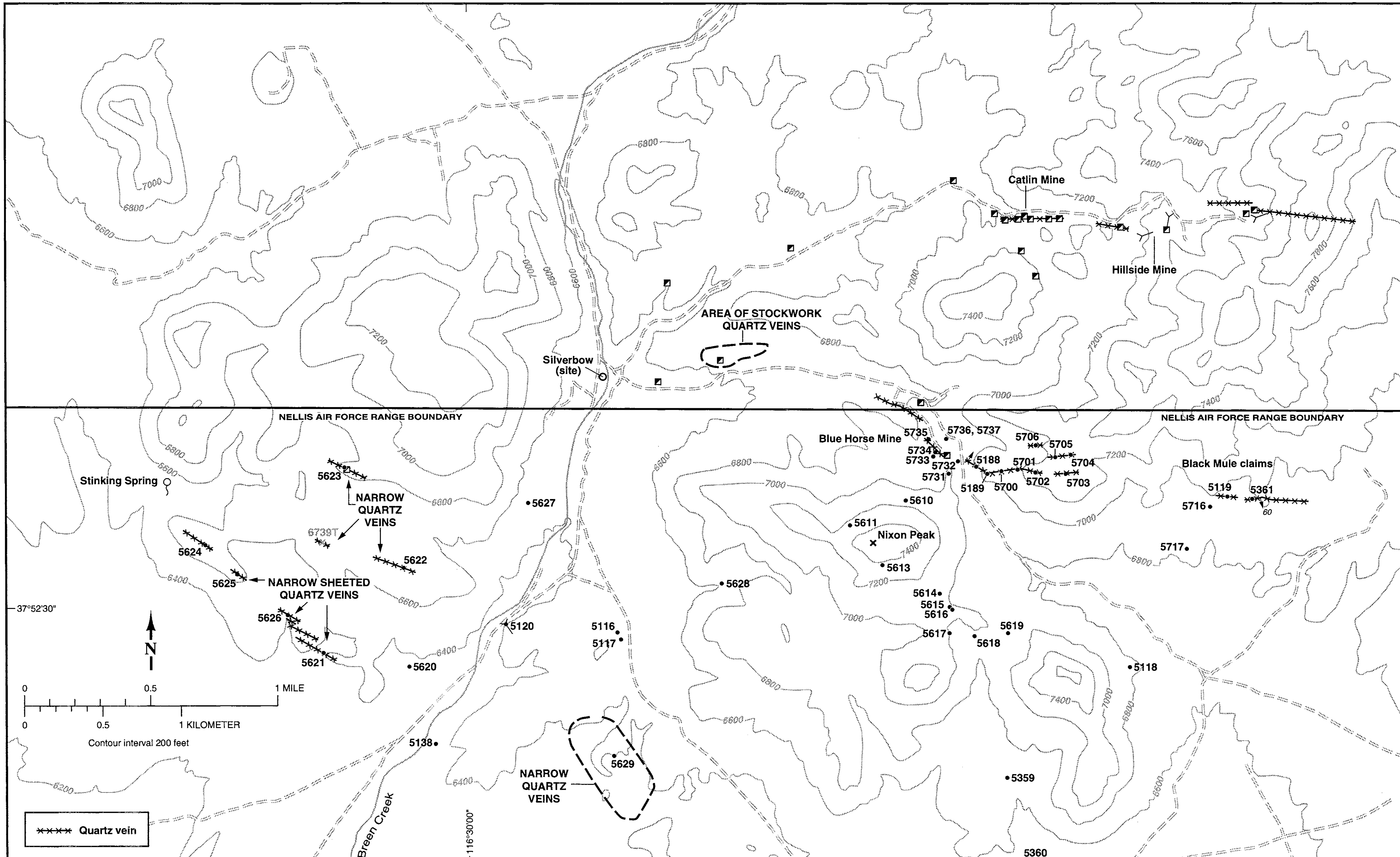


Figure 7-50 Map showing locations of samples and major veins in the Silverbow mining district, Nye County, Nevada.

vein quartz. Quartz and adularia are the major gangue minerals; locally there are lattice textures after bladed calcite.

Similar silver- and gold-bearing, steeply south-dipping, finely crustiform-banded veins of quartz and adularia, as much as 2 m wide, crop out about 1.6 to 2.0 km east of the Blue Horse Mine in an area known as the Black Mule claims (fig. 7-50). The veins, which can be traced for approximately 500 m, strike slightly north of west, are offset only slightly from those exposed on the hill east of the Blue Horse Mine and are reasonably interpreted as an eastward continuation of the Blue Horse vein system. Portions of the veins have undergone hydrothermal brecciation and contain rounded fragments of quartz vein material in a matrix of fine-grained silica and reddish iron oxides.

Numerous thin veins of quartz ± adularia, in general less than 0.5 m in width, crop out west of Breen Creek between Silverbow townsite and Stinking Spring. These veins locally contain ore-grade concentrations of gold and silver, but are too narrow and are spaced too widely to be considered for bulk-mining operations.

Zones of steeply dipping fractures containing narrow, locally finely banded veins of fine-grained quartz and pyrite form resistant outcrops south and southwest of Silverbow townsite (fig. 7-50). The veins and resistant rocks mainly strike N50°W to N60°W. Less frequently, as at the site of sample 5138, the fractures and veins strike about N15°E.

Published reports refer to kaolinization as the principal wall-rock alteration near the veins at Silverbow (e.g., Ball, 1907). However, observations indicate that near-vein alteration of the country rocks in the main part of the district generally consists of silicification accompanied by mixtures of kaolinite and illite-sericite that replace feldspar and biotite phenocrysts, and locally includes adularization of sanidine phenocrysts. Iron oxides including jarosite are locally abundant and suggest that small amounts (<1 percent) of pyrite were present prior to weathering. In certain areas there is little added quartz and the wall rocks are soft and porous. Resistant rocks of the sheeted vein zones south and west of the townsite contain clear sanidine phenocrysts, but the plagioclase phenocrysts are invariably removed by dissolution and/or replaced by mixtures of adularia, illite, kaolinite and quartz. Very fine-grained quartz, kaolinite and illite have replaced the groundmass, and small blebs of iron oxides probably represent the weathering products of finely disseminated pyrite. The near-vein alteration is surrounded by large areas of subtle, but pervasive alteration of the ash-flow tuffs characterized by the replacement of the plagioclase phenocrysts by fine-grained adularia, ±illite, and by very fine-grained quartz and illite. The adularia appears to have been partially to completely replaced by the mixtures of quartz and illite. Very fine-grained quartz ± opal, forms linings and fillings of small vugs and relict phenocryst sites. The groundmass is composed of fine-grained mixtures of granular quartz, potassium feldspar and kaolinite. This type of hydrothermal alteration gives moderately to densely welded ash-flow tuff the weathering appearance of non-welded to partially welded ash-flow tuff.

Geochemistry

Specimens for geochemical analyses for this report were collected only from areas of veins and mine workings within and near the boundary of the NAFR and the results are tabulated in appendix C. The highest concentrations of precious metals were determined in specimens from outcrops and mine dumps along the Blue Horse - Black Mule vein system. Select and chip samples indicate that these veins contain on the order of 0.3 to 100 oz silver and 0.005 to 0.1 oz gold per ton. Strongly elevated silver and gold concentrations continue to the east of the Blue Horse Mine, well within the NAFR. Lower, but nevertheless anomalous concentrations of silver and gold are present in rocks containing fine-grained quartz veins and breccia cement near the margins of intrusive rhyolite southeast of Nixon Peak (e.g., samples 5615, 5616, and 5618, appendix C). Similar concentrations were determined in samples from narrow, northwest-striking quartz veins southwest of Nixon Peak and between Breen Creek and Stinking Spring (fig. 7-50).

Although veins at the Blue Horse Mine locally contain macroscopic grains of electrum, most samples are much richer in silver than in gold (appendix C). The silver-dominant nature of the entire district is evident in the silver-to-gold ratios, which vary from about 8 to 200 for all samples containing more than 0.1 oz silver per ton. Silver-to-gold ratios vary less in samples containing less than 1.0 oz silver per ton, ranging from about 18 to 200.

Modest to high concentrations of arsenic, antimony, mercury, and molybdenum are associated with elevated silver and gold and are widely distributed around the southern periphery of the district, as is typical of many epithermal vein systems. Tungsten is somewhat elevated in many specimens. Tellurium, bismuth, and thallium concentrations are low, as are copper, lead, zinc, manganese and tin. Veins in the Black Mule area are particularly interesting as concentrations of silver and gold are locally in excess of 1 oz silver and 0.05 oz gold per ton, respectively, but arsenic and antimony contents are 1 to 2 orders of magnitude lower than in silver-gold rich veins in the Blue Horse area.

Identified Mineral Resources

There are no identified mineral resources in the part of the Silverbow district included within the NAFR.

Mineral Resource Potential

Vein textures, mineralogy, and geochemical characteristics, together with wall-rock alteration assemblages and the overall geologic setting indicate that Silverbow is a classic example of the volcanic-rock hosted, low base-metal type of epithermal, low-sulfidation (adularia-sericite) fissure-vein district. Silverbow shares a number of similarities, such as the general nature and comparable aerial extent of veins and hydrothermally altered rocks, with more productive districts such as Aurora in Nevada (Osborne, 1991), and Bodie (Chesterman and others, 1986) and Hayden Hill in California (Finn, 1987). However, available data suggest that Silverbow is of the more silver-rich, gold-poor part of the spectrum represented by these deposits. There are no records of exploratory drilling of the major veins, so data are biased by the shallow depths of previous mining. Narrow, gold-rich bonanza ore shoots amenable to selective underground mining could be present at depth at Silverbow, particularly in the Blue Horse-Black Mule vein system, and possibly in the Catlin Mine area. Lower-grade, disseminated deposits suitable for bulk-mining have not been found at the surface or in shallow drilling north of the NAFR boundary, despite repeated attempts. However, the zones of sheeted veins west and east of Breen Creek have elevated precious- and indicator-element concentrations that might attract exploratory drilling if opened to the public, and potential may exist within these zones for disseminated deposits within a few hundred meters of the surface.

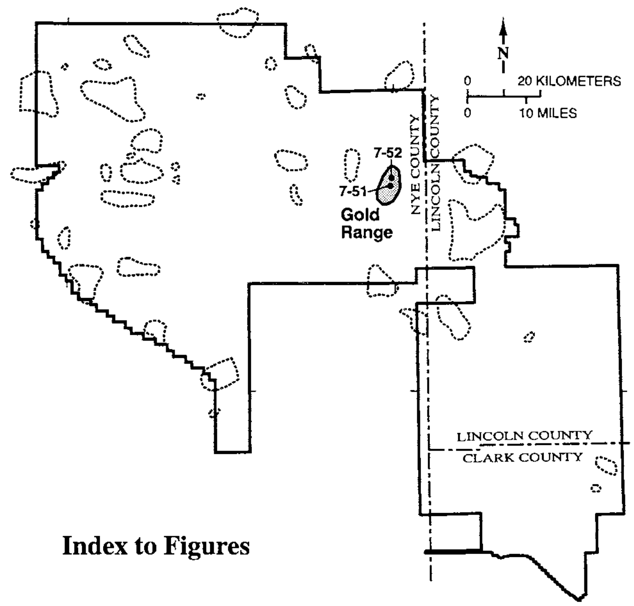
An estimate of high potential (level C) is assigned to the Blue Horse-Black Mule area for small-tonnage, bonanza-vein-type silver-gold deposits of the low-base-metal, low-sulfidation epithermal type. Moderate potential (level C) is estimated for volcanic-hosted disseminated, bulk-mineable, precious-metal deposits of the low-base-metal, epithermal type at depth in the areas of quartz veins at Silverbow, in the vicinity of the Blue Horse Mine, and in areas east and west of Breen Creek within the NAFR.

<u>7.3.6 Belted Range</u>

<u>7.3.6.1 Gold Range District</u>

Location

The Gold Range district lies on the east side of the northern Belted Range in an area roughly defined by Belted Peak on the northwest, Wheelbarrow Peak on the southwest, and Chalk Mountain on the east (fig. 7-1). The small mines and prospects of the district are located in low, rolling foothills of the range that project east toward Chalk Mountain and form the western part of the low divide separating Monotony Valley on the north from Emigrant Valley on the south.



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The area now known as the Gold Range district was first known as White Blotch (Nye County mining claim records). An old location notice found at a shaft site in the northern part of the district referred to that area as the Oroville district (R. Nicholson, personal commun., 1994), but this name has been found in no other references. Notices of intent to hold certain claims in the district in 1930 refer to the district as Cliff Spring, and then state that the district name was changed to Goldrange. Notices of location filed in 1931 used Gold Range as the district name (Nye County mining claim records) but newspaper accounts in 1932 consistently used the name Goldrange.

History of Discovery, Exploration, and Mining

The Gold Range district may have been prospected shortly after discovery of Goldfield in the early 1900s but no claims were taken up at that time (Goldfield News and Weekly Tribune, Dec. 25, 1931). The earliest record of claim activity in this area is in 1926 when the White Block Claim was staked by P. L. Smith near White Blotch spring in the north part of the district. The Buckhorn claims were staked by Cleveland Poplin and Fred Pine on showings in the central part of the district in March, 1930 and gold was reported to have been found over a distance of some 20 km^2. No high-grade was taken out, but ore values of $145 to $200 per ton were reported (Goldfield News and Weekly Tribune, April 25, 1930). In early 1932, the camp boasted a population of about one hundred people but still reported only "splendid showings" and no production. Later in 1932, the Goldrange Standard Mining Co. was organized and a shaft, the Red Rose, was sunk to 130 feet (40 m). A drift was run 80 feet (24 m) on the vein at the 85-foot (26-m) level and is reported to have encountered both milling and shipping ore (Goldfield News and Weekly Tribune, Nov. 11, 1931).

Later, a second shaft was reported to have been sunk to 40 feet (12 m) by the Nevada Western Gold Co. on its holdings 1.6 km west of the Goldrange Standard property (unpub. report, Pardners Mines Corp., Alvin McLane files). The existence of this shaft is questionable, however, as it could not be found when the area was examined (R. Nicholson, personal commun.). At some point, a shaft was sunk at the Oroville site east of White Blotch Spring in the north part of the district but there is no record of when this was done. The shaft extends to 44 m with 7 m of drift at the 35-m level (R. Nicholson, unpub. report, 1995). Examination of the district in 1991-1995 revealed the Red Rose Shaft had been sunk to about 55 m but no other more extensive work had taken place following the 1930-32 activity (R. Nicholson, unpub. report, 1995).

Mining claim activity appears to have ceased following 1936 and the district has been largely forgotten.

Previous Investigations

The regional geology of the Gold Range area is described by Ball (1907), Ekren and others, (1971), Cornwall (1972), and Sargent and Orkild (1973). Ball (1907) described "beds of silicified rhyolite" south of Belted Peak, and mentioned a large area east and southeast of Belted Peak which appeared to be "much altered." This is the Gold Range district and Ball must have been describing the altered rocks surrounding the Red Rose Shaft. The only specific literature reference to the Gold Range district found, however, was Hewett and others (1936), who stated there was no record of production from the district.

Present Investigation

Mapping and sampling of the Gold Range district was carried out by R. Nicholson, DRI, between 1991 and 1995.

Geologic Setting

Most of the Gold Range district is underlain by rhyodacite and quartz latitic ash-flow tuff of the tuff of Monotony Valley, rhyolitic welded ash-flow tuff of the tuff of Antelope Springs, and rhyolitic ash-flows of the tuff of White Blotch Spring (the upper cooling unit of the tuff of White Blotch Spring has been reassigned to the Pahranagat Formation of Best and others, 1995). The southern part of the district is underlain by ash-flows of the Tuff of Belted Peak and to the west, a small band of Cambrian and Ordovician carbonate rock crops out on the lower northeast flank of Belted Peak (Cornwall, 1972).

Mineral Deposits

The prospects in the Gold Range district explore narrow, low-sulfidation quartz veins and silicified zones in rhyolitic welded ash-flow tuff.

In the central part of the district, the Red Rose Shaft was sunk on a silicified breccia zone formed along a N20°E, 85°SE-dipping shear zone in biotite-rich welded ash-flow tuff (Tuff of Monotony Valley, Cornwall, 1972). The tuff contains smoky quartz phenocrysts and shows limonite staining on fracture surfaces. There is sparse quartz veining and limonite staining in the wall rock adjacent to the shear zone. The hillside east of the shaft is littered with jasper float and lenses and pods of jasper and silicified breccia crop out high on the ridge to the east at sample site 5504. Sample site 5504 is within the Tuff of Antelope Springs, east of its contact with the Tuff of Monotony Valley. Shearing at this site strikes N10°E and dips 85° SE. Slickensides are abundant on rock surfaces here. The shaft is approximately 55 m deep (fig. 7-51), and now has water standing at 44 m below the collar (R. Nicholson, unpub. report). Surface samples collected at this site were uniformly low in gold and silver and, with one exception, contained low values in all other metallic elements. Sample 5504 (appendix C), the exception, contained moderately elevated values in arsenic and mercury and slightly elevated antimony.

To the north, at the other major workings in the district, the West White Blotch Shaft was sunk on a east-trending, vertical fault zone in moderately kaolinized, silicified, welded ash-flow tuff (Tuff of Monotony Valley) (fig. 7-52). The structure shows slickensides, and clots of white, crystalline calcite can be seen on the shaft dump but do not appear in outcrop. The tuff is iron-oxide stained. The shaft was sunk to a depth of 44 m along the south side of the fault and, at the 35-m level, a drift was driven 7 m eastward along the fault (R. Nicholson, unpub. report, 1995). Samples of silicified fault gouge collected from the bottom of the shaft and from the drift (Samples 91-24, 91-25, appendix C) contained elevated lead values but only trace amounts of gold or silver. Another sample (5505) collected from the shaft dump was essentially barren of all value.

Samples were also collected at locations in altered tuff east of Gold Range camp and from an outcrop of silicified limestone southwest of Gold Range camp. None of these samples contained elevated values for any metallic or metallic pathfinder elements.

Identified Mineral Resources

No identified mineral resources are present in the Gold Range district.

Mineral Resource Potential

There is moderate resource potential, certainty level C, for the discovery of mineable vein deposits of gold-silver in the Gold Range district. The potential for disseminated gold mineralization in locations where more porous tuff units may be present is rated moderate with certainty level B.

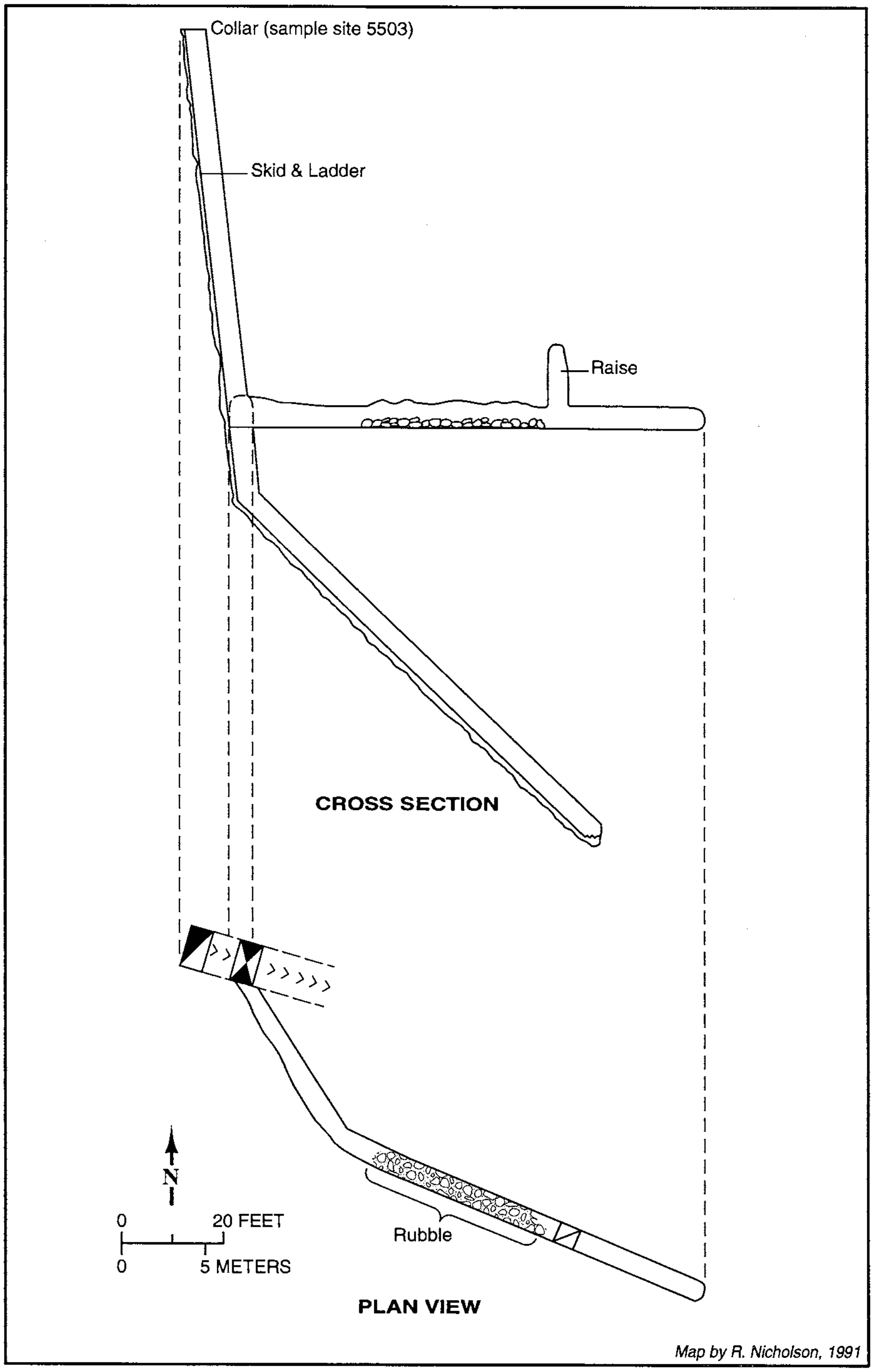


Figure 7-51 Red Rose shaft, Red Rose #1 claim, Gold Range district, Nye County, Nevada.

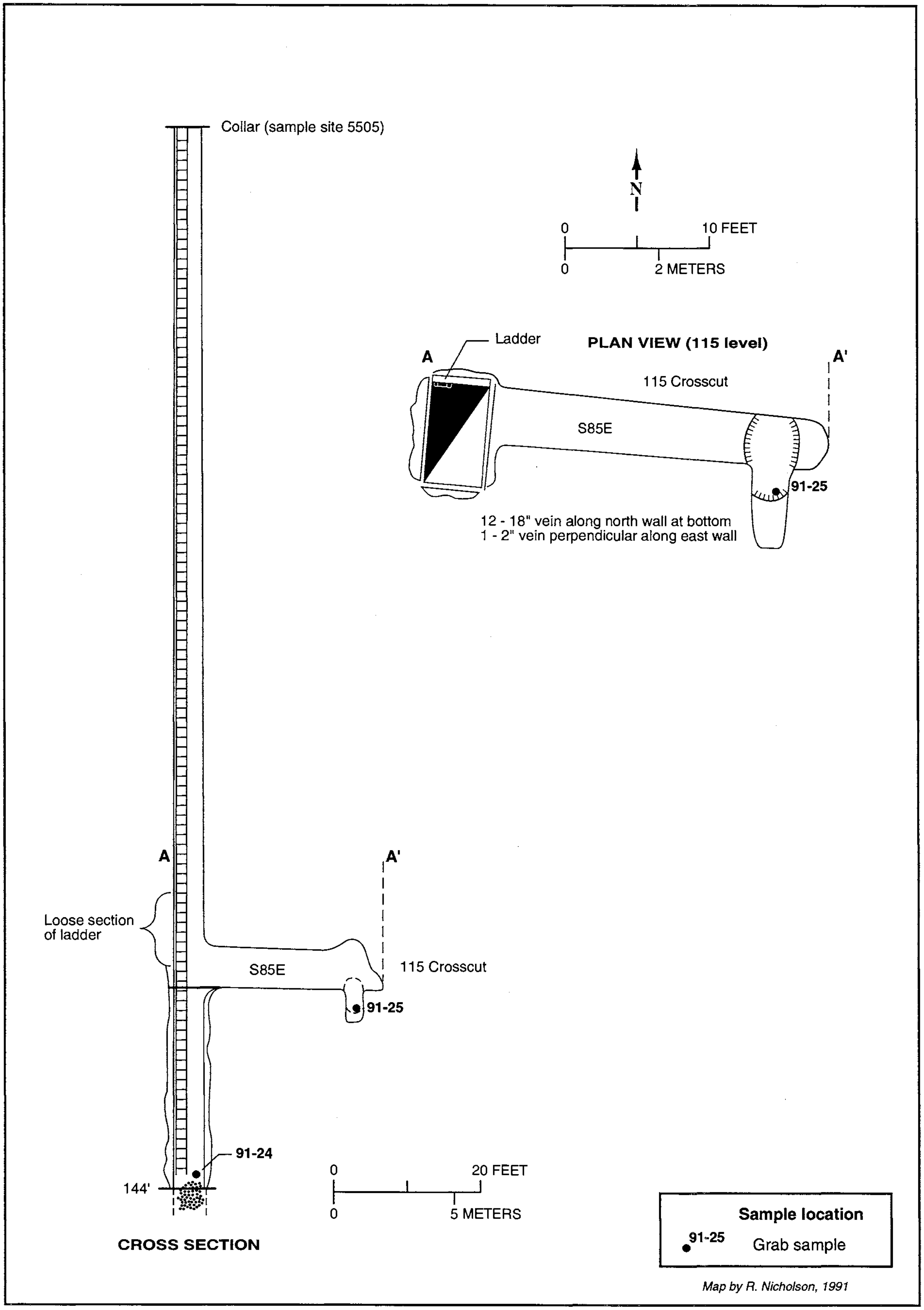
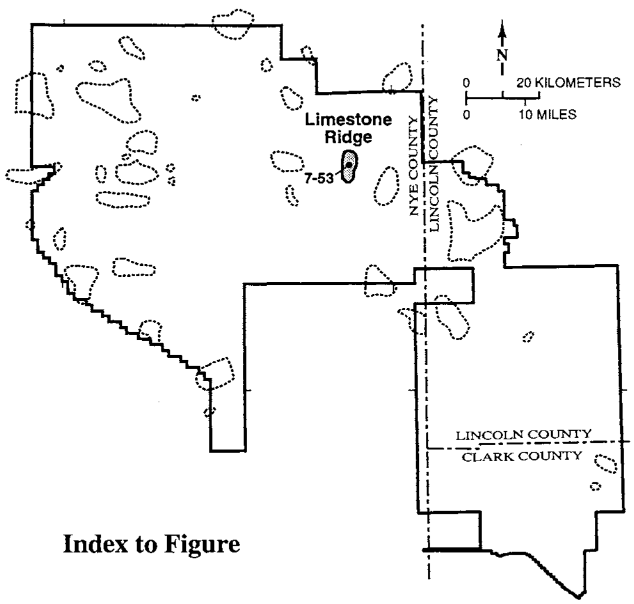


Figure 7-52 Cross section of the West White Blotch shaft, Gold Range district, Nye County, Nevada.

District-wide reconnaissance geologic mapping would provide information necessary to more clearly define the potential for disseminated mineralization. The low values in gold, silver, and elements associated with gold and silver in this type of deposit do not, however, allow other than a moderate potential to be assigned at this time.



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7.3.6.2 Limestone Ridge area

Location

The Limestone Ridge area is west of the Gold Range district in the northern Belted Range (this report), and hydrothermal alteration extends westward from that district to an altered area south of Belted Peak described by Ball (1907, p. 131) that was not visited during this study. Workings in the Limestone Ridge area consist of a few prospect pits and a very shallow shaft. These were visited during the fall of 1995, and seven dump and outcrop geochemical samples were collected.

History of Discovery, Exploration, and Mining

Ball (1907, p. 130) briefly mentioned prospects that "... are located on either side of the road from Kawich to Cliff Spring, near the eastern border of the Pogonip limestone. The supposed ore is in part a fine-grained quartzite and in part vein quartz, in which are small disseminated iron-pyrite cubes and thin stringers of pyrite. The veins where examined are thin."

The field work for Ball's report was done in 1905, so the prospects were in existence then. Probably they date from that time or a few years earlier, when prospecting extended out from Goldfield to the numerous districts in the area of the Kawich Range, particularly Gold Reed, 16 km to the west. The property at sample site 5730 is probably the one to which Ball refers. No further information is available concerning the history of the Limestone Ridge prospects.

Geologic Setting and Mineral Deposits

Limestone Ridge is made up of late Precambrian through Silurian carbonate rocks, quartzite, and shale. These units are nearly vertical or overturned to the east, and are cut by both high- and low-angle normal faults (Ekren and others, 1967). The Paleozoic units are overlain to the east by Oligocene and Miocene ash-flow tuffs, which are in turn overlain and intruded by rhyolite flows and related dikes and plugs.

Samples collected at prospects and mineralized sites are from narrow quartz veins and/or areas of silicification, mainly in lower Paleozoic carbonate and clastic rocks. Chalcopyrite, bornite, and oxide copper minerals are found in vein quartz at one locality (5803) and pyrite in quartz with late fluorite is found at another (5730). Silicified carbonate rocks (jasperoid) were observed at several sites (5801, 5848, and 5801), locally with manganese oxides and limonite gossan.

The age of mineralization at Limestone Ridge is unknown, and it is possible that more than one age of mineralization is present. If the hydrothermal alteration in Tertiary volcanic rocks to the east (Belted Peak area) is genetically related, mineralization would be Tertiary. Such hydrothermal fluids could speculatively be related to Miocene rhyolitic intrusive rocks which occur nearby (rhyolite of Belted Peak, see fig. 7-53).

Geochemistry

One geochemical sample from the area that contains copper sulfide minerals is anomalous in silver as well as copper, but little else. Many of the other samples of the Limestone Ridge area are moderately anomalous in arsenic and two are anomalous in antimony. Several samples from areas of jasperoid, gossan, and manganese oxides are anomalous in barium, molybdenum, zinc, tungsten, scandium, yttrium, and uranium. Some of these elements may have been concentrated in iron-oxides during or after their formation as supergene oxide minerals (e.g., uranium).

Jasperoid development is a characteristic of carbonate-hosted gold-silver (Carlin-type) deposits, as is the indicator-element suite of gold + arsenic + mercury + antimony + tungsten + thallium ± molybdenum ± fluorine (Berger, 1986). The fact that gold was not found in the samples of jasperoid from the Limestone Ridge area is not particularly uncommon in such deposits, and is not a strong argument against the presence of such deposits here. Many jasperoids in areas of Carlin-type gold mineralization are pre-gold or are otherwise devoid of gold while being enriched in arsenic, antimony, and mercury (Percival and

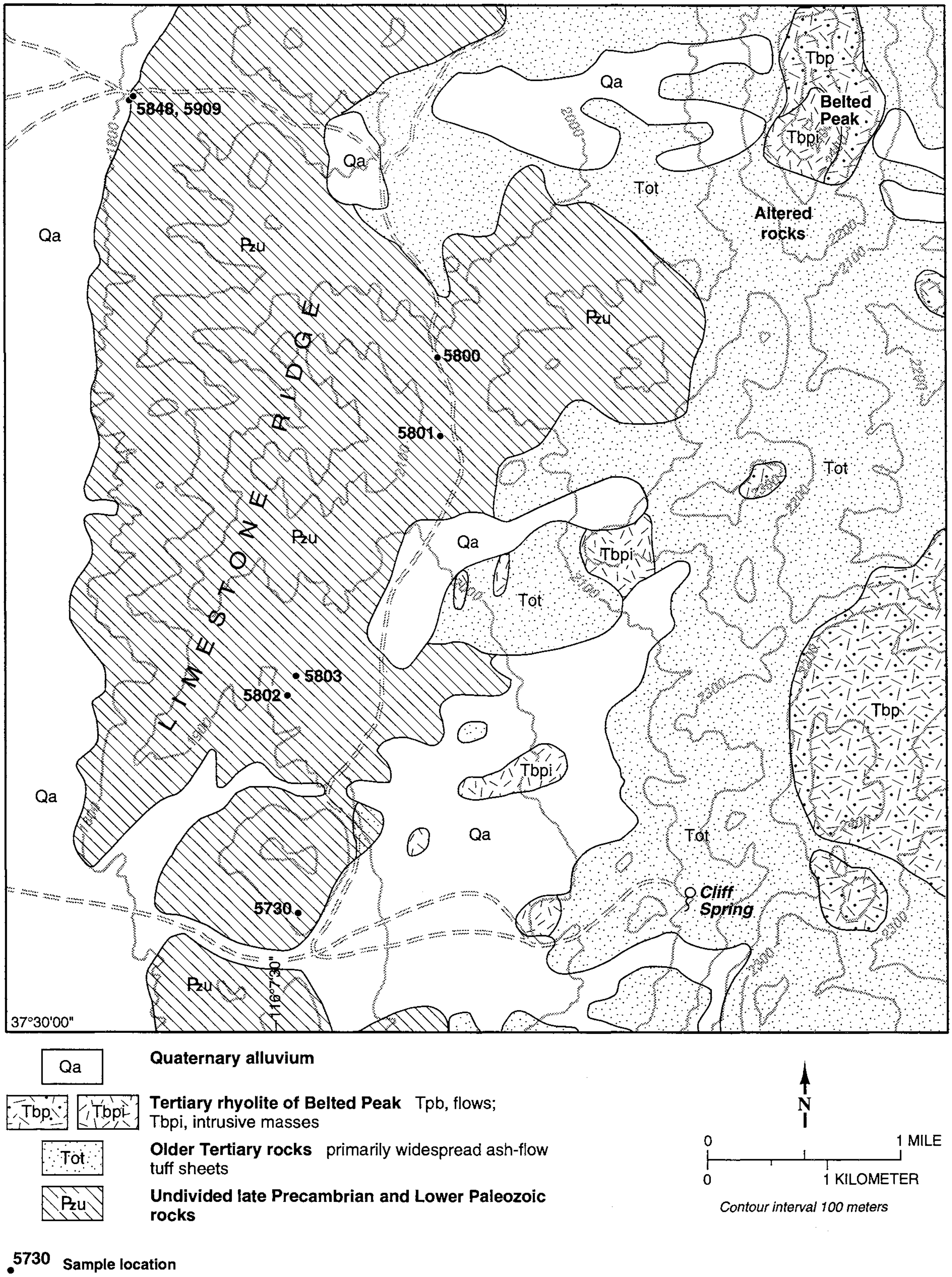


Figure 7-53 Simplified geologic map of the Limestone Ridge area, Belted Range, showing sample sites (modified from Ekren and others, 1967). Faults not shown.

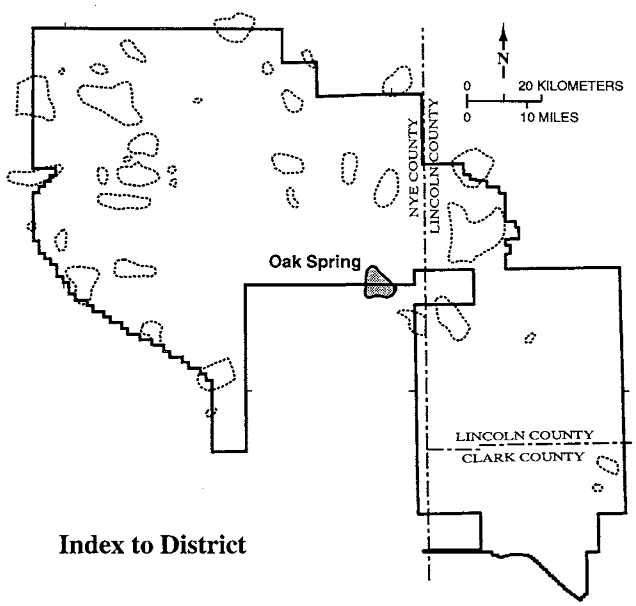
others, 1988, p. 20). The uniformly low mercury values may be more unfavorable, as mercury is commonly more widely distributed; however, anomalous amounts of many of the indicator elements for such deposits are found in the samples from Limestone Ridge.

Identified Mineral Resources

There are no identified mineral resources in the Limestone Ridge area.

Mineral Resource Potential

Based on the presence of jasperoid and elevated arsenic and antimony, characteristics considered favorable for the presence of Carlin-type gold deposits, the portion of Limestone Ridge having prospects and mineralization as well as the hydrothermally altered area to the east in Tertiary volcanic rocks south of Belted Peak is estimated to have moderate potential for disseminated, sediment-hosted gold-silver deposits, certainty level B.



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7.3.6.3 Oak Spring District

Location

The Oak Spring district is located near Oak Spring Butte on the east side of the southern Belted Range in southern Nye County (fig. 7-1). The productive tungsten mines of the district are located south of Oak Spring Butte on the Nevada Test Site. The part of the district within the NAFR, north of Oak Spring Butte, contains only a few scattered prospects in the area between Oak Canyon and Carbonate Wash.

History of Discovery, Exploration, and Mining

There is no record of the prospecting activity in this part of the Oak Spring district. None of the workings are extensive and prospecting has been minor. There is no record of production from this part of the Oak Spring district.

Present Investigation

The four small prospects in the northern Oak Spring district were investigated and sampled by R. Nicholson in 1994.

Geologic Setting and Mineral Deposits

The part of the Oak Spring district north of Oak Spring Butte is underlain mainly by Paleozoic carbonate rocks that are covered on the northeast and southwest by Miocene and Oligocene ash-flow tuffs (Frizzell and Shulters, 1990). The Paleozoic rocks range from Cambrian Nopah Formation through Ordovician Pogonip Group and Ely Springs Dolomite to undivided Devonian dolomitic rocks. These rocks strike generally to the north and are cut by north-trending thrust and normal faults. The Miocene-Oligocene tuffs are in fault contact with the carbonate rocks on the south, and cover Oak Spring Butte. South of Oak Spring Butte, in the central Oak Spring district, Pogonip Group carbonate rocks again crop out south of the ash-flow tuffs. In this area, the carbonate rocks are intruded by quartz monzonite of the Climax stock and contain skarn tungsten and stockwork molybdenum mineralization.

Very little descriptive material is available on the prospects in the northern Oak Spring district. Samples were collected from four sites in the area, two on the north immediately south of Carbonate Wash, and two on the south in Oak Canyon.

One of the samples near Carbonate Wash (0894-G27, appendix C) was collected from a gossan exposure near a north-trending fault in Devonian dolomite. The other Carbonate Wash sample was collected from a prospect in silicified, calcite-veined limestone of the Ordovician Pogonip Group. Both samples contained trace amounts of silver and gold, elevated arsenic, antimony, highly elevated mercury, and moderately to slightly elevated copper.

Both samples from the Oak Canyon area were collected from prospects on the Butte fault. At this location, the fault separates the Aysees Member of the Antelope Valley Limestone on the west, from recent sediments, on the east. At sample site 1094-G30, an adit with a small stope has explored a gossan exposure formed in silicified, silica-veined limestone along the fault. The sample contained visible galena rimmed with cerussite in a hematite-rich gossan. Both samples taken on prospects along the Butte fault (1094-G30 and G31, appendix C) contained very high lead values (about 5 and 7 percent) with elevated silver, gold, arsenic, antimony, mercury, copper, and zinc. Tungsten values were moderately elevated in both samples.

Identified Mineral Resources

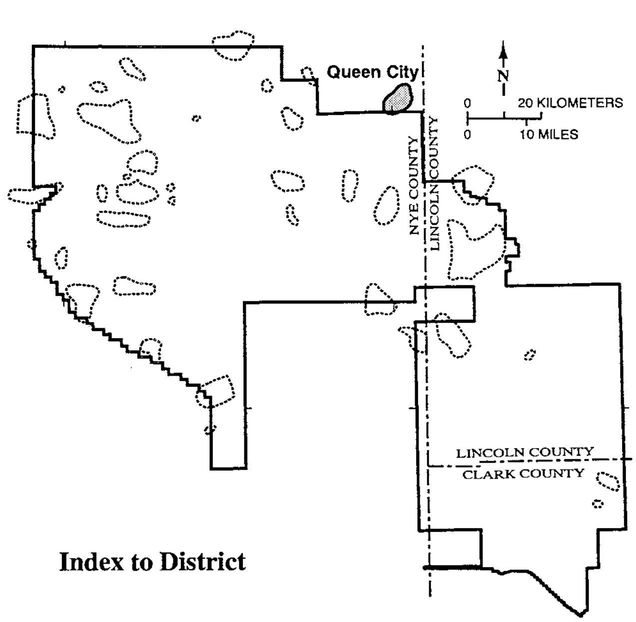
There are no identified mineral resources in the part of the Oak Spring district within the NAFR.

Mineral Resource Potential

There is moderate resource potential, certainty level B, for the discovery of polymetallic vein and replacement deposits along fault structures and in favorable carbonate horizons in this district. The geochemical element associations of the samples collected indicate that lead-silver mineralization with associated copper and gold, similar to that in the Groom and Papoose districts, could be found here.

There is also moderate resource potential, certainty level B, for the discovery of skarn tungsten mineralization in the area beneath the ash-flow tuffs covering Oak Spring Butte. Elevated tungsten values in the two samples collected here could indicate the presence of undiscovered tungsten orebodies under volcanic cover to the south.

7.3.7 Queen City Summit



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7.3.7.1 Queen City District

Location

The Queen City district (fig. 7-1) occupies the low hills northeast and southwest of State Route 375 at Queen City Summit. The mines and prospects of the district are all located north of the NAFR boundary, near the eastern border of Nye County.

History of Discovery, Exploration, and Mining

Mercury was discovered in the area in 1929 and, between 1930 and 1960, about 80 flasks of mercury were produced, mainly from the Black Hawk Mine (Bailey and others, in prep.). In 1938, silver-mercury deposits were prospected at the Oswald Mine, located about 2.4 km north of the NAFR boundary, and about 14 flasks of mercury are reported to have been produced from the property (Bailey and others, in prep.). In 1983, a large part of the district was staked and prospected for disseminated gold (Tingley, 1984a). Exploration for precious metals has continued intermittently and, in 1990, most of the eastern part of the district was staked by Kennecott Exploration Co. (Tingley, 1991).

Geologic Setting

The small part of the Queen City district that lies along the NAFR boundary is underlain by the Oligocene Monotony Tuff, a major rhyolitic ash-flow sheet containing abundant quartz phenocrysts (Ekren and others, 1971).

Mineral Deposits

The Monotony Tuff weathers to a brownish outcrop and has undergone very weak argillic alteration. Narrow silicified ribs have formed along north-trending fault zones in several wide-spaced areas along the NAFR fenceline. The widest of these seen was about 1-m wide and consisted of hairline quartz veinlets with seal-brown limonite-after-pyrite points along them.

Identified Mineral Deposits

There are no prospects within the NAFR portion of the district and there are no known mineral resources in this part of the Queen City district.

Mineral Resource Potential

There is low mineral resource potential, confidence level C, for the discovery of silver-gold vein deposits (low-sulfidation) in the part of the Queen City district within the NAFR.

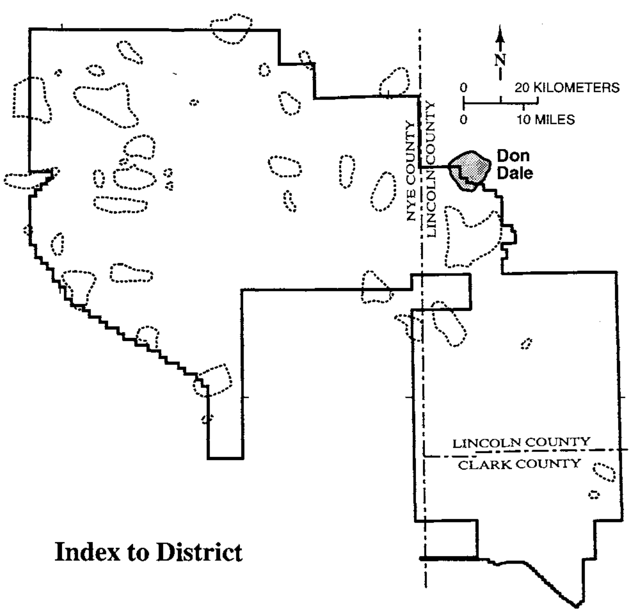
7.3.8 Groom Range

7.3.8.1 Don Dale District

Location

The Don Dale district covers the north end of the Groom Range and extends from State Route 375 on the north to Bald Mountain. The district includes the Andies mercury mine on the northeast tip of the range, small gold prospects south of the Andies Mine near Old Tikaboo Spring, the Don Dale Mine on the north-central tip of the range, and several gold prospects along the western front of the range south of the Don Dale Mine. Only the prospects south of the Don Dale Mine on the west side of the range are within the NAFR.

Prior to 1945, properties in the main portion of the Don Dale district were probably considered to be within the Tem Piute district (Tschanz and Pampeyan, 1970). Prospects on



the west side of the present district, between the Don Dale Mine and Cattle Spring, may have been originally included in the Groom district to the south.

History of Discovery, Exploration, and Mining

The Don Dale district was organized about 1945 (Tschanz and Pampeyan, 1970). Many of the mines in the district are much older, however, and probably date from the 1860s when the adjacent Groom district was active. The Andies mercury deposit was discovered in 1919, but the only recorded production was in 1955. The first record of production from the Don Dale Mine was in 1940. Total recorded production from the Don Dale district consists of three flasks of mercury from the Andies Mine (Bailey and others, in prep.) and 200 tons of silver-lead-copper ore from the Don Dale Mine (Tschanz and Pampeyan, 1970).

Previous Investigations

General geology of the Groom region is described by Wheeler (1872, 1875) and Spurr (1903). The first description of the geology of the Don Dale district was prepared by Tschanz and Pampeyan (1970). A mineral inventory and geochemical survey of the Groom Mountain Range was prepared in 1985 (Quade and Tingley, 1985) that contained descriptions of most of the mines and prospects in the district. The Don Dale district was also described by Tingley (1991) in a report on the mineral resources of the Timpahute Range 30′ by 60′ Quadrangle.

Present Investigations

The present report draws entirely upon earlier work of Tschanz and Pampeyan (1970) and of Quade and Tingley (1985) because no additional field work was within the scope of the NAFR project. Selected samples taken during the 1985 study were, however, obtained from sample archives of the NBMG, Reno, and the USGS, Denver, and reanalyzed using improved analytical methods. Mineral deposit descriptions have been expanded and, where necessary, interpretations have been revised.

Geologic Setting

The northern end of the Groom Range is composed of Cambrian and Ordovician sedimentary rocks intruded by many granitic dikes and a small stock. The lower flanks of the range are covered by Tertiary volcanic rocks which are cut by andesite porphyry dikes (Tschanz and Pampeyan, 1970). The volcanic rocks on the west flank of the range are intruded by masses of rhyolite that may be the same age as the intensely altered rhyolite tuffs that crop out near the Andies Mine. Ekren and others (1977) inferred that the volcanic rocks on the north end of the Groom Range may have originated in the Bald Mountain caldera, located in the central part of the Groom Range about 11 km south of the Don Dale district.

Mineral Deposits

The only deposits known to occur within the NAFR portion of the Don Dale district are low-sulfidation quartz veins that were prospected for gold and silver and one possible disseminated gold prospect.

The veins are narrow, are generally brecciated, and occur along shear zones in Cambrian Prospect Mountain Quartzite. The most extensive workings are at a location that Tingley (1991) referred to as the Big Red prospects. Workings there consist of an inclined shaft, adit and drifts and cuts on at least three parallel, silicified, brecciated faults cutting the quartzite. The faults strike N60°-80°W, but old mine workings follow N20°-30°E cross-structures that cut the silicified outcrops. Brecciated vein material at the prospects consists of fine-grained, bluish quartz with clots and streaks of pyrite and an unidentified gray sulfide. Other prospects in the area near the Big Red workings explore similar veins. The veins vary in strike from northeast to northwest, but most of the pyrite-bearing vein-breccia bodies follow a northeast trend. Vein widths vary from 0.5 m to about 1.5 m and most display iron- and manganese-oxide-stained outcrops. The veins are vuggy and the vugs are commonly lined with clear, acicular quartz crystals. Pyrite and a fine-grained, gray sulfide mineral are found in most of the vein material.

Samples collected from the vein deposits contain variable amounts of gold and silver associated with elevated arsenic, antimony, and mercury. Samples from the Big Red prospects also contained moderately elevated copper, molybdenum, lead, zinc, tellurium, and bismuth.

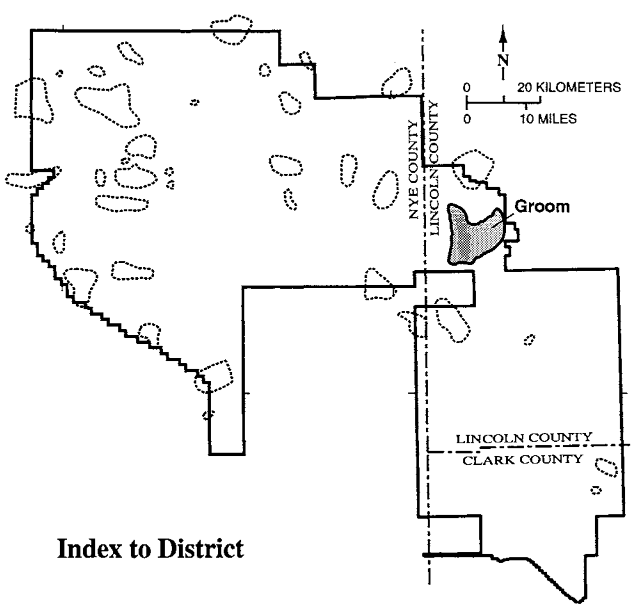
At the B. W. claims in the southeastern part of the district, the geologic setting and trace element associations are similar to those of the Carlin-type disseminated gold deposits presently being mined in northern Nevada. This property includes an area of dominantly limestone outcrops north of Bald Mountain. In places within the claim group, minor jasperoid and hematite-rich gossan occur along bedding planes in thin-bedded limestone. Samples collected from the B. W. claims were elevated in arsenic and mercury and slightly elevated in antimony; no gold was detected, however.

Identified Mineral Resources

There are no identified mineral resources within the parts of the Don Dale district that lie within the NAFR.

Mineral Resource Potential

There is moderate potential, certainty level C, for small silver-gold orebodies along the narrow veins in the western part of the district. Detailed mapping and sampling of the individual structures would be necessary to confirm or eliminate this potential. There is moderate potential, certainty level B, for the discovery of Carlin-type gold deposits in the southeastern part of the district.



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7.3.8.2 Groom District

Location

The Groom mining district includes all of the southern Groom Range in southwestern Lincoln County (fig. 7-1). The district is centered around the historic Groom Mine on the south end of the range, but includes mines and prospects extending from the Groom Mine north to the Don Dale district.

The district has been known as Groom since its discovery and organization in the 1860s. Claim owners near Cattle Spring, north of the Groom Mine, referred to that area as the Goldrock mining district for a short time beginning in 1932 (Goldfield News and Weekly Tribune, May 27, 1932). Goldrock never boomed, however, and the name never came into wider use.

History of Discovery, Exploration, and Mining

The deposit later developed as the Groom Mine was discovered in 1864 and the Groom mining district was organized in 1869 (Tschanz and Pampeyan, 1970). An 1870 account of the Groom district (White, 1871) mentions that ore containing "fine chloride of silver" was present in mines on the western slope of Tem-Piute Peak (now known as Bald Mountain) and some of the earliest activity may have been in the northwestern portion of the range as well as at the site of the present Groom Mine. These mines were worked for a 5-year period, ending in 1874, during which they yielded a small, but unrecorded, production. In 1872, patents were issued on claims covering the Groom deposit and in 1885 the Groom property was acquired by the Sheahan family. Descendants of the Sheahan family still own the Groom Mine. The Golden Star deposit, near Cattle Springs north of the Groom Mine, reported to have been discovered about 1908, was actively prospected into the 1930s and possibly later. This and adjacent properties may have produced a small amount of gold but there is no official record of production. There is no record of production from the Groom district for the 5-year period following the initial discoveries. Tschanz and Pampeyan (1970) reported a steady but somewhat sporadic production from the Groom Mine beginning in 1915 and extending through 1956 with a total production of $935,000 in lead and silver and minor copper, zinc, and gold. Production data from sources available at NBMG (USBM figures and NBMG files) shows the Groom district had far more production than reported by Tschanz and Pampeyan (1970). A compilation of production records is shown in table 7-10.

Previous Investigations

The general geology of the Groom region is described by Wheeler (1872), Gilbert (1875), and Spurr (1903). The first detailed description of the geology of the Groom district was prepared by Humphrey (1945), and later work by Tschanz and Pampeyan (1970) drew heavily from the work of Humphrey. A mineral inventory and geochemical survey of the Groom Range was prepared in 1985 (Quade and Tingley, 1985). This report contained descriptions of most of the mines and prospects in the district, but did not describe the Groom Mine in detail. The Groom district was also described by Tingley (1989) in a report on the mineral resources of the Pahranagat Range 30′ by 60′ Quadrangle.

Table 7-10. Groom district production.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1915	164	0.51	3287	1,480	171,298	
1916	1,455	4.33	26,185	15,488	1,549,723	
1917	1,526	3.7	23,232	14,311	1,425,798	
1918	1,178	1.38	18,623	10,688	1,482,904	
1922	72	0.18	1,201	457	66,731	
1923	263	1.66	4,224	1,901	282,726	
1924	191	0.46	3,326	1,164	215,600	
1925	327	0.62	4,708	1,274	307,245	
1926	245	0	2,922	1,040	180,233	
1927	99	0	1,,561	563	102,488	
1928	146	0.49	2,821	971	183,061	
1929	195	1.17	2		20,613	
1930	77	0.53	1,009	563	64,340	
1931	57	0.56	856	738	68,805	
1933	26	0.31	583	284	31,751	
1934	48	0.36	751	499	53,096	
1936	24	0.1	176	0	11,418	
1937	106	2	493	200	36,700	
1942	4,085	2	5,549	1,800	382,600	
1943	1,560	0	2,828	0	203,500	
1944	1,146	3	6,040		444,000	
1945	2,194	5	8,304	4,000	633,000	
1946	3,107	11	8,530	2,900	717,400	11,100
1947	1,730	0	5,765	3,200	394,300	28,000
1948	1,911	2	3,484	1,700	318,600	
1949	1,690	0	1,205	0	175,600	
1950	2,731	1	1,046	1,200	157,300	
1951	4,511	0	3,437	3,400	409,400	
1952	211	1	1,044	400	64,200	
1953	968	0	333	500	52,500	
1954	2,285	1	990	1,300	152,200	
1956	156	1	764	400	66,300	
Total	**34,484**	**45.36**	**145,279**	**72,421**	**10,425,430**	**39,100**

Present Investigation

The present report draws completely upon earlier work by Humphrey (1945), Tschanz and Pampeyan (1970), and Quade and Tingley (1985). No additional field work was within the scope of the NAFR project. Selected samples taken during the 1985 study were, however, obtained from sample archives of the NBMG, Reno, and the USGS, Denver, and reanalyzed using improved analytical methods. Mineral deposit descriptions have been expanded and, where necessary, interpretations have been revised.

Geologic Setting

The Groom Range consists of a homoclinal sequence of lower Paleozoic rocks that strike north and dip steeply eastward. The Lower Cambrian Prospect Mountain Quartzite, the oldest rock unit, is here more than 2,400 m thick and makes up most of the west half of the range (Humphrey (1945). The total exposed Cambrian section exceeds 6,000 m in thickness, and the total thickness of continuously exposed Paleozoic rocks is about 8,000 m (Tschanz and Pampeyan, 1970). The Paleozoic rocks are covered on the north and east by Tertiary volcanic rocks. The major volcanic feature of the Groom Range is the Bald Mountain caldron, centered on Bald Mountain (Ekren and others, 1977). The caldron measures about 10 km north to south and, before basin-and-range faulting, probably measured an approximately equal distance east to west. The caldron is filled with two or more rhyolite ash-flow tuff units that are informally called the tuff of Bald Mountain (Ekren and others, 1977). Numerous large landslide masses of various Paleozoic rocks are intercalated with the tuffs, and the caldron-filling rocks have been intruded by numerous dikes and sills of porphyritic quartz latite and rhyodacite. The historic Groom mines are situated in a 600-m-wide, complexly faulted graben with Lower and Middle Cambrian shale and limestone dropped down against the Prospect Mountain Quartzite (photo 7-42). Most of the quartzite within the graben appears to be part of a thrust sheet that overlies shale units. West-dipping normal faults of the graben have offset the thrust plate and both the thrust fault and the west-dipping faults are offset by east-dipping, post-ore normal faults (Tschanz and Pampeyan, 1970). The Main fault, a north-striking fault that bounds the graben on the east, is thought to have a vertical movement of over 900 m (Humphrey, 1945). Humphrey (1945) believed that this fault was the primary feeder for the mineralization at the Groom Mine.

Mineral Deposits

The largest and most productive deposits in the Groom district are lead-rich polymetallic replacement deposits at the Groom and Black Metal Mines. Most of the workings of these mines were sunk on visible mineralization that cropped out along north-striking faults of the graben. At the Groom Mine, fissures sympathetic to the north-trending Main fault served as conduits for mineralizing solutions that formed irregular replacement and bedding replacement deposits in the Lower and Middle Cambrian Lyndon Limestone and Pioche Shale (Humphrey, 1945). The bedding replacement deposits formed in three thin limestone beds in the upper part of the Pioche Shale and they contain a large tonnage that ranges between 4 and 5 percent lead. The irregular replacement deposits are in the Lyndon Limestone along steep fissures related to the Main fault. The limestone along the mineralized fissures is commonly silicified. The fissures are in the hanging wall of the Main fault; the limestone beds are also in the west or hanging-wall block of the Main fault and the beds dip to the east, into the west-dipping fault (Humphrey, 1945). Argentiferous galena and subordinate sphalerite are the primary ore minerals, but cerussite and anglesite occur in oxidized, near-surface ores. According to Bob Sheahan (personal commun., 1985), the best silver values at the Groom Mine are associated with replacement orebodies in limestone. In these ores, silver values as high as 23 oz per ton have been obtained.

At the Black Metal Mine ([Black Medal Mine of] Humphrey, 1945), south of the Groom Mine, the ores contain 6 percent to 22 percent zinc with selected samples carrying as much as 30 percent lead (Tschanz and Pampeyan, 1970; Quade and Tingley, 1985).

The Lyndon Limestone, along with the immediately underlying limestone beds of the upper Pioche Shale, contain all of the known orebodies in the Groom mines. These units are of limited depth as a result of their eastward dip into the Main fault, although they are exposed for a distance of about 3 km as a comparatively thin rib along the east edge of the graben (Humphrey, 1945).

All of the samples collected from the replacement deposits at Groom show elevated values in lead, copper, silver, antimony, mercury, cadmium, and zinc. Zinc values, while high in most Groom ores, are highest in ore from the Black Metal Mine. Gold values are uniformly very low, and cadmium values are variable. Mercury values are very high, much higher than would be expected for this type of mineral occurrence.

Narrow, polymetallic quartz veins hosted by the Prospect Mountain Quartzite have been prospected for gold in several locations west and northwest of the Groom Mine. These veins range from a few centimeters up to 1 m in thickness and are commonly brecciated and stained with iron and manganese oxides. Tetrahedrite, galena, and pyrite occur with quartz in unoxidized vein material. The veins strike north to northeast, dip northwest and generally are parallel to bedding in the host quartzite. Some veins were formed in shaly, argillaceous interbeds within the quartzite.

One of these occurrences, the Kahama Mine about 5 km northwest of the Groom Mine, explores a N5°-10°E-striking, tungsten-dipping quartz vein. Wall rock adjacent to the vein has been chloritized and is laced with quartz veinlets. The vein is vuggy and is stained with iron- and manganese-oxides. Workings at the Kahama Mine consist of two inclines, trenches, and stopes dug along about 1 km of vein outcrop. A composite sample of vein material collected from a number of cuts along the outcrop in 1980 contained 0.245 oz gold per ton and 0.273 oz silver per ton (L. H. Beal, personal commun., 1985). The vein, where sampled, ranged from several centimeters up to 0.5 m in width.

At the Kahama property, few other elements are associated with gold. Arsenic is generally elevated and bismuth, mercury, lead, and antimony are moderately elevated in some samples from the property. Silver-to-gold ratios in the Kahama ores range from about 1:4 to 1:10.

On the Chicago, Illinois, and Wisconsin claims about 900 m north of the Kahama Mine, workings expose a similar north-trending quartz vein that cuts a shaly unit within quartzite. This vein is parallel to, but west of, the vein exposed in the Kahama workings. Galena and pyrite are present in the vein outcrop along with iron- and manganese-oxides. This vein is exposed for about 250 m along strike by three adits, trenches, and numerous cuts.

Geochemical associations in these ores are similar to those at the Kahama with the exception that lead and antimony values are much higher; lead is highly elevated and antimony is moderately to highly elevated. Silver-to-gold ratios are much higher in samples taken from these prospects, ranging from about 6:1 to 200:1.

North of the Chicago Group of claims and slightly less than 1.6 km southwest of Cattle Spring, workings of the Golden Star and Highgrade properties explore a northeast- to east-trending vein system. The veins crop out along the upper margin of a small basin south of the Cattle Spring drainage and may cross a north-trending ridge to the adjacent Highgrade Mine. The veins exposed at the Golden Star, the Highgrade, and at several outcrops between the two, range from 15 to 50 cm thick, are stained with iron and copper oxides at the surface, and contain variable amounts of galena and tetrahedrite. The veins are brecciated and crosscut bedding in the quartzite wall rock. The wall rock is kaolinized and chloritized near the veins.

Workings at the Golden Star consist of numerous cuts and a short adit in the upper basin outcrop and a lower main adit about 75 m below the upper. The Golden Star vein strikes N70°E and dips 55° to the northwest. The lower adit crosscuts southeast 80 m to the vein intersection then turns to follow the vein along strike for about 18 m.

In 1932, the owner of this property reported the discovery of a rich oreshoot on the vein; a sample of the material assayed 3 oz gold and 6 oz silver per ton(Goldfield News and Weekly Tribune, May 27, 1932).

The vein exposed at the Highgrade Mine also strikes N70°E, but dips 70° to 75° to the northwest. The Highgrade Mine is developed by an inclined shaft, now (1985) flooded with water to within about 10 m of the collar. Dumps present at the shaft collar suggest that there may be 100 m or more of underground workings in the mine.

The ores at the Highgrade and Golden Star properties contain gold in association with silver, copper, lead, bismuth, and mercury. Silver values are higher than in the properties to the south, and mercury values are highly elevated. The silver/gold ratio in the samples taken ranges from about 20:1 to over 4,000:1.

Stream drainages below the Kahama-Chicago, Illinois, and Wisconsin properties and the main drainage west of Cattle Spring were worked for placer gold using dry washers (Humphrey, 1945). There is no record of this production, but a few gold nuggets up to the size of a grain of wheat were reported.

The Gold Butte and Jumbo claims, staked in 1933, cover the northernmost of the prospects on the west side of the Groom district. The claims are located about 2.5 km west of Cattle Spring. Although notices found on the Jumbo claims document activity in 1933, the workings appear to be much older and may date back to the 1870 period of activity.

Workings at the Gold Butte claims explore several quartz veins that follow a N20°-50°E-striking, northwest-dipping shear zone in quartzite. The main vein is up to 1 m thick and can be traced in outcrop for more than one hundred meters along strike. The vein is brecciated and recemented by hematite and manganese oxide.

On the Jumbo claims, a 10- to 15-m-deep prospect shaft was sunk to explore a N70°-75°W-striking, 60°SW-dipping quartz vein formed along a shale-quartzite contact. Shale wall rock is brecciated and laced with limonite-hematite veinlets. The vein quartz is brecciated and recemented by quartz; the breccia matrix contains magnetite and pyrite.

Metal values obtained from samples taken on the Gold Butte and Jumbo claims were generally low. Base-metal values were slightly elevated but were much lower than values found at the Golden Star and Chicago, Illinois, and Wisconsin claims. Zinc values were slightly higher but lead values were much lower. Silver-to-gold ratios range from 1:1 to over 600:1. These values are not very meaningful, however, since the highest silver value was only about 4 oz per ton, and the highest gold value was only 0.05 oz per ton.

There are a few scattered prospects on the east side of the Groom Range. Most of these were dug on outcrops of iron-oxide-stained fault zones in quartzite or volcanic rocks and none have been developed beyond the raw prospect stage. Samples taken at these prospects were essentially barren of metals.

Identified Mineral Resources

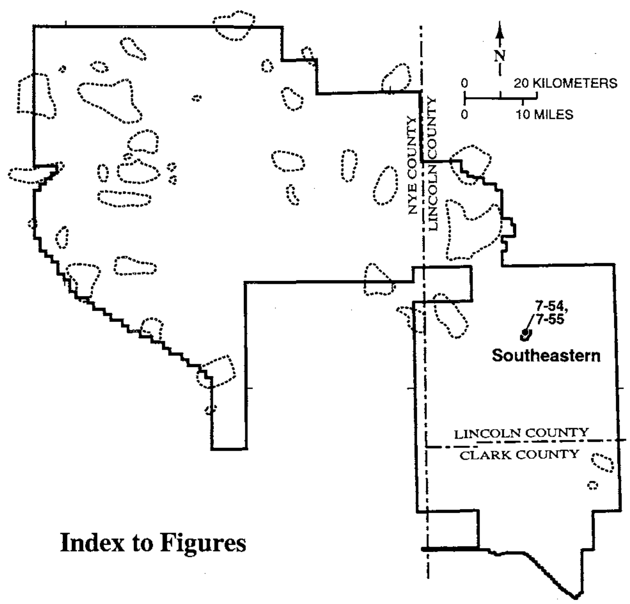
There are no identified mineral resources known to be present within those parts of the Groom district included within the NAFR. Surface samples collected by Beal (personal commun., 1985) along the Kahama vein contained values in gold that would be ore grade if sufficient tonnage of mineable-width material were present. There is insufficient information on vein width and depth extent, however, to estimate ore reserves for the Kahama property. There may be reserves of lead ore within the Groom Mine property but the Groom Mine is privately owned and is not part of the NAFR mineral assessment.

Mineral Resource Potential

There is high resource potential, certainty level C, for polymetallic replacement deposits within the central graben that contains the Groom and Black Metal Mines. The prospective area is west of the Main fault, and extends from the pediment south of the Black Metal Mine north to the point the north-striking faults that form the graben boundary pass under volcanic cover rocks. This area extends beyond the boundary of the private land surrounding the old mines.

There is also moderate potential, certainty level C, for the discovery of small silver-gold deposits (polymetallic vein type) on the Kahama; the Chicago, Wisconsin, and Illinois; and the Golden Star vein systems. These veins, in outcrop, range from a few centimeters up to 1 m in thickness and undiscovered ore sections in them could be expected to be of the same limited dimensions. Values could be expected to be mainly in silver, with small amounts of associated gold.

7.3.9 Pintwater Range



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7.3.9.1 Southeastern District

Location

The Southeastern district is located at the north end of the Pintwater Range near its junction with the Desert Range. The district is on the southeastern margin of Emigrant Valley about 30 km southeast of the Groom Mine. Most of the mines and prospects of the district are situated in section 33, T9S, R57E and section 4, T10S, R57E, Lincoln County.

The district name appears as Southeastern in the earliest reference to the area (Whitehill, 1873). This name apparently fell into disuse for a time, however, for claims staked in 1904 used no district name. In the 1920s, reports referred to the area as the Arrow district. The Arrow Mining Co. controlled the major property in the district at that time. By 1970 the district was simply called Arrowhead Mine after the name used for one of the mines located there (Tschanz and Pampeyan, 1970).

History of Discovery, Exploration, and Mining

The Southeastern district was discovered and organized in September 1870 at which time seven locations were made (Whitehill, 1873). No records exist of this early work, however, and little is known of the district until 1904 when the four claims of the South Eastern Group were staked and surveyed by the Arrow Mining Co. (Mineral Survey 2214 A, BLM records). These claims were patented June 8, 1907 (Mineral Certificate 824, BLM records). Shaft sinking and drifting were being done on the patented claims in 1919 (Lincoln County mining records), but no production was mentioned. In 1921, the Arrow Mining Co. was still active in the district. An additional fourteen claims had been staked around the original four and patents were applied for on these. The company stated that some $60,000 had been spent on the property, including $20,000 by previous owners, and drifting was being done from the bottom of a 206-foot (63 m) shaft (Weed, 1921). By 1922, the Arrow Mining Co. was stating that eighteen of their claims in the district were patented (Weed, 1922). This may be in error, however, as patent documents were found for only the original four South Eastern claims. Activity in the Southeastern district becomes vague again after about 1931. Taxes on the patented claims were being assessed to Milt Steele and others, through 1958, then to Teledyne, Inc. through 1977 (Lincoln County official records). Production records of the Southeastern district were found for only two years, 1940 and 1947. During those two years, Milt Steele produced 31 tons of ore containing 352 oz silver, 1,400 pounds of copper, and 2,700 pounds of lead (USBM records, NBMG files).

Previous Investigations

The Southeastern district was mentioned by Wheeler (1872), and the geologic setting was briefly described by Tschanz and Pampeyan (1970).

Present Investigation

Mines and prospects in the Southeastern district were mapped and sampled by R. Nicholson between 1991 and 1995.

Geologic Setting

The northern Pintwater Range is composed mainly of Paleozoic carbonate rocks that generally form the west limb of a large anticline, the east limb being the Desert Range (Tschanz and Pampeyan, 1970). Rocks cropping out in the Southeastern district are mainly limestones of the Ordovician Pogonip Group and the overlying Eureka Quartzite. The Southeastern district lies immediately southeast of the Arrowhead Mine fault, a northeast-trending fault of Laramide age. This fault is the northwestern-most of a set of faults comprising the Pahranagat shear zone, a regional structure interpreted to be a major basement shear zone with as much as 50 km of right-lateral movement (Tschanz and Pampeyan, 1970). The mines and prospects in the Southeastern district occur along silicified fault zones near the top of the Pogonip Group. These structures generally follow the same northeast trend as the regional Arrowhead Mine fault.

Mineral Deposits

The deposits in the Southeastern district are classified as polymetallic replacement deposits of lead, copper, and silver formed in brecciated carbonate rock along faults. Early reports on the district (Whitehill, 1873) stress the abundance of copper in the ore, and state that ore occurs in quartzite and porphyry; porphyry (i.e., igneous rock) has not been found in or near the district. Later descriptions (Weed, 1921) describe the occurrence as "fissure veins in quartzite and lime," a more accurate depiction as the fault-controlled deposits are vein-like in form.

Workings at the Arrowhead (Southeastern or Argentine) Mine consist of a main shaft, about 43 m deep with workings on the 20-m level (photo 7-43); a large cut with two shafts of unknown depth east of the main shaft (one of these could be the 206-foot (63 m) shaft mentioned by Weed, 1921); an adit over 120 m long in the canyon to the east of the main shaft (photo 7-44); and numerous shallow declines, cuts, and pits. Most of the early work in the district is believed to have been restricted to the adit and other prospects in the canyon as remains of two fairly primitive mining camps were found in the wash; debris and tools found near the camp sites and workings suggest a turn-of the century age (R. Nicholson, personal commun., 1995).

The Arrowhead Mine workings follow a steep, fairly narrow, shear zone in limestone that can be traced in surface exposures from the shaft northeast to the adit area, a distance of about 500 m. The surface pits and cuts, as well as the underground workings, follow a general N50°E trend, but individual shear structures vary from N20°E to N70°E.

The main shaft was sunk about 43-m (fig. 7-54) on the brecciated fault zone that, at this point, dips 53° to the east. Twenty meters below the collar of the shaft, a drift follows the fault northeast for approximately 15 m. A sample of the silicified carbonate breccia from this drift assayed 27.9 oz silver per ton, 4.91 percent copper, 10.2 percent lead, and 3.1 percent zinc (Sample 91-11, appendix C).

On the mine structure about halfway between the main shaft and the adit, a cut in the north slope of a ridge exposes both a northeast-trending, near-vertical rubbly zone and a northeast-trending, low-angle, southeast-dipping silicified zone formed along bedding in limestone. Secondary copper minerals melaconite, chalcocite, malachite, and chrysocolla, are present as stains, coatings and small pods and lenses along both structures. One sample collected at this site contained approximately 29 oz silver per ton, 3.5 percent copper, and 8.8 percent lead with elevated values in zinc, tellurium, arsenic, antimony, cadmium, and mercury (Sample 5148, appendix C).

The adit in the canyon to the northeast (fig. 7-55) was driven N33°E for over 120 m along the "mine" shear zone. At this location, the shear structure dips steeply to the east. Most of the mining in the adit appears to have been done in silicified fault breccia; the breccia is oxidized and contains abundant secondary copper minerals. With the exception of a 10-m winze with an additional 15- to 20-m of drifts, very little development work such as stoping or crosscutting was done from the adit. A sample collected from the northerly drift off of the winze assayed 7.28 oz silver per ton, 1.84 percent copper, 4.57 percent lead, and 1.75 percent zinc (Sample 91-12, appendix C).

Northwest of the adit about 300 m, a parallel structure with associated copper-oxide mineralization cuts limestone. This structure may correlate with the northeast-trending structure exposed along the nose of a ridge about 245 m northwest of the main shaft. This structure, like the structure followed in the Arrowhead Mine workings, is generally parallel to the regional Arrowhead Mine fault of Tschanz and Pampeyan (1970).

Nearly all of the samples collected in the Southeastern district contained highly elevated silver, copper, and lead, with many values in the percent range. Arsenic, antimony, cadmium, and mercury were also highly elevated and tellurium was very high.

Although many samples collected in the Southeastern district contain copper and lead in the percent range, with multi-ounce silver values, the structures are not well enough exposed to allow tonnage and grade estimates to be made.

Identified Mineral Resources

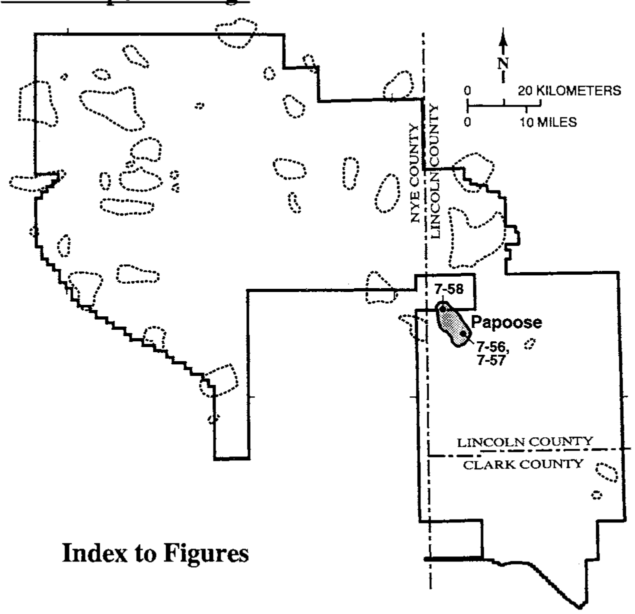
No identified mineral resources are present in the Southeastern district.

Mineral Resource Potential

Structures exposed in the Southeastern district are persistent and geochemical associations of the ores sampled are consistent with those of polymetallic replacement deposits. Prospecting in the Southeastern district has been confined to narrow shear zones exposed at surface. While occasional lenses of high-grade mineralization may be found along known structures or along undefined parallel structures, the major potential of this district is for the discovery of manto-like replacement deposits that may exist in favorable limestone horizons below surface. Prospecting would be conducted by searching for intersections of the mineralized fault or shear zones with suspected favorable replacement horizons and drilling these targets. Surface mapping would first be necessary to determine attitudes and thickness of the carbonate rocks to determine if such targets could exist. The expected targets would be combination silver-copper-lead orebodies with values mostly in copper and lead. Silver values from surface ores in the district are high, however, and replacement orebodies could also be high in silver, allowing smaller, deeper deposits to be economically feasible.

The potential for discovery of small polymetallic silver-copper-lead orebodies is rated high, certainty level C. The potential for the development of manto-like polymetallic replacement deposits in the Southeastern district is rated high with a certainty level B.

7.3.10 Papoose Range



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7.3.10.1 Papoose District

Location

The Papoose district includes all of the Papoose Range in southwestern Lincoln County. The range and the encompassing district lie between Groom Lake and Papoose Lake

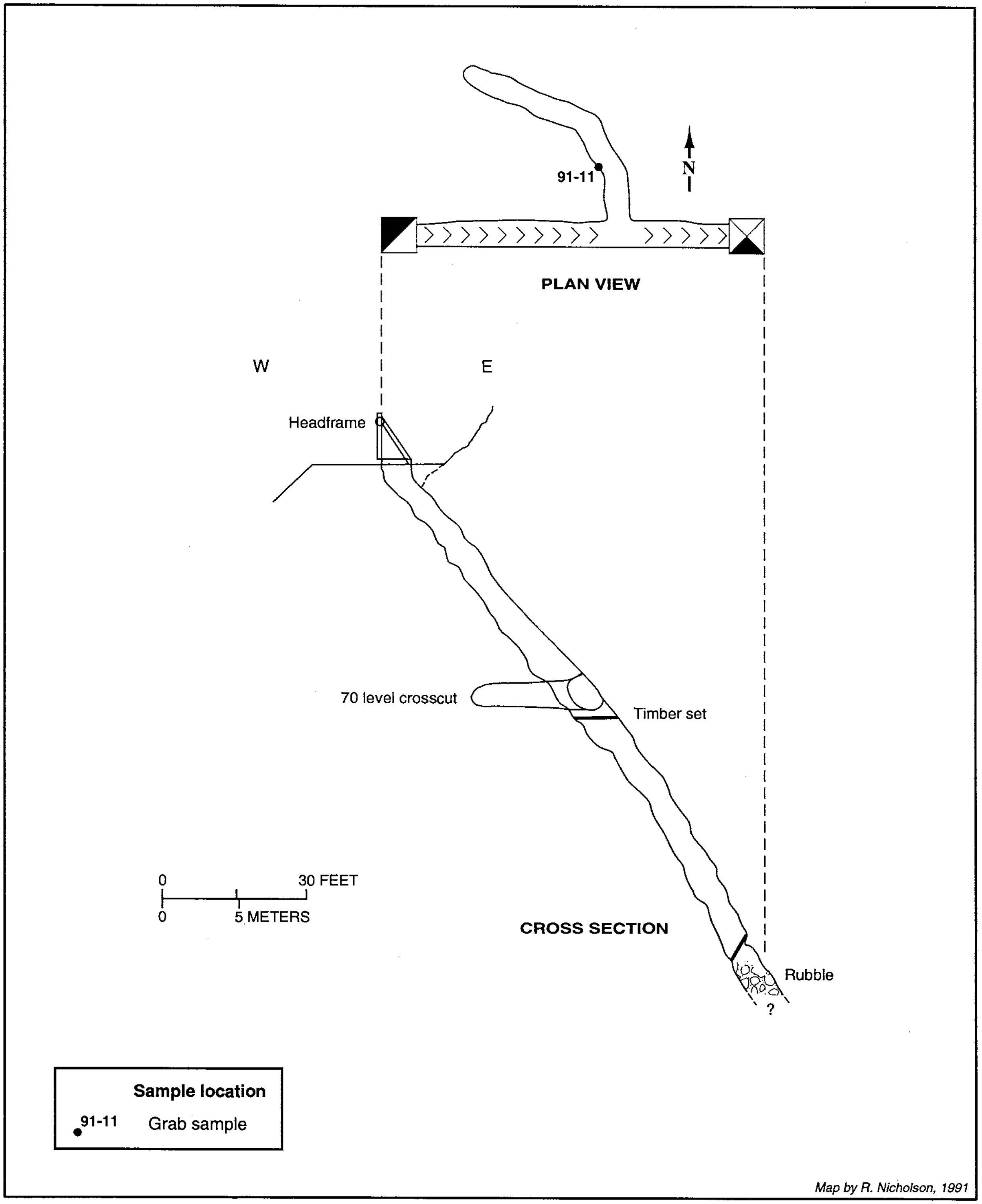


Figure 7-54 Cross sectional and plan view of the Southeastern (Arrowhead) shaft, Southeastern mining district, Lincoln County, Nevada.

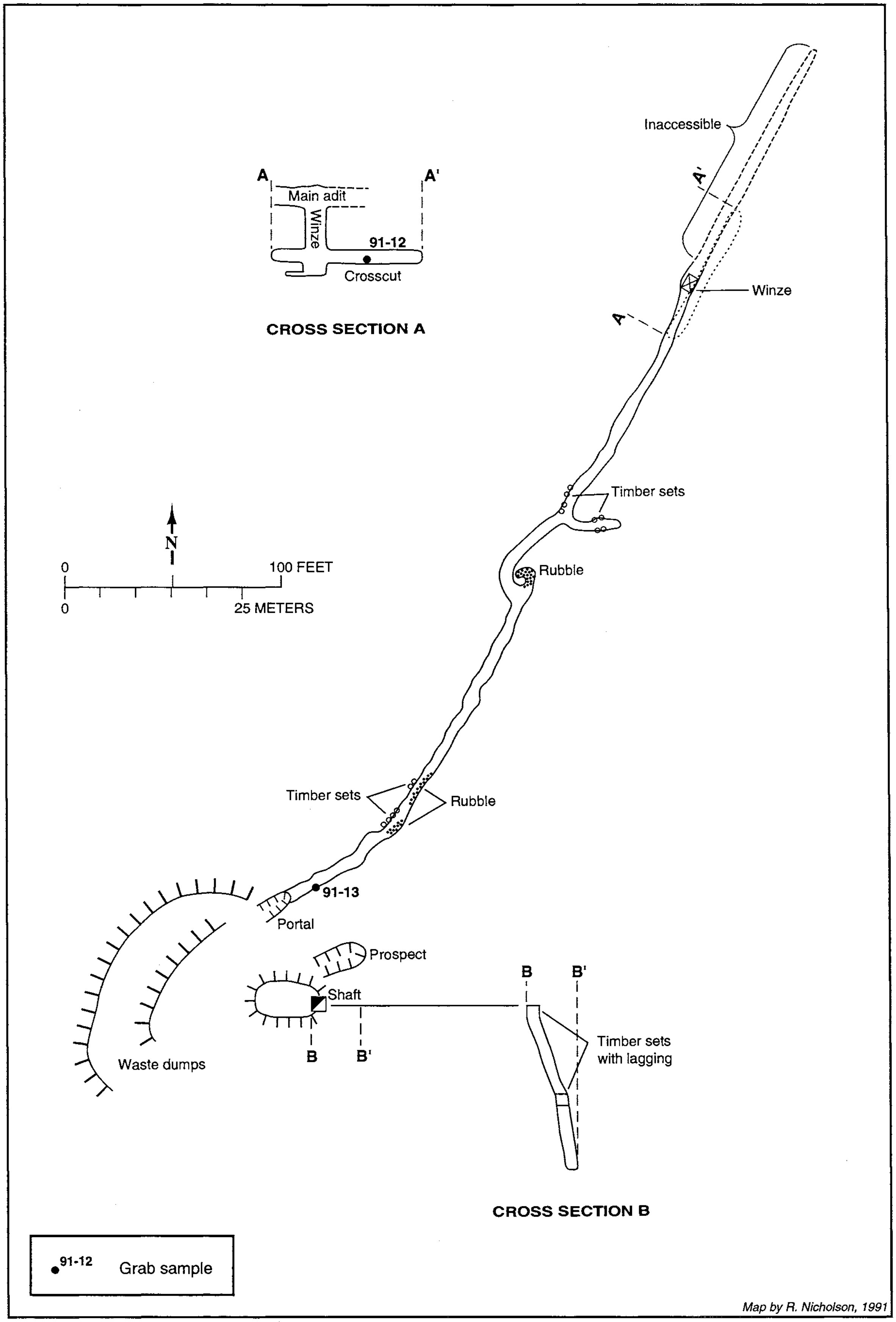


Figure 7-55 Plan and cross sectional view of the Southeastern mine main adit with winze and nearby shaft, Southeastern mining district, Lincoln County, Nevada.

at the south end of Emigrant Valley. Most of the prospects and the one major mine in the district, the Kelly, are on the east side of the range.

Newspaper reports of activity at this site in the 1930s referred to it simply as the Kelly Mine, without any specific district name. Tschanz and Pampeyan (1970) used the name Papoose, and that name is used in this report.

History of Discovery, Exploration, and Mining

The earliest records of mining activity in area of the Kelly Mine are relocation notices filed on the Blue Bell claims by James Kelly in April 1909 (Lincoln County official records). Relocation, of course, implies the original claims in the district were staked before 1909. A proof of labor notice filed on these claims in 1910 describes a 30-foot (9 m) shaft on the Blue Bell No. 4 Claim. No other activity was recorded in the district until 1929 when new claims were filed. Proof of labor notices were filed up to 1937 and most of the development work in the district is believed to have taken place during this period.

According to Tschanz and Pampeyan (1970), recorded production from the Papoose district is 1,157 oz silver, 3 oz gold, and 44 pounds of lead. These figures do not match production records on file at NBMG, and are much lower than production listed by tungsten. A. Smith, owner of the Kelly Mine in 1940 (unpub. document, NBMG files). Smith reported that Kelly, the original mine owner, shipped three cars of ore to the U.S. Smelting and Refining Co. smelter in Salt Lake City in 1916. Smith shipped one car (year unknown), and lessees shipped two cars to the A. S. & R. Co. smelter in 1926. The three cars of ore shipped in 1916 assayed 39, 41, and 53 percent lead respectively; Smith's car of ore assayed 46 percent lead; and the ore shipped in 1926 assayed 42 percent lead. These six cars of ore total between 100,000 and 200,000 pounds of lead (depending on the size of the railroad car), far more than is officially credited to the mine. In addition, production is on record for 1933, 1937, and 1938. For these years, 77 tons of ore were produced that yielded 1.54 oz gold, 497 oz silver, 400 pounds copper, and 49,686 pounds lead (USBM records, NBMG files).

Present Investigation

Sampling and examination of mine workings in the Papoose district were carried out by R. Nicholson, DRI, between 1991 and 1995.

Geologic Setting

The Papoose Range is mostly composed of complexly faulted Cambrian Prospect Mountain Quartzite. Tertiary volcanic rocks unconformably overlie the quartzite at the north end of the range and Cambrian carbonate rocks are present along the east side. A small outcrop area of Precambrian Johnnie Formation has been identified on the northwest flank of the range (R. Nicholson, personal commun., 1994). This area has not been mapped in detail, and the extent of the Johnnie Formation is unknown.

A major north-trending fault east of the Kelly Mine is inferred between the Prospect Mountain Quartzite and the low hills of Cambrian limestone and dolomite (Tschanz and Pampeyan, 1970).

Mineral Deposits

Two types of mineral deposits have been explored in the Papoose district. At the Kelly Mine, pod-like polymetallic replacement deposits of lead and silver were mined. The replacement deposits formed along fracture zones and fault intersections in Prospect Mountain Quartzite. In the northwest part of the district, a gold-bearing gossan zone in shale of the Johnnie Formation has been prospected.

The four major workings that make up the Kelly Mine are situated on a low hill of Prospect Mountain Quartzite at the southeast corner of the Papoose Range. At the Kelly adit on the east side of this hill (fig. 7-56, photo 7-45), the quartzite, which strikes northwest and dips 50°-60° to the northeast, has been extensively fractured. One set of irregular fractures coincides with the quartzite bedding while the other strikes generally east-west and dips northerly (Romney, 1940). Mineralization occurred as irregular, lenticular replacement masses along both sets of fracture planes. In the main adit of the Kelly Mine, the quartzite is highly broken and some lead carbonate is visible in joints and cracks. The adit follows a generally west-trending shear zone. A rubble zone along the fault has been stoped both above and below the adit level but most of the ore mined from this workings was taken from a stope above the level. The stope is on an intersection of fracture planes, has a sill length of about 6 m and has been mined for an average width of about 1 m. At the west end of the adit, the main shear zone is cut by a northerly cross-structure. A pipe-like orebody evidently formed in the fractured zone at this structural intersection. A winze at this point was sunk that follows the rake of the intersection 20 m down to the next lower level. At the bottom of the 20-m winze, the quartzite country rock is solid and the ore minerals are confined to a zone about 1 m thick. The drift from the bottom of the winze follows an easterly striking fissure, and two small stopes were started on the mineralized structure (Romney, 1940). The mineralized fractures are heavily stained with limonite and hematite. Visible minerals are cerussite, malachite, and chrysocolla. Samples collected underground from the Kelly adit workings were high in lead and copper with elevated values in mercury, arsenic, antimony, and zinc. The main values are in lead and copper (samples 91-4, 5, and 6, and 91-20 and 21, appendix C).

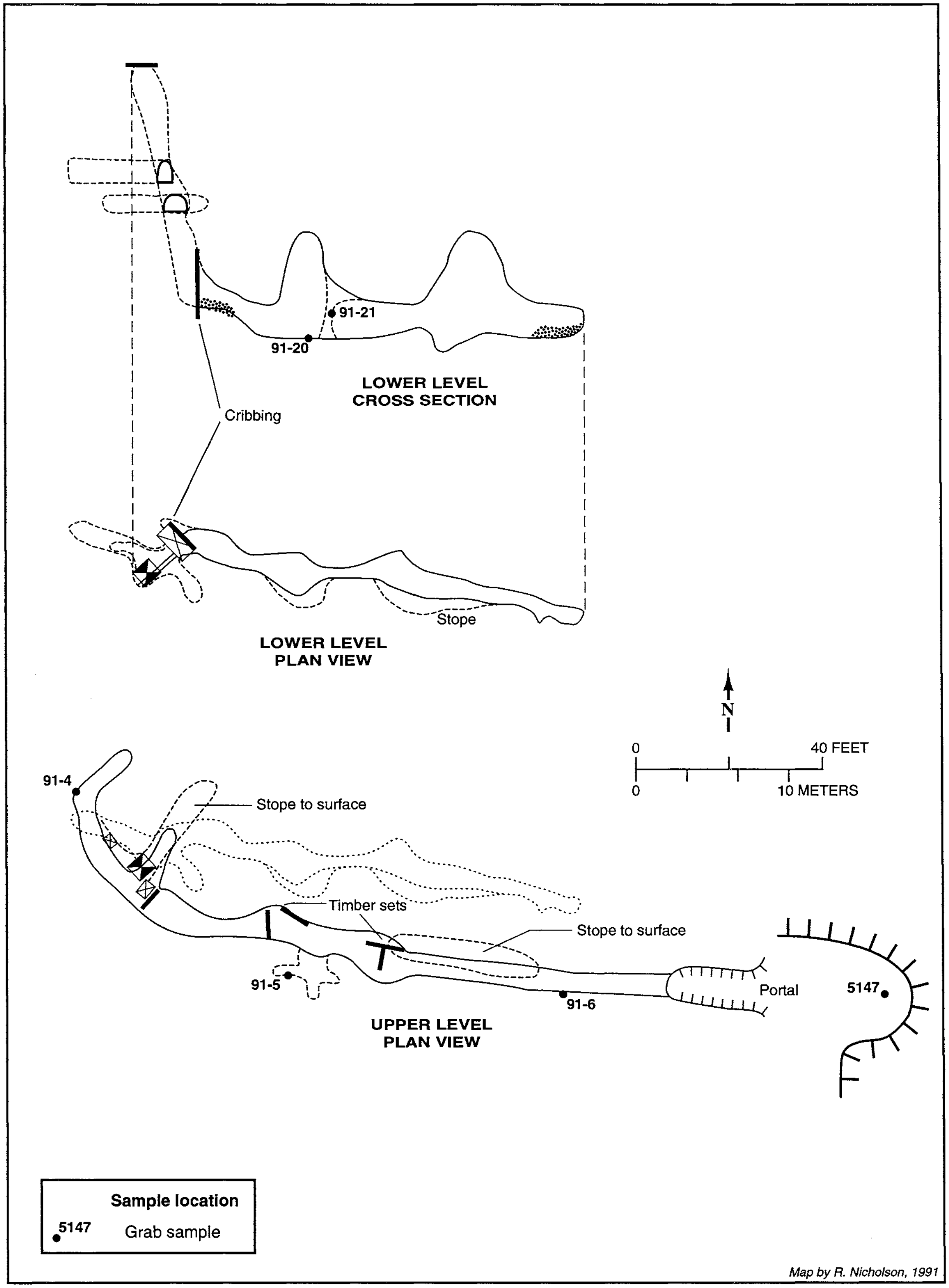


Figure 7-56 Cross sectional and plan views of the major levels of the Kelly mine, Papoose mining district, Lincoln County, Nevada.

At the Kelly Shaft, on the west side of the quartzite hill, some stoping and crosscutting was done from the bottom of a 64 m inclined shaft (fig. 7-57, photo 7-46). The shaft stopes are irregular and parallel the 45° easterly dip of the shaft. Three samples collected at this site (samples 91-16, 17, 18, 19, appendix C) were of breccia and fault gouge filling fracture zones. One sample, 91-18, was of silica-replacement material in limestone. Lead values in these samples were high, zinc was high, copper was moderately elevated, and arsenic and antimony were only slightly elevated.

In addition to the Kelly Mine, prospects were found in one other area in the Papoose district. At the north end of the range, near the base of the western slope, a prospect has been developed by a shallow adit and small excavations dug into the slope (West Windy prospects, fig. 7-58). Although the adit appears to have been driven through barren ground, the excavation, extending approximately 15 m underground, is in highly altered, fractured, hematite-stained rock. The open cut exposes a lens of massive, flat-lying, hematite-limonite gossan formed in fissile shale. The gossan lens is about 2-m thick in the center and dips gently to the north, toward the wash. The adit driven south from the south bank of the wash does not, however, intersect the zone. The outcrop of the lens is black from manganese-oxide-rich desert varnish. The hillside to the east of the cut is composed of Cambrian Prospect Mountain Quartzite; the shale exposed in the cut is Precambrian Johnnie Formation (R. Nicholson, personal commun., 1994), an older formation that underlies the Prospect Mountain Quartzite in ranges to the north and south. Samples collected at this prospect (samples 91-23, 5502, appendix C) contained elevated gold, arsenic, antimony, mercury, and bismuth. Copper and lead values were moderately elevated and zinc values were not elevated.

Identified Mineral Resources

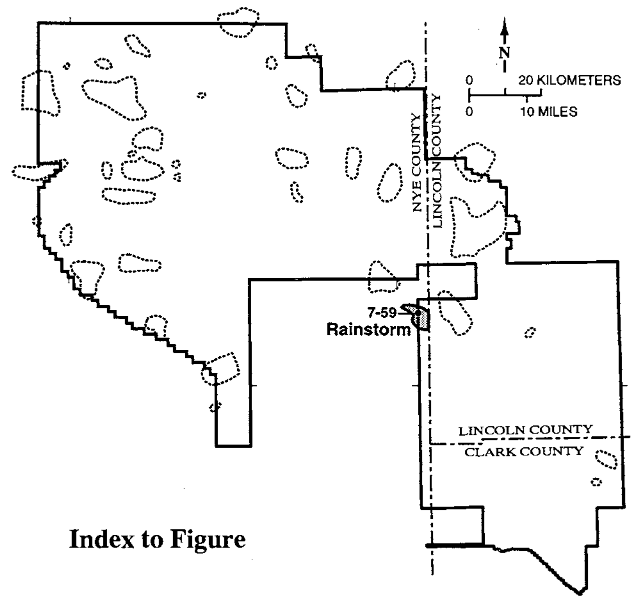
There are no identified mineral resources in the Papoose district.

Mineral Resource Potential

There is high potential, certainty level C, for the development of additional polymetallic replacement orebodies of oxidized lead-silver ore in the immediate area of the Kelly Mine. Prospecting for these deposits would be done by drilling along strike and down-dip on structures exposed in the old mine workings and mapping and sampling on surface near the workings to define other mineralized structures. The expected rewards would be small lenses of ore similar to those mined; high in lead with accessory silver and some value in copper. The Precambrian Johnnie Formation, the rock unit that underlies the Prospect Mountain Quartzite, can be expected to be present at depth in the Kelly Mine area. If geologic mapping determined the Johnnie were within reasonable distance beneath the fracture-controlled mineralization at the Kelly, there could be potential for manto-like, lead-copper-silver replacement deposits in the underlying unit. There are dolomite units in the upper portion of the Johnnie (Tschanz and Pampeyan, 1970) that could provide favorable replacement horizons. Based on the limited information available, the potential for discovery of manto deposits in the Kelly area is low with a certainty level of B.

There is moderate potential, certainty level B, for discovery of replacement orebodies of low-grade, bulk-mineable gold in the northwest portion of the Papoose district. Little information is available on the gold-bearing gossan exposed at this site, but detailed geologic investigation of the area could define areas favorable for discovery of large, low-grade gold deposits formed in favorable carbonate rocks or shale in the Johnnie Formation.

7.3.11 Halfpint Range



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7.3.11.1 Rainstorm area

Location

The Rainstorm area is located on the northeast side of Cockeyed Ridge, a northwest-trending ridge that forms the northeastern portion of the Halfpint Range. The mines and prospects are on the east side of Cockeyed Ridge, west of the low divide in Emigrant Valley that separates Groom Lake basin on the north from Papoose Lake on the south. This area is in Nye county.

Kral (1951) and Tingley (1992) included this area in the Oak Spring district although it lies approximately 13 km southeast of the main part of that district. Claims filed in the 1920s referred to the area as the Rainstorm mining district.

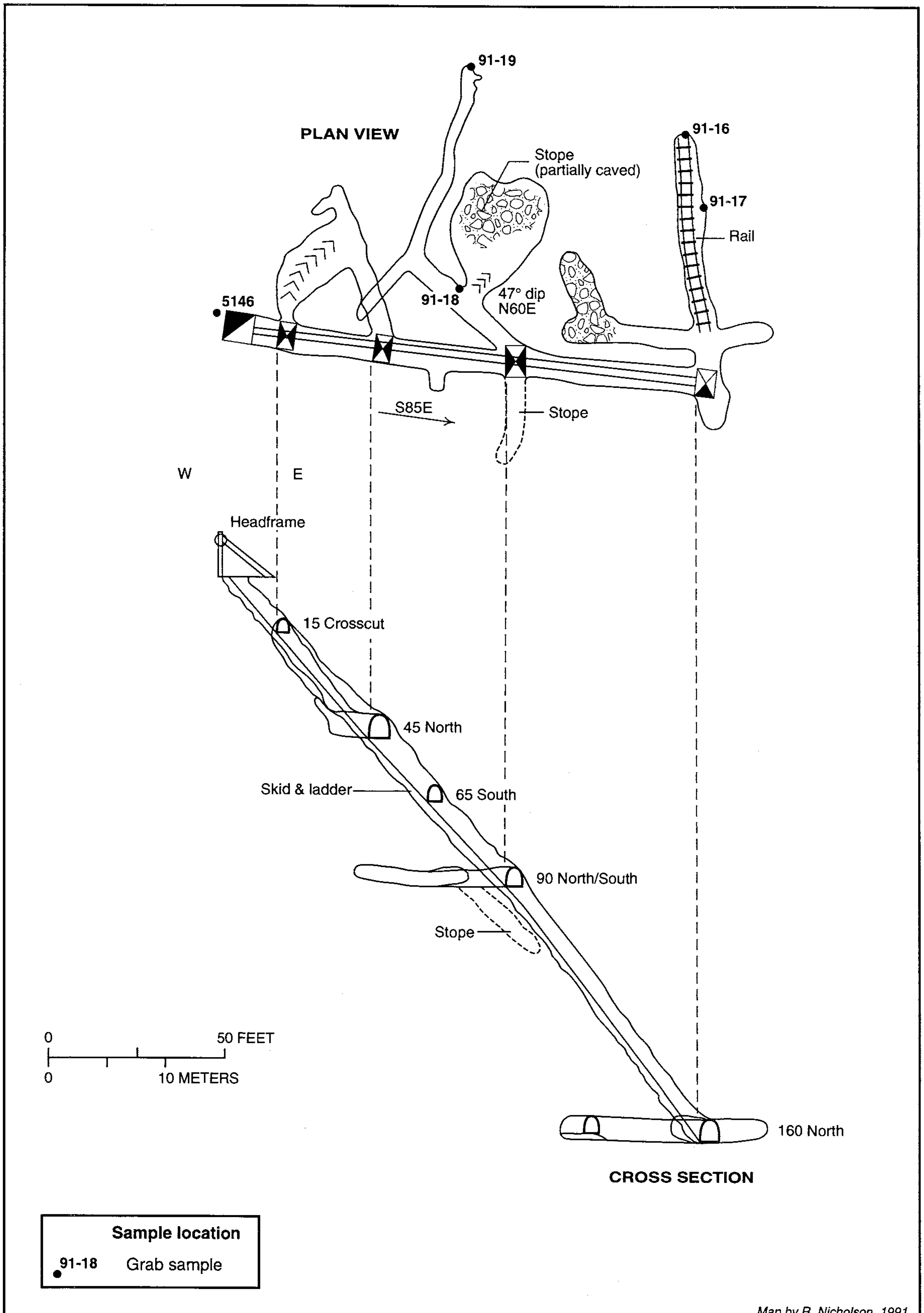


Figure 7-57 Cross sectional and plan views of Kelly shaft, Papoose mining district, Lincoln County, Nevada.

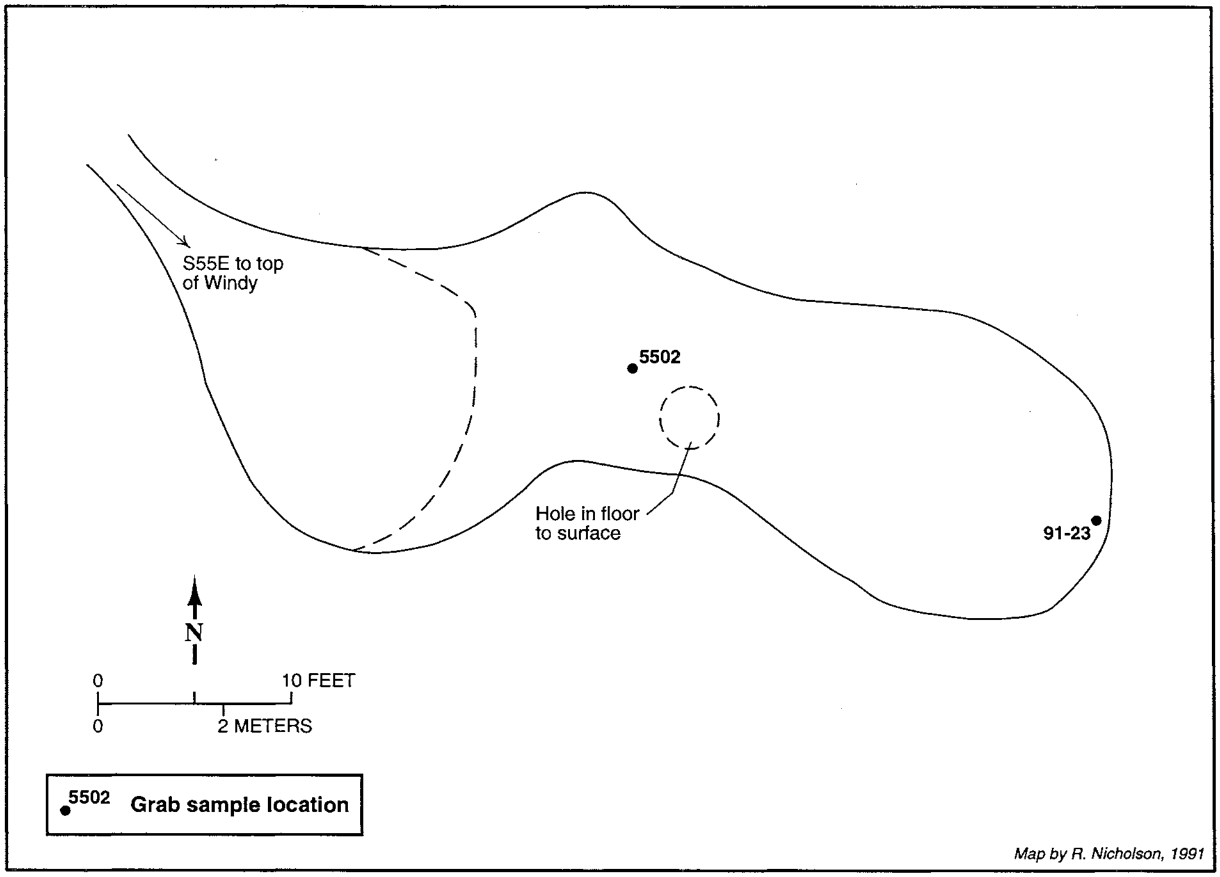


Figure 7-58 Plan view of West Windy prospect, Section 28, T8S, R55E, west side of the Papoose Range, Lincoln County, Nevada.

History of Discovery, Exploration, and Mining

The original Rainstorm Claim was located in February 1928 and additional locations were filed in 1929-33 (Nye County official records). The first production is credited to F. A. Monson in 1933. USBM production records (NBMG files) show production of 37 tons of ore containing 4.74 oz gold, 888 oz silver, 128 pounds copper, and 41,041 pounds lead from the Snowstorm Mine of F. A. Monson in 1933. This property is credited with 2 tons of ore containing 30 oz silver and 1,700 pounds of lead in 1950. This production does not exactly match with Kral (1951) who reported 80 tons shipped prior to World War II "said to contain 55 percent lead, 25 oz silver per ton, and 0.25 oz gold per ton."

Present Investigation

Background information on the Rainstorm area was taken from Quade and Tingley (1984) and Tingley (1989). The area was examined and sampled by R. Nicholson between 1991 and 1995.

Geologic Setting

The eastern part of Cockeyed Ridge is underlain by Precambrian Johnnie Formation and Precambrian Sterling Quartzite (Cornwall, 1972). The upper part of the Johnnie Formation, consisting mostly of shale, siltstone, and silty limestone, has been named the Rainstorm Member by Barnes and others (1965) for exposures near the Rainstorm Mine. The Sterling Quartzite conformably overlies the Johnnie Formation in the Specter Range to the south but in the Rainstorm area, all contacts between these two units are mapped as thrust faults or normal faults (Cornwall, 1972). All of the mines and prospects in the Rainstorm area are within the Johnnie Formation.

Mineral Deposits

All of the mineral deposits seen and described in the Rainstorm area are polymetallic veins following faults and shear zones in quartzite and siltstone units of the Johnnie Formation. The values are mainly in lead and silver with minor associated copper and gold.

The Rainstorm Mine workings (fig. 7-59) consist of a 58-m shaft with a 6-m crosscut at the 27-m level, a 67-m adit with a 64-m drift along the main vein, and several small prospect pits. The workings are aligned along a nearly vertical vein system that strikes N70°W. Veins exposed in the main shaft are highly oxidized and brecciated and are up to 60 cm wide in places. Minerals present are galena, oxide-copper minerals, and iron-oxides. The adit is collared at the bottom of the hill northwest of the shaft; both are on the same vein, but they do not connect underground. The adit follows the N70°W vein in an irregular fashion for its entire length. At about 58 m from the portal, a lateral trends N25°E for about 64 m, apparently following a second vein. Quade and Tingley (1984) reported that mineralization appears limited to the N70°W vein. Samples collected from the shaft ranged from 20 to 58 oz silver per ton with high lead values and minor copper. Samples collected from the adit and its dump were high in lead with lesser amounts of silver and copper. Elevated bismuth, tellurium, and uranium values were found to occur in some samples from this area (appendix C).

About 2.5 km southeast of the Rainstorm Mine, several small prospects and a shaft explore a series of N70°W-striking, near-vertical quartz veins in fractured, altered quartzite and siltstone of the Johnnie Formation. These veins are on the southeastern projection of the Rainstorm veins. The veins are brecciated and oxidized but samples collected here contained only trace amounts of silver and gold with low base-metal values.

Identified Mineral Resources

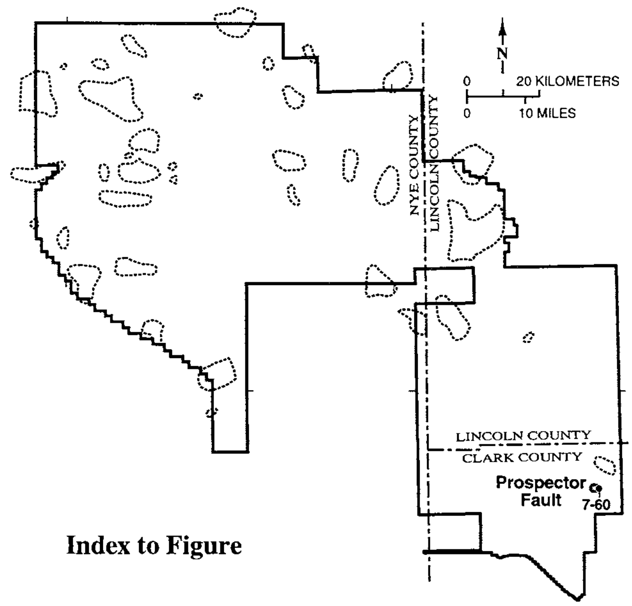
There are no identified mineral resources within the Rainstorm area.

Mineral Resource Potential

Within the area of the Rainstorm Mine and extending several kilometers to the southeast are numerous highly oxidized, brecciated quartz veins that crop out along silicified fault zones in the Johnnie Formation. Drainages in the area contain float of similar material. Most of the veins are similar to those seen in the workings of the Rainstorm Mine and most carry visible ore minerals. Detailed mapping and sampling would be necessary to identify areas of potential along these structures.

There is moderate resource potential, certainty level C, for the discovery of polymetallic vein deposits along the Rainstorm vein and associated structures. The expected occurrences would be small lenses of lead-silver ore within brecciated quartz veins. There is moderate potential, certainty level B, for discovery of polymetallic replacement deposits in favorable lithologies adjacent to vein deposits and associated structures.

7.3.12 Desert Range



7.3.12.1 Prospector Fault Area

Location

A few scattered prospects are found in the Desert Range in an area about 8 km southwest of the Slate District and 1.6 km north of White Sage Gap. G. L Dixon (personal commun., 1994) has referred to this area as the Prospector Fault area. The Prospector Fault is the low-angle feature that underlies the mountain (peak elevation 5096) just north of White Sage Gap and continues to the east where it cuts across the Desert Range (Guth and others, 1988).

History of Discovery, Exploration, and Mining

A mining claim notice from 1941 was found at the Sidewinder Claim; there is no evidence of earlier prospecting in the area, and the area was closed to prospecting in the 1950s. The regional geology is portrayed at 1:100,000-scale by Guth (in prep.). The prospects in the area were observed and briefly visited during helicopter sampling in mid-1994. Mapping and further sampling was done several months later.

Geologic Setting

The central part of the Desert Range, where these prospects are located, is underlain mainly by Upper Proterozoic to Devonian miogeosynclinal rocks. The Late Proterozoic to Lower Cambrian strata are primarily siliciclastic rocks and the Middle Cambrian to Devonian rocks are primarily carbonate rocks. These units have undergone Mesozoic-age (Sevier) thrust faulting and mid- to late-Tertiary high- and low-angle normal faulting (Guth, 1990). No igneous rocks are known to crop out in the central Desert Range.

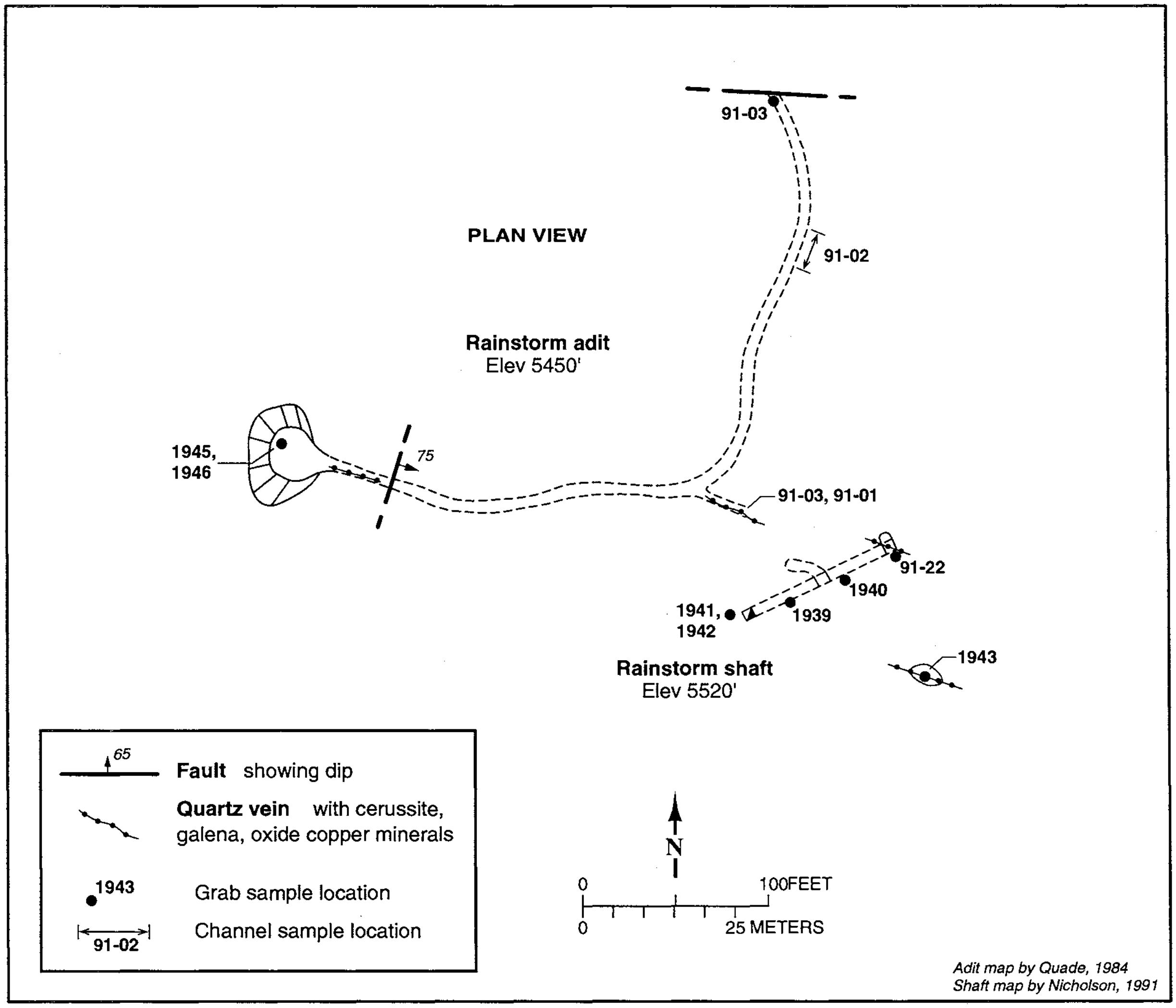


Figure 7-59 Underground plan map of Rainstorm adit and horizontal projection of Rainstorm shaft showing veins and sample locations, Rainstorm mining district, Nye County, Nevada.

In the area north of White Sage Gap, massive, banded dolomite of the Banded Mountain Member of the Cambrian Bonanza King Formation appears to be in low-angle fault contact with rocks of the underlying Late Proterozoic Johnnie Formation. This fault places younger strata over older, and is interpreted as a low-angle normal fault (i.e., see Guth, 1990). Guth and others (1988) mapped the Prospector Fault as an east-striking feature crossing the Desert Range in this area, and then, as a concealed fault that turns southwest parallel to the east margin of the Desert Range and passes between the Desert Range and the Black Hills (Alamo Road-Prospector Fault). Other, less important low-angle faults were also noted during detailed mapping in the area north of White Sage Gap. Some of these low-angle faults have hanging wall breccia zones. Extreme clast-rotated breccias are reported by Wernicke and others (1984) to characterize low-angle normal faults but are thought to be extremely rare in Mesozoic (Sevier) thrust faults (which have also affected the pre-Tertiary rocks of the area). Quartz veins in the Johnnie Formation below this major low-angle fault are along faults which have dips of 0° to 20° south. If these faults are related to the major detachment fault, which is mid to late Tertiary, then mineralization must be at least somewhat younger than that detachment faulting (but see below).

Mineral Deposits

Mineralization in the Prospector Fault area is contained in veins (both high- and low-angle) in siliciclastic rocks of the Johnnie Formation and silicification, iron staining, and bleaching along high-angle faults and in a dolomite that is interpreted to be part of the Johnnie Formation (fig. 7-60). The veins consist of milky, white, massive, greasy to platy-fracturing "bull" quartz which occurs up to 1 m in thickness.

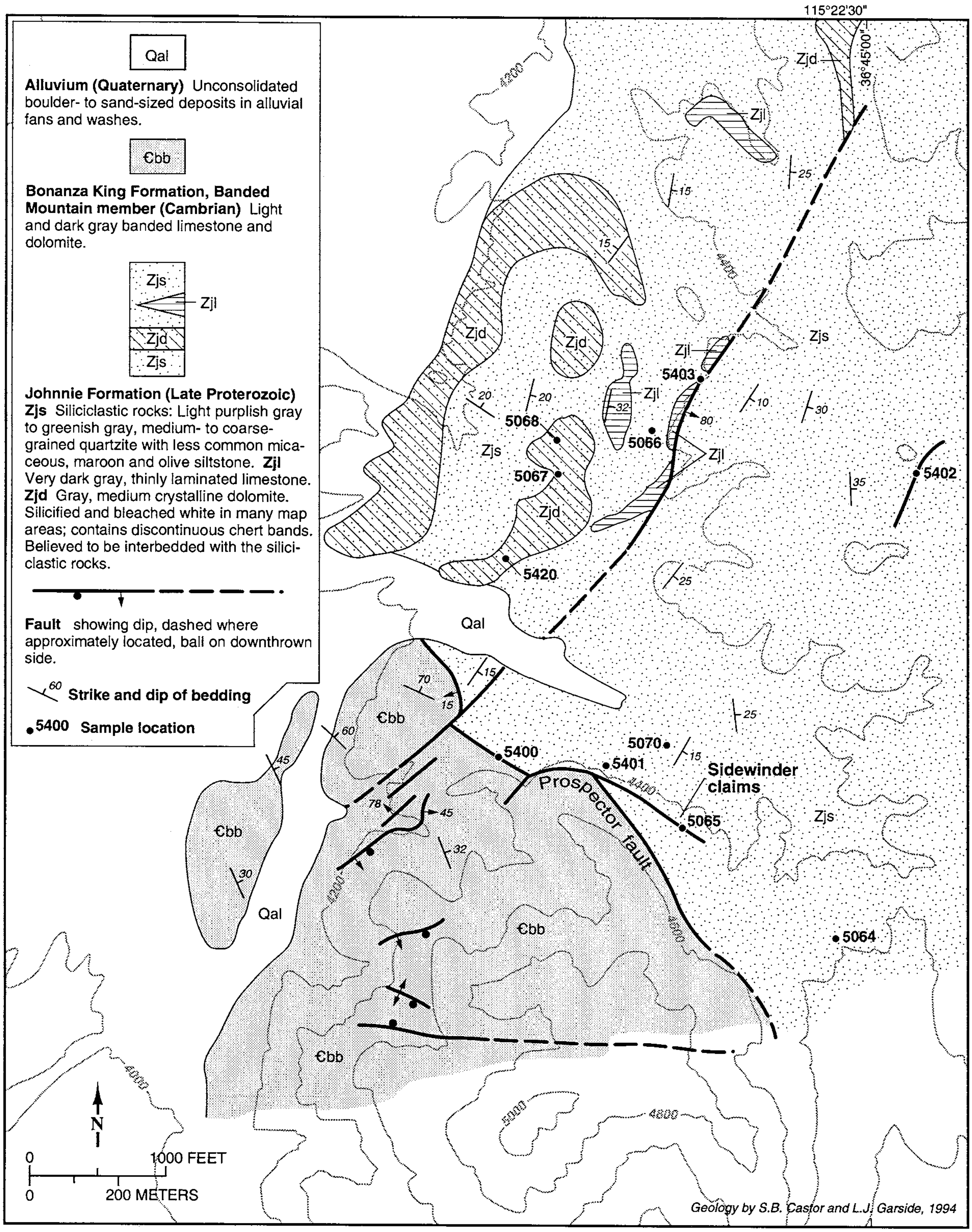


Figure 7-60 Geologic map of the Prospector fault area, central Desert Range, Clark County Nevada.

Veins thicken and thin, and most are only a few tens of cm wide. The vein material is locally stained with iron-oxide minerals and rarely with oxide copper minerals (chrysocolla and malachite). Limonite boxworks after pyrite and other sulfide mineral(s) are also present.

Milky "bull" or "buck" quartz veins having planar domains of crystal faces are not characteristic of epithermal vein deposits, but are the dominant type of vein in the plutonic environment (Dowling and Morrison, 1989). Such veins are commonly noted within and in the vicinity of granitic plutons in Nevada, with sparse copper mineralization and are of little economic significance. In addition, where such euhedral buck quartz veins have been studied elsewhere, they are not reported to be gold-bearing unless they have other superimposed textures (Dowling and Morrison, 1989). The bull quartz veins of the Prospector Fault area are not anomalous in gold, but one sample has anomalous bismuth, an element that is more commonly associated with igneous-related mineralization. It is, however, difficult to argue that the Prospector Fault bull quartz veins are related to the plutonic environment, as no plutonic rocks are known for more than tens of kilometers. Because the veins are in the vicinity of and possibly associated with low-angle normal faults, they might be considered as minor and relatively high-level mineralization of the detachment-fault-related type (e.g., Long, 1992). The geochemistry of the veins does not support this correlation, however. The veins have anomalous arsenic, one anomalous thallium value (7.5 ppm), and one high (10 ppm) bismuth value. The arsenic and thallium are not commonly anomalous in the detachment-fault-related deposits (Long, 1992). In addition, the veins locally contain anomalous amounts of copper, lead, and silver, and slightly anomalous amounts of zinc and barium were also observed. Some samples contain several percent iron, as limonite and/or hematite. The sample with the highest silver, copper, and lead also has the most gold noted in the district (2 ppb), suggesting that gold may be slightly anomalous. This sample is also the only one anomalous in bismuth (10 ppm). The anomalous metals and other trace elements present suggest that unoxidized veins would be found to contain sulfides such as chalcopyrite, galena, and pyrite. Silver and bismuth could be associated with a major sulfide phase such as galena.

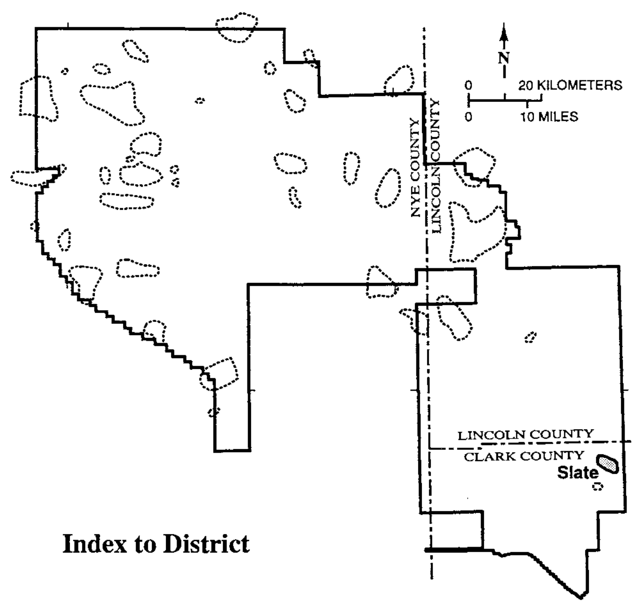
Bull quartz is also commonly associated with mesothermal veins believed to have been deposited from fluids of predominantly metamorphic origin. Some deposits of this type include the Mother Lode veins of California, slate belt veins of Queensland, Australia (Dowling and Morrison, 1989; Peters, 1993) and the milky bull quartz veins of the Sierra district of Pershing County, Nevada (Johnson, 1977; Bonham and others, 1985). Although the best examples of this type have ribbon and stylolite textures not noted in the Prospector Fault area, the low-sulfide nature of the Prospector veins and presence of lead, copper, bismuth, arsenic, etc., is comparable. Thus, the geochemical and physical characteristics suggest that the Prospector Fault veins are most likely rather weak examples of either polymetallic veins (e.g., Cox, 1986) or low-sulfide mesothermal quartz veins. Because there are no related igneous rocks observed or known in the area, the mesothermal origin is favored. A mesothermal origin would suggest a probable Mesozoic age for the veins.

Identified Mineral Resources

There are no identified mineral resources in the area.

Mineral Resource Potential

The area of prospects and anomalous metal-element values is considered to have moderate potential, certainty level B for veins containing base metals and possibly silver.



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7.3.12.2 Slate District

The Slate mining district is located in the Desert Range, east of the south end of Dog Bone Lake. Other than a notation on the Shafer and Cook (1947) map, there is no record of mining activity in this area. D. L. Schmidt (personal commun., 1992) reported that Hancock Stone Quarry produced greenstone-flagstone, possibly during the 1920s, from a quarry in this area (photo 7-47). See section 8.2.3 (Building Stone) for further information on this district.

7.3.13 Spotted Range

A grab sample of black shale (sample 5473) was collected from the dump of a shaft in a wash located between Mercury Ridge and the Ranger Mountains, near the southwest end of the Spotted Range (fig 6-15). The shaft appears to be about 40 m deep and is situated near the bottom of a wash in an area of mainly alluvial cover. There are no other workings in the area, and it is likely that the shaft was an attempt to locate shallow groundwater in the wash. The shaft is collared in a very small outcrop of quartzite-cobble conglomerate; black, greasy, organic-rich shale was apparently penetrated at depth, as it makes up much of the dump. Barnes and others (1982) have included nearby outcrops in the Tertiary Horse Spring Formation, and this unit is reported to include quartzite-pebble conglomerate beds. The black shale is, therefore, likely to be part of the Horse Spring Formation, although similar black shales are not reported from the area. The rock is submature, based on a ROCK-EVAL Tmax temperature of 413°C (C. E. Barker, written commun., 1995) and thus has not been subjected to any significant heating (due to burial, for example). This low maturity is consistent with the interpretation that the black shale is from a Tertiary unit such as the Horse Spring Formation.

Rocks on the dump do not display any indications of hydrothermal alteration or mineralization. The sample has a total organic content (TOC) of over 3 percent (C. E. Barker, written commun., 1995) and is moderately anomalous in arsenic, molybdenum, vanadium, and uranium, and possibly anomalous in cobalt, copper, and nickel. Elevated concentrations of such trace metals are likely in organic-rich black shales (e.g., Mason, 1952, p. 172), and are not indicative of epigenetic mineralization. Although anomalous, the metal contents are not high enough to be of interest as a source of metals.

A sample of Eureka Quartzite with strong iron-oxide staining (sample 5237) was collected at a site northeast of Aysees Peak in the Spotted Range. No anomalous metals were found in the sample.

Identified Mineral Resources

There are no identified mineral resources in the Spotted Range.

Mineral Resource Potential

There is low mineral potential, certainty level D, for metallic minerals in the areas sampled.

Photo 7-1 Mine hoist at the site of the Nancy Donaldson Mine, Eastern Goldfield district *(Central Nevada Historical Society, Philip Metschler Collection).*

Photo 7-2 Sailor's Mine, Quartz Mountain area, Eastern Goldfield district *(Central Nevada Historical Society, Nevada Historical Society Collection).*

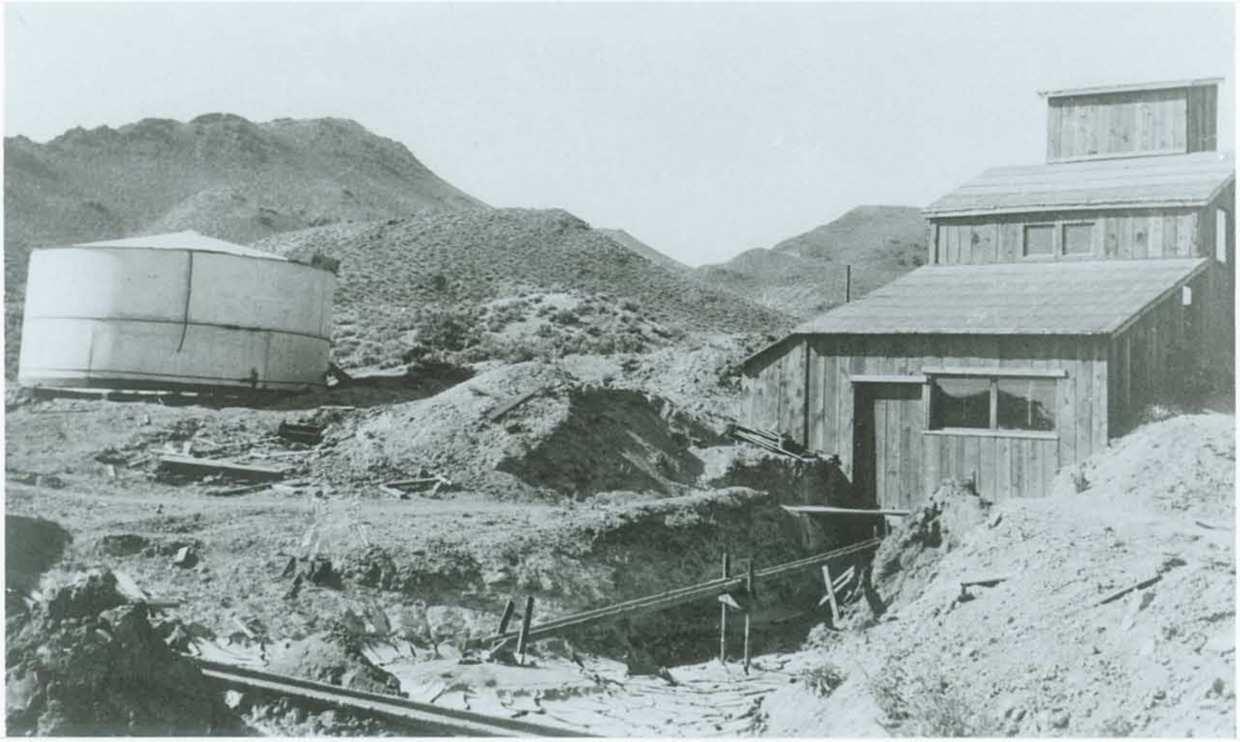

Photo 7-3 Mill building at the Sailor's Mine, in the 1920s, Quartz Mountain area, Eastern Goldfield district *(Central Nevada Historical Society, Nevada Historical Society Collection).*

Photo 7-4 Mine dump on manganese-rich vein, South of Mud Lake district *(J. Tingley photo).*

Photo 7-5 Ferricrete layer capping pediment surface, Cactus Springs West area. Prospects are in altered tuff below the ferricrete *(J. Tingley photo).*

Photo 7-6 Main mines in the eastern part of the Antelope Springs district. Large dumps are the Antelope View Mine located on the Antelope View Vein. Shaft in the foreground is located on the Auriferous Vein *(J. Tingley photo).*

Photo 7-7 Exposure of the sheeted Antelope Vein near the Antelope View Mine, Antelope Springs district. The walking staff extends across the vein from footwall to hanging wall *(J. Price photo).*

Photo 7-8 Green copper-oxide minerals formed in oxidized portion of the Antelope View Vein, underground workings of the Antelope View Mine, Antelope View district *(J. Price photo).*

Photo 7-9 Remains of hand windlass over shaft at sample site 5538, Antelope Springs district *(J. Tingley photo).*

Photo 7-10 Mine dump at the main shaft of the Fairday Mine, Cactus Springs district. Urania Peak is in the background *(J. Tingley photo).*

Photo 7-11 Urania Peak, Cactus Springs district *(J. Tingley photo).*

Photo 7-12 Acid-sulfate altered rocks on the hill northeast of Urania Peak. Rugged outcrops to the right are flow - banded rhyolite. White outcrops to the left are ash-flow tuff *(J. Tingley photo).*

Photo 7-13 Mine dumps at the Urania Mine, Cactus Springs district. Lower dump is in the foreground, and upper dump is at upper right. The small dump between the two marks an air shaft connecting to the lower adit *(J. Tingley photo)*.

Photo 7-14 Mine dump at the lower adit of the Twentieth Century Mine, Cactus Springs district *(J. Tingley photo)*.

Photo 7-15 Mine workings along the principal veins of the Silver Sulfide (Fairday) vein system, Cactus Springs district. The vein exposures follow a northeast trend extending from the Fairday shaft (behind the iron-stained white hill at right) into the valley at upper left-center *(J. Tingley photo)*.

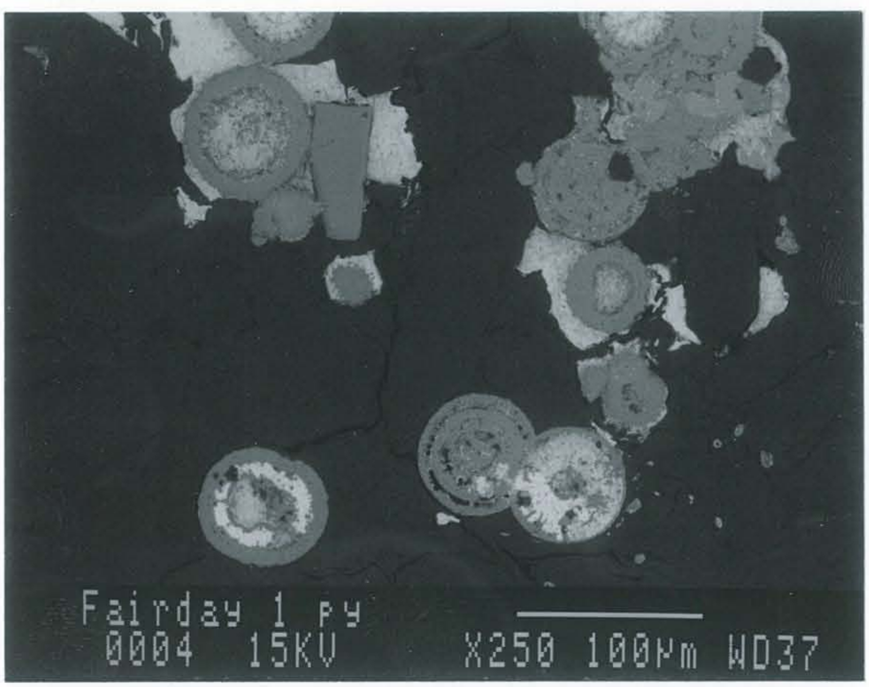

Photo 7-16 Back-scatter electron image of ore minerals from the Fairday Mine, Cactus Springs district, showing spherical grains composed of pyrite, galena, and a silver-bearing telluride mineral *(L. Christensen photo)*.

Photo 7-17 Rugged outcrop of acid-sulfate altered ash-flow tuff exposed on the hill northeast of Urania Peak (sample site 5629), Cactus Springs district *(J. Tingley photo).*

Photo 7-18 Mine dump at the Thompson Mine, Cactus Springs West area. Stonewall Mountain is in the background *(C. Henry photo).*

Photo 7-19 Photograph of outcrop showing multiple, crosscutting veins (stockwork) composed of quartz, muscovite, and pyrite, turquoise prospect area north of Sleeping Column Canyon, Cactus Springs West area *(S. Weiss photo).*

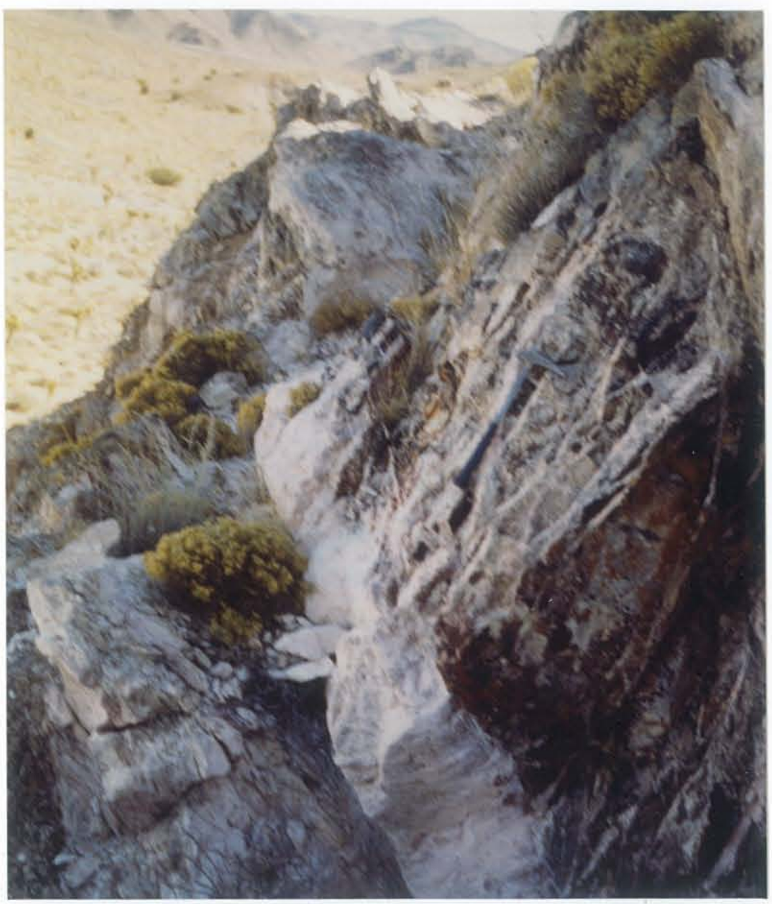

Photo 7-20 View to the south along a vein of alunite near sample sites 5382 and 5383 (white band in center of photo), Cactus Springs West area *(S. Weiss photo).*

Photo 7-21 Mellan Gold Mine camp, Mellan Mountain district, 1937. View is to the northeast with the Kawich Range in the background *(Silver Eagle Resources, Ltd. file photo).*

Photo 7-22 Headframe, hoist house, and orebin remaining at the Mellan Incline, Mellan Mountain district *(C. Henry photo).*

Photo 7-23 Mellan Gold Mine, Mellan Mountain district, in 1937 (Silver Eagle Resources, Ltd. file photo).

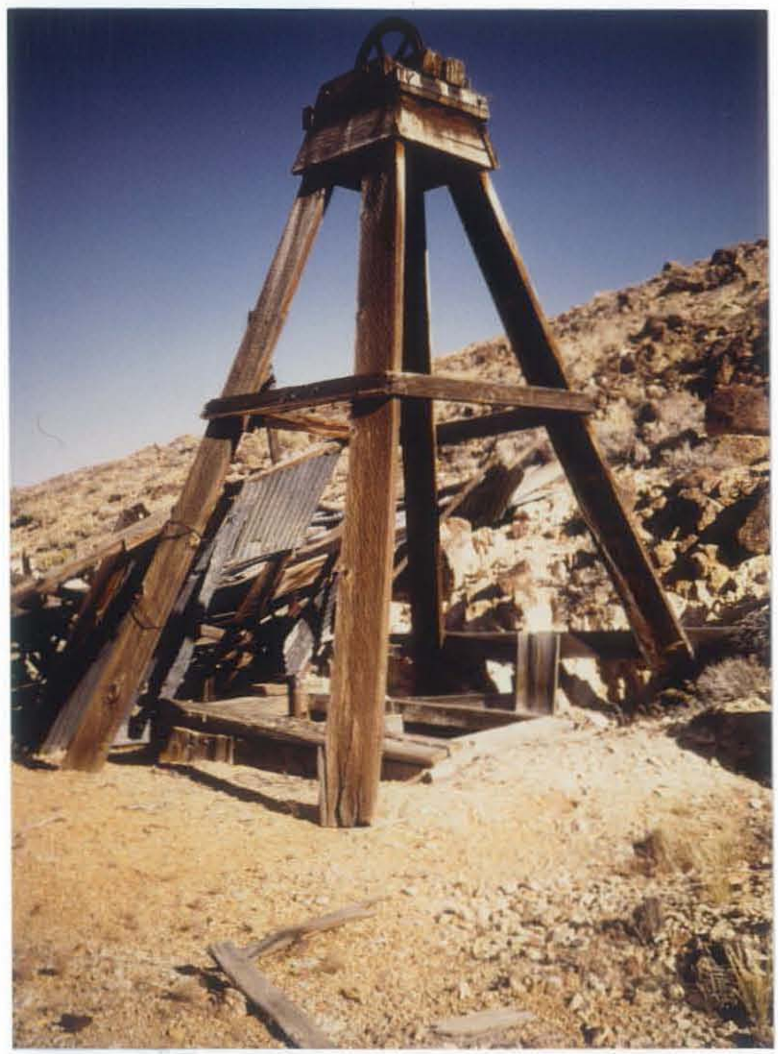

Photo 7-24 Headframe remaining at the vertical shaft on the Golden Leo Claim, Mellan Mountain district *(J. Tingley photo).*

Photo 7-25 Bleached, argillically-altered tuff along the trace of the stockwork vein exposed west of the Bellows Adit (sample site 5547), Wellington district. Vein crops out along lighter zone that extends from the adit dump to the saddle on the horizon *(J. Tingley photo).*

Photo 7-26 Mine dumps at the main shaft, Hope Now, Hope Next patented claims, Wellington district. Dark rock layers in the immediate background are outcrops of post-mineral age Stonewall Flat Tuff; Stonewall Mountain is in the distant background *(J. Tingley photo).*

Photo 7-27 Open stope and dumps at the Clarkdale Mine, Clarkdale district. Rhyolite of Obsidian Butte crops out in the background *(S. Weiss photo).*

Photo 7-28 Yellow Gold Mine, Clarkdale district *(S. Weiss photo).*

Photo 7-29 Headframe remaining at the Gold Hill (?) Mine, Gold Crater district. Altered rocks extend to the north until they are covered by post-mineral flows of the Stonewall Flat Tuff (dark bands in left-central background). The Cactus Range is in the distant background *(S. Weiss photo).*

Photo 7-30 Remains of collapsed wooden headframe (on dump above white vehicle) at the main shaft of the Golden Chariot Mine, Jamestown district. A rib of quartz-alunite altered rock can be seen on the left-central skyline *(S. Weiss photo).*

Photo 7-31 Headframe and cabin remaining at the Franz Hammel Mine, Jamestown district *(J. Tingley photo).*

Photo 7-32 Photograph showing Spearhead Member of the Stonewall Flat Tuff (upper left) in contact with altered rocks exposed in the central Jamestown district (area of bleached outcrops and white mine dumps in upper center). Antelope Peak is on the center skyline *(J. Tingley photo).*

Photo 7-33 Resistant ledge of vuggy-silica texture quartz and alunite in the central Jamestown district. The dumps of the Golden Chariot Mine are in the upper left background *(J. Tingley photo).*

Photo 7-34 Stonewall Spring vein system. View is to the southeast *(S. Weiss photo).*

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Photo 7-35 Main adit of the Life Preserver Mine, Tolicha district (above dump and old vehicle in center of photo). Sample site 5460 is from the adit at upper left dump *(L. Garside photo).*

Photo 7-36 Main vein at Quartz Mountain, Tolicha district *(H. Bonham photo).*

Photo 7-37 Silver-bearing sheeted vein, northern part of the Wilsons district *(H. Bonham photo).*

Photo 7-38 Outcrop of silicified dacite porphyry north of old shaft at sample site 5126, on the east side of the Kawich Range north of Cedar Pass *(J. Tingley photo).*

Photo 7-39 Dump at sample site 5144, north of Corral Spring on the west side of the Kawich Range. *(J. Tingley photo).*

Photo 7-40 Dump at sample site 5806, main (eastern) part of the Gold Reed district. The main dump of the Gold Reed Mine is at the upper left edge of the photo *(J. Tingley photo).*

Photo 7-41 Outcrop of vein material along the eastern part of the Blue Horse vein system, Silverbow district *(J. Tingley photo).*

Photo 7-42—Northern mine workings at the Groom Mine, Groom district. View is to the east. Altered carbonate rocks of the central graben form the light outcrops in the area of the mine dumps *(J. Quade photo).*

Photo 7-43 Headframe remaining over the main shaft of the Arrowhead Mine, Southeastern district *(R. Nicholson photo).*

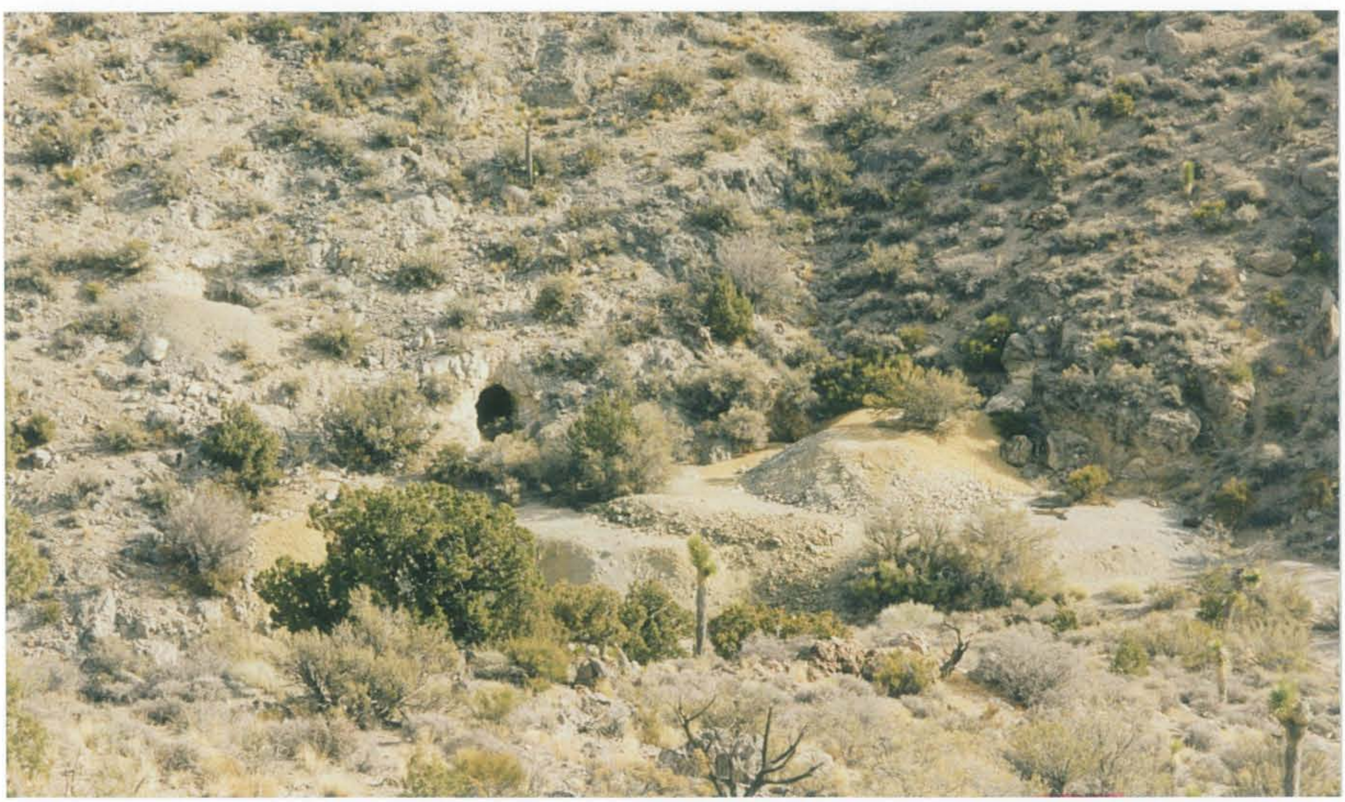


Photo 7-44 Adit in the canyon east of the Arrowhead Mine shaft, Southeastern district *(R. Nicholson photo).*

Photo 7-45 Portal of the main adit of the Kelly Mine, Papoose district *(R. Nicholson photo).*

Photo 7-46 Headframe remaining over the Kelly Shaft, Papoose district *(R. Nicholson photo).*

Photo 7-47 Small pit in the area of the Hancock Stone Quarry, Slate district *(S. Castor photo).*

8.0 ASSESSMENT OF MINERAL AND ENERGY RESOURCE POTENTIAL

8.1 METALLIC MINERALS

Two levels of data have been used to assess the metallic resource potential of the NAFR.

On a regional level, geochemical data from the reconnaissance stream sediment sampling program (Section 6.2.2) were used to construct stream sediment anomaly dot maps (figs. D-1 through D-23, appendix D) and from these, element anomaly maps (figs. 8-1 through 8-15) were prepared. By comparing the various element anomaly maps, areas of mineral resource potential for precious and base metals were outlined, rated and assigned confidence levels based on the number of metallic elements present, the number of indicator elements present, the geologic setting, and other local considerations. These areas of mineral resource potential are shown on figures 8-16 through 8-19.

At a district level, mine sampling and examination data were used to define specific areas of metallic resource potential. These areas of resource potential are described under each of the district/area headings of Section 7.3. The areas of mineral resource potential generated from the mine sampling and examination program are shown on figures 8-20 through 8-36. The areas are also shown on figures ES-9 and ES-10 and are listed in tables ES-3 and ES-4 in the summary section of this report.

8.1.1 Gold and Silver

Treasured since ancient times for its beauty and permanence, gold has emerged in the late 20th century as an essential industrial metal. The oldest use of gold, and still the most important in terms of quantity used, is its use in jewelry. Of the industrial uses of gold, the most important is in electronic devices, especially in printed circuit boards, connectors, keyboard contacts, and miniaturized circuitry. Gold brazing alloys are used in the aerospace industry and gold is used as a reflector of infrared radiation in radiant heating and drying devices and heat-insulating windows for large buildings. In specific reference to Nevada, gold is classified as a critical mineral.

In 1995, with production of 6.76 million ounces of gold from 38 major mines, Nevada supplied 65 percent of the total United States production. Nevada accounted for 10 percent of the world production in 1995 and, if it were a country, would rank third, trailing only South Africa and Australia. At the end of 1995, published gold resources in Nevada totaled 145 million ounces of gold, enough to sustain gold production at substantial levels for at least 20 years, assuming stable prices (Price, 1996).

Much of Nevada's gold production originates from two types of deposits: sediment-hosted gold deposits located mainly in the northeast and north-central parts of the state; and volcanic-hosted epithermal deposits located in the west-central and southwest parts of the state. The sediment-hosted gold deposits (Section 7.2.1.2) have large tonnages of ore with generally low gold grades. In most of these deposits, silver is not an important component of the ore. Deposit size is usually several million up to hundreds of millions of tons with ore grades ranging from 0.02 to as high as 0.6 oz gold per ton. The deposits are mined using open-pit methods, but some mines on the Carlin trend in Eureka County and at the Getchell Mine in Humboldt County are evolving to underground operations. The volcanic-hosted deposits (Section 7.2.1.1) are also large and are mined using open-pit methods. These deposits usually contain silver equal to or exceeding the gold content. Deposits range from several hundred thousand tons up to tens of millions of tons ore with grades ranging from about 0.03 to as high as 0.3 oz gold per ton. Round Mountain in Nye County, the largest of this type currently being mined in Nevada, has a reserve of 151 million tons containing 0.024 oz gold per ton (Bonham and Hess, 1995). Most of the volcanic-hosted deposits now being mined, such as Round Mountain and Bullfrog, are low-sulfidation deposits. The large gold-silver deposit at Paradise Peak, northern Nye County, and the gold deposit at Goldfield, Esmeralda County, are high-sulfidation deposits. Paradise Peak is now closed but small-scale open-pit mining is still in progress at Goldfield.

Silver has a profile quite similar to gold. Like gold, silver is relatively scarce and, though not as scarce as gold, its durability and desirability have allowed it to retain a comparable position as a medium of exchange or monetary base. In addition, major uses for silver are in photography, sterlingware, and electrical contacts and conductors. Jewelry, arts, and crafts also account for a substantial use of silver. Silver is classified as a strategic and critical mineral.

Nevada is the nation's leading silver-producing state and, in 1994, reported production of 22.8 million ounces. Nevada silver production is likely to increase over the next several years, especially if precious metal prices remain attractive. A large share of the increase will be from by-product silver produced from Nevada's gold mining industry.

Large gold-silver mining operations close to the NAFR include the Round Mountain Mine in Smoky Valley, about 80 km north of the NAFR boundary; the Bullfrog Mine near Beatty, about 24 km west of the NAFR boundary; the Sterling Mine west of Crater Flat, about 8 km west of the

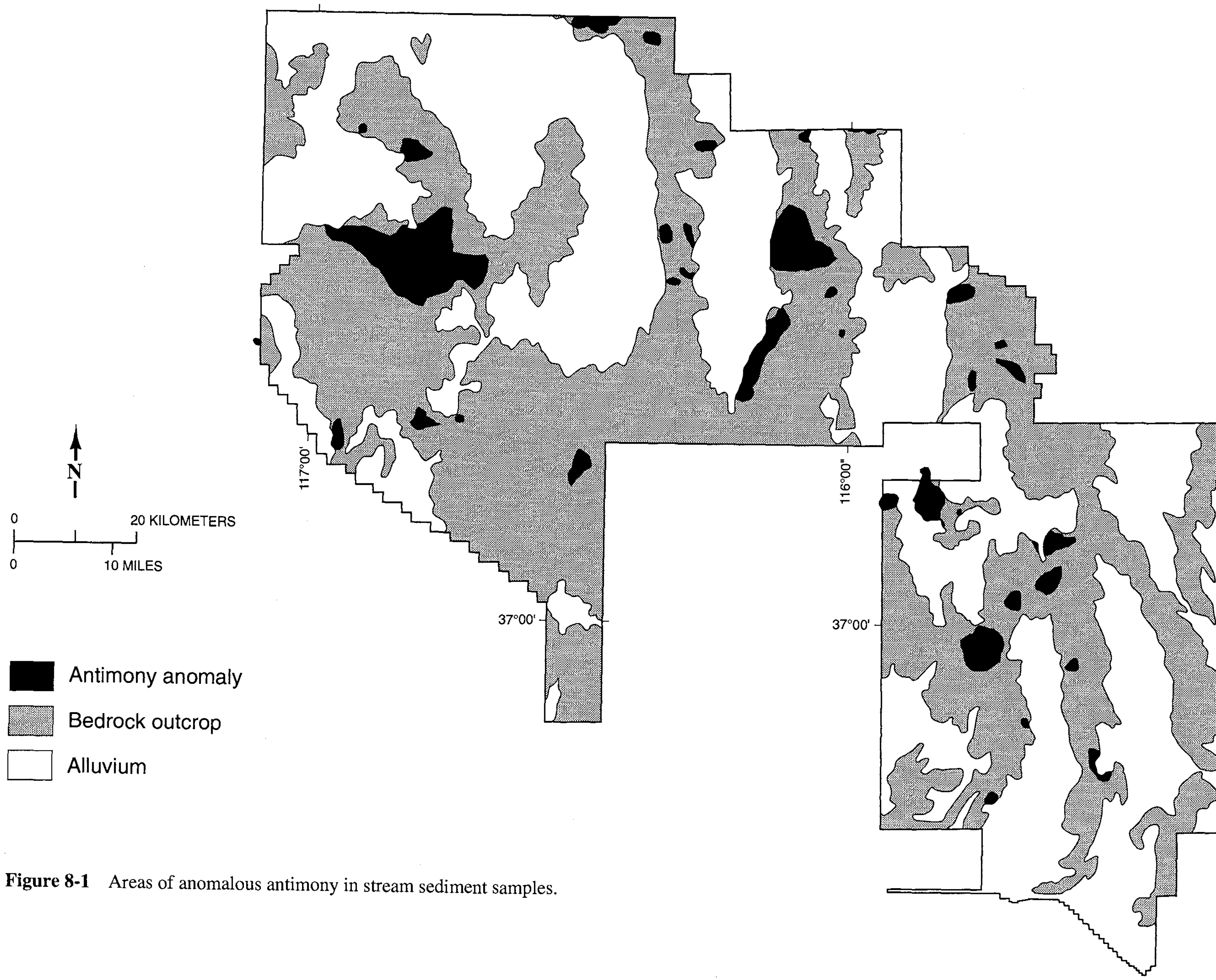


Figure 8-1 Areas of anomalous antimony in stream sediment samples.

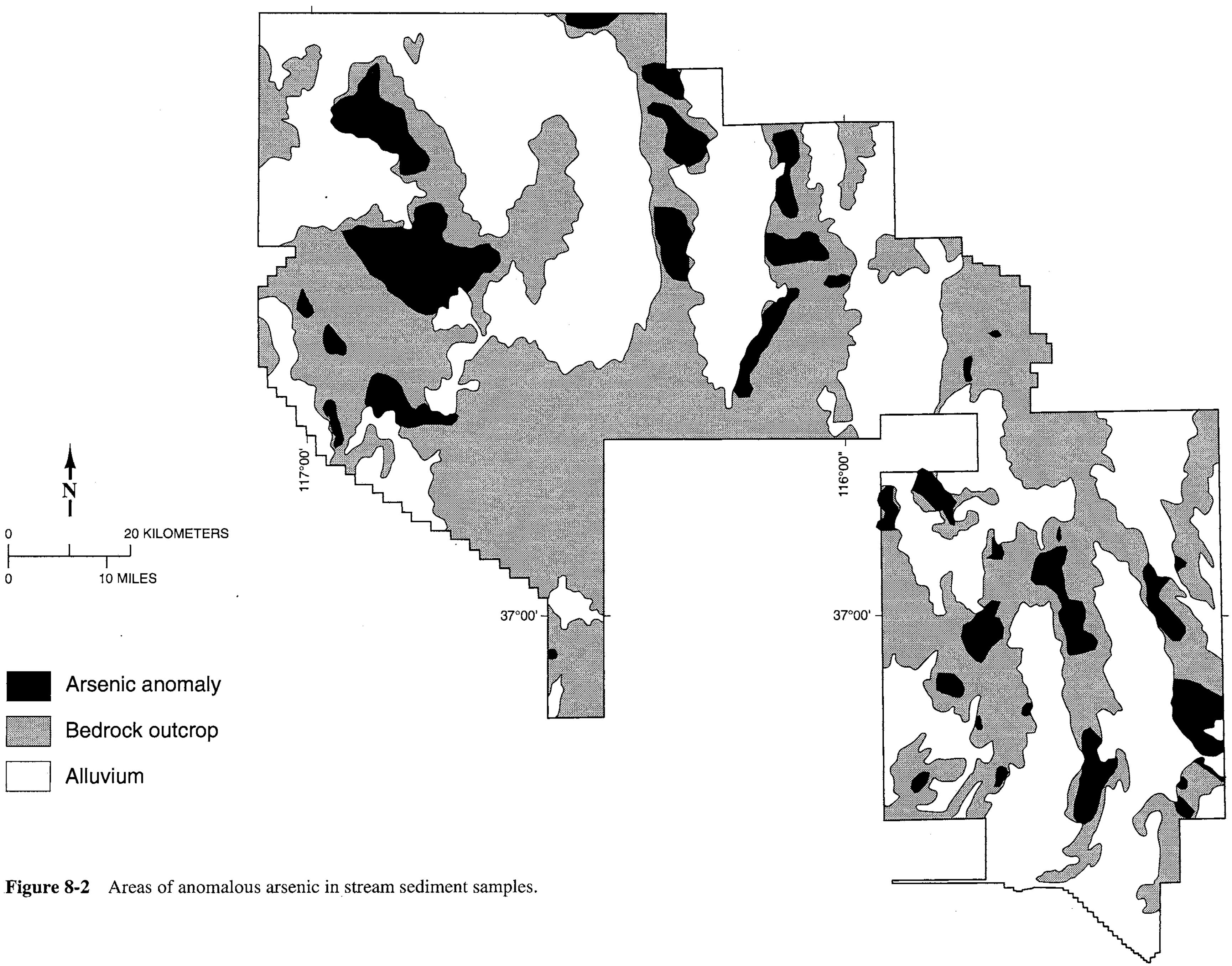


Figure 8-2 Areas of anomalous arsenic in stream sediment samples.

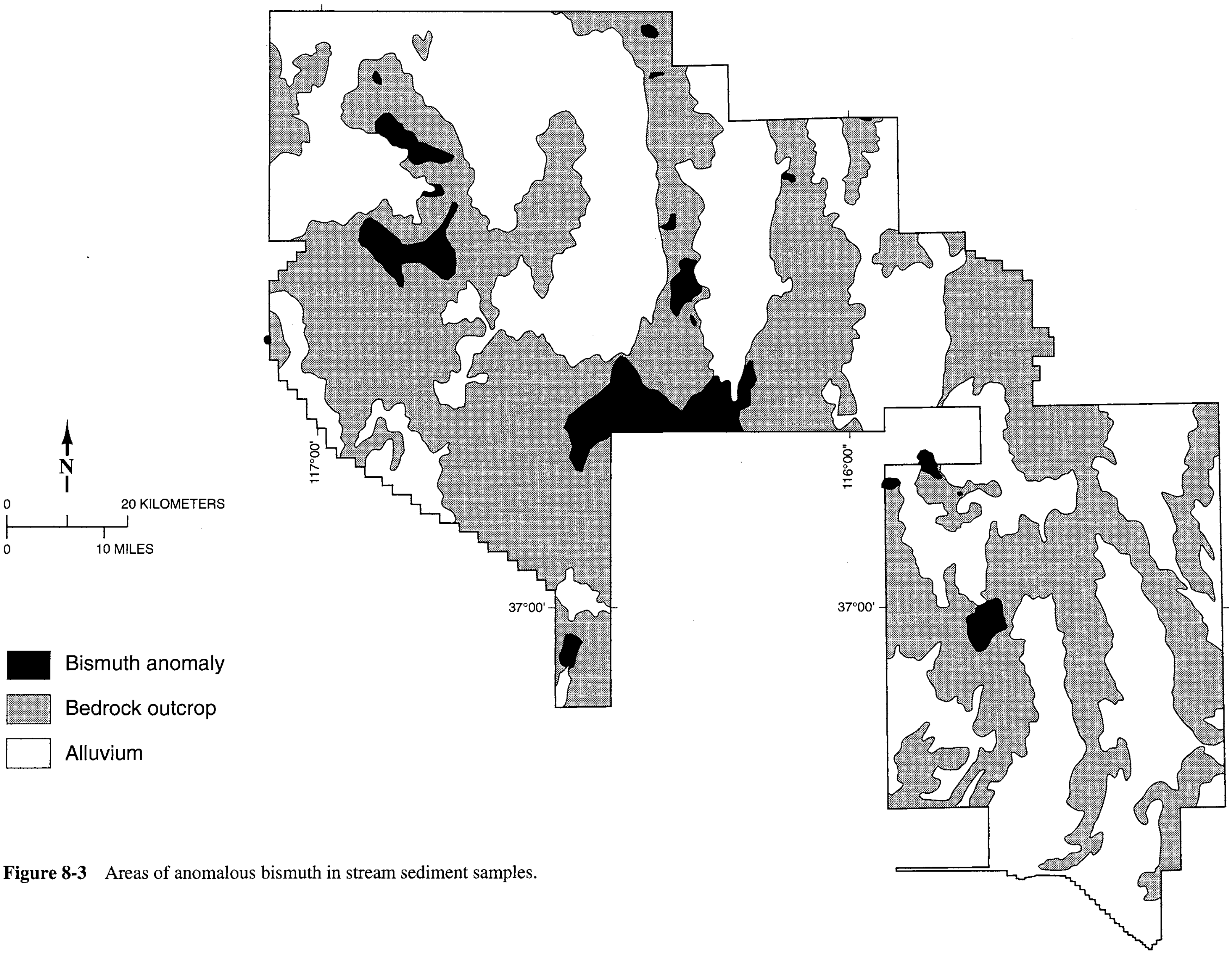


Figure 8-3 Areas of anomalous bismuth in stream sediment samples.

Figure 8-4 Areas of anomalous cobalt in stream sediment samples.

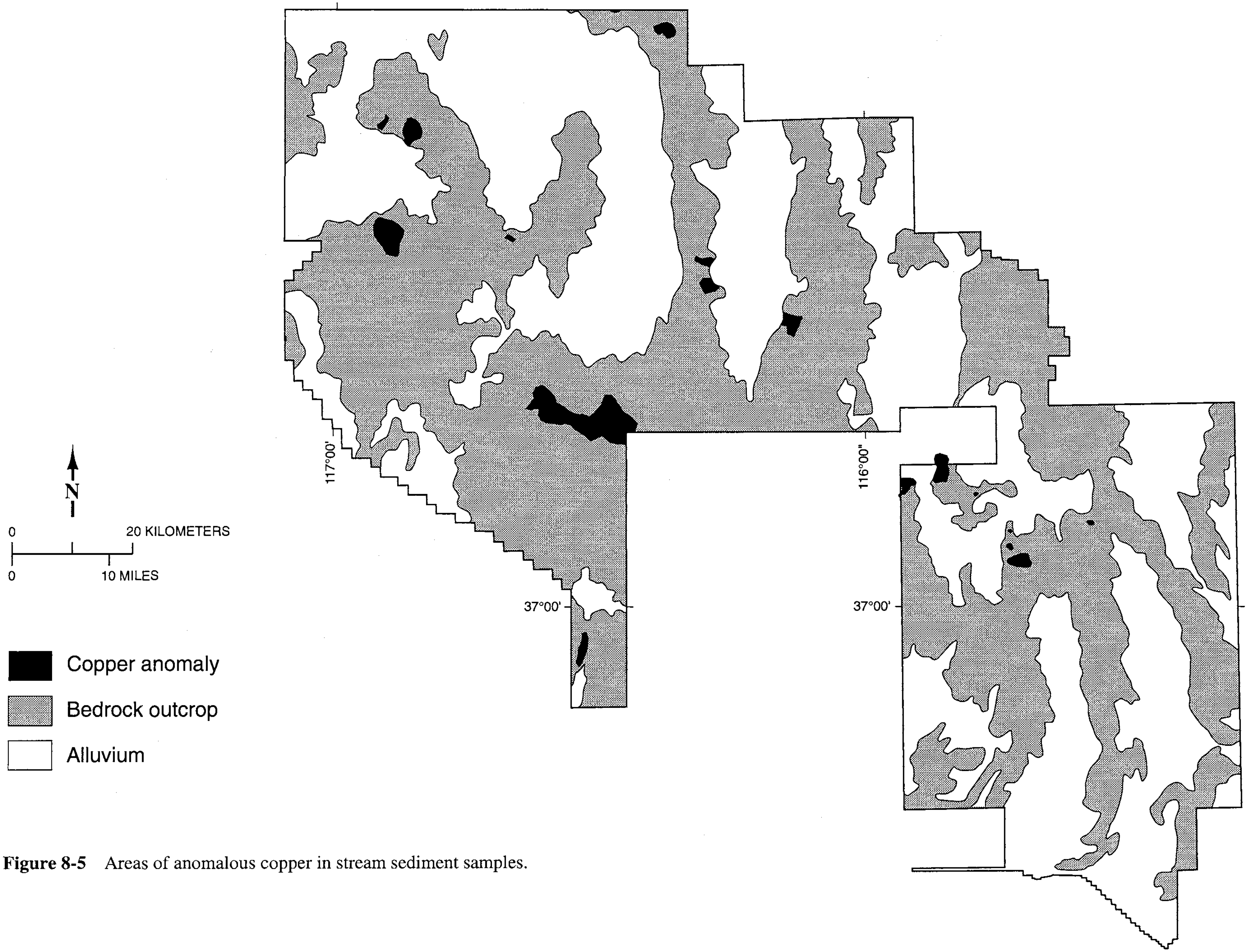


Figure 8-5 Areas of anomalous copper in stream sediment samples.

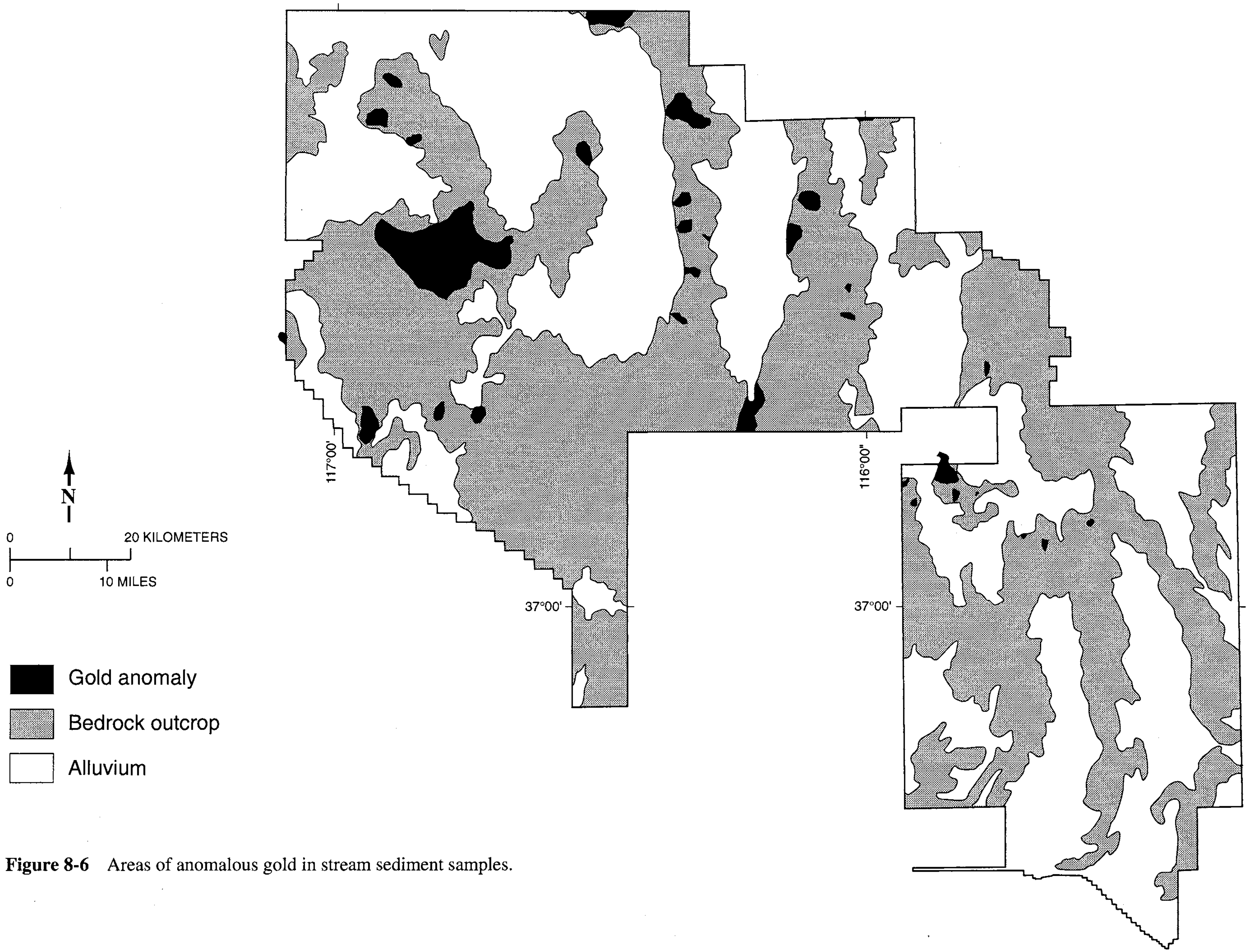


Figure 8-6 Areas of anomalous gold in stream sediment samples.

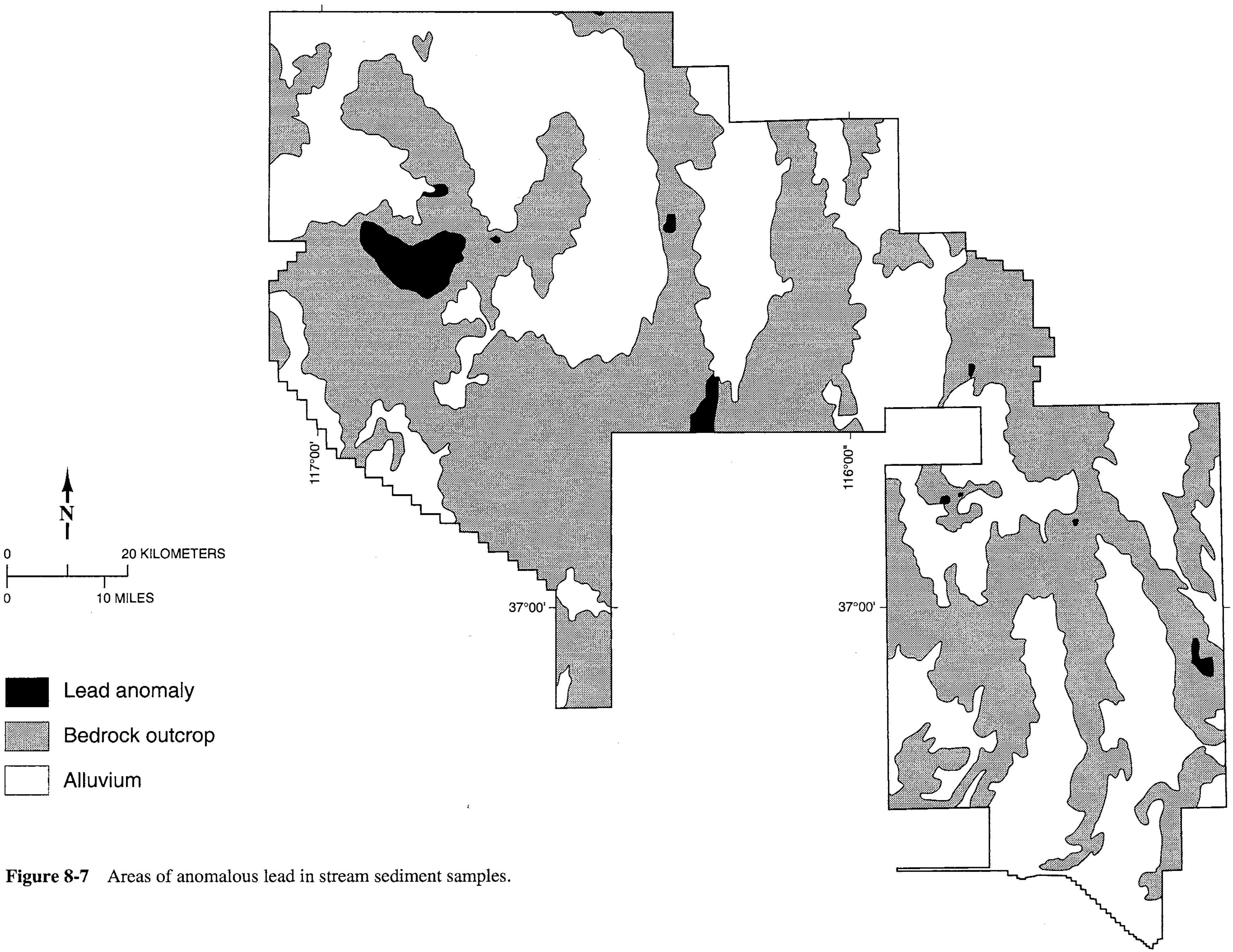


Figure 8-7 Areas of anomalous lead in stream sediment samples.

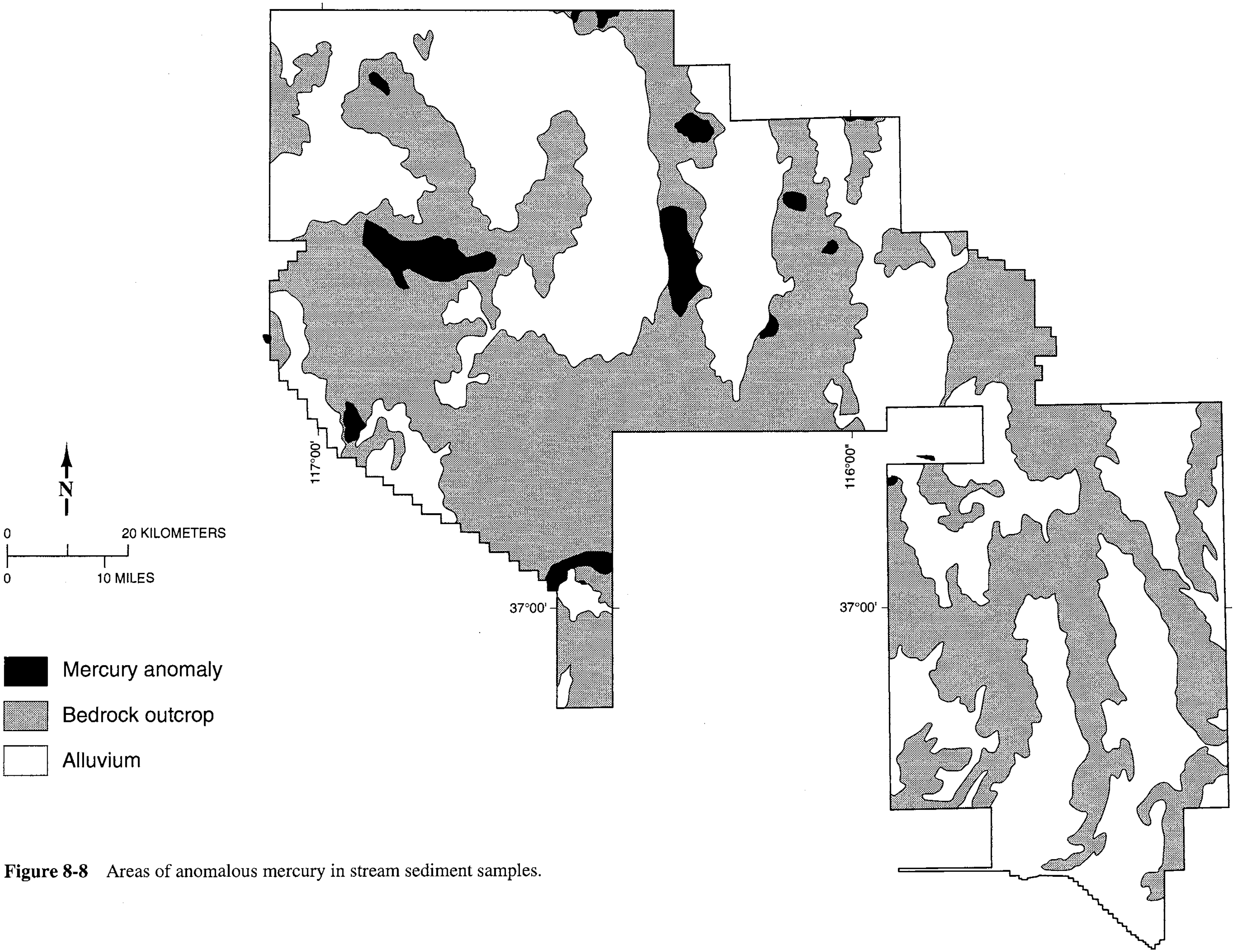


Figure 8-8 Areas of anomalous mercury in stream sediment samples.

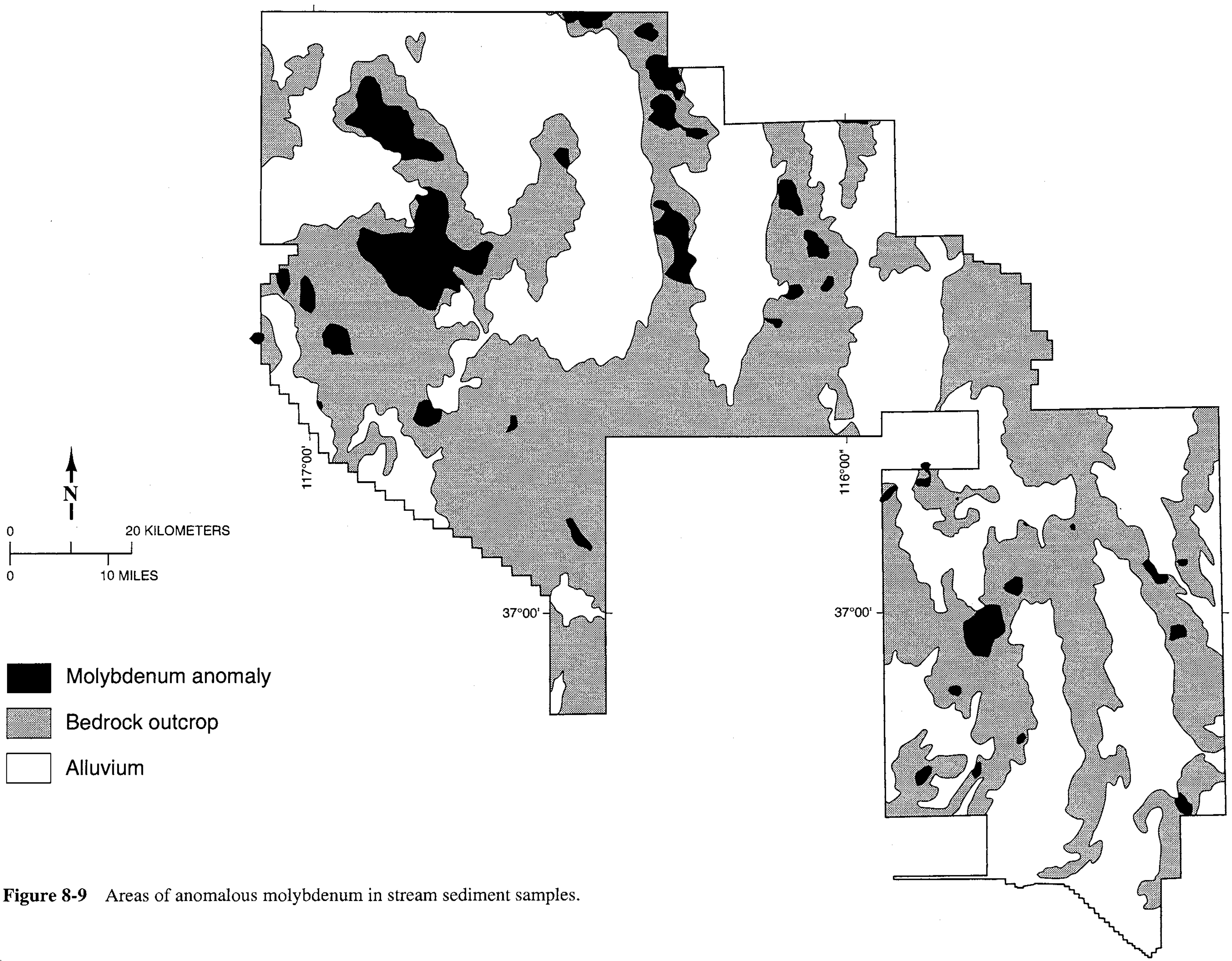


Figure 8-9 Areas of anomalous molybdenum in stream sediment samples.

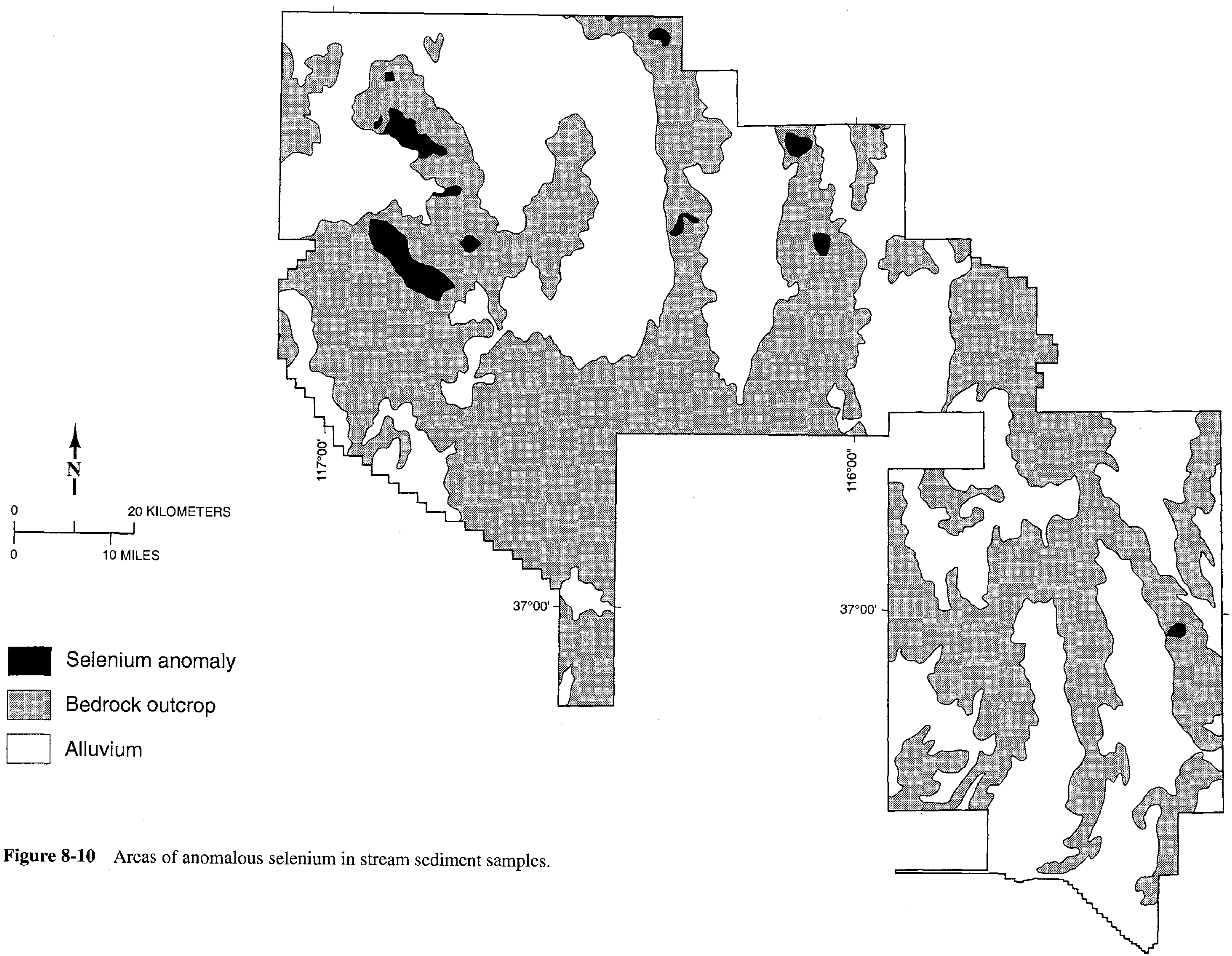


Figure 8-10 Areas of anomalous selenium in stream sediment samples.

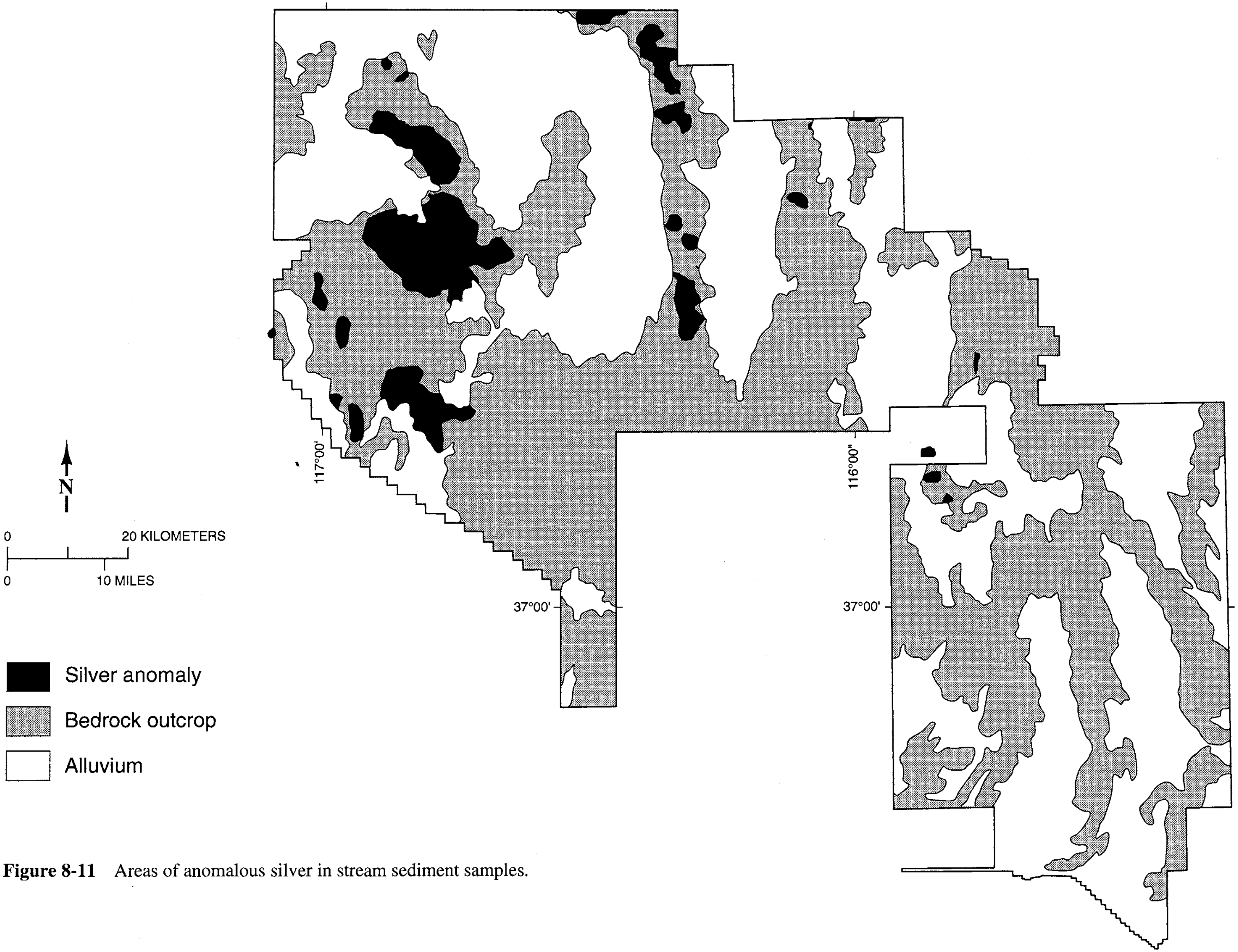


Figure 8-11 Areas of anomalous silver in stream sediment samples.

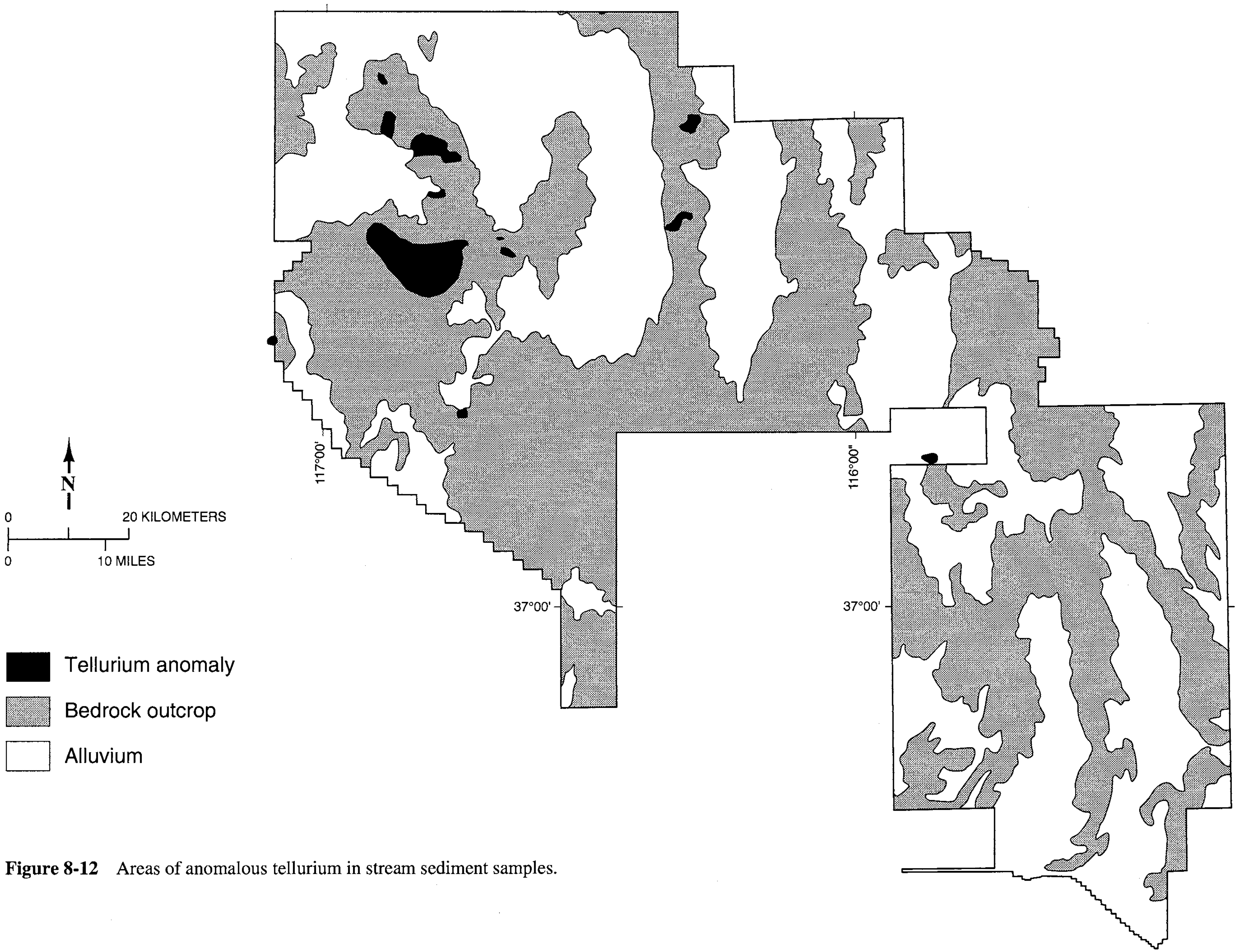


Figure 8-12 Areas of anomalous tellurium in stream sediment samples.

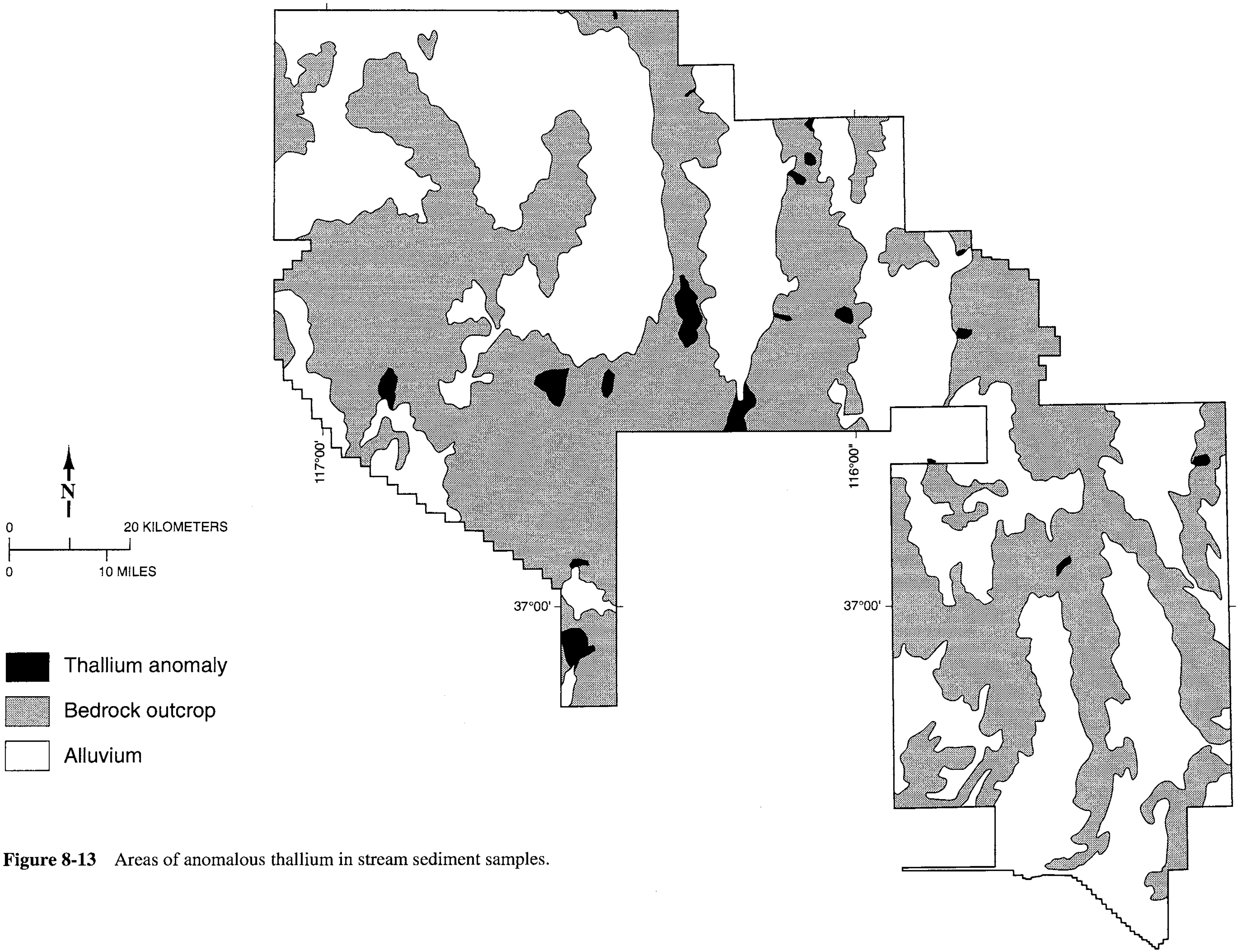


Figure 8-13 Areas of anomalous thallium in stream sediment samples.

Figure 8-14 Areas of anomalous tungsten in stream sediment samples.

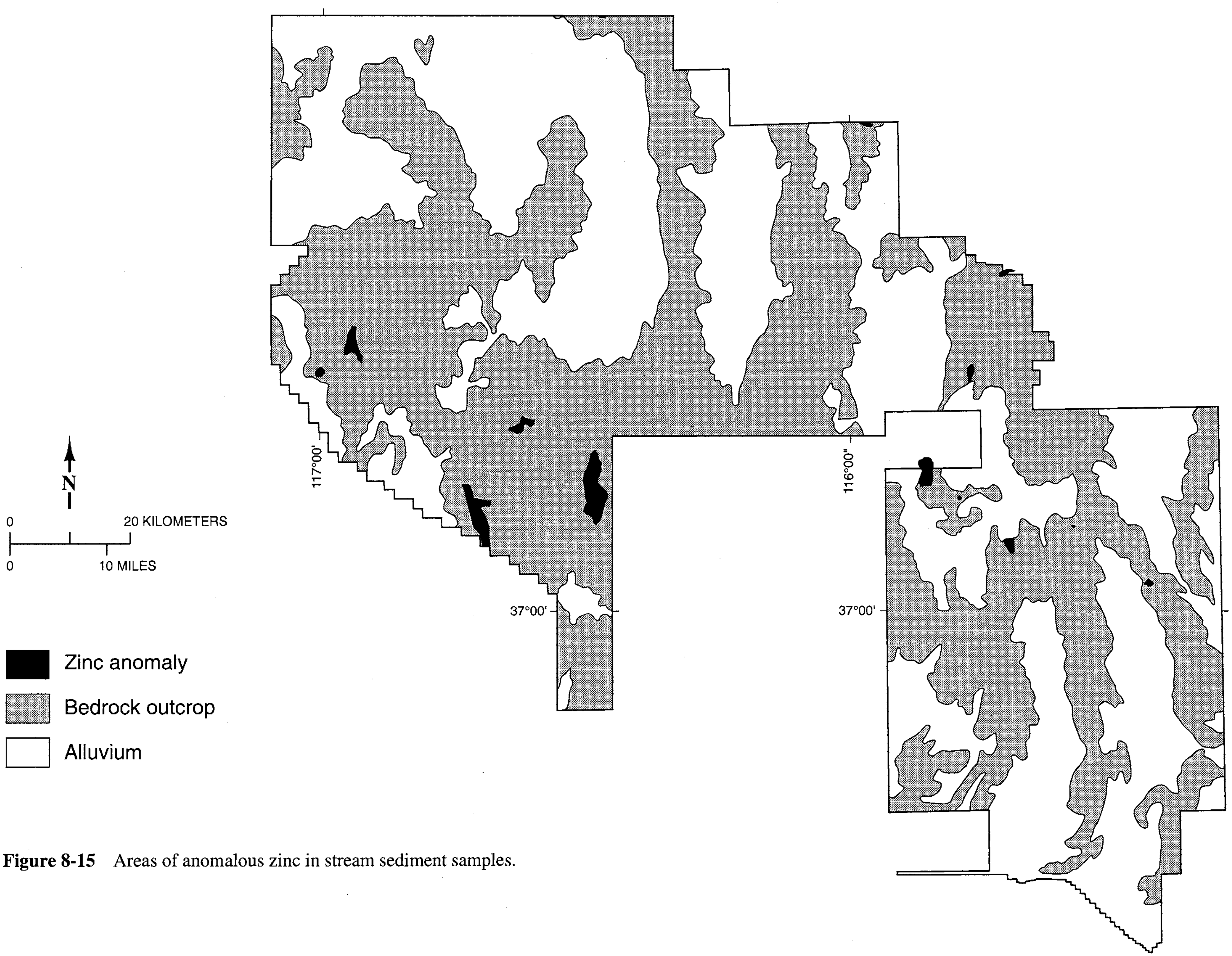


Figure 8-15 Areas of anomalous zinc in stream sediment samples.

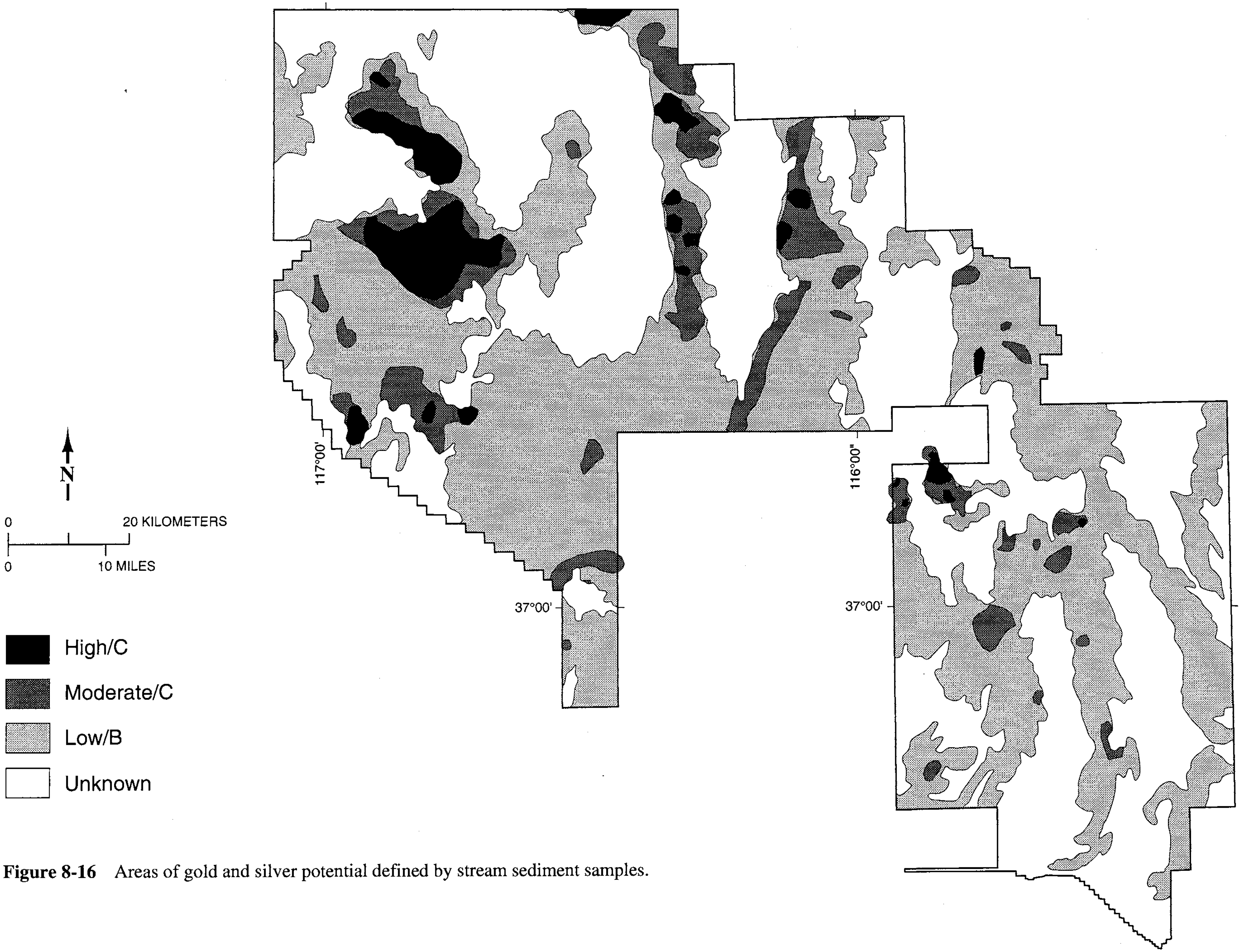


Figure 8-16 Areas of gold and silver potential defined by stream sediment samples.

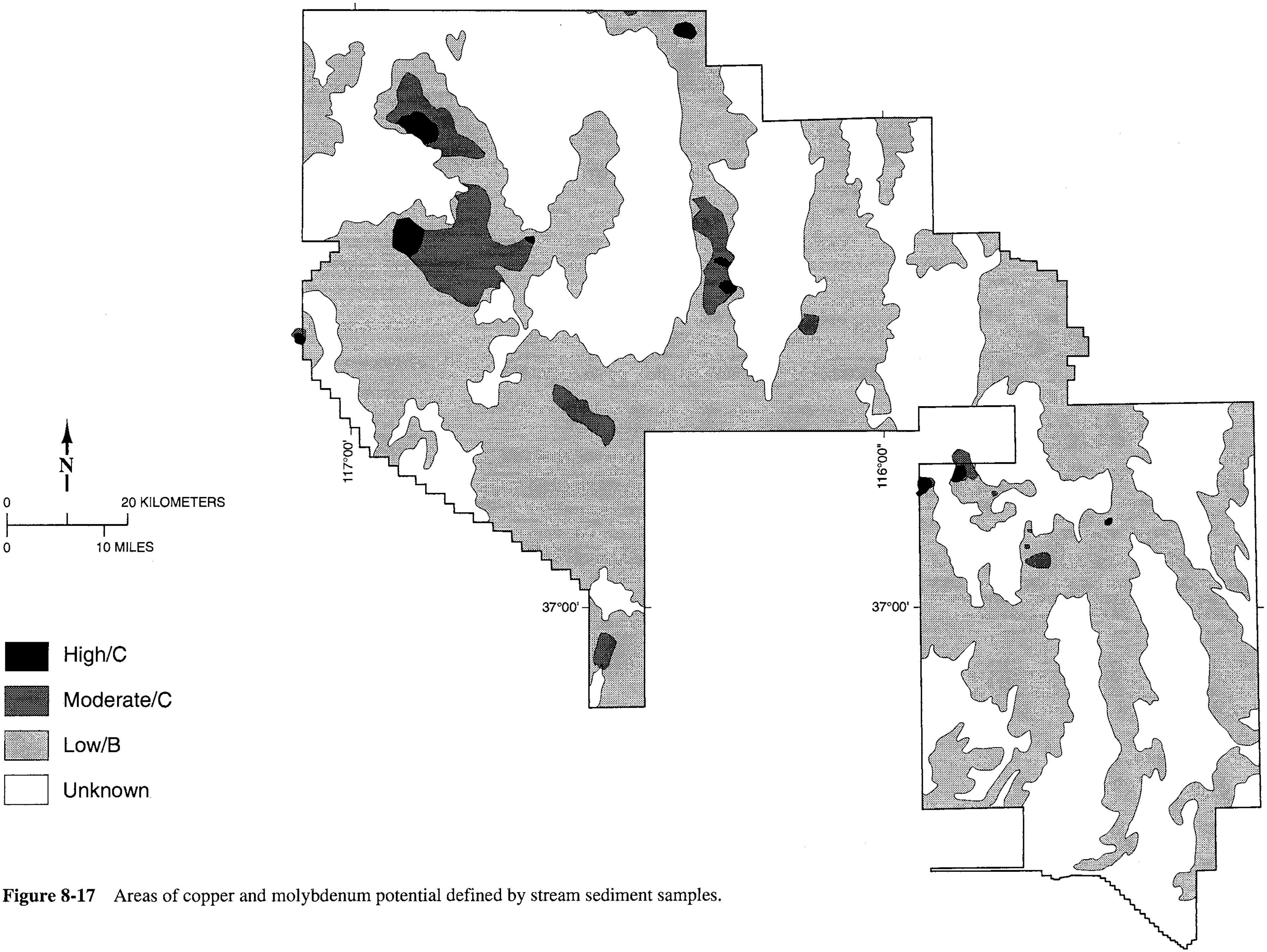


Figure 8-17 Areas of copper and molybdenum potential defined by stream sediment samples.

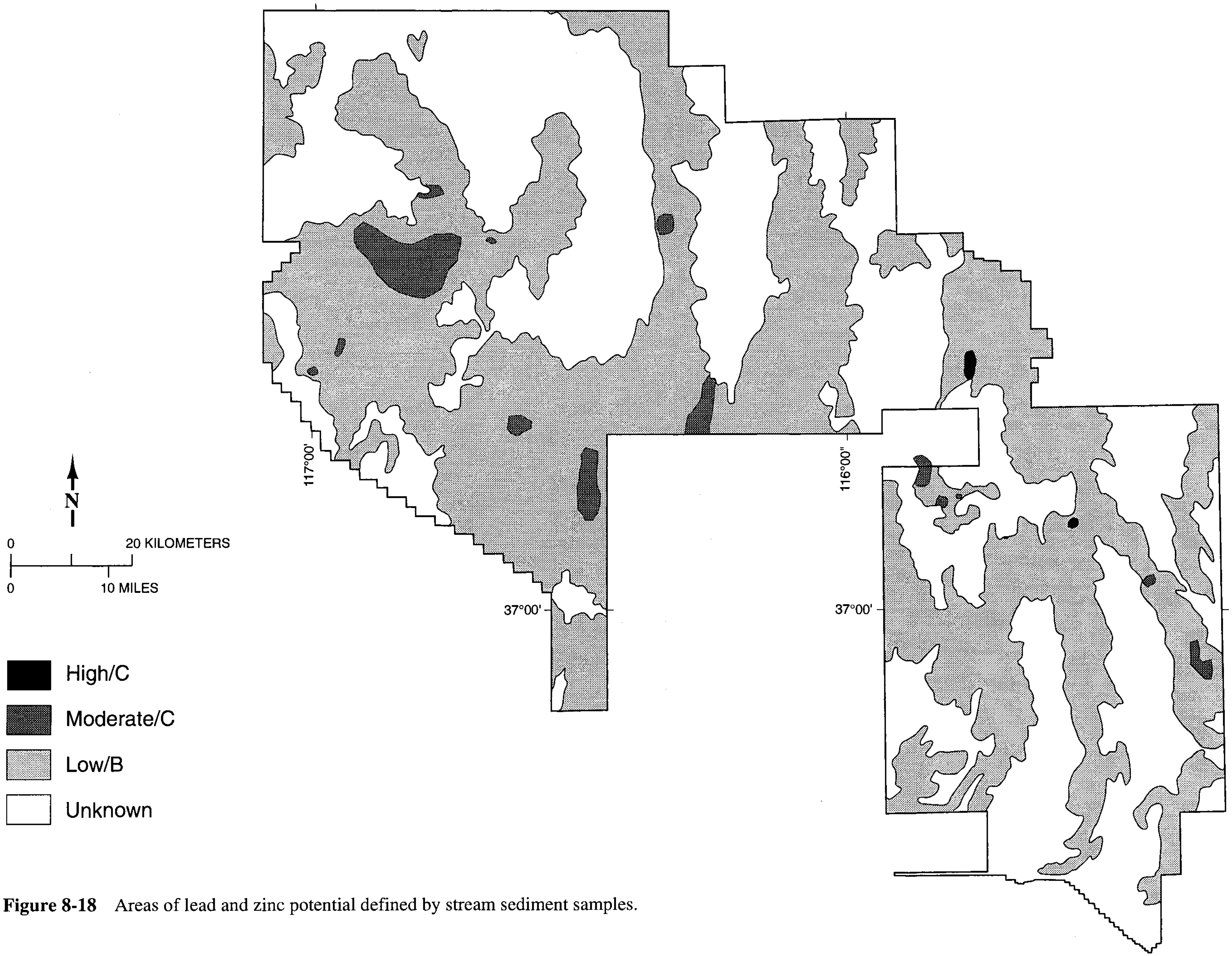


Figure 8-18 Areas of lead and zinc potential defined by stream sediment samples.

Figure 8-19 Areas of mercury potential defined by stream sediment samples.

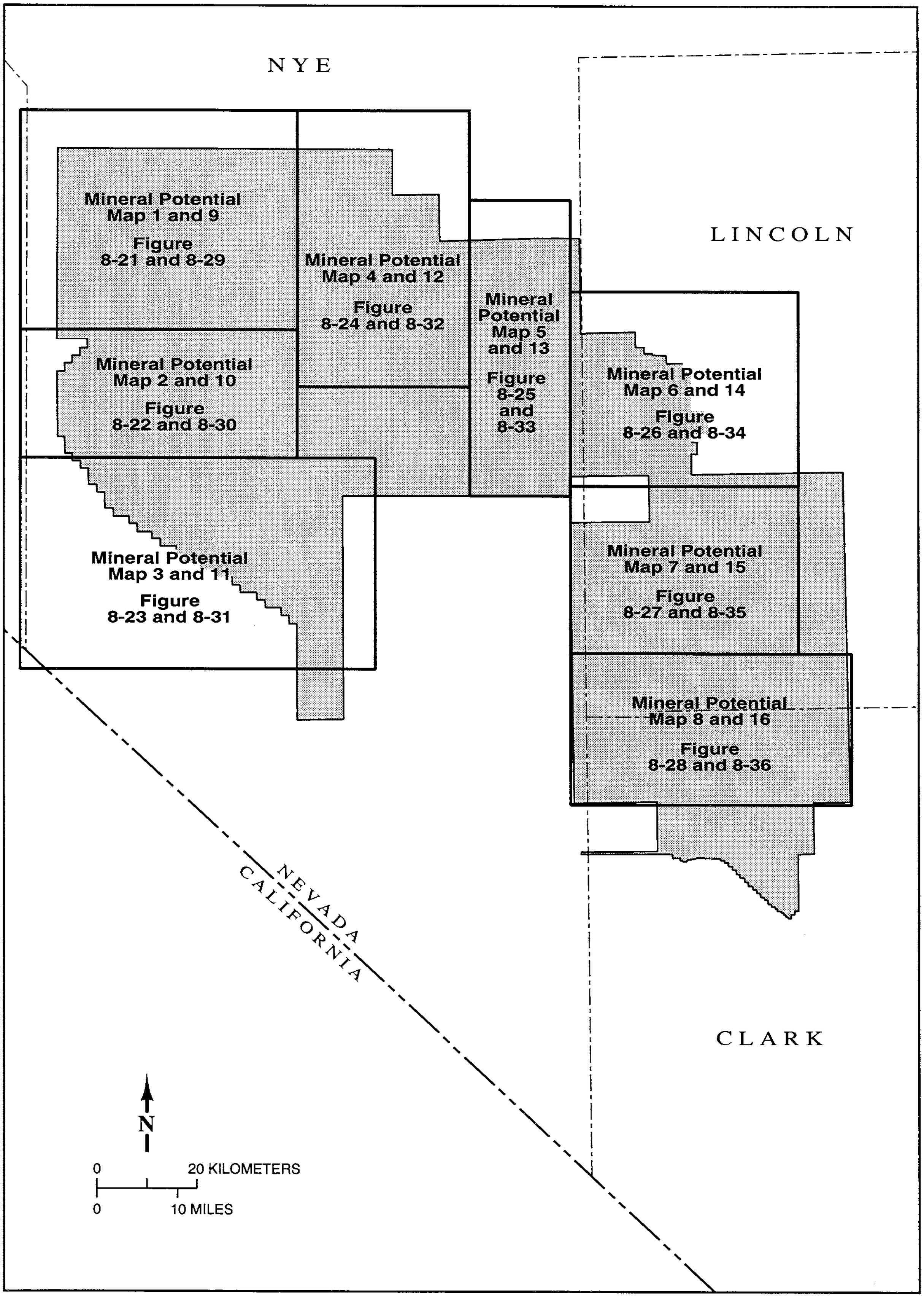


Figure 8-20 Index to mineral potential maps.

NAFR boundary; and the Goldfield project at Goldfield, about 11 km west of the NAFR boundary. Recent precious metals exploration projects on lands surrounding the NAFR include work by Kennecott Exploration at Goldfield, at Midway in southern Smoky Valley, and in Reveille Valley; exploration by Rayrock Yellowknife Resources, Inc. near the Daisy Mine, east of Beatty; and work by Phelps Dodge at Silverbow, in the Kawich Range north of NAFR.

8.1.1.1 Gold and Silver in the NAFR

Areas of gold and silver potential defined by stream sediment sampling (fig. 8-16) are concentrated in the northern portion of NAFR and most are either within or adjacent to known mining areas. Large areas of high resource potential were defined in the Cactus Range, southeast of the Cactus Springs district; and in the Mount Helen area, extending from the Antelope Springs district on the north to Mount Helen on the south. Areas of high resource potential outside of known mining areas were defined near Cedar Pass, north and south of the Gold Reed district in the Kawich Range, and north of Limestone Ridge in the Belted Range. Areas of moderate gold and silver potential generally surround the areas of high potential and may reflect geochemical haloes of one or more of the major precious metal indicator elements.

With the exception of the Slate district, and possibly the Prospector Fault area in the southern part of the NAFR, gold and/or silver have been sought in every district within NAFR. Compared to nearby districts such as Tonopah and Goldfield, the production from districts within the NAFR has been very small (table 7-1). Many districts have no recorded production and it is obvious from the workings and exposures that, in fact, no significant ore left those areas except as occasional specimens. However, current concepts in ore deposit types and interrelationships (Section 7.2.1) are quite different than those of the 1920s and 1930s when most of the NAFR districts were last active. These new concepts and technologies are taken into account in the assignment of levels of potential. The specific areas of gold-silver potential and their ratings are described in Section 7.3 and are shown on figures 8-21 through 8-27.

8.1.2 Copper and Molybdenum

Copper has been one of the more important metals in the advance of modern industry and technology and is considered vital to any industrialized society. Used primarily by ancient civilizations for jewelry, coinage, and weaponry, copper is used by modern society in thousands of applications because it possesses a versatility surpassed by few metals. More than 50 percent of the copper produced domestically is used in the electrical and communications industries, while another 40 percent is used in brass mills. Other materials may substitute for copper in some applications, such as aluminum in electrical equipment, automobile radiators, and refrigerator tubing; titanium and steel in heat exchangers; steel in artillery shell casings; optical fiber in telecommunications cable; and plastics in water pipe and plumbing fixtures. Copper is classified as a strategic and critical mineral.

The United States was the leading copper producing country between 1883 and 1981. Chile became the premier copper-mining country in 1982 and, for most years since then, has remained first. Principal copper producing states are: Arizona, Utah, New Mexico, Montana, Nevada, and Michigan. About 25 percent of the total copper used in the United States is imported, mainly from Chile, Canada, and Peru.

Molybdenum is a strategic element used principally as an alloying agent in steels, cast irons, and superalloys for hardening, strength, toughness, and resistance to wear and corrosion. Molybdenum finds significant usage as a refractory metal and in numerous chemical applications, including catalysts, lubricants, and pigments. Molybdenum is classed as a strategic and critical mineral.

The United States is a leading producer of molybdenum, traditionally producing about 50 percent of the world supply from primary molybdenum ores and as a byproduct of copper mining. Principal molybdenum producing states are: Colorado, Idaho, Arizona, New Mexico, Utah, Montana, and California. Major import sources of molybdenum are Chile, Canada, and China.

Copper is currently being produced in only two districts in Nevada. In the Yerington district in Lyon County, oxide ores are being recovered from the Yerington and MacArthur Mines and treated in a solvent extraction-electrowinning plant at the Yerington site. Up to 80,000 pounds of copper per day is produced from a reserve base of about 15 million tons averaging 0.32 percent copper. In the Robinson district of White Pine County, Magma Copper Co. brought the new Robinson Mine into production in early 1996. This mine has reserves of 252 million tons containing 2.1 billion pounds of recoverable copper and 1.8 million ounces of gold (Tingley, 1994). Both Yerington and Robinson are porphyry copper deposits (section 7.2.1.7).

Small amounts of copper have been produced from several mining districts around the NAFR, but all production has been as a by-product of precious metals or lead mining. Districts near NAFR with small copper production include Tonopah, Goldfield, Tem Piute, Pahranagat, and Oak Spring.

At the present time, no molybdenum is being produced in Nevada. There are large deposits at several localities within the state, however, and production could resume if market

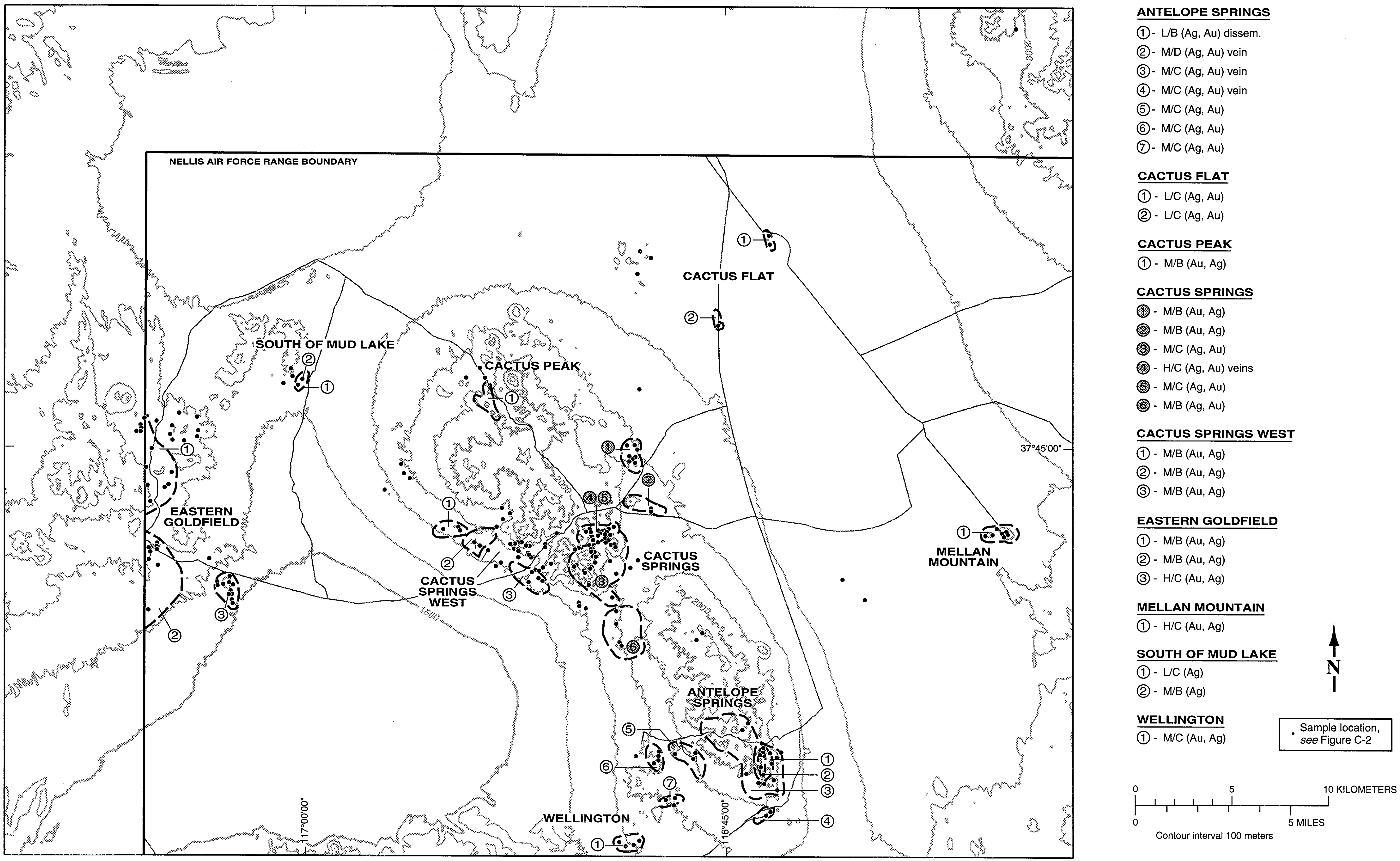
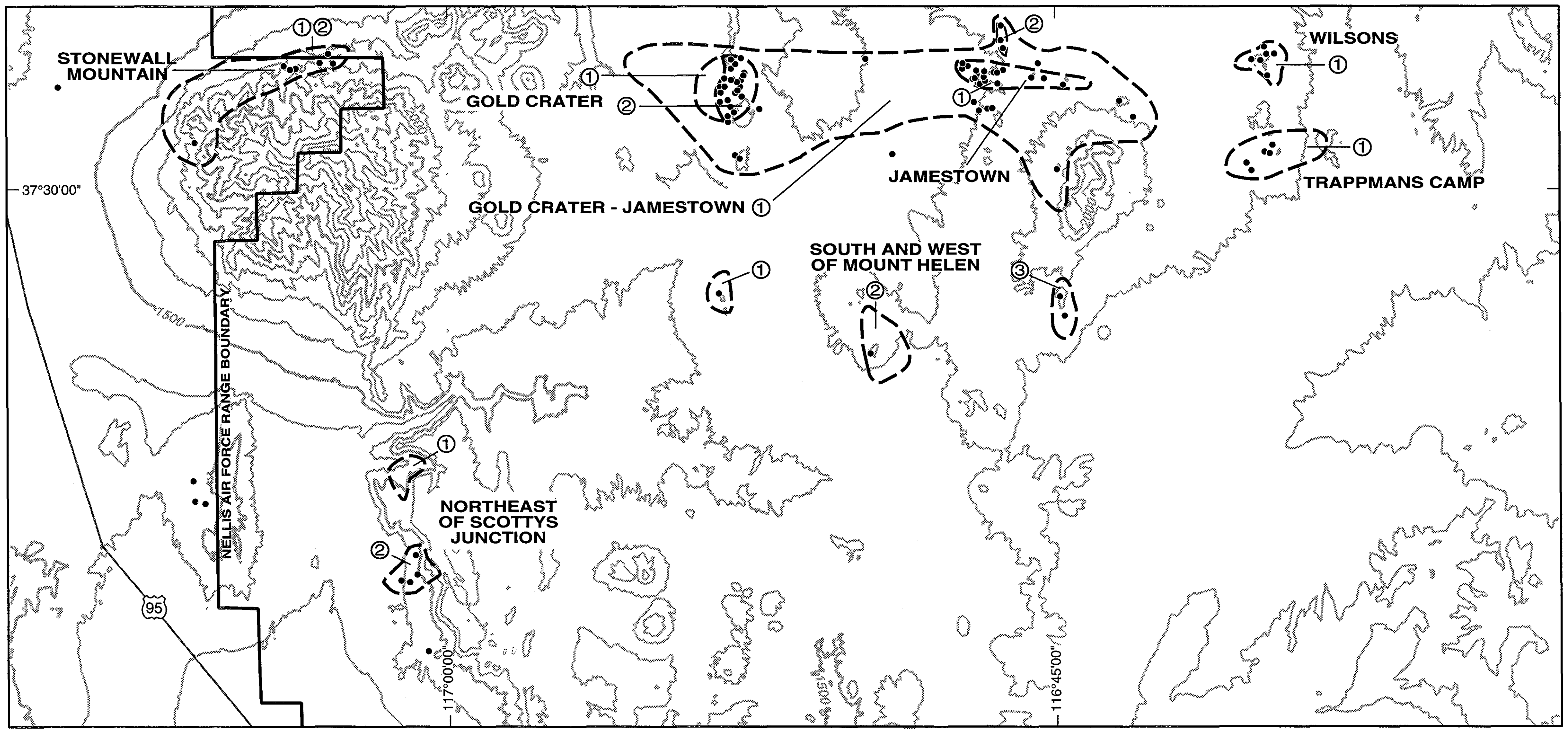


Figure 8-21 Mineral potential map 1.



GOLD CRATER

① - H/B (Au, Ag)

② - H/C (Au, Ag)

GOLD CRATER - JAMESTOWN

① - M/B (Au, Ag)

JAMESTOWN

① - H/C (Au, Ag)

② - H/C (Au, Ag)

NORTHEAST OF SCOTTYS JUNCTION

① - M/B (Au, Ag)

② - M/B (Au, Ag)

SOUTH AND WEST OF MOUNT HELEN

① - M/B (Au, Ag)

② - M/B (Au, Ag)

③ - M/B (Au, Ag)

STONEWALL MOUNTAIN

① - H/C (Ag, Au)

② - M/B (Ag, Au)

TRAPPMANS CAMP

① - M/C (Ag, Au)

WILSONS

① - H/C (Au, Ag)

N

• Sample location, *see* Figure C-3

0 5 10 KILOMETERS

0 5 MILES

Contour interval 100 meters

Figure 8-22 Mineral potential map 2.

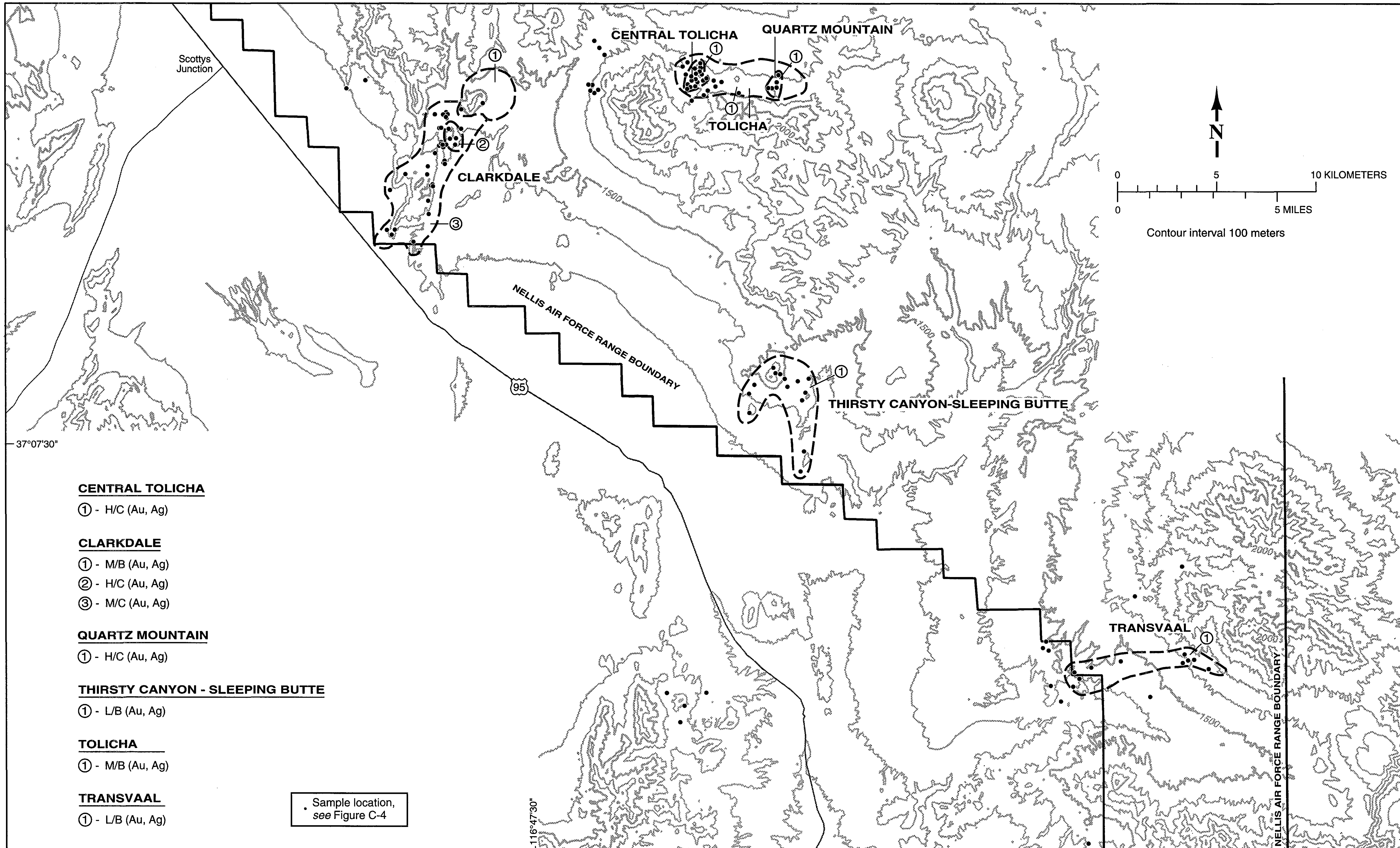
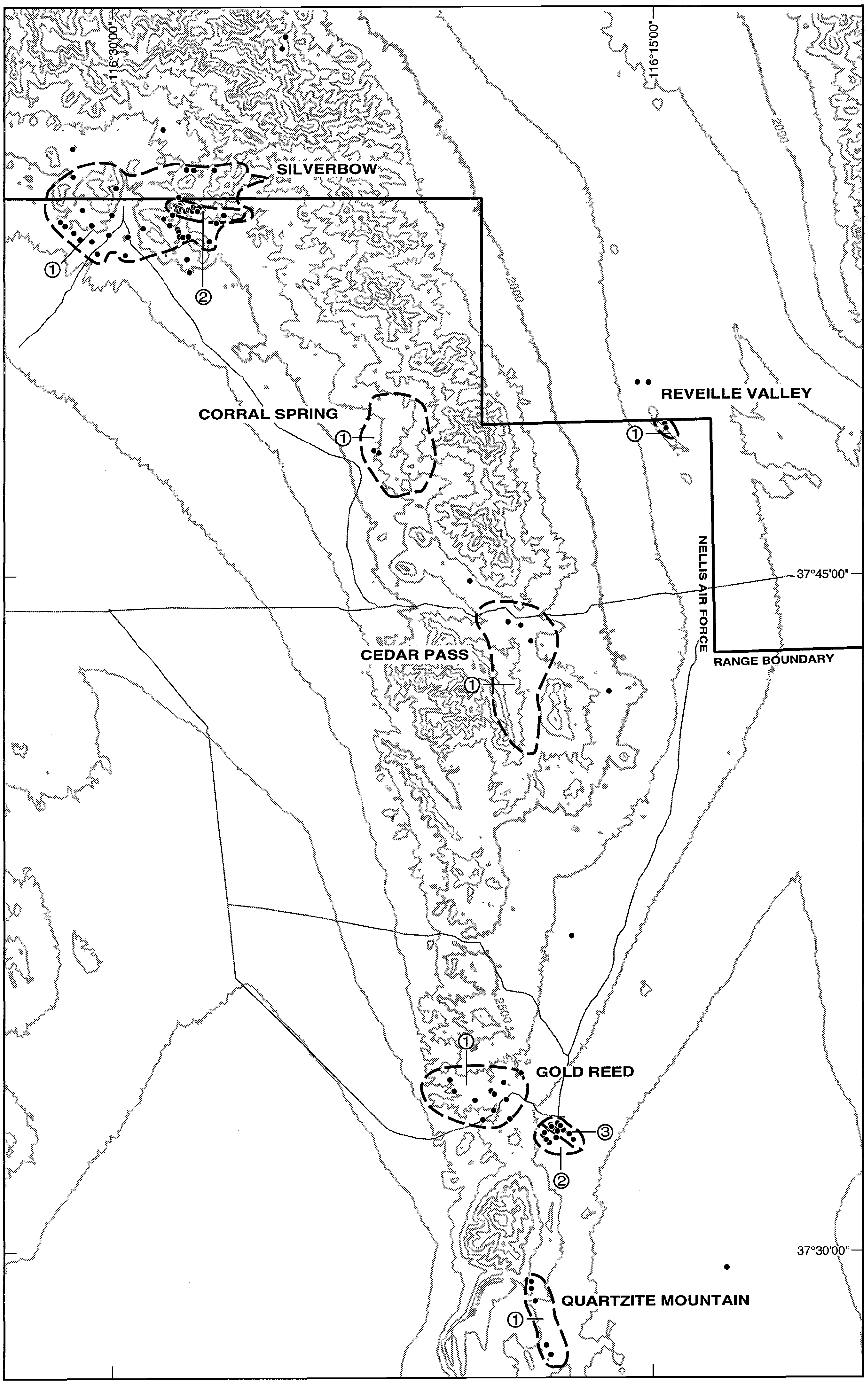


Figure 8-23 Mineral potential map 3.



CEDAR PASS
① - M/B (Ag, Au)

CORRAL SPRING
① - M/B (Au, Ag)

GOLD REED
① - M/C (Au, Ag)
② - M/B (Au, Ag)
③ - H/C (Au, Ag)

QUARTZITE MOUNTAIN
① - L/C (Ag, Au)

REVEILLE VALLEY
① - M/B (Au, Ag)

SILVERBOW
① - M/C (Ag, Au)
② - H/C (Ag, Au)

• Sample location, *see* Figure C-5

N

0 5 10 KILOMETERS
0 5 MILES

Contour interval 100 meters

Figure 8-24 Mineral potential map 4.

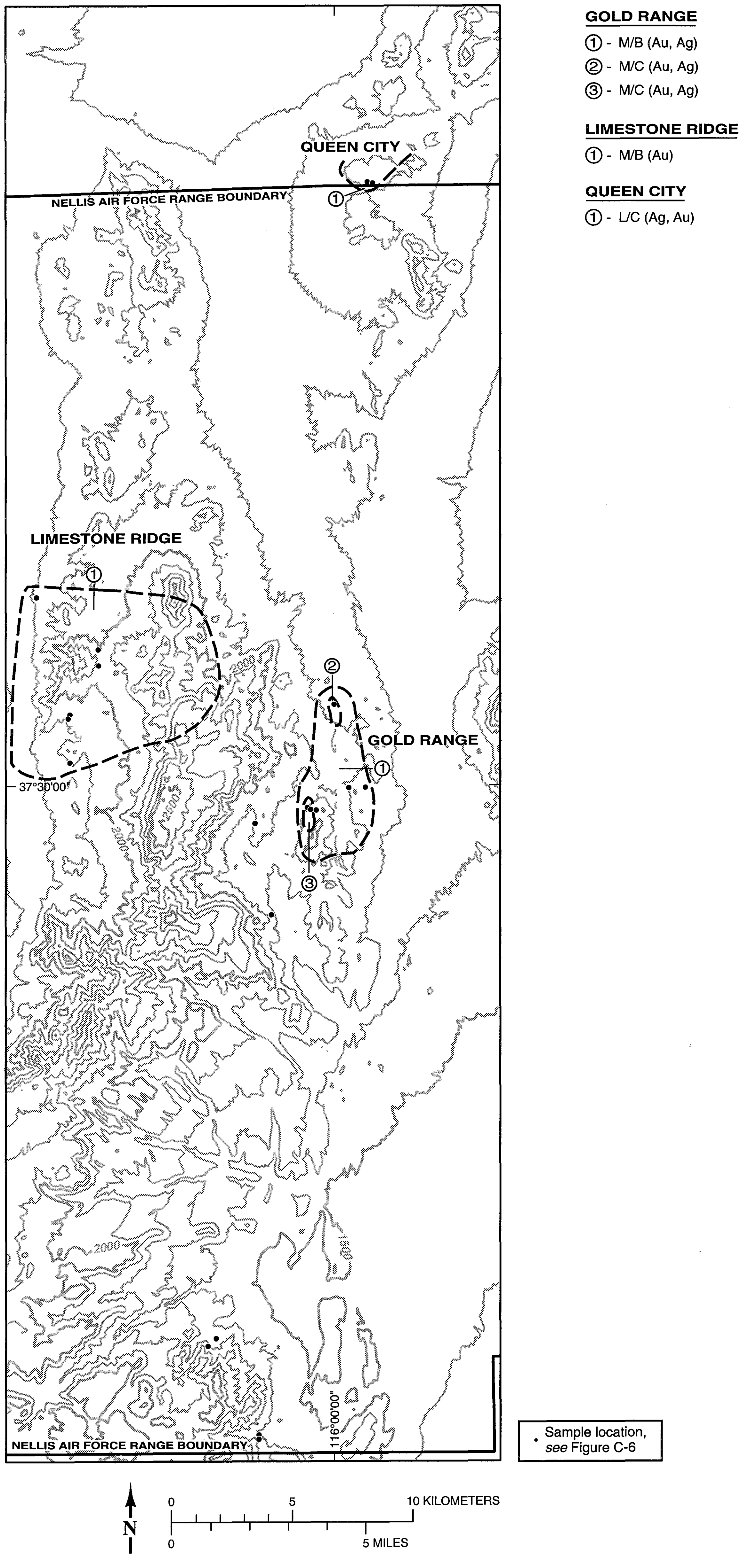


Figure 8-25 Mineral potential map 5.

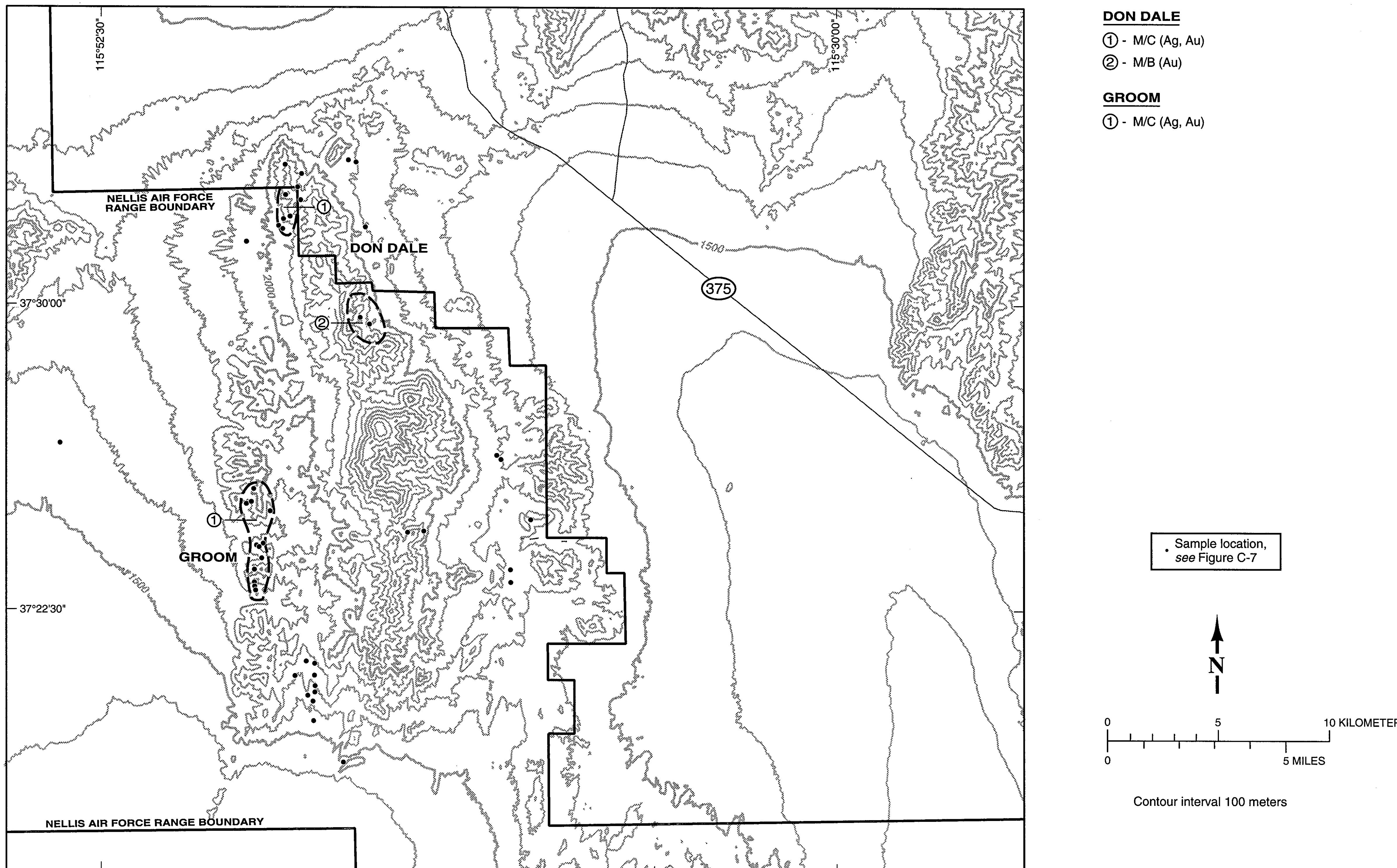


Figure 8-26 Mineral potential map 6.

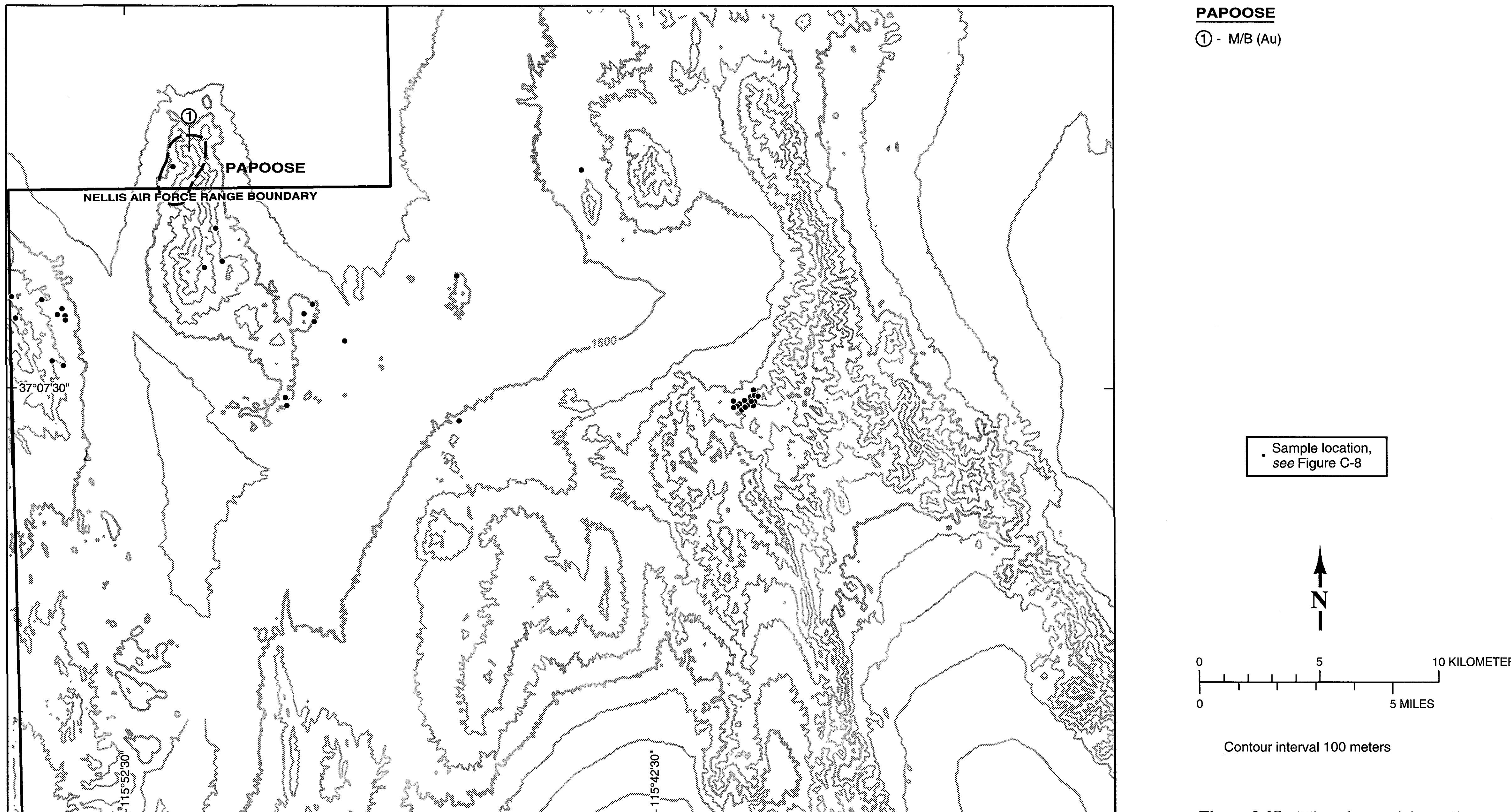
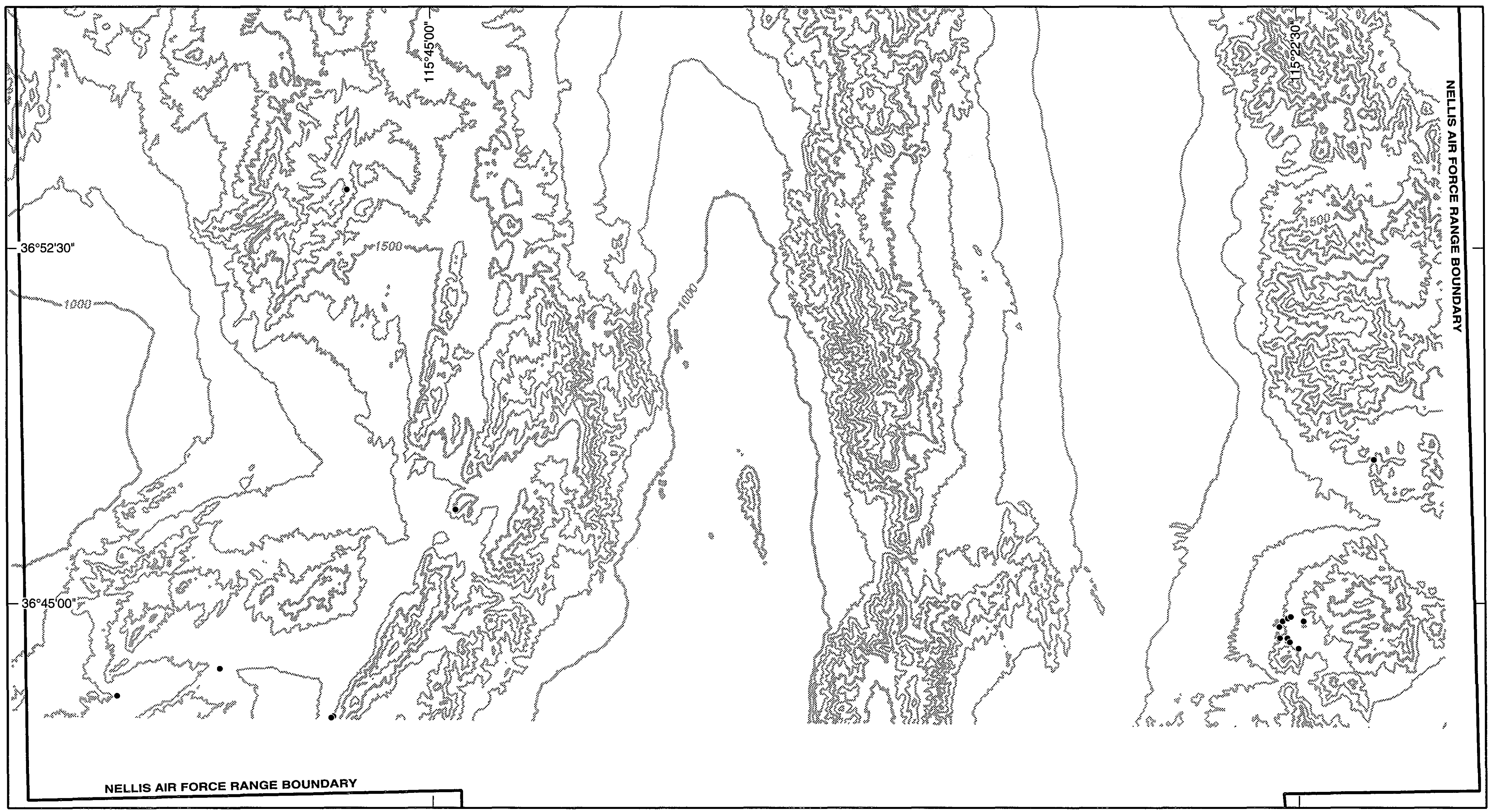


Figure 8-27 Mineral potential map 7.



No areas of gold-silver potential have been identified within this map sheet.

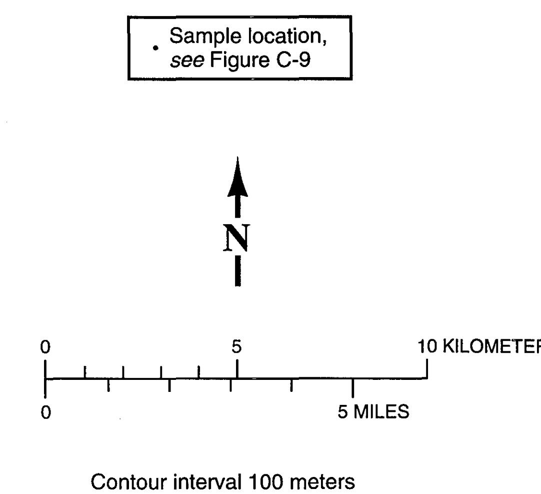
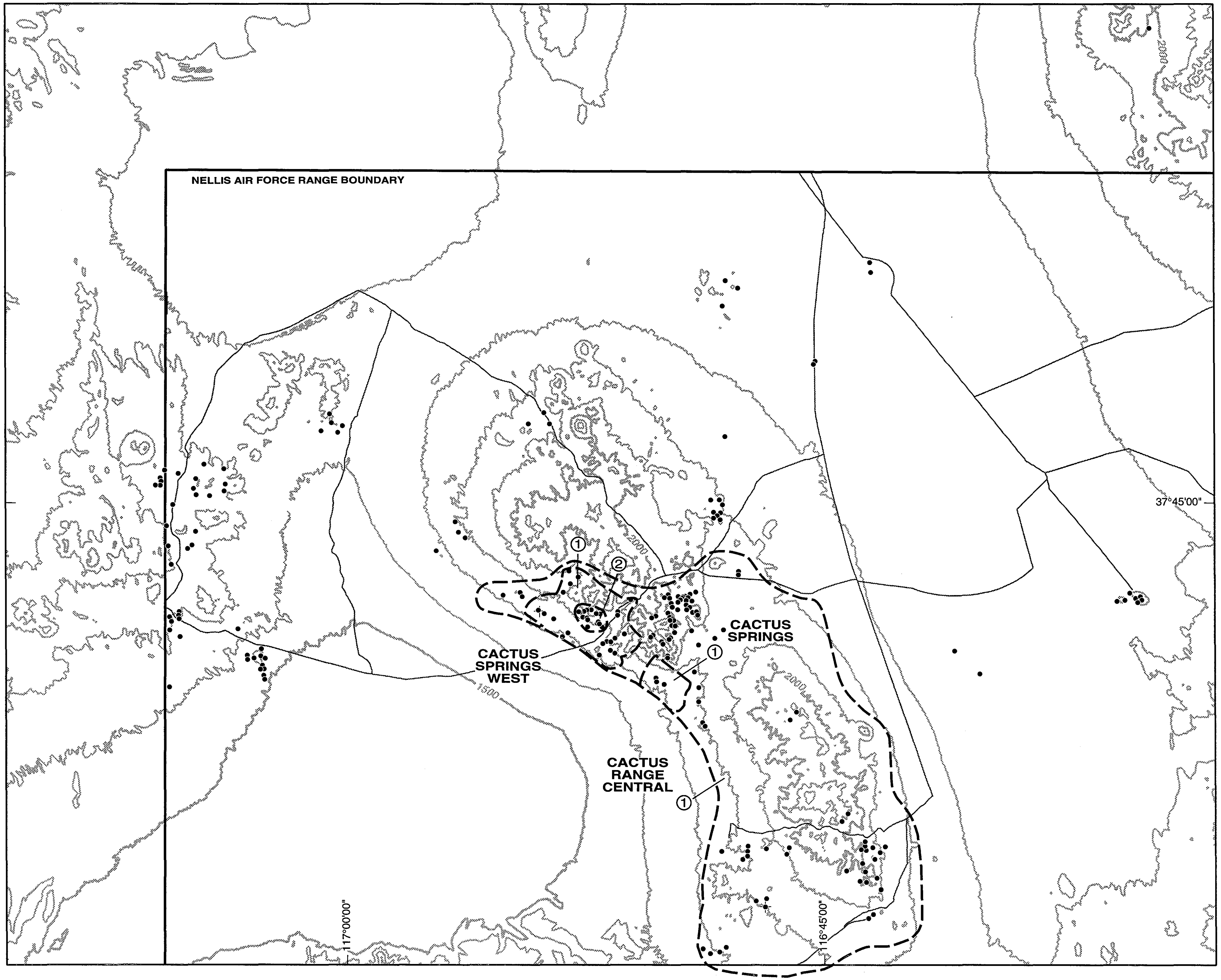


Figure 8-28 Mineral potential map 8.



CACTUS RANGE CENTRAL

① - M/B (Cu, Mo, Au)

CACTUS SPRINGS

① - M/B (Zn, Pb, Ag)

CACTUS SPRINGS WEST

① - M/C (Cu, Mo)

② - H/C (Turquoise)

• Sample location, *see* Figure C-2

N

0 5 10 KILOMETERS

0 5 MILES

Contour interval 100 meters

Figure 8-29 Mineral potential map 9.

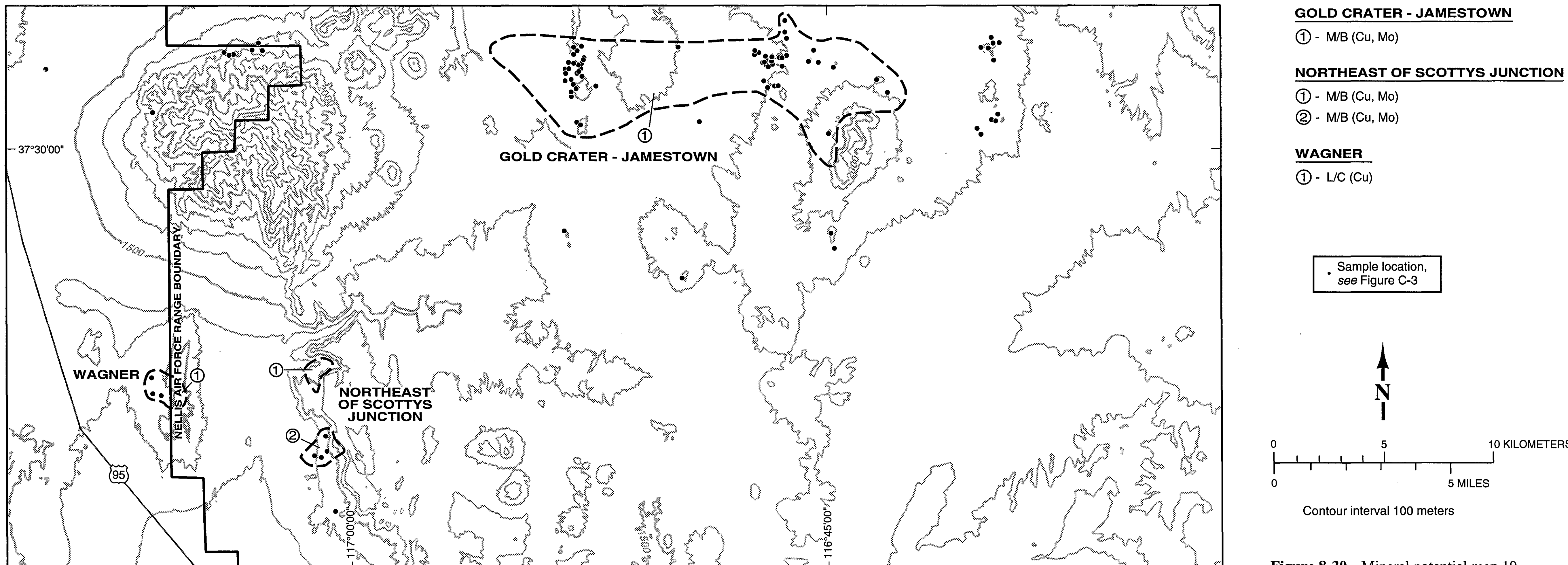


Figure 8-30 Mineral potential map 10.

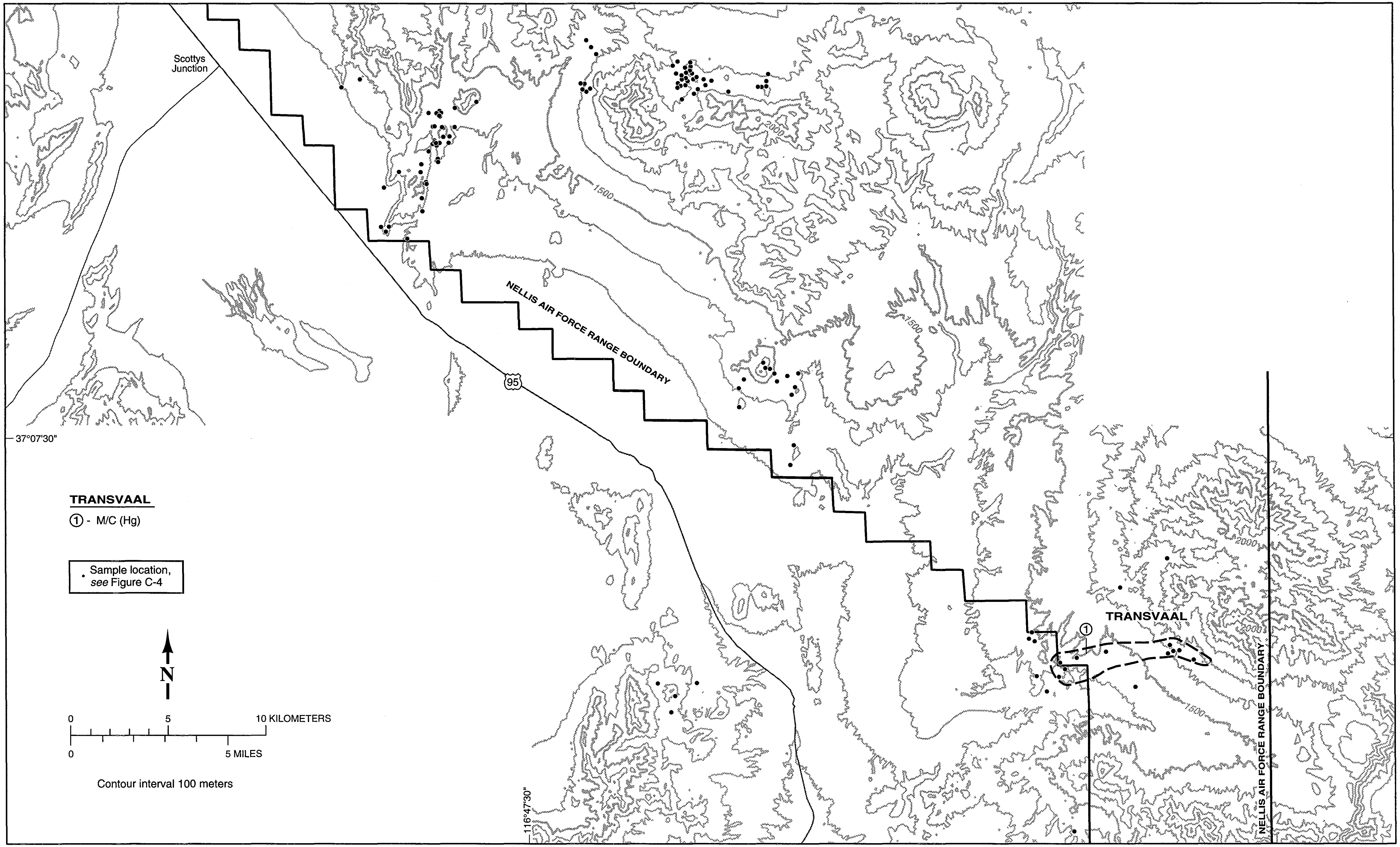


Figure 8-31 Mineral potential map 11.

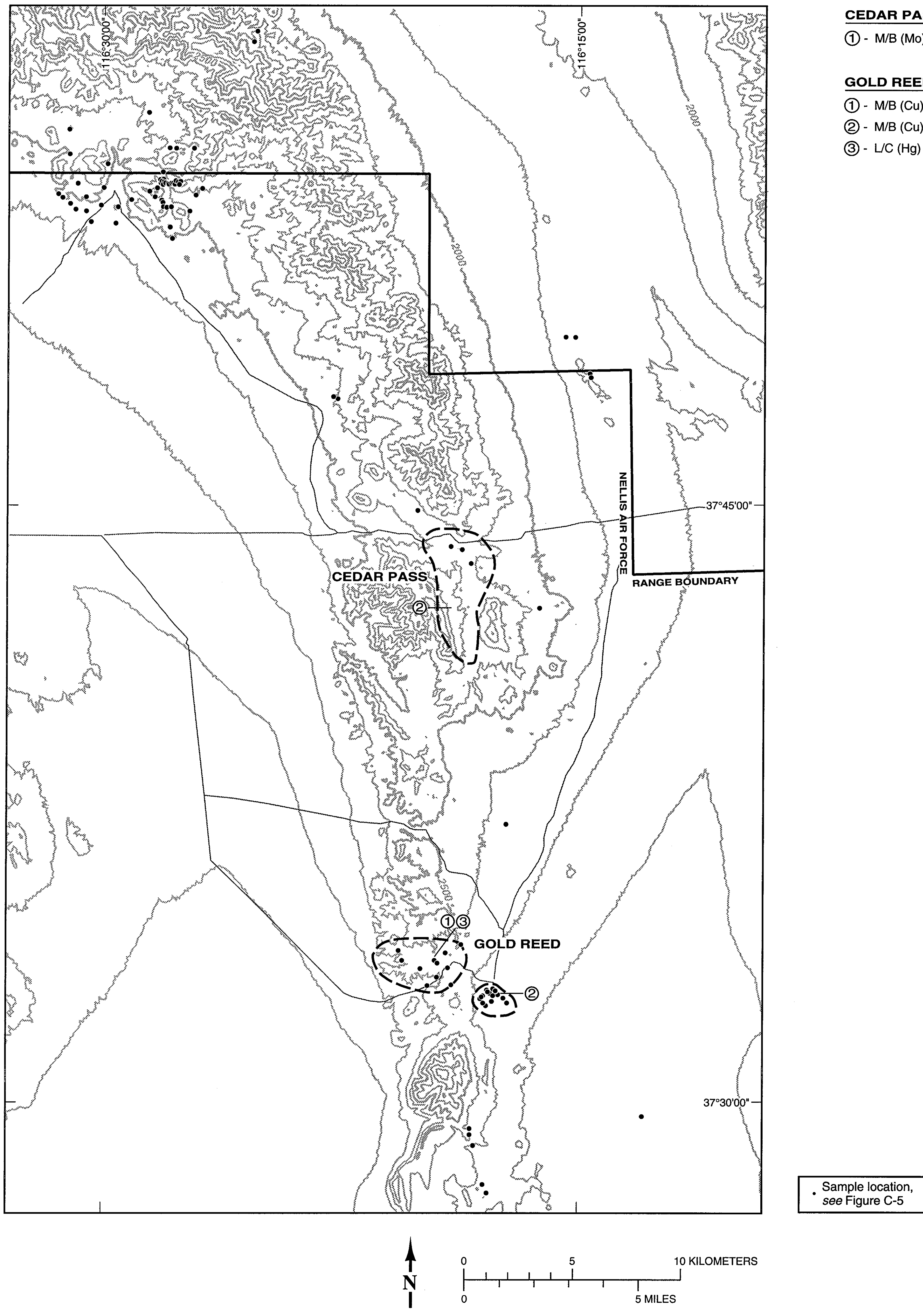


Figure 8-32 Mineral potential map 12.

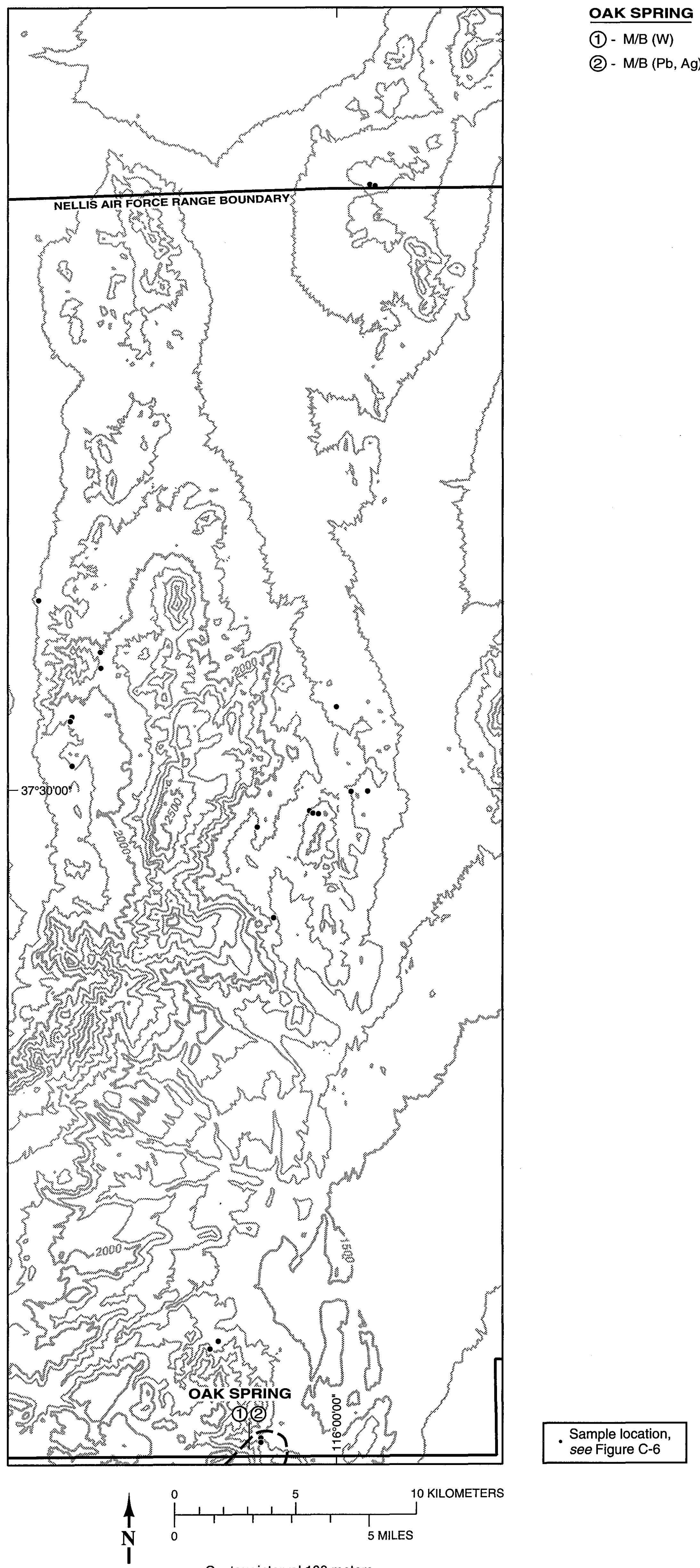


Figure 8-33 Mineral potential map 13.

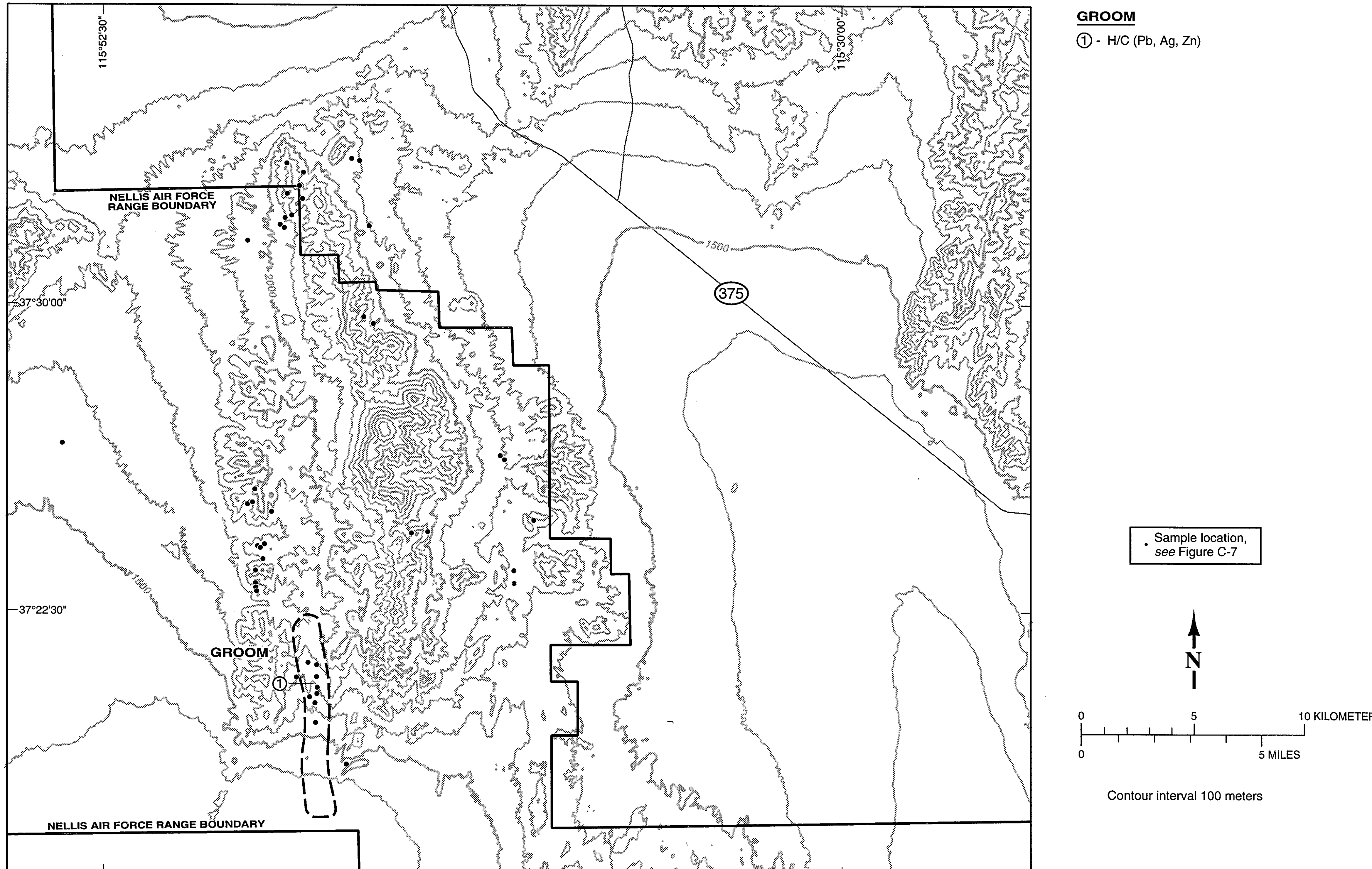


Figure 8-34 Mineral potential map 14.

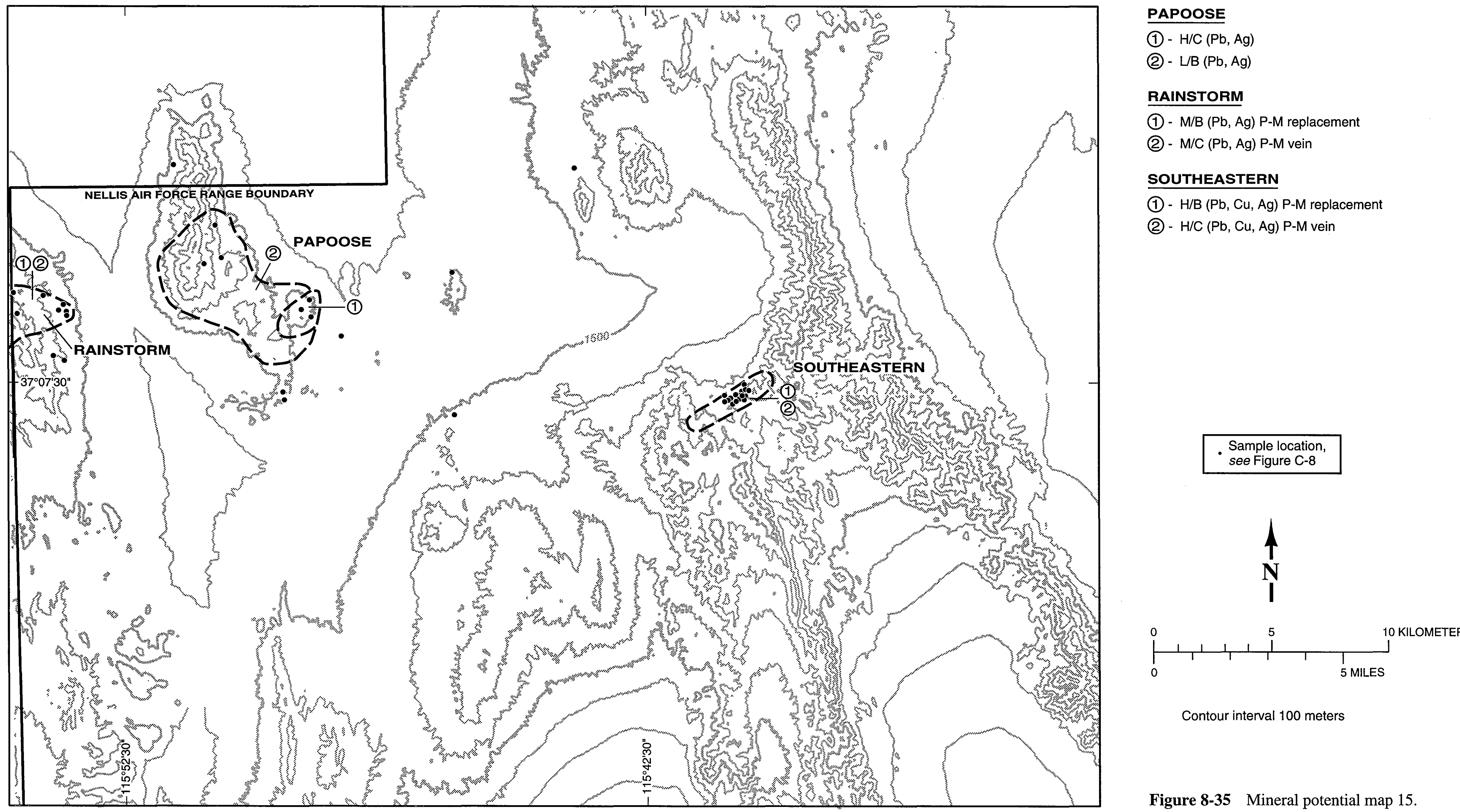
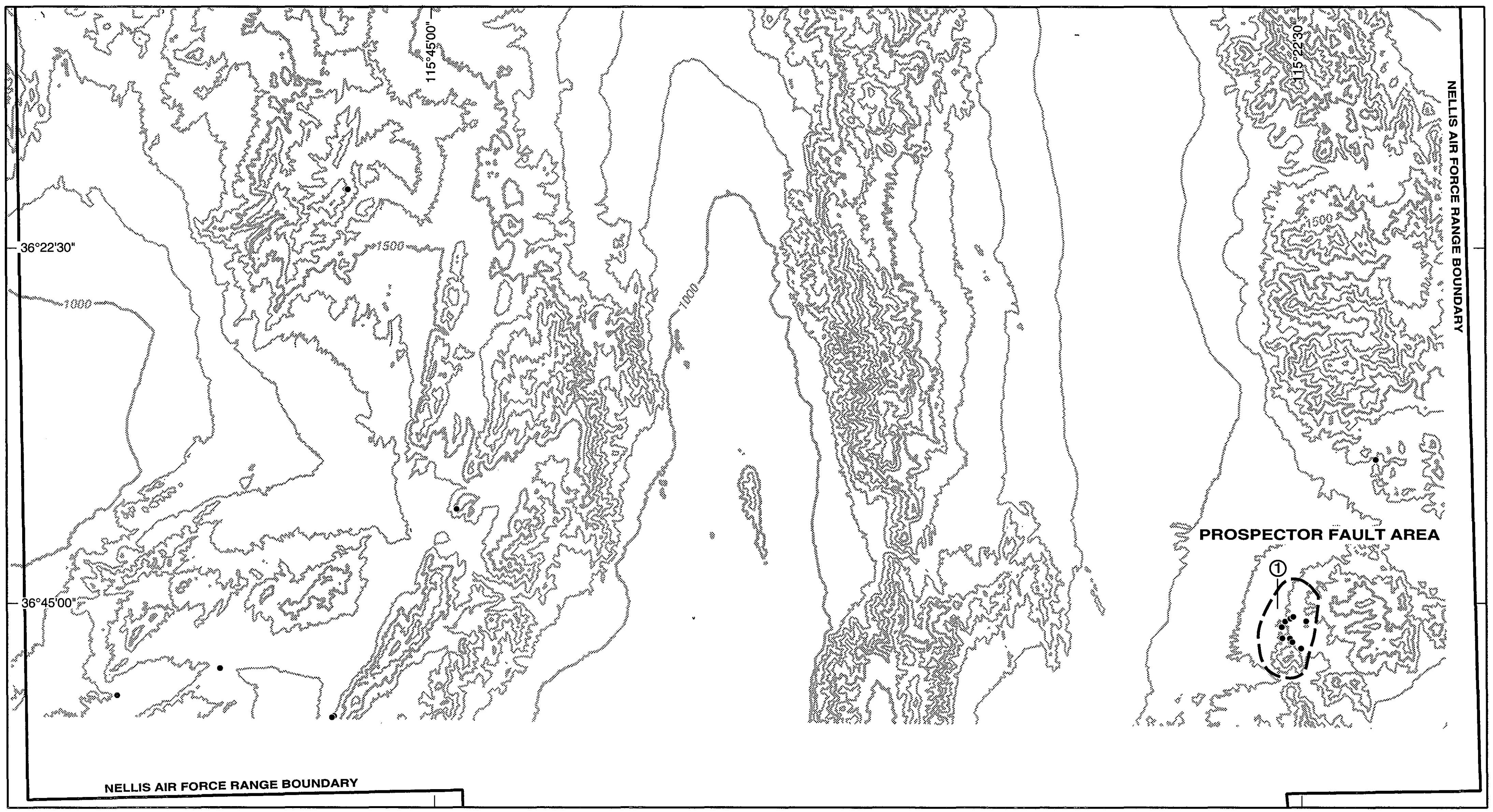


Figure 8-35 Mineral potential map 15.



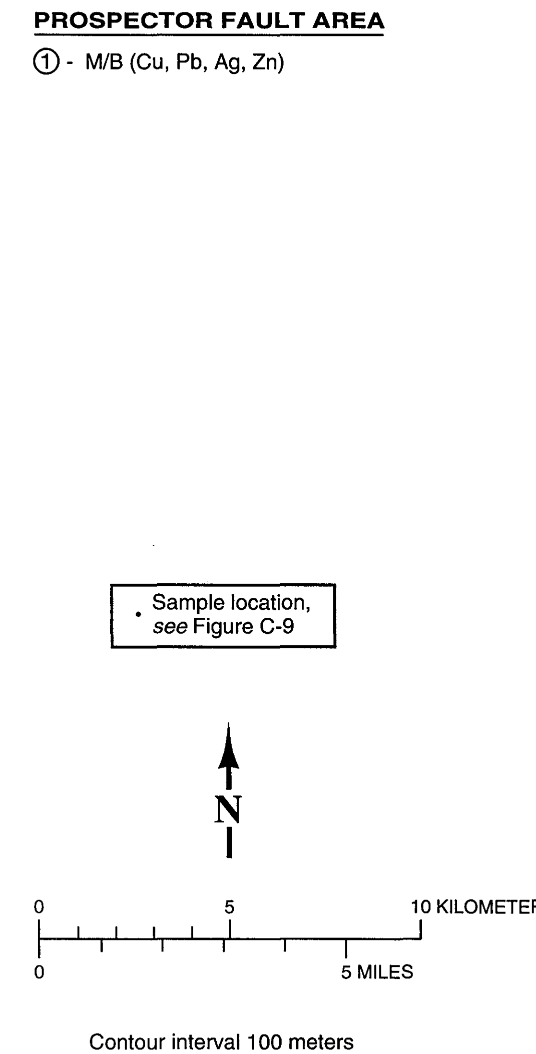


Figure 8-36 Mineral potential map 16.

conditions improve. The closest deposit to the NAFR is at the Hall Mine located in the San Antonio district about 40 km north of Tonopah. The Climax Mine area, in the Oak Spring district on the Nevada Test Site, is highly prospective for porphyry molybdenum deposits, but no exploration has been undertaken there.

8.1.2.1 Copper and Molybdenum in the NAFR

Stream sediment sampling outlined several areas of copper-molybdenum potential within NAFR (fig. 8-17). The largest of these encompass the west slope of the northern Cactus Range, the area extending from Gold Crater through Mount Helen to the Trappman Hills, and the area surrounding Gold Reed in the southern Kawich Range. Smaller anomalies are focused on known mineralized areas within the Rainstorm, Papoose, Southeastern, Wagner, and Corral Spring districts.

Copper has been produced from the Groom, Southeastern, Oak Spring, Antelope Springs, Wilsons, and Papoose districts within the NAFR. Production has been small, and has been limited to material recovered during primary mining for gold, silver, or lead. Molybdenum has not been produced from the NAFR.

Only two potential copper mining projects have been undertaken or proposed on ground in or adjacent to NAFR in the past few decades. In the 1960s, plans were considered for a nuclear test on claims in the Jamestown district to study the feasibility of using nuclear devices for in situ mining of copper. Copper is commonly associated with high-sulfidation precious metals mineralization, such as that present at Jamestown. When present, the copper occurs in deeper porphyry-type deposits (section 7.2.1.7). This deep copper potential, although only inferred, may have been the target of the proposed nuclear mining project. The most recent copper exploration in the area has been in the Wagner district, located on the western border of the NAFR a few kilometers south of Stonewall Mountain. In 1991, BHP Minerals drilled at least one deep hole on what was inferred to be a buried porphyry copper target. This drilling was not successful, but BHP believes there is potential for the discovery of copper-bearing polymetallic replacement bodies in the district.

There is mineral resource potential for three types of copper deposits within the NAFR. In the Cactus Springs West district, rock alteration and surface trace element associations indicate potential exists for porphyry-type copper-molybdenum mineralization. High-sulfidation epithermal systems such as those present at Jamestown, Gold Crater, and part of the Cactus Springs West districts could contain disseminated copper mineralization. There is potential for polymetallic replacement deposits of copper in the Wagner, Southeastern, Groom, Papoose, and Rainstorm districts. The specific areas of copper-molybdenum potential and their ratings are described in Section 7.3 and are shown on figures 8-29, 8-30, 8-32, 8-35, and 8-36.

8.1.3 Lead and Zinc

Lead is the fifth major metal used in the world following iron, aluminum, copper, and zinc. The United States has been a leading lead producing country for several years and, in 1995, accounted for about 14 percent of the total world mine production. However, the country is also the largest consumer of lead, and thus is a net importer. Lead is classified as a strategic and critical mineral.

Lead is one of the oldest metals used by man; lead pipe was used in ancient Egypt, and the hanging gardens of Babylon were floored with sheets of lead. Many medieval buildings in Europe still stand under their original lead roofs. At present, the largest use for lead is in storage batteries, fuel tanks, solder, seals, and bearings. Lead is also used in the construction, communications, ammunition, and electrical industries; and in paint, TV glass, ceramics, and as ballast.

Seven lead mines in Missouri plus lead-producing mines in Alaska, Colorado, Idaho, and Montana yielded most of the total United States production in 1995 (USGS, 1996).

Zinc stands fourth among metals of the world in annual consumption, being surpassed only by steel, aluminum, and copper. About 75 percent of domestic demand is used in protective coatings for steels and as die cast articles largely for the automobile industry. Other uses are as a chemical compound in rubber and paints. In the United States, zinc ores are widely distributed from Maine to the Rocky Mountains. In 1995, twenty-five states had zinc production. Four states, Alaska, Missouri, New York, and Tennessee, contributed almost 90 percent of the total domestic output; Alaska alone produced over half of the national production (USGS, 1996). Zinc is classified as a strategic and critical mineral.

At the present time, there is no lead or zinc production from Nevada. Large lead-zinc-producing districts in the state, such as Eureka, Eureka County, Pioche and Groom, Lincoln County, and Goodsprings, Clark County, have been idle for many years. These deposits, and other similar smaller occurrences around the state, are classified as polymetallic replacement and/or polymetallic vein deposits. Deposits of this type range from several hundred thousand to several million tons with combined lead-zinc grades exceeding 3 to 4 percent (Cox and Singer, 1986). Pioche, the largest of this type deposit within Nevada, produced some 6 million tons of ore containing about 3 to 5 percent lead and as much as 14 percent zinc (Gemmill, 1968).

8.1.3.1 Lead and Zinc in the NAFR

Stream sediment sampling defined only two areas of high potential for lead and zinc (fig. 8-18). One of these is centered on the Groom district, the largest known lead-producing district within NAFR. The second is focused on the Southeastern Mine in the northern Pintwater Range. Moderate resource potential for lead and zinc was defined in the Gold Crater-Jamestown-Mount Helen area.

Lead production is reported from seven districts within NAFR, zinc production is reported from only one. The Groom district, with over 10 million pounds of lead and 39,100 pounds of zinc production is the largest. Papoose, the second largest, has produced 301,673 pounds of lead and no zinc (table 7-1). The Groom production originated entirely from patented mining claims now surrounded by the NAFR. All of the deposits within NAFR are polymetallic replacement or polymetallic vein types (Sections 7.2.1.5 and 7.2.1.6).

There is potential for development of polymetallic vein or polymetallic replacement deposits of lead and/or zinc in four districts within the NAFR. In the Groom district, replacement orebodies could occur in favorable carbonate horizons in unexplored sections of a central graben bounded by north-south-trending faults. Most of the area of potential is within privately-held land, but this potential also extends south into the large pediment area north of Groom Lake, within the NAFR. Potential also exists in the Papoose, Rainstorm, and Southeastern districts. The specific areas of lead-zinc potential and their ratings are described in Section 7.3 and are shown on figures 8-29, 8-33, 8-34, 8-35, and 8-36.

8.1.4 Mercury

Mercury, also known as quicksilver, was used by the Greeks as early as the fourth century B.C. Until the 16th century, however, consumption was small and chiefly for medicinal and cosmetic purposes. For several centuries following the discovery of rich silver and gold deposits in the Americas, large quantities of mercury were used in the amalgamation process to recover those metals from their ores. The history of mercury usage in the United States is also closely associated with gold and silver mining and usage rose in response to the development of California's early gold industry. Since about the time of World War I, however, significant quantities of mercury have been used in explosives, drugs, electrical apparatus, and instruments. The mercury cell process to produce caustic soda and chlorine became widespread following World War II and continues to be a major factor in mercury usage. In recent years, mercury use has drastically declined due to strict regulation and environmental concerns. In mid-1995, the U.S. Government suspended sales of mercury from its stockpile and there is speculation that the stockpile may become a repository for what is being looked upon as a hazardous material. Mercury is, however, classified as a strategic and critical mineral.

Since the mid-1970s, Nevada has been the primary source of U.S. mercury production. All of Nevada's production in 1994 was a byproduct from sediment-hosted gold mines in the northern part of the state.

There are no large mercury-producing districts near the NAFR. Small amounts of mercury were produced from mines in the Queen City district, west of Rachel. The Andies Mine in the Don Dale district on the north end of the Groom Range also produced a few flasks of mercury. Mercury has been produced from small deposits on the northeast side of Bare Mountain, east of Beatty and from deposits north of Bare Mountain, on the western part of Yucca Mountain. Evidence of mercury mining is also present at Mine Mountain, on the Nevada Test Site.

8.1.4.1 Mercury in the NAFR

Stream sediment sampling outlined two areas within NAFR with moderate resource potential for mercury. Both of these areas, the Gold Reed district in the southern Kawich Range and the Transvaal Hills south of Pahute Mesa, coincide with areas of known mercury prospects. A third anomalous area is centered on the Wagner district, south of Stonewall mountain; this area, however, is mostly west of the NAFR boundary.

Prospecting for mercury is evident in only two districts within the NAFR. The Bristol Group claims in the Gold Reed district were evaluated for mercury in the early 1930s. There is no evidence of mining, and no mercury production is recorded from the area. This area is within a larger area of weak alteration related to a high-sulfidation gold system. A small area of shallow hot-spring alteration and possible sinter development is present in the eastern part of the Transvaal district (fig. 7-1). The specific areas of mercury potential and their ratings are described in Section 7.3 and are shown on figures 8-31 and 8-32.

8.1.5 Tungsten

Tungsten in its pure form is a silver-gray or white metal whose usefulness is related directly to its special or unique physical and chemical properties. The major uses of tungsten relate not only to the special characteristics of the metal itself but also to the properties that it imparts to its compounds and its alloys: extreme hardness, the ability to retain hardness and strength at elevated temperatures, high tensile strength, adequate electrical conductivity, and high wear resistance. The largest use for tungsten is in the manufacture of tungsten carbide for use in drill bits and tool steel. Other important uses are in lamps and lighting, electrical and electronic machinery, and chemicals. More than 90 percent of the world's estimated tungsten resources are located outside the United States. Even so, the United States, in the past, has had an active tungsten mining industry and there are large tungsten ore reserves at former mines in California, Nevada, Montana, Idaho, Colorado, and North Carolina. Tungsten is classified as a strategic and critical mineral.

There has been no tungsten mining in Nevada since 1982 when short-lived attempts to reopen the Nevada-Massachusetts Mine in Pershing County and the Tem Piute Mine in Lincoln County failed. These are the two largest skarn-type tungsten deposits in Nevada; each has reserves exceeding 1 million units (1 unit is 20 pounds) of WO3. The closest known tungsten properties to NAFR are the Tem Piute Mine, located in Lincoln County about 16 km northeast of the NAFR boundary, and the Climax Mine at Oak Springs in the Nevada Test Site.

8.1.5.1 Tungsten in the NAFR.

No areas of tungsten resource potential were defined by the stream sediment sampling program.

There are no known tungsten mines or prospects within the NAFR. Anomalous tungsten values were reported in samples collected from two prospects located in the NAFR a little over 1.6 km north of the Climax Mine. There is potential for skarn tungsten deposits to be found in this area. The area is described in Section 7.3 and is shown on figure 8-33.

8.2 NONMETALLIC (INDUSTRIAL) MINERALS

Assessment of potential for nonmetallic, or industrial, minerals is approached in a different manner than that used for metallic minerals. For most nonmetallic commodities, the ore deposit models do not have the same importance as they do for the metallic commodities. Many commodities are specific to certain rock types or depositional environments; potential is mapped by rock stratigraphy and drilling/sampling programs covering large areas. This type of program is beyond the scope of the present study. Assessments are based on the limited information available from the few nonmetallic occurrences documented within NAFR (fig. 8-37) combined with regional knowledge of favorable geologic settings.

In the following sections, commodities of potential importance within NAFR are described and assigned potential ratings. The ratings are compiled in table ES-5 in the summary section of this report.

8.2.1 Barite

Barite (barium sulfate) is the most abundant mineral of the metal barium, but it is mainly used in the mineral form. Pure barite has a calculated specific gravity of 4.5, although natural barite deviates somewhat from this number. In some types of deposits, barite contains up to several weight percent strontium, which substitutes for the barium, and barite may be finely intergrown with other minerals, such as quartz or carbonate minerals, reducing its density. The high density of barite, its relatively inert chemical properties, and its abundance have made it an important industrial mineral commodity.

Commercial deposits of barite may be divided into four types: bedded barite deposits; vein barite deposits; karst barite deposits; and residual barite deposits. Bedded barite deposits are the most commercially attractive because they may be relatively large and high grade. Some bedded barite deposits contain several million tons of ore, and individual beds within these deposits contain as much as 95 percent barite that can be used with little or no beneficiation other than grinding (Brobst, 1994). Most bedded barite deposits occur in Paleozoic sedimentary sequences that typically contain abundant chert and black shale and siltstone. The origin of bedded barite deposits has been a matter of debate, with early researchers proposing hydrothermal replacement as the origin, and most later researchers arguing for some sort of synsedimentary barite deposition. The most favored explanation is that bedded barite deposits were formed as a chemical precipitate from hydrothermal brines discharged at the sea floor during deep-sea sedimentation. In Nevada, bedded barite deposits are mainly in allochthonous Ordovician and Devonian rocks in a well-defined, northeast-trending belt about 500 km long and 100 km wide (Papke, 1984; Poole, 1995).

Vein-type barite deposits exhibit great variation in size and geometry; from long, relatively narrow tabular veins to stock work vein or breccia deposits. Vein barite occurs in many different host rocks that range from Precambrian to Tertiary in age. Most barite in vein deposits is associated with sulfide minerals such as pyrite, galena, and sphalerite, and with other minerals such as quartz and calcite. In addition, most barite veins contain wall rock fragments. However, some vein deposits are of nearly pure barite. Vein barite deposits are mostly considered to have formed from low-temperature epithermal solutions, particularly those in the western United States (Brobst, 1994). Vein barite deposits are not as important commercially as bedded barite deposits, but still yield significant tonnages. In Morocco, which has produced more barite than the United States in recent years (Searls, 1993), barite is mined from vein deposits.

In Nevada, vein barite deposits generally occur in, or adjacent to, the belt of bedded barite deposits described above. Only two vein barite deposits in Nevada have produced more than 1,000 tons of barite. By comparison, 21 bedded barite deposits have produced more than 25,000 tons, and three have produced more than a million tons.

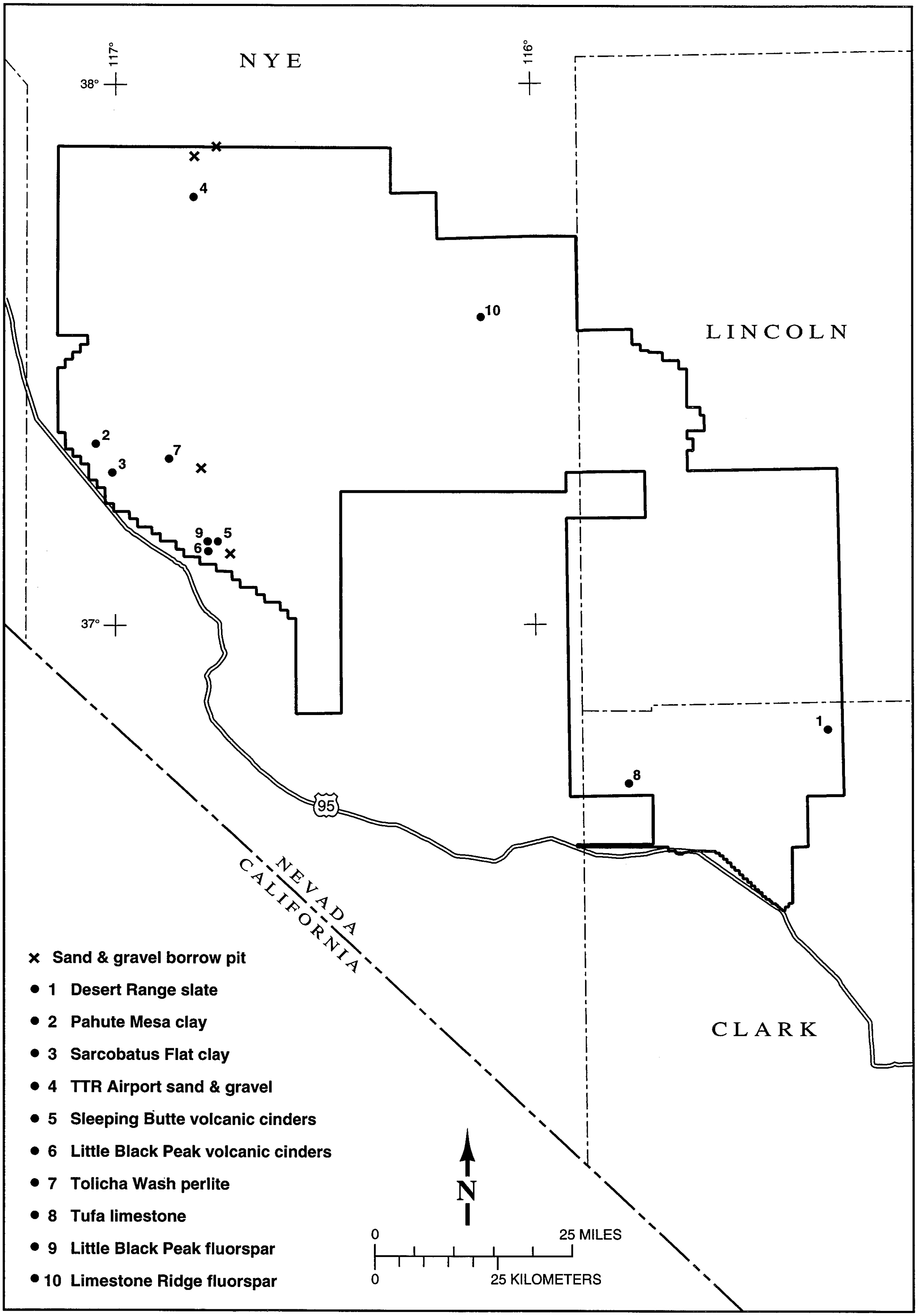


Figure 8-37 Industrial mineral deposits on the Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

Karst barite deposits, in which barite occurs in circular deposits in cavern or collapse structures, occur in central Missouri. Karst barite ores are rich, but generally small (Searls, 1993). Karst barite deposits are not known to occur in Nevada. Residual barite deposits are shallow, surface concentrations of unconsolidated material formed from weathering and erosion of other deposits. The size and grade of these deposits is highly variable. Four areas of residual or alluvial barite deposits are known in Nevada. Two have been mined, but neither produced more than 25,000 tons of barite (Papke, 1984) .

Residual and bedded barite deposits are typically mined by open-pit methods, but some bedded and vein deposits may be mined by underground methods. All barite mined currently, or in the recent past, in Nevada is from open-pit mines (Papke, 1984). In many cases, bedded barite is sufficiently pure that beneficiation is not required, but vein deposits typically require flotation to produce commercial grades (Brobst, 1994).

Approximately 5 million metric tons of barite are produced annually worldwide, of which 90 percent is consumed by the petroleum industry as drilling mud additive (Brobst, 1994). China became the largest producer of barite in the 1980s, and importation of Chinese barite caused domestic production to plummet. Domestic production of barite has ranged between about 300,000 and 410,000 metric tons for the last five years (Bearden, 1995) and most of this barite has come from Nevada. Current Nevada barite production is only about 15 percent of the peak production of more than 2 million metric tons that was reached in 1981 (fig. 8-38). Barite production in the state now comes from only four or five mines operated by four companies, whereas in the early 1980s barite was produced from more than 25 mines (Castor, 1993).

The bulk of barite consumed in the world is used for production of high density oil and gas well drilling muds which cool and lubricate drill bits, clean and stabilize drill holes, and help contain high pressure gas and oil. Most domestic barite is sold into the United State's Gulf Coast, where major oil well drilling technology companies are located. Barite is also used in glass manufacturing, as a high density filler and weighting agent in plastics and rubber, and when bleached, as a pigment. The mineral is also used as radiation shielding and as an indicator in X-ray photography.

The average value of domestic drill-grade barite (f.o.b. at the mines) was about $42 per metric ton in 1994 (Bearden, 1995). Although China's growing position in world production had the effect of driving down prices for barite in the 1980s, recent equilibration of domestic rail shipping costs with ocean freight rates has made Nevada barite prices competitive with Chinese and Indian barite in the Gulf Coast (Griffiths, 1995). High-value, paint-grade barite (96-98 percent barium sulfate) sells for more than $300 per metric ton delivered in the United Kingdom (Industrial Minerals, 1995).

Barite consumption is mainly dependent on the amount oil and gas drilling. The growing world population will put pressure on existing energy resources and the pace of drilling will probably increase in the long term as older oil and gas fields pass their peak production years. The amount of barite needed to drill oil and gas wells will also increase as wells go deeper, particularly in North America. Thus the demand for barite is expected to increase in the long term, although byproduct barite from metal mining and reprocessing of barite tailings ponds may partly offset higher demand.

No barite deposits are known within the NAFR. However, the NAFR was withdrawn before the recent period of barite exploration that corresponded with the peak in Nevada barite production (fig. 8-38), and were therefore not subjected to intense modern exploration for the mineral.

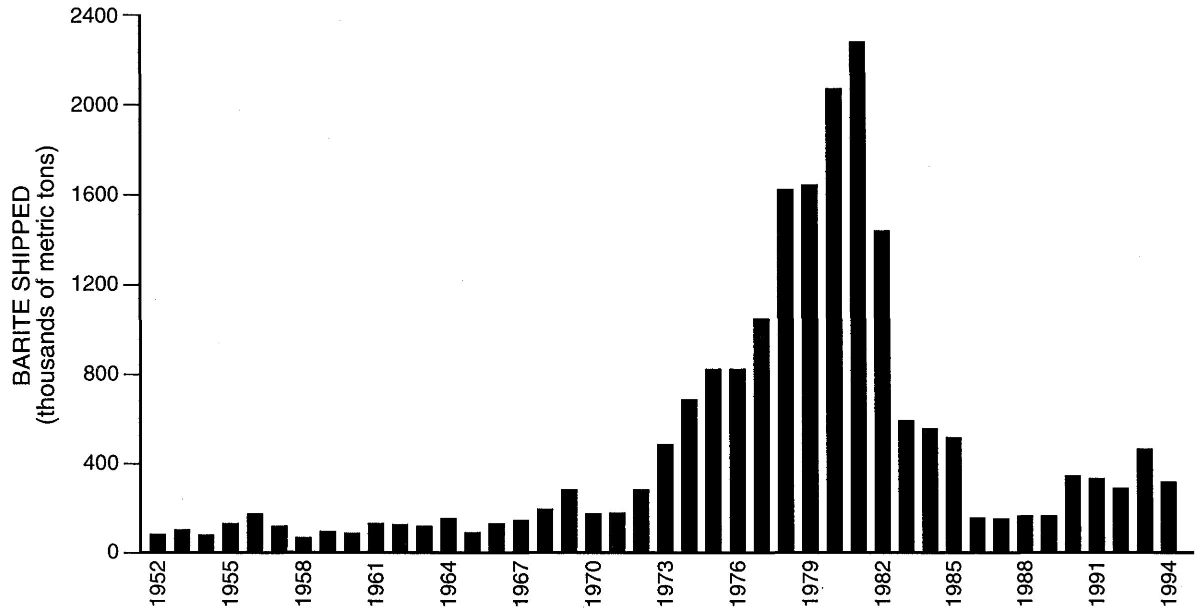
Barite has been mined from five deposits in the region around the NAFR, including three deposits of bedded barite in Paleozoic rock that are north of the northern NAFR, and two vein barite deposits that lie to the west of the northern NAFR. There are no barite deposits within 50 km of the southern NAFR.

The largest barite deposit in the area around the NAFR is the Jumbo deposit, located about 20 km north of the NAFR boundary. At this deposit, at least 25,000 short tons of barite was mined from a steeply dipping, pod-shaped body in chert, limestone, and argillite (Papke, 1984) of Ordovician or Cambrian age (Kleinhampl and Ziony, 1984). The average mining width of the barite body was about 6 m, but no estimate of length is given, although exploration was confined to an area about 150 m in diameter (Papke, 1984). Two smaller bedded barite deposits in fine clastic rock, limestone, and chert of Devonian or Mississippian age are present near Warm Springs about 35 km north of the NAFR.

Small amounts of barite were mined from two vein deposits west of the NAFR. The American Barium Mine had the most production, about 1,000 short tons between 1907 and 1919 (Albers and Stewart, 1972). The barite was mined underground and from an open pit that exploited 1- to 6-m-thick veins of barite with minor quartz and mica and local sulfide minerals and gossan that cut Cambrian sedimentary and metamorphic rocks (Papke, 1984). Less than 1,000 tons was produced from the Put property from a barite vein about 1 m thick in Cambrian siltstone and mudstone (Papke, 1984).

8.2.1.1 Barite in the NAFR

Although Paleozoic sedimentary rocks are extensively exposed in the southern NAFR, they are not considered to be favorable for bedded barite deposits because they are miogeoclinal rocks that lie east of the belt of allochthonous



Sources: 1952-1977, U.S. Bureau of Mines; 1978-1994, The Nevada Mineral Industry, Nevada Bureau of Mines and Geology Special Publications MI-1978 through MI-1994

Figure 8-38 Production of barite in Nevada, 1952–1994.

eugeoclinal rocks that are favorable for barite deposits. In the northern NAFR, relatively small amounts of Paleozoic sedimentary rocks are present, and with the possible exception of rocks mapped as Mississippian to Devonian Eleana Formation in the Cactus Range (Cornwall, 1972), none are considered to be favorable for bedded barite deposits.

Vein barite deposits may be present in the NAFR, but are unlikely to be of economic size. Seven samples of vein material collected during this study contain more than 1 percent barium, and most of these samples are from veins in Tertiary volcanic rocks. Vein barite deposits in Tertiary volcanic rocks are rare in Nevada. Papke (1984) identified only two such deposits, neither of which had significant production. In the present studies, only two samples were found to contain more than 5 percent barium. Sample 5922, at 19.8 percent barium (corresponding to about 34 percent barite), is a chip sample of silicified fault breccia in volcanic rock with barite and hematite. This sample was taken over a width of 135 cm in the Free Gold Mine, east Goldfield mining district. Sample 3007, at 9.2 percent barium (corresponding to about 16 percent barite), is a sample of quartz vein with copper minerals in shale from the Groom Range. Because of the small size of the veins that yielded them, neither of these samples is considered to represent a commercially minable deposit of barite.

The NAFR is considered to have low potential for economic barite deposits, certainty level B.

8.2.2 Borate Minerals

The bulk of world boron production comes from the minerals borax, kernite, colemanite, and ulexite in continental sedimentary deposits that are located in Turkey, China, and southeastern California in the United States (Kistler and Helvaci, 1994). Large borate deposits are bedded deposits in lacustrine sediments that were deposited in closed, nonmarine basins. These deposits generally form in arid to semiarid climates, which promote evaporative concentration of borates during deposition.

Most borate mineral production comes from large open pits, but borates are also mined underground and boron is extracted from brines. Boric acid is produced by most operations, but the greatest use of boron is in the production of glass, fiberglass insulation, and other glass fiber products for which boron minerals such as colemanite can be used directly. Boron is also used in household products, insecticides, metallurgical fluxes, fillers, and fire retardant materials.

Boron mineral concentrate and mineral production in the United States in 1994 was about 1.05 million metric tons. Most domestic production is from the Kramer borate deposit in California, a world class producer since 1976 that continues to be the largest source of borate in the world (Siefke, 1991). Prices quoted in 1995 range from about $250 to $720 per metric ton for various boron compounds, all FOB California (Industrial Minerals, 1995).

8.2.2.1 Borate Minerals in the NAFR

Tertiary lacustrine sedimentary rocks that occur in the southern NAFR have been correlated with the Miocene Horse Spring Formation (Guth and others, 1988). Bedded borate deposits occur in the Horse Spring Formation in the Muddy Mountains about 70 km southeast of the NAFR. These deposits were mined in the 1920s, producing more than 200,000 tons of colemanite. During sampling and reconnaissance of Tertiary sedimentary exposures in the NAFR, neither borate minerals nor rock types that accompany colemanite beds in the Muddy Mountains (algal limestone, interbedded gypsum and limestone, and dolomitic marl) were noted. In addition, elements that are associated with the Muddy Mountain borate deposits, lithium, strontium, and arsenic (Castor, 1993) are relatively low in GSC samples of Tertiary sedimentary rock from the NAFR. Much of the Tertiary sedimentary rock in the NAFR is covered by younger rocks and alluvium, however, and the presence of bedded borate deposits cannot be ruled out.

Borate potential is therefore considered to be low, certainty level B, in the NAFR.

8.2.3 Building Stone

The term "building stone" is used in this report for rock that is sold in finished shapes for specific uses. In this way it is distinguished from "construction aggregate," which is crushed and screened for use in particulate form for applications such as roadbase fill and concrete. Building stone may be quarried in large blocks that are later cut for further finishing, or it may be sold in natural or broken pieces that remain unfinished and are used for paving or other purposes. Building stone is mainly used in the construction of buildings, monuments, civil structures, and in landscaping.

Dimension stone is a type of building stone that is cut to specific sizes. This includes all building stone which is cut or broken to specific dimensions, often on all sides. Surfaces may be textured, smoothed, or polished to specification. Dimension stone can take many forms. Tile and facing sheets are made from thin panels of stone that often have some form of finished surface. Large finished blocks of dimension stone are prepared as monumental stone, which includes grave markers and statuary. Stone shaped into regular pieces along natural fractures can be used for such uses as wall construction and roofing slate. Large blocks of rough-hewn stone can be used in the construction of retaining walls, seawalls, and bridges. More thorough description of categories and uses of building stone may be found in Power (1994).

In general, commercial building stone comes from economically accessible deposits of durable rock that contains few fractures. The use of rock as building stone is principally governed by a combination of unique physical properties and aesthetic appeal. Aesthetic appeal has always been difficult to define and quantify, and may change with building and decorating fashions. But physical properties are carefully defined in technical specifications and standards, and these form the basis for the selection of natural stone for a wide variety of construction applications.

There have been major changes in almost every sector of the building stone industry over the last decade. There has been a movement in personal tastes back to natural materials and finishes, and this has stimulated the market for building stone. New fabrication techniques produce finished stone as unitized tiles and panels, which are thinner, often composite with a concrete backing, and relatively light in weight. Much of the industry is now automated, making production costs lower and finished stone feasible for a greater number of construction projects.

The United States market for building stone experienced strong growth during the more affluent latter half of the 1980s, but slowed in some sectors during the 1990s as a reflection of a slowing in economic growth. For 1994, United States production of dimension stone was down by 13 percent from 1993 (Taylor, 1995). Despite these short-term fluctuations, the long-term market outlook is one of continuing growth.

Since the turn of the century, only a few attempts at the production of building stone have been made in and around the NAFR. In the past, attempts were made in the area around the NAFR to produce marble. In the early part of this century, at Carrara Canyon, about 12 km southeast of Beatty, and 12 km west of the NAFR, an unsuccessful attempt was made to produce building stone from a white marble zone in Cambrian limestone and dolomite. The operation was a failure, probably because of close-spaced fracturing of the stone (Horton and Olson, 1964). An inactive marble quarry is on the southwest side of Gass Peak in the Desert National Wildlife Range about 40 km southwest of the southern NAFR. This quarry, in vuggy carbonate in Mississippian limestone, is a small excavation that was shown on the 1:250,000-scale U.S. Geological Survey map of the Las Vegas $1° \times 2°$ Quadrangle printed in 1908.

The only active building stone producer in the Nellis region is Nevada Neanderthal Stone. This company quarries and cuts 12 varieties of Miocene-age ash-flow tuff from localities adjacent to the NAFR to produce floor tiles, wall panels, and other stone products. Blocks weighing up to 25 tons are hauled to a cutting shop near Beatty which has the capacity to produce 2,000 square feet (186 m^2) of tile per day (Castor, 1991). Nearly 100,000 square feet (9,290 m^2) of tile were produced in 1993 (Castor, 1994). The stone is available in a variety of colors and textures, and is relatively lightweight and easily worked. It is marketed mostly as tile and slabs, but custom-cut shapes, such as pillars, are also produced.

8.2.3.1 Building Stone in the NAFR

Slate quarries in the Desert Range are the only known mining sites for building stone in the NAFR (fig. 8-37). These quarries are within three groups of claims, the B.E. Gleib and others Group, the B.B. Blann and others claim, and the M.P. Custer and others Group (Shafer and Cook, 1947), which were all nullified by withdrawal in 1947. Little is known about the mining history of these quarries, but "greenstone-flagstone" is said to have been produced from the Hancock Stone Quarry in this area, possibly in the 1920s (Tingley, 1992).

The slate quarries exploited light green to greenish-gray phyllitic siltstone that splits easily into sheets up to 1 m across that range from less than 1 cm to 30 cm thick. The siltstone, which contains interbeds of fine micaceous quartzite, is composed predominantly of chlorite and quartz with minor muscovite and plagioclase. It is locally ripple-bedded, but is dominantly planar-bedded. The quarried siltstone is from a green fine clastic sequence about 120 m thick in the Precambrian Johnnie Formation. The Johnnie Formation is described as containing green shale units as much as 75 m thick in the type section in the Spring Mountains (Nolan, 1929) to the south of the NAFR, but slate mining from the formation outside the NAFR is not noted in the literature. In the area of the quarries, the siltstone is underlain by about 20 m of laminated black limestone and overlain by a 50-m-thick unit of light gray cherty dolomite. On the basis of field and aerial photograph examinations, the siltstone unit that was quarried is known to extend for at least 3 km along a north-northwest trend. The largest quarry, near the site of sample GSC 34, is along a poorly preserved road along a canyon through the Desert Range that connects the Alamo Road on the Desert National Wildlife Range on the east with Air Force access in the Dog Bone Lake area on the west.

The siltstone that has been quarried in the NAFR may have potential as a unique building stone because similar deposits are not known to have been mined in the region. The siltstone does not appear to break into large sheets of 3/8-inch (1 cm) or less in thickness, the established specification for roofing slate (Bowles, 1955). However, it may have potential for use as structural slate in such products as floor tiles or steps. It has clear potential for use as decorative paving stone or flagstone, although alternate sources of stone that can be used for such purposes are known close to the Las Vegas area (Longwell and others, 1965), and Jurassic sandstone is now mined near Goodsprings (Castor, 1994).

Large amounts of Tertiary ash-flow tuff similar to that utilized by Nevada Neanderthal Stone are present in the NAFR. Such rocks are uniform over large lateral distances, and exposures of these tuffs in the NAFR provide a considerable range of lithologic textures and colors. Commercial production of such material for building stone is dependent on intangible factors such as future demand for particular colors and textures of stone. It is possible that some types of tuff in the NAFR have unique features that would make it particularly valuable for dimension stone products such as those that are now produced by Nevada Neanderthal Stone from sites outside the NAFR.

Figure 8-39 shows bedrock areas with potential for building stone in the NAFR. Although much of the rock is moderately to highly fractured and not suitable for dimension stone, most of the rock in these areas is physically suitable for other types of building stone. However, due to local features such as hydrothermal alteration, not all bedrock areas contain rock of sufficient quality for building stone. In addition, it is difficult to predict public preferences for colors and textural features that will make certain types of stone marketable. Therefore, delineation of more specific areas within those underlain by bedrock that have potential for building stone is considered to be highly speculative and beyond the scope of this study.

Stone that is suitable for building stone is undoubtedly present in the NAFR. However, production of building stone from the NAFR is not likely because of the lack of regional markets and the presence of alternative sources for most types of stone that are in the NAFR.

8.2.4 Clay

Clay is natural fine-grained material that is composed mostly of one or more of a group of crystalline minerals known collectively as the clay minerals. Clay minerals are hydrous silicates composed mainly of silica, alumina, and water. Some clay minerals contain significant amounts of the alkali metals, alkali earths, and iron. As mineral commodities, clays can be classified into several distinct groups. In the sixth edition of "Industrial Minerals and Rocks" published by the Society for Mining, Metallurgy, and Exploration, clay commodities are subdivided into common clay, bentonite, kaolin, and hormites.

Common clay is mainly used in construction products such as bricks, roofing tiles, and Portland cement. It is also used in pottery and as a filler in paint. The term encompasses a variety of naturally occurring materials, including illite, kaolinite, and smectite. Common clay is mined in every state in the United States except Alaska and Rhode Island (Murray, 1994).

Bentonite is composed of one or more varieties of smectite (chiefly montmorillonite). High-swelling or sodium bentonites have active colloidal properties, forming gel-like matter when added to water. They are widely used as drilling mud, and as a binder in foundry sand and pelletized iron ores. In the United States, high-swelling bentonite is produced from Wyoming at a rate of about 2.5 million metric tons per year (Virta, 1993). High swelling bentonites of comparable quality are relatively rare in the United States, and only relatively minor amounts of such clay come from

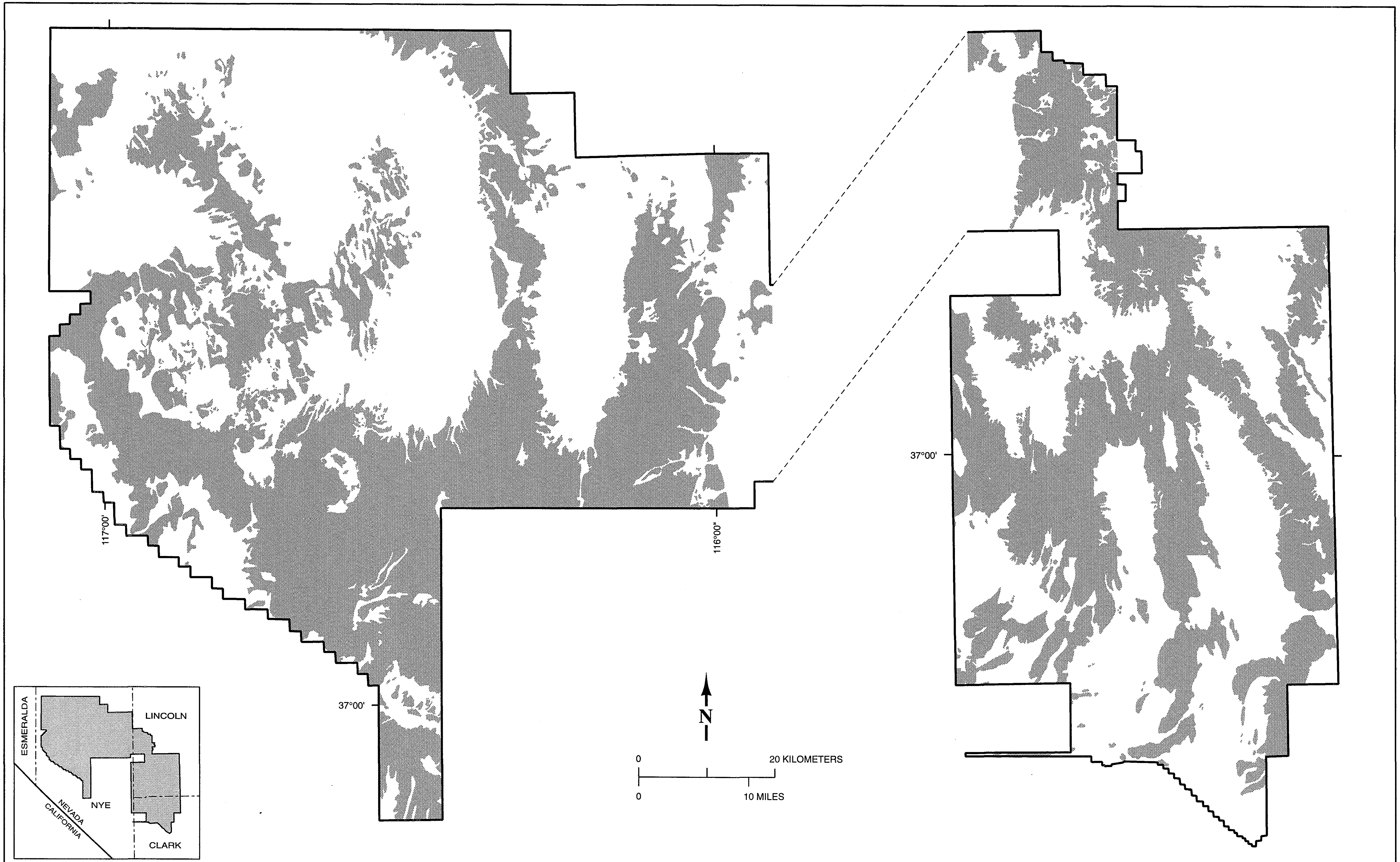


FIGURE 8-39 Areas with moderate potential, certainty level B, for building stone.

deposits in Nevada. Non-swelling bentonite is generally calcium bentonite, and is mainly mined in Mississippi. However, saponite, a magnesian bentonite, is produced in moderate amounts in Nevada. Hectorite, a high-value, lithium-bearing bentonite, is mined in low volumes from a few sites in California and Nevada. Fuller's earth, an antiquated term that was applied to clay materials used in cleaning wool, includes both bentonite and hormite clays.

The states of Georgia and South Carolina contain the world's major kaolin producing area where kaolin is produced at an annual rate of about 8 million metric tons (Pickering and Murray, 1994). Kaolin has many industrial applications, including uses as fillers, coating agents, extenders, binders, whitening agents, and in ceramics. Nevada contains eight deposits of kaolinite and the related clay mineral halloysite (Papke, 1973).

Hormite clays include the minerals palygorskite, which is mined in large amounts in Georgia and Mississippi, and sepiolite, which is mined in moderate amounts in Nevada. These are magnesian clays with fibrous structure that are used mainly as absorbents and in salt-water drilling.

Clay is one of the most important domestic industrial minerals in terms of value and volume of production. Production in the United States in 1994 was 42.2 million tons with a value of $1.6 billion (U.S. Bureau of Mines, 1995a). Over the last ten years, annual domestic clay production has been relatively stable at around 40 million tons.

Most clays are mined from open pits with waste-to-clay ratios ranging from 0.25:1 for common clays to 7:1 for kaolin (Virta, 1993). A small number of clay mines are underground operations. Because of wide variations in demand, quality, and processing costs, clay commodity values are highly variable. Common clays are the most inexpensive, with an average value of about $5 per short ton (Virta, 1993). Wyoming bentonite sells for $52 to $470 per short ton f.o.b. plant (Industrial Minerals, 1995). Georgia kaolin sells for $52 to $470 per ton f.o.b. plant, based on purity and the type of processing. The average unit value for fuller's earth has been reported at about $100 per ton (Virta, 1993). High-value clay commodities include water washed hectorite that sells for as much as $3.15 per pound, and the specially treated organoclays which bring as much as $4,500 per short ton in the United States (Russell, 1991).

Although domestic clay production has been static for ten years, long-term market trends have been generally upward over the last four decades. Bentonite is likely to remain the most widely used clay for drilling applications in the years to come, and therefore bentonite sales will be linked to levels of exploration for oil, gas, and minerals. The potential for market growth for fuller's earth is expected to be higher than that for bentonite (Elzea and Murray, 1994). World wide markets for specialty clays such as purified white bentonite are likely to increase with general economic growth (Elzea and Murray, 1994).

Clay is currently mined at two sites in the region around the NAFR. It also occurs in abandoned clay mines and in unmined deposit.

The largest clay producer in Nevada is the IMV Division of Floridin Co., a subsidiary of U.S. Borax Inc. (Castor, 1995). The company mines sepiolite, montmorillonite, saponite (magnesium smectite), and hectorite from deposits in the Ash Meadows area about 45 km south of the NAFR. The clay is processed at a plant near the mines, and more than 20 different standard and specialty clay products are shipped. These include low unit value bentonite products, mid-priced sepiolite, and high-value products that sell for as much as $3,600 per ton (Castor, 1992). Between 1989 and 1994, the company's annual production ranged between 25,200 and 45,000 short tons of clay (Nevada Department of Minerals, 1990 through 1995).

The deposits of all four clay minerals mined by IMV occur in approximately correlative Pliocene lacustrine and alluvial beds clustered in different parts of an essentially contiguous basin (Hay and others, 1986). Hay and others (1986) proposed that the montmorillonite was either sedimentary in origin or formed by the alteration of volcanic ash, whereas magnesium smectite and sepiolite were considered to have been chemical precipitates - an origin first proposed for the sepiolite by Papke (1972). The clay minerals are mined in open pits from flat-lying deposits with little overburden.

According to Kral (1951), bentonite was mined from bedded deposits in Ash Meadows as early as 1918, and the thickest bed was mined from the surface to a depth of 7 m where mining was halted by ground water. Hosterman and Patterson (1992) reported that the average thickness of bentonite beds in the area is 0.6 - 0.9 m, and that the overburden is 3 - 8 m. thick. No reserve figures for the deposits have been published, but clay pits up to 600 × 200 m were mapped by Papke (1970). According to analyses reported by Papke (1970), samples from clay pits in the main part of the Ash Meadows district are dominantly saponite (magnesium-rich smectite) that contain as little as 10 percent impurities, mainly as quartz and feldspar. Clay from the eastern part of the district is composed of montmorillonite, with less than 6 percent impurities.

At the New Discovery Mine, 3 km south of Beatty and 20 km west of the NAFR, the Vanderbilt Minerals Co. mines high-grade montmorillonite clay that is used in pharmaceutical and cosmetic products. The montmorillonite is a product of hydrothermal alteration of volcanic rocks and occurs in fault-bounded bodies up to 60 x 12 m in welded ash-flow tuff (Papke, 1970). It is mined in shallow underground workings, crushed, blended, and shipped to Kentucky for further processing along with clays from other deposits in Nevada that are stockpiled on the New Discovery property.

Estimates of grades and reserves at the New Discovery Mine have not been published, but samples were found to contain 42 percent clay-sized material (Papke, 1970).

Other clay deposits in the region around the NAFR are abandoned or unmined hydrothermal montmorillonite deposits in ash-flow tuff near Beatty (Papke, 1970).

8.2.4.1 Clay in the NAFR

Two areas of clay deposits are present along the lower slope of Pahute Mesa near the western boundary of the NAFR (fig. 8-37). These areas and detailed mineralogic and testing data on samples collected from them are described in Papke (1970). Both deposits were examined during this study, and the following descriptions are a combination of information collected during these examinations and data from Papke (1970).

The Pahute Mesa property consists of 10 unpatented mining claims staked by Oscar and Raymond Williams. The clay is exposed in outcrops, bulldozer scrapes, and access road cuts that are scattered in an area about 750 m by 150 m. In part of this area, clay-rich rock is overlain by variable amounts of clay-poor zeolitized non-welded ash-flow tuff, which in turn is overlain by resistant welded ash-flow tuff up to 10 m thick that constrains the area of easily mined clay. The tuff sheets have nearly horizontal attitudes. White and pink montmorillonite clay occurs as alteration products in non-welded ash flow tuff, and clay-rich rock has an estimated thickness of 3-5 m. Clay samples from this property were reported to have fair to good physical properties, and a company interested in finding a source of high-quality montmorillonite explored the property in 1967 and 1968 (Papke, 1970). Samples collected during this study were found to contain montmorillonite with sparse to abundant zeolite and traces of gypsum. Papke (1970) found non-clay impurities to include feldspar, cristobalite, and calcite.

The Sarcobatus Flat clay property also consists of claims staked by Oscar and Raymond Williams, and lies about 6 km southeast of the Pahute Mesa property. Montmorillonite clay is locally exposed in trenches, bulldozer scrapes, and access road cuts in an area about 1 km square. The clay is in light-colored, slightly welded ash-flow tuff that is overlain by a resistant welded ash-flow tuff sheet with nearly horizontal attitudes. Alteration of the tuff to clay is extremely variable, with some prospects showing intermixed clay-rich material and glassy tuff. The thickness of clay-rich rock is up to at least 2 m. The clay is light pink to buff and contains lithic fragments along with moderate to abundant phenocrysts of quartz and feldspar. X-ray diffraction analysis done for this study shows abundant zeolite, while that reported by Papke (1970) shows no zeolite, but indicates local calcite. On the basis of tests for swelling capacity and plastic viscosity, Papke (1970) rated a sample from this property as the second best clay out of 93 samples from throughout Nevada.

Other deposits of clay minerals are probably present in the northern NAFR because hydrothermally altered volcanic rocks are common. However, no unique sources of high-grade clay have been identified. Halloysite is not known to occur within the NAFR. According to Tingley and Papke (1987), testing of montmorillonite collected from a locality in Cactus Flat showed that swelling and plastic viscosity were well below values needed for a commercial clay. The value of the two deposits in altered ash-flow tuff that are described above cannot be ascertained without drilling and quality testing that is beyond the scope of this study. Altered areas in volcanic rocks in the northern NAFR are considered to have moderate potential, certainty level B, for small clay deposits such as those that have been mined in the Beatty area.

Examination of areas of Tertiary sedimentary rock has not located large amounts of clays such as those in the Ash Meadows area. However, the Tertiary sediments are generally poorly exposed and areas of clay mineralization may be present under alluvium.

Figure 8-40 shows areas of potential for clay in Tertiary rocks in the NAFR. These include areas that are underlain by Tertiary sedimentary units known to contain fine clastic and tuffaceous rocks as well as areas of altered Tertiary volcanic rocks. Delineation of more specific areas with clay potential at a higher certainty level is beyond the scope of this report.

Some Tertiary volcanic rock units in the area around the Groom Lake basin are reported to be altered (Jayko, in prep.) but not enough information is available on these rocks to determinations clay potential, even at a B certainty level. They are therefore shown on figure 8-40 as having unknown clay potential.

Potential for clay deposits in pre-Tertiary rocks, which are mainly in the southern NAFR, is considered to be low, certainty level C, because these types of rocks are not favorable for clay deposits in the western United States.

8.2.5 Construction Aggregate

Construction aggregate consists of a variety of materials used to provide bulk and strength in portland cement concrete, asphalt concrete, fill, road base and loose road surfacing, railroad ballast, concrete block, and stucco. Mined natural materials provide most of the construction aggregate used in the United States, although recycled materials such as crushed glass and smelter slag are used as well as manufactured lightweight aggregate. Sand and gravel, crushed stone, and volcanic cinders are mined materials that are currently used for construction aggregate in Nevada.

Sand and gravel are mined from unconsolidated stream-channel, flood-plain, or terrace deposits; alluvial fan deposits; glacial or glacio-fluvial deposits; and beach deposits of lacus-

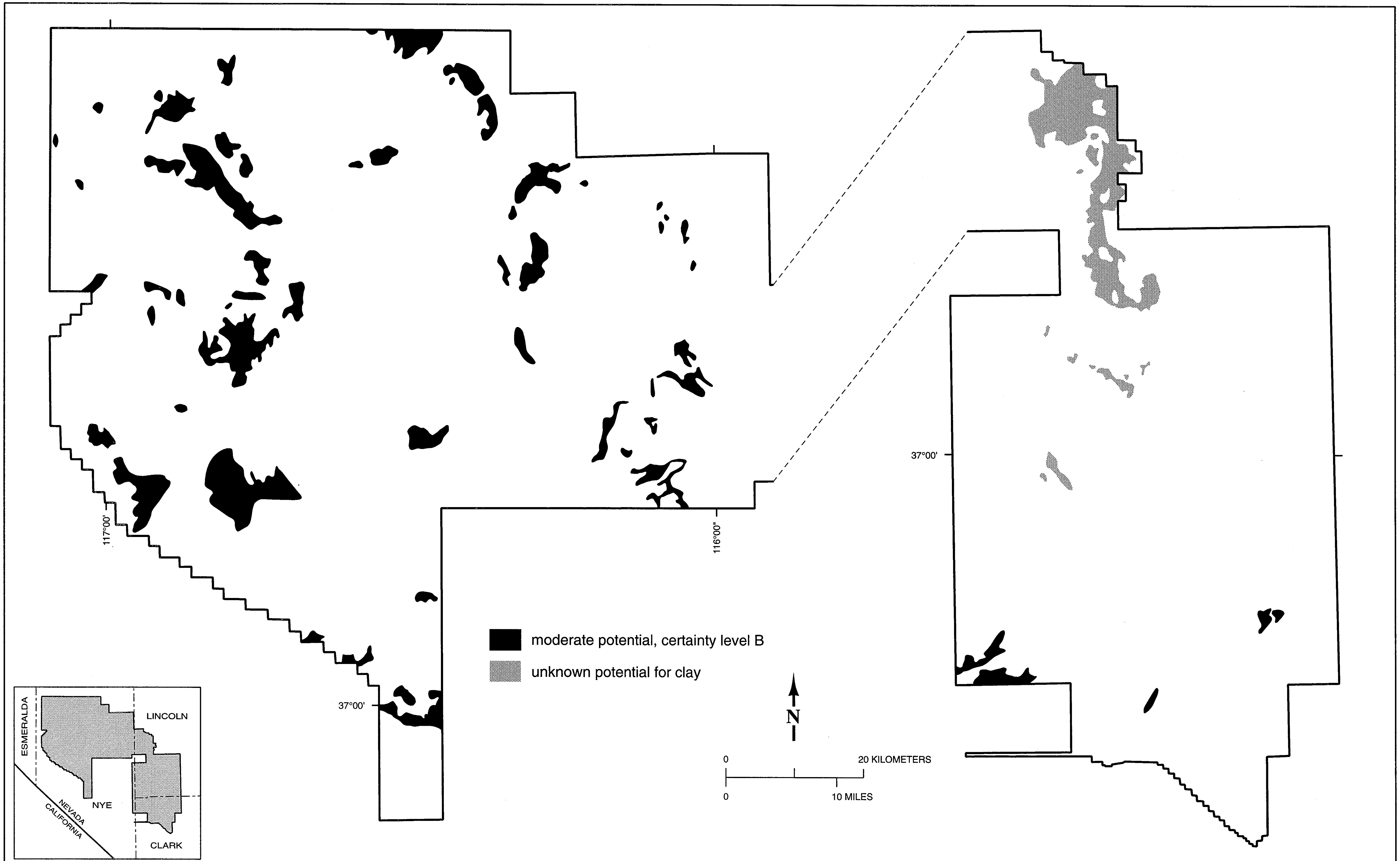


FIGURE 8-40 Areas with moderate potential, certainty level B, and areas with unknown potential for clay deposits.

trine or marine origin. In southern Nevada, almost all sand and gravel production is from alluvial fan deposits, with minor production from fluvial deposits in active stream channels. Sand and gravel that is ideally suitable for most construction aggregate is composed of clean, uncoated, properly shaped and sized detritus that is sound and durable. Individual sand and gravel particles must be resistant to physical stress and to chemical and physical changes. Sand and gravel that contains excessive amounts of clay, organic matter, soluble minerals, or friable altered or weathered particles, generally makes poor aggregate, although some such materials may be removed by screening and washing. Sand and gravel deposits that contain reactive rock types, such as certain siliceous volcanic rocks, may not be suitable for use in portland cement concrete without special treatment (Goldman, 1994).

Many different rock types are used in crushed stone, and the types used are determined mainly by availability and rock quality. Such rock types must meet the same, or more stringent, soundness and durability requirements for sand and gravel, and therefore must not contain reactive minerals or be weakened by alteration. However, extremely hard or abrasive rock types are generally not used in crushed stone because of high crushing and screening costs. For most uses, it is important that the rock break into more-or-less equant fragments when crushed, and platy rocks such as slate generally make poor aggregate. Certain mineral components, such as mica in some schists, are deleterious in aggregate because they cause structural weakness. Some types of crushed stone are particularly desirable for specific uses. For example, fine-grained basalt is commonly used in asphalt concrete, and crushed rhyolite is used in lightweight portland cement concrete and in concrete blocks. as is the case with sand and gravel, certain siliceous volcanic rocks, including rhyolitic ash-flow tuffs, are unsuitable for portland cement concrete aggregate because of alkali-silicate reactivity (Malisch, 1978).

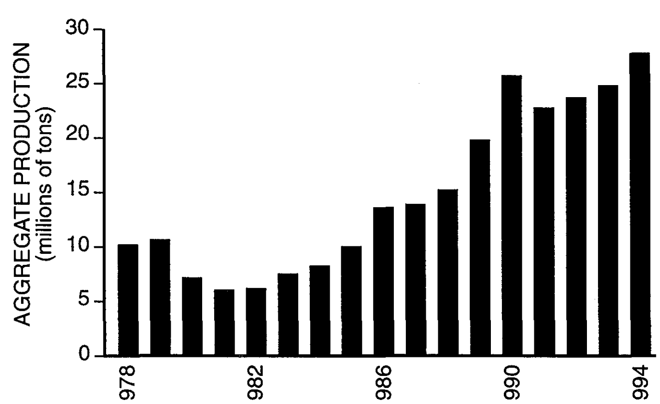
Volcanic cinder deposits are composed of loose fragments of scoriaceous basalt or andesite, generally found in relatively young cinder cones. Because they have low density, but are relatively strong structurally, volcanic cinders are used in lightweight aggregate for portland cement concrete and in concrete block. High-quality cinder deposits adjacent to metropolitan markets (generally in the western United States) are prized because of low mining and crushing costs. Cinder finds minor use as decorative stone and barbecue rock.

Mining of all construction aggregate, whether for sand and gravel, crushed rock, or volcanic cinders, is by open-pit methods. Because most sand and gravel deposits are of unconsolidated material, drilling and blasting are not required, whereas crushed stone generally is produced from quarries where excavation requires drilling and blasting.

On the basis of data from Tepordei (1993a, 1993b), the annual domestic production of construction aggregate has been over 1.5 billion short tons for more than 25 years, except during the recession years of 1981 through 1983. The annual amount used averaged 1.84 billion tons between 1970 and 1990, and reached a maximum of 2.17 billion tons during 1988 (Langer and Glanzman, 1993). The value of domestic crushed stone and sand and gravel, which was estimated to be more than $10 billion in 1994 (Tepordei, 1995), exceeds the value of any other mineral commodity produced in the United States.

Production of construction aggregate in the region that includes the NAFR is minor, consisting of a few small sand and gravel pits and a volcanic cinder mine. The volcanic cinders are produced from a cinder cone northwest of the town of Amargosa Valley and are mainly sold into the Las Vegas construction market for use in concrete block. No data are available on annual construction aggregate production in the Nellis region, but it is probably under 300,000 tons.

Production of construction aggregate in Nevada has increased fairly steadily since the early 1980s, rising from about 6 million tons in 1981 to about 28 million tons in 1994 (fig. 8-41). The Las Vegas metropolitan area, which has undergone unprecedented growth and a tremendous boom in residential, commercial, and municipal building since the mid 1980s, consumes more than 60 percent of the state-wide, total production of building aggregate. In 1991, 32 active construction aggregate mining sites, operated by 29 different companies, were identified in the Las Vegas area (Castor and others, 1992). In 1994, most of the 18 million tons of construction aggregate used in the Las Vegas area was from alluvial fan sand and gravel deposits in the Lone Mountain, Henderson, and Spring Mountain Road areas (Castor, 1995). In the Lone Mountain and Spring Mountain Road areas, gravel pits are in alluvial fans consisting almost entirely of Paleozoic carbonate detritus. In the Henderson area, the gravels mainly contain volcanic



Source: The Nevada Mineral Industry, Nevada Bureau of Mines and Geology Special Publications MI-1978 through MI-1994.

Figure 8-41 Production of construction aggregate in Nevada, 1978-1994.

detritus. Crushed stone, consisting mainly of Paleozoic limestone and minor amounts of lightweight rhyolite, accounted for only about 10 percent of the total aggregate production in the Las Vegas area.

Reserves of natural material that can be used as construction aggregate are almost limitless. However, environmental and commercial concerns preclude mining in some areas such as in or near metropolitan areas (where most aggregate is consumed). In the Las Vegas area, large tracts of public land have been identified as having good potential for aggregate (Castor and others, 1992). However, the BLM has generally been unwilling to issue new leases for aggregate mining or to extend existing leases in the Las Vegas basin, and private land in many parts of the metropolitan area has more value for building sites than for sand and gravel mining.

Prices for aggregate vary with quality and application. Pit run sand and gravel can generally be used for fill, but base aggregate must be screened, and in cases where abundant oversize material is present it must be crushed as well. Aggregate used in portland cement concrete must be screened and washed, and is therefore more costly. The gravel pits in the Las Vegas area contain only minor sand size detritus (particularly in the productive Lone Mountain and Spring Mountain Road areas), requiring additional crushing to produce material suitable for use in portland cement concrete.

According to figures in Tepordei (1995), the average value for sand and gravel in Nevada in 1994 was $4.40 per ton, whereas the average value for crushed stone (which includes some stone used to make cement and lime) was $7.88. In large market areas such as Las Vegas, production costs may be lower than elsewhere in Nevada due to economies inherent in large-scale mining. However, rates for transporting aggregate are generally higher in congested metropolitan areas. According to Goldman (1994), a good estimate for transport is 10¢ to 16¢ per ton-mile. At 10¢ per mile, an increase of a few tens of miles in the hauling distance would render most deposits outside the Las Vegas basin uneconomic for that market, and there are no large sand and gravel operations more than 12 miles from the center of the Las Vegas urbanized area (see maps in Castor and others, 1992). Crushed stone is mined in large amounts at Apex and Sloan, no more than 20 miles from the Las Vegas urban center. However, volcanic cinder and lightweight aggregate appear to have values that can withstand the costs of longer transport. Volcanic cinders are shipped about 90 miles by road from the mine near the town of Amargosa Valley in the vicinity of Yucca Mountain, and the lightweight aggregate is trucked from a site about 25 miles south of Las Vegas.

Domestic use of construction aggregate is projected to increase gradually in future years (Tepordei 1993a, 1993b). Work on the national infrastructure, which has declined constantly since the 1960s as a percentage of the gross domestic product, was projected to increase following the passage of the Intermodal Surface Transportation and Infrastructure Act of 1991. However, anticipated increased in aggregate production due to this factor have not materialized, and production has not increased beyond the highs for sand and gravel reached in 1978 and that of crushed stone reached in 1988 (Tepordei, 1993a, 1993b, 1995).

In the region around the NAFR, future use of construction aggregate will probably remain relatively small. However, aggregate use in the expanding Las Vegas metropolitan area may become a factor in the region, as it already has for volcanic cinder mining near Amargosa Valley. If the explosive growth of the Las Vegas metropolitan area continues, and potential sand and gravel producing areas are preempted for residential and commercial construction, new sand and gravel producing areas will be needed. On the basis of information in Castor and others (1992), good potential for new sand and gravel mining sites lies in areas to the north, northwest, and southwest of Las Vegas.

The estimated population of Clark County (which is predominantly in the Las Vegas metropolitan area) increased from 562,280 to 971,680 between 1985 and 1994 (Nevada State Demographer, 1994), an average rate of 5-6 percent per year. During this period, construction aggregate consumption rose from about 6 million tons to about 18 million tons, or about 12 percent per year, considerably outstripping the population increase, probably due to the construction of several large resort-casinos and to aggressive public works building during this time. On the basis of 1994 figures, yearly aggregate consumption in the Las Vegas metropolitan area is nearly 20 tons per capita. If population growth in the Las Vegas metropolitan area continues at a rate of 5.5 percent per year, yearly consumption of construction aggregate in the area could increase to about 25 million tons in the year 2000 and 74 million short tons in 2020. However, more conservative estimates put Las Vegas annual growth at about 3.2 percent between 1994 and 2000 due to increased investments by gaming corporations in states other than Nevada (Nevada State Demographer, 1993), which would decrease predicted aggregate production rates to 24 million short tons in the year 2000 and 72 million short tons in the year 2020.

Although sand and gravel production exceeds crushed stone production in the Las Vegas area by a large factor, crushed stone as a percentage of the Las Vegas market increased from less than 2 percent in 1989 to 10 percent in 1994 (Castor, 1990; 1995). If this trend continues, crushed stone that is produced from sites that are topographically less attractive to urban growth could make up possible shortfalls in sand and gravel production, obviating the need for movement of aggregate production to sites that are much more distant from Las Vegas than the present sites.

8.2.5.1 Construction Aggregate in the NAFR

The region in and around the NAFR contains vast resources of sand and gravel and huge amounts of material suitable for the production of high-quality crushed stone. Large amounts of sand and gravel derived from Paleozoic carbonate highlands (one of the preferred construction aggregate materials in Las Vegas) are available in alluvial fans along Highway 95 as are large exposures of Paleozoic carbonate rock (used in crushed stone in Las Vegas). However, the NAFR is more than 32 km by road from the Las Vegas metropolitan center, rendering these resources uneconomic at the present time. Furthermore, there is no rail service between Las Vegas and the NAFR, so that high-cost truck transport is necessary. It is therefore likely that the construction aggregate production will remain relatively minor in the region. However, high-quality sand and gravel and crushed stone are undoubtedly available from areas dominated by Paleozoic highlands such as the those within the southern NAFR. Areas of alluvium in the NAFR that include Tertiary sedimentary detritus are considered to have considerably lower potential, because they may contain deleterious amounts of gypsum.

The valleys and alluvial fans in the northern NAFR contain large amounts of sand and gravel. Most of the detritus in this alluvium is probably sound, durable welded ash-flow tuff. However, some structurally inferior non-welded and bedded tuff fragments are probably also present in many areas. In addition, large areas of altered volcanic rock that contain deleterious materials such as clay minerals and reactive silica are known to be present in the northern NAFR. Alluvium that may contain such materials on the basis of provenance is considered to have low potential for construction aggregate.

In the past, aggregate was mined from alluvial fan material at a site on the Tonopah Test Range. The aggregate was taken from two adjoining sand and gravel pits about 8 m deep and 100 m in diameter near the Tonopah Test Range Airport (fig. 8-37). Sand and gravel from these pits consists of about 50 percent of moderately rounded pebbles and cobbles of dark colored ash-flow tuff and lava with about 50 percent of granule size or smaller material, including substantial amounts of clay or silt. Minor amounts of altered volcanic rock fragments are present. Pit run material was crushed and screened for use in base fill and was used in portland cement concrete that was produced in a nearby batch plant. However, quality problems were encountered with portland cement and asphalt concrete that was produced from this aggregate (Bryan and Vineis, 1983), and the material has only been used as fill since 1983 (Dennis Bryan, personal communication, 1996). Two specific problems were identified by testing: aggregate samples contained two much material with particle sizes less than 200 mesh; and coarse aggregate failed sulfate soundness loss tests, probably due to fragments of friable, hydrothermally altered tuff (Bryan and Vineis, 1983). In addition, pit run material was found to contain clays and soluble salts which are both deleterious materials for concrete aggregate. Following these discoveries, a 1295 km^2 area in Cactus Flat on the Tonopah Test Range was explored for aggregate acceptable for use in concrete. In this area, alluvial fan material was found to be of poor quality. Recent alluvium in washes was found to be of better quality in terms of size distribution, but samples of this material failed sulfate soundness testing (Bryan, 1983). Basalt from a site in the area was recommended as acceptable concrete aggregate (Bryan, 1983), but it was eventually decided that it would be more effective to use concrete aggregate mined from outside the NAFR (Bryan, personal communication, 1996).

Sand and gravel have been mined at several sites in the NAFR for use as fill materials. In addition to aggregate from the site near the airport described above, sand and gravel were mined from pits located near the housing and industrial parts of the Tonopah Test Range (Tingley and Papke, 1987). One of these pits, located near the sewer lagoon southwest of the housing area, is estimated to have produced about 75,570 m^3 of sand (E. C. Moon, written commun., June 7, 1996). Borrow pits for material used as fill are also located near the Tolicha Operation Center and near Sleeping Butte in the NAFR (fig. 8-37). In 1990, the Department of Energy produced 206,430 m^3 of sand and gravel from a site on the east side of Yucca Mountain (BLM records, Las Vegas district office). This site is along the border of the southern part of the NAFR, but is probably within the adjacent Nevada Test Site. No information is available on the quality of material from these sites, and aggregate for use in portland cement or asphalt concrete in the NAFR is probably hauled from outside the NAFR.

The NAFR has low potential, for large-scale construction aggregate production from sand and gravel or crushed stone under present conditions. Production of some construction aggregate for internal use by the U.S. Air Force or its contractors is necessary, but the NAFR is more than 32 km from the Las Vegas metropolitan area on existing major paved roads, and truck haulage costs (at 6¢ per ton-km) would amount to $2.00 per short ton, substantially increasing the price for material delivered to the Las Vegas market. Furthermore, large amounts of sand and gravel and of bedrock that are usable for high-quality construction aggregate are present in areas that are less distant from Las Vegas than the NAFR. Other construction aggregate markets in the vicinity of the NAFR, such as the Tonopah area, require only minor amounts of aggregate that are readily met by local sources.

Areas in the NAFR that are underlain by large amounts of sand and gravel that are likely to have potential as high quality construction aggregate are shown in figure 8-42. Potential for such deposits in alluvial basins surrounded by pre-Tertiary rock in the southern NAFR is considered to be high, certainty level B; whereas alluvial basins in the northern NAFR are mostly filled with volcanic detritus and considered to have moderate potential, certainty level B. Areas in the NAFR that are underlain by pre-Tertiary rock are considered to have high potential, certainty level B, for deposits suitable for crushed stone construction aggregate (fig. 8-43).

Although the NAFR probably contains large amounts of material that would be suitable for construction aggregate, the likelihood of economic production from such deposits is currently low. As noted above, under current conditions, aggregate production from the NAFR would not be economically competitive in this market due to high haulage costs. However, future marketing and political changes in the Las Vegas area may make sand and gravel and crushed stone from the NAFR more attractive economically. In addition, increased construction activity in areas along State Route 95, as well as new construction in the NAFR, could make construction aggregate production in the NAFR economically feasible.

Volcanic cinder is a relatively valuable type of construction aggregate that can be shipped longer distances in the Las Vegas area. Volcanic cinder from the deposit near Amargosa Valley, which is about 13 km south of the NAFR, is shipped about 145 km into the Las Vegas market. Two deposits of volcanic cinder are near the southwestern boundary of the NAFR (fig. 8-37). The largest forms an asymmetrical cone approximately 600 m in diameter on the north side of Sleeping Butte. It is composed of reddish-brown to black, light weight scoria cinders that average less than 1 cm in diameter, although large blocks are present near the center of the cone. Basaltic flows, scoria agglomerate, and ash flows extend northward and eastward from the base of the cone. The other deposit, Little Black Peak, which is about 2 km southwest of Sleeping Butte, is a cinder cone about 400 m in diameter that contains cinders identical in color, density, and particle size to those at Sleeping Butte. These cinder cone deposits are only 5 to 6 km from U.S. Highway 95; however, they are more than 225 km by road from the Las Vegas market area. In the short term, these deposits are considered to have only moderate potential as a source of lightweight construction aggregate because of the long haul to Las Vegas, and the presence of more advantageously located deposits elsewhere in the region. The two cinder cones are considered to have moderate potential for production of construction aggregate, certainty level C.

8.2.6 Fluorspar

The commercial name for the mineral fluorite is "fluorspar." Pure fluorite contains 51 percent calcium and 49 percent fluorine, it is used extensively in mineral form and is the raw material for most of the world's fluorine compounds. There are three market grades of fluorspar: acid-grade fluorspar (acidspar), used to manufacture hydrofluoric acid which is an intermediate product in the manufacture of industrial fluorine compounds; ceramic-grade fluorspar, mainly used in glass making; and metallurgical grade fluorspar (metspar) that is mainly used as metallurgical flux. Acidspar typically contains not less than 97 percent calcium fluoride and less than 0.10 percent water,1.5 percent silicon dioxide, 0.10 percent sulfur. Ceramic grade requires a minimum of 97 percent calcium fluoride, under 3.0 percent silica, low calcium and iron, and only traces of lead and zinc. In the United States, metspar generally contains at least 60 percent "effective" fluorspar, not over 0.30 percent sulfide sulfur, and less than 0.50 percent lead.

The United States is the leading consumer of fluorspar and fluorine-based industrial products in the world, relying heavily on imports. China is the largest supplier. The United States has only one significant fluorspar producer that mined from three underground mines in Illinois (Burger, 1991). No fluorspar has been mined in Nevada since 1989, and since the early 1960s production in the state followed a general downward trend.

On the whole, fluorspar markets have been in transition for much of this decade, and market movement is still a major feature of the fluorspar industry. This has made marketing predictions difficult. Prices for fluorspar in the United States in 1995 ranged from about $100 per ton for metspar to $150 per ton for acidspar.

Most of the fluorspar mined in Nevada has come from replacement deposits in Paleozoic carbonate rocks, but significant production has come from a vein deposit in Tertiary volcanic rock, and breccia pipe deposits in Paleozoic rock (Papke, 1979).

Metallurgical grade fluorspar was mined continuously for more than 60 years in the Bare Mountain district 8 to 12 km west of the southern NAFR boundary. In this district, fluorspar is associated with gold and mercury mineralization. When mining ceased in 1989, the district had produced more than 300,000 short tons of fluorspar, over 40 percent of the total production in Nevada. The Daisy Mine was the most important producer with about 135,000 short tons, followed by the Goldspar and Mary Mines. Fluorspar ore bodies at the Daisy Mine are near-vertical pipelike hydrothermal replacement bodies in dolomite, and most of the ore graded 70-80 percent calcium fluoride with 2-4 percent silicon dioxide (Papke, 1979). At the Goldspar and Mary Mines, fluorite occurs in irregular, pipe-like breccia bodies in Paleozoic sedimentary rock, mainly dolomite. From 1958 to 1967, ore containing about 40 percent calcium fluoride from the Goldspar Mine was used in cement manufacturing in southern California; total production was estimated at approximately 75,000 tons (Papke, 1979).

Significant amounts of fluorspar have been mined from veins in igneous rock in Nevada. The second most produc-

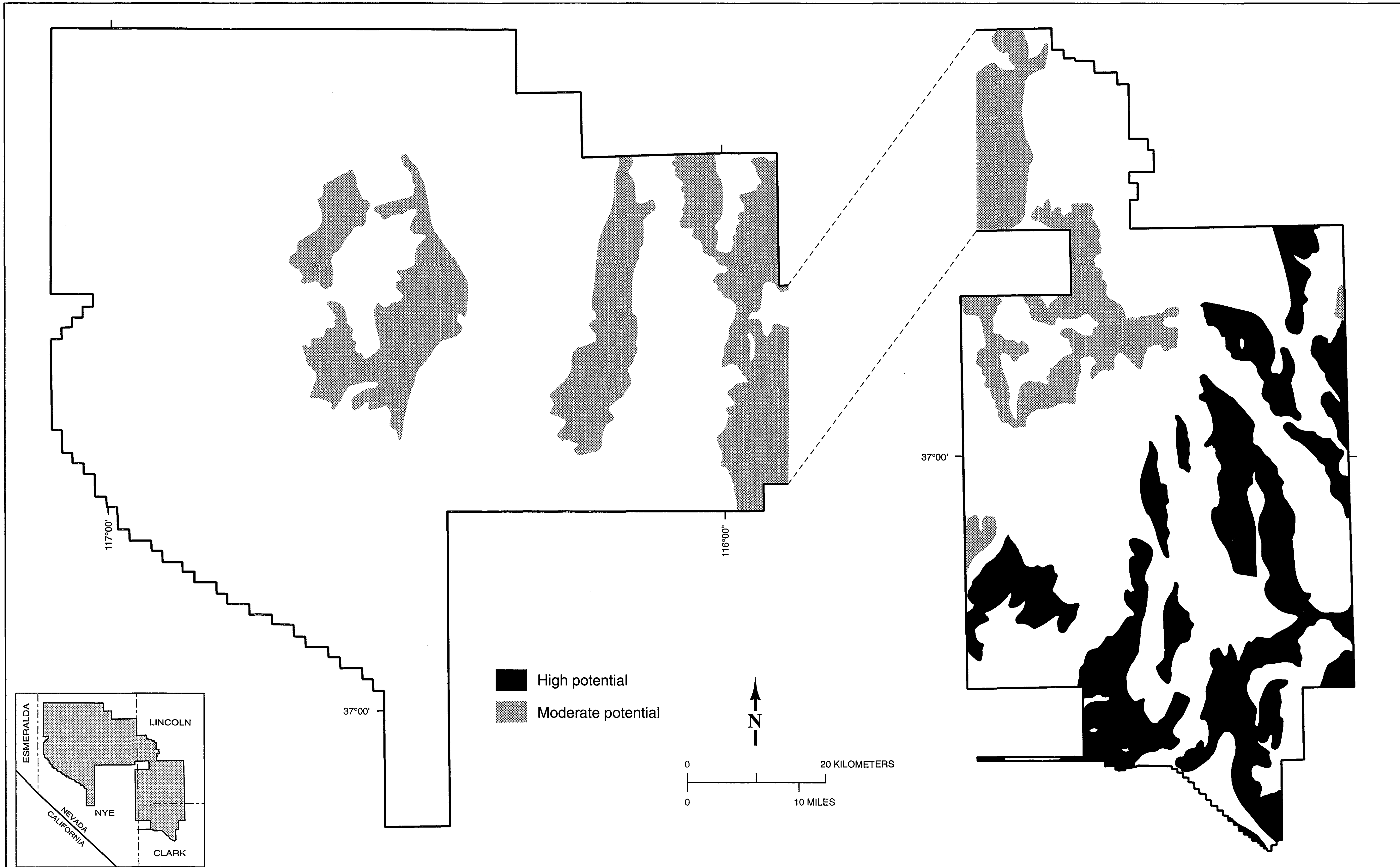


FIGURE 8-42 Areas with moderate and high potential, certainty level B, for sand and gravel deposits suitable for contstruction aggregate.

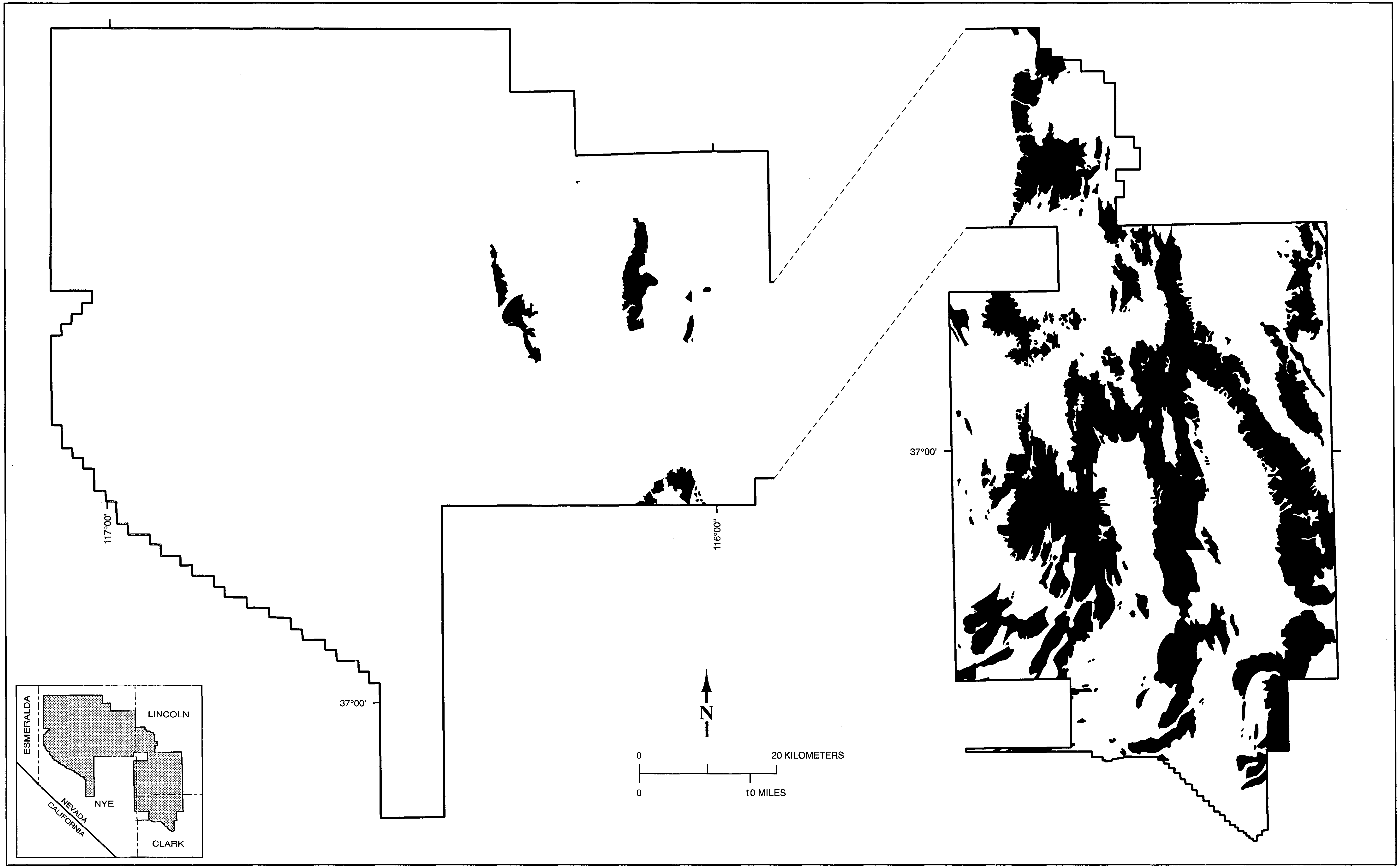


FIGURE 8-43 Areas with moderate potential, certainty level B, for bedrock suitable for construction aggregate.

tive fluorspar property in the state, the Baxter Mine near Gabbs, produced 182,000 tons of fluorspar ore that contained about 50 percent calcium fluoride from veins in Tertiary andesite (Papke, 1979). The Nyco Mine, about 40 km northeast of the NAFR, produced about 1,000 short tons of fluorspar from 0.3-1.5-m-thick veins in quartz latite porphyry (Papke, 1979). This mine is in the Quinn Canyon mining district, an area of numerous fluorspar mines and prospects scattered over an area of about 25 km in diameter, which produced nearly 30,000 tons of fluorspar ore, mainly from replacement deposits in Paleozoic limestone (Papke, 1979).

8.2.6.1 Fluorspar in the NAFR

Fluorite has been identified in samples from three prospects in the NAFR. Purple to white fluorite was found in veinlets and vugs in pieces of silicified welded ash-flow tuff from the dump of a small prospect pit about 1 km north of Little Black Peak in the southern NAFR (fig 8-37). A hand sample of this rock (sample 5450) contains about 20 percent of fluorite by visual estimate. Such rock was not found to comprise large exposures in the area, and the amount of such material is probably limited. Samples containing fluorite were not found on the dump of a short inclined shaft nearby that probably lies along the same mineralized structure explored by the prospect pit, and fluorite was absent in seven other samples collected from prospects within 3 km of sample site 5450. Clear to pale green fluorite cubes up to 2 mm in diameter form the matrix of breccia collected from the dump of the Zabriskie Shaft in the Limestone Ridge area in the northern NAFR (fig 8-37). A hand sample of the breccia, which was found only on the shaft dump, consists of about 60 percent fluorite by visual inspection (sample 5730). Six other samples were taken from prospects in the Limestone Ridge area, but none were found to contain fluorite. Sample 5935, which was taken from a small prospect pit in the East Goldfield mining district, northern NAFR, was found to contain minor amounts of fluorite, and yielded an analysis of 0.15 percent fluorine. The fluorite at this prospect occurs in trace amounts as tiny crystals on fracture surfaces.

Because most of the mining districts and hydrothermally altered areas in the NAFR were examined during this study, and only minor amounts of fluorite were found at three sites, the fluorspar potential in the NAFR as a whole is considered to be low, certainty level B. Because fluorite occurs only in trace amounts in the eastern East Goldfield district, this area is not considered to have potential for fluorite deposits.

8.2.7 Gypsum

Gypsum (hydrated calcium sulfate) and its non-hydrated counterpart, anhydrite, are mined in large amounts, mainly for use in wallboard, portland cement, and agricultural products. Over 17 million tons of crude gypsum and anhydrite were mined in the U.S. in 1994 (Austin, 1995); Nevada produced about 1.5 million tons, mostly from mines in the Las Vegas area (Castor, 1995). The average price per ton for crude gypsum in 1994 was reported at $6.70 per ton, but this is mainly based on values given for intra-company use (most gypsum is used in wallboard manufacture by the company that mines it). Quoted prices for crude gypsum are higher, about $10-20 per ton (Industrial Minerals, 1995).

About 1 million tons per year of gypsum, at values of $5 to $15 per ton, are mined in the Las Vegas area, mainly for wallboard production. About half of this production comes from high-grade deposits (more than 90 percent gypsum) in the Permian Kaibab and Toroweap Formations. Gypsum has also been produced in the Las Vegas area from lower grade deposits (70 percent gypsum or more) in Tertiary sedimentary rocks.

8.2.7.1 Gypsum in the NAFR

The Permian Kaibab and Toroweap Formations, source rocks for gypsum in the Las Vegas area, are not present in the NAFR. During sampling and reconnaissance of NAFR Tertiary sedimentary deposits, rock with more than a few percent gypsum was not noted. However, much of the Tertiary sedimentary rock in the NAFR is covered. The study area is considered to have low potential, certainty level B, for gypsum deposits.

8.2.8 Halite and Other Saline Minerals

Saline minerals, such as halite and sodium sulfate have been produced from evaporative deposits in playa lakes in Nevada (Papke, 1976).

Halite (sodium chloride), commonly known as salt, is an important industrial commodity that is said to have 14,000 different reported uses. Most of this commodity is consumed by the chemical industry, although large amounts are also consumed in food processing and road deicing. Halite is mined from bedded or salt dome deposits, and sodium chloride is extracted from brine. Nearly forty million metric tons of salt were produced in the United States in 1994, but Nevada salt production, which came from a dry lake near Fallon, only amounted to 19,000 tons in 1994 (Nevada Division of Minerals, 1995). No other leasable saline minerals are produced in Nevada.

Halite beds and small salt domes in Tertiary sedimentary rocks in the Overton Arm, Lake Mead area, about 100 km east of the southern NAFR, were mined for salt from prehistoric times to the 1930s (Papke, 1976). These deposits were mostly covered by the waters of Lake Mead in the late 1930s.

8.2.8.1 Halite and Other Saline Minerals in the NAFR

Tertiary sedimentary rocks in the NAFR were not found to contain halite or other leasable saline minerals during sampling and reconnaissance programs. Playas in the NAFR not found to have significant surficial deposits of evaporite minerals during the reconnaissance for lithium described in section 8.2.10, and the samples collected for lithium evaluation have only normal contents of sodium and potassium (table 8-4). Data on the subsurface of playas in the NAFR could not be located.

On the basis of available information, the NAFR as a whole is considered to have low potential, certainty level B, for leasable saline minerals.

8.2.9 Limestone and Dolomite

Limestone and dolomite compose almost 15 percent of all sedimentary rocks available for exploitation, and are the most useful and widely utilized of all the industrial minerals and rocks. Limestone is a sedimentary carbonate rock composed of 50 percent or more of calcite or aragonite (both calcium carbonate). Dolomite is a similar rock, but is composed mainly of the mineral dolomite (calcium-magnesium carbonate). Variable mixtures of both calcium carbonate minerals, dolomite, and other carbonate minerals occur in many carbonate rocks, and most limestones and dolomites contain impurities, most commonly clay, chert, and organic matter. The purity of a deposit of carbonate rock, its size, and its lithological and compositional consistency depend on the environment of deposition and its mineralogical and tectonic history.

Geological assessment of the industrial potential of limestone and dolomite are based initially on bulk chemical composition, carbonate mineral content, and the amounts of clay, silica and other contaminant materials. Physical attributes of the rock may also be important. For example, high-calcium lump lime is generally produced from very fine grained limestone because most coarsely crystallized carbonate rock decrepitates during calcination. Mineral, chemical, and physical attributes of carbonate rocks can generally be related to their depositional and tectonic history. Many classification systems for carbonate rocks allow for interpretation of these factors and, combined with models for deposition and tectonic history, allow some predictability in the selection of carbonate rocks for industrial applications. Beyond the utilization of carbonate rock for the production of construction aggregate and building stone (which are covered above), there are four major areas of application: portland cement, lime, fillers and extenders, and agricultural limestone and dolomite.

Raw materials for cement making are used in an essentially untreated form; limestone is the most common source of calcium, and it is blended with shale or clay as a source of silica and alumina. In most cases limestone is the most important ingredient, and cement plants are located near large deposits of limestone. Acceptable cement limestone has calcium carbonate contents greater than 70-75 percent in most cases. Magnesium is generally the most critical impurity, and the content of magnesium carbonate is limited to about 5 weight percent in any raw mix. Contents of other elements, particularly sodium, potassium, phosphorus, manganese, sulfur, and fluorine also play critical roles in selecting limestone for cement making.

Limestone is calcined at temperatures of between 1,000° and 1,300°C to form lime (calcium oxide). Calcined products are also produced from dolomite; dolime is prepared as a hydrated dolomitic lime and dead-burned dolomite is used as a refractory material. On the whole, the suitability of a limestone or dolomite for calcination can only be subjectively tested under actual kiln conditions, and test results may depend upon factors such as kiln type and particle size. According to Harben (1992), limestone usable for lime must generally contain more than 98.6 percent calcium carbonate and less than 1 percent silicon dioxide. According to Gillson (1960), limestone that is used to make lime contains 97 percent, or more, calcium carbonate.

Carbonate fillers are produced from high-quality white limestone and dolomite. White carbonate fillers are produced by fine grinding, and range from coarse fillers with a mean particle size of 22 - 40 microns to ultrafine filler with sizes ranging from 0.7 to 2 microns (Harben, 1992. Limestone is also used in glass making, and must contain at least 97.8 percent calcium carbonate and less than 1.25 percent magnesium carbonate and 0.095 percent iron oxide (Carr and others, 1994). Limestone and dolomite are also used in agriculture as soil conditioners and plant nutrients.

Numerous deposits of limestone are mined in the southwestern United States, most supplying the cement and lime industries, especially in populous southern California, and to a lesser extent Nevada, Arizona, and New Mexico. California leads the country in cement production, mainly from plants in southern California. The sole cement producer in Nevada is Nevada Cement Co., supplying about 400,000 tons per year of cement from its Fernley plant near Reno to markets in Nevada and northern California. Limestone raw material for this operation is Tertiary lacustrine tufa that is mined near Fernley. There is no cement production in the Las Vegas area.

Chemical Lime Co. produces over 500,000 tons per year of lime products from two plants in Nevada near Las Vegas; high-calcium lime at Apex, just northeast of Las Vegas and about 50 km southeast of the NAFR, and dolomitic lime in Henderson from dolomite mined at Sloan, south of Las Vegas (Castor, 1994). Whole rock analyses of representative samples from the quarries are reported in table 8-1.

Table 8-1. NAFR and quarry carbonate rock analyses. Oxide analyses in weight % by XRF. $CaCO_3$ and $MgCO_3$ calculated from oxide.

Sample	Unit Sampled	Age	CaO	$CaCO_3$	MgO	$MgCO_3$	SiO_2	Al_2O_3	Fe_2O_3	Na_2O	K_2O	P_2O_5	TiO_2	MnO	LOI	Total Oxide & LOI
Limestone																
GSC-1	Pogonip Group	Ord	53.00	94.3	0.67	1.4	2.9	0.19	0.16	0.02	0.17	0.00	0.02	0.02	42.09	99.19
GSC-19	Guilmette	Dev	53.00	94.3	0.49	1.0	4.4	0.02	0.11	0.00	0.04	0.00	0.02	0.01	41.10	99.15
GSC-27	Simonson Dol.	Dev	54.45	96.9	0.66	1.4	0.5	0.05	0.06	0.00	0.03	0.00	0.01	0.02	43.62	99.34
GSC-38	Bonanza King	Cam	51.55	91.8	1.49	3.1	1.3	0.20	0.27	0.00	0.16	0.06	0.02	0.05	44.27	99.34
GSC-39	Bonanza King	Cam	48.06	85.5	7.05	14.7	1.1	0.11	0.09	0.00	0.11	0.00	0.02	0.01	43.00	99.55
GSC-40	Nopah	Cam	50.48	89.9	4.27	8.9	0.5	0.06	0.10	0.00	0.02	0.00	0.01	0.02	44.05	99.48
GSC-46	Ops	Ord	51.08	90.9	1.49	3.1	4.6	0.20	0.14	0.00	0.20	0.47	0.02	0.04	40.98	99.25
GSC-56	Joana ?	Miss	56.30	100.2	0.46	1.0	0.4	0.04	0.06	0.00	0.01	0.00	0.00	0.04	43.45	100.76
GSC-64	Guilmette	Dev	54.80	97.5	1.76	3.7	0.5	0.09	0.07	0.00	0.03	0.00	0.01	0.01	43.44	100.74
GSC-82	Tys	Tert	55.33	98.5	0.31	0.6	0.4	0.09	0.06	0.00	0.02	0.00	0.01	0.02	43.02	99.25
GSC-85	Ops	Ord	52.10	92.7	0.50	1.0	5.0	0.18	0.17	0.00	0.07	0.18	0.01	0.03	40.95	99.19
GSC-86	Joana	Miss	54.31	96.7	0.48	1.0	1.1	0.02	0.05	0.00	0.01	0.06	0.01	0.03	43.13	99.20
GSC-88	Tys	Tert	52.80	94.0	0.58	1.2	2.9	0.05	0.11	0.00	0.02	0.06	0.01	0.05	42.46	99.02
GSC-90	Tys	Tert	54.46	96.9	0.62	1.3	0.3	0.02	0.04	0.00	0.02	0.00	0.01	0.02	43.77	99.24
GSC-92	Guilmette	Dev	45.94	81.8	7.39	15.4	1.1	0.22	0.13	0.00	0.08	0.00	0.02	0.01	44.17	99.06
GSC-114	Joana ?	Miss	53.10	94.5	0.99	2.1	1.8	0.15	0.14	0.00	0.05	0.06	0.02	0.02	42.90	99.20
5086	Guilmette	Dev		0.0		0.0										0.00
5087	Guilmette	Dev	54.60	97.2	0.40	0.8	0.6	0.06	0.07	0.03	0.04	0.00	0.01	0.01	43.40	99.17
5088	Guilmette	Dev		0.0		0.0										0.00
5089	Guilmette	Dev	52.65	93.7	1.60	3.3	2.1	0.18	0.13	0.00	0.12	0.00	0.02	0.01	42.61	99.42
Apex	Sultan	Dev	54.94	97.8	0.34	0.7	0.8	0.16	0.12	0.02	0.03	0.04			43.15	99.61
Dolomite																
GSC-3	Guilmette	Dev	30.37	54.1	20.61	43.1	1.2	0.14	0.10	0.03	0.05	0.00	0.03	0.02	46.60	99.12
GSC-15	Laketown Dol.	Sil	30.30	53.9	21.66	45.3	0.1	0.00	0.05	0.06	0.01	0.00	0.02	0.02	46.97	99.22
GSC-16	Simonson	Dev.	30.39	54.1	21.21	44.3	0.7	0.13	0.12	0.01	0.05	0.00	0.03	0.01	46.41	99.05
GSC-17	Pogonip Group	Ord	30.30	53.9	21.20	44.3	0.7	0.12	0.16	0.00	0.06	0.00	0.02	0.01	46.50	99.04
GSC-20	Ely Springs Ls.	Ord	30.60	54.5	20.70	43.3	0.9	0.12	0.09	0.00	0.04	0.11	0.03	0.02	46.52	99.08
GSC-22	Pogonip	Ord.	31.59	56.2	21.12	44.2	1.0	0.10	0.12	0.00	0.03	0.00	0.02	0.02	45.35	99.32
GSC-28	Sevy Dol	Dev.	30.62	54.5	20.04	41.9	1.7	0.21	0.12	0.00	0.08	0.00	0.03	0.01	46.46	99.25
GSC-30	Sevy-Laketown	Dev/Sil	30.51	54.3	20.83	43.5	0.4	0.01	0.04	0.02	0.01	0.00	0.02	0.02	47.22	99.09
GSC-41	Nopah	Cam	30.76	54.8	20.90	43.7	0.4	0.05	0.10	0.00	0.04	0.05	0.02	0.03	46.97	99.31
GSC-42	Goodwin Ls.	Ord	30.10	53.6	21.50	44.9	0.0	0.01	0.02	0.02	0.01	0.00	0.02	0.01	47.50	99.22
GSC-43	Ely Springs Dol.	Ord	30.05	53.5	20.89	43.7	0.5	0.08	0.09	0.01	0.03	0.05	0.02	0.01	47.40	99.15
GSC-45	Antelope Valley	Ord	29.00	51.6	20.07	41.9	5.2	0.52	0.23	0.04	0.23	0.00	0.00	0.02	45.50	100.80
GSC-54	Ely Springs Dol.	Ord	32.65	58.1	22.18	46.4	0.2	0.06	0.07	0.00	0.02	0.00	0.02	0.01	43.94	99.16
GSC-76	Laketown Dol.	Sil	31.00	55.2	21.13	44.2	0.3	0.05	0.05	0.00	0.02	0.00	0.02	0.02	46.56	99.17
GSC-84	Ely Springs Ls.	Ord	30.55	54.4	21.30	44.5	0.2	0.04	0.05	0.00	0.02	0.00	0.02	0.01	46.95	99.15
GSC-95	Simonson Dol.	Dev	30.25	53.8	21.25	44.4	0.5	0.03	0.06	0.00	0.02	0.00	0.02	0.02	47.22	99.41
GSC-96	Sevy-Laketown	Dev/Sil	30.17	53.7	20.97	43.8	1.2	0.43	0.19	0.00	0.15	0.00	0.04	0.01	46.00	99.14
GSC-97	Tys	Tert	30.82	54.9	20.20	42.2	1.0	0.18	0.13	0.00	0.05	0.00	0.03	0.02	46.80	99.21
GSC-99	Dev/Sil siltstone	Dev/Sil	30.18	53.7	21.32	44.6	0.4	0.20	0.11	0.00	0.08	0.00	0.02	0.02	46.89	99.22
Sloan	Monte Cristo Ls.	Miss	29.70	52.9	21.49	44.9	0.6	0.19	0.05	0.04	0.04	0.03			46.82	98.93

Continental Lime Inc. produces high-calcium lime from a plant and quarry near Wendover in northeastern Nevada. At both the Apex and Wendover operations, the high-calcium lime is produced from correlative units of very fined-grained, pure Devonian limestone - the Crystal Pass Member of the Sultan Formation at Apex, and the upper part of the Devils Gate Limestone near Wendover. The dolomite mined at Sloan is from the Bullion Dolomite Member of the Mississippian Monte Cristo Limestone. The deposit consists of nearly pure dolomite that is thought to have originated by hydrothermal replacement of limestone (Deiss, 1952).

Prices for limestone, dolomite, lime products, and cement depend substantially on the grade of limestone and dolomite, or lime, or the specific product requirements, and are here quoted from Harben (1992). Crushed limestone for aggregate uses, agricultural applications, and for cement making is generally priced at $3 to $5 per ton. The prices for fillers ranges from $25 per ton for coarse filler and $200 per ton for ultra-fine fillers. Lime is priced at about $50 per ton, f.o.b. plant, but dolomitic lime produced from the Sloan deposit is sold for $75 or more per ton. Grades for cement powder may also vary considerably, but Solomon (1995) gives an average domestic price for portland cement in 1994 at about $60 per ton.

The long-term demand for limestone and dolomite is expected to grow at an annual rate of about 2 - 2.5 percent (Carr and others, 1994). Demand could be stimulated by need for limestone and lime for flue gas desulfurization based on the 1990 Clean Air Act Amendment. The long-term outlook for cement consumption is one of steady but moderate growth.

8.2.9.1 Limestone and Dolomite in the NAFR

The southern NAFR contain extensive exposures of Paleozoic carbonate rock that includes limestone and dolomite that appear to meet specifications for lime and cement raw materials. In addition, an area underlain by Tertiary tufa in the Spotted Range (fig. 8-37) appears to meet specifications for cement limestone.

Three GSC samples of limestone were found to contain more than 97 percent calcium carbonate, the general standard for high-calcium lime, by calculation from calcium oxide (table 8-1). This includes a sample of fossiliferous limestone (GSC 56) that is probably correlative with the Mississippian Joana Limestone. In general, the Joana Limestone contains too much silica, in the form of chert, to be used to make lime (e.g., samples GSC 86, and GSC 114, table 8-1). A sample of Guilmette Formation limestone (GSC 64, table 8-1) was also found to meet specifications for high-calcium lime material, although its magnesia content is a little high. The upper part of the Guilmette Formation is correlative with the Devonian limestone that is quarried at Apex, northeast of Las Vegas. Four chip samples of the upper part of the Guilmette Formation were collected from sites along the west side of the Spotted Range (samples 5086-5089, table 8-1). Three of these samples, which represent 6 m to 30 m of stratigraphic section, were found to meet chemical specifications for high-calcium lime raw material. However, at all sites where the Guilmette Formation was examined in the NAFR, it was found to be recrystallized to somewhat coarser calcite than it is in the Apex area, and it is possible that this limestone would decrepitate during calcination, making it unacceptable for lump lime production. Sample GSC 82, which is chemically suitable for high-calcium lime production (table 8-1), is of limestone from the Tertiary "younger sedimentary rocks." However, this limestone occurs as relatively minor beds in a sequence of sandstone, conglomerate, and tuff, and is not present in large enough amounts to make large scale exploitation feasible.

On the basis of chemical, mineral, textural, and other information, the limestone examined and sampled during this project in the NAFR is considered unsuitable for lime production. However, because it was beyond the scope of this project to evaluate all limestone in the NAFR, it is possible that acceptable high-calcium limestone is present. The potential for high-calcium limestone deposits is considered low, certainty level B, in the NAFR as a whole.

Specifications for cement limestone are less stringent than for high-calcium limestone, and many of the limestone samples collected in the southern NAFR are of material that would make good cement limestone. A particularly interesting example is tufa (sample GSC 90) in the southern NAFR. The tufa is mainly coarsely crystalline limestone that has algal textures, fallen tufa tubes, recemented breccia, and thinolite beds. It commonly contains a few percent of chalcedonic silica (although sample GSC 90 does not). It forms an elongate mound about 1.5 km long, 1 km wide, and 50 m high that contains an estimated 100 million tons of rock. This limestone is considered to have high potential, certainty level B, for cement rock. Further work would be needed to raise this certainty level.

On the basis of the chemical data that are presented in table 8-1, portions of the Paleozoic carbonate sequence ranging from Cambrian to Mississippian in age are suitable for cement production. Because it was impossible to characterize the cement potential of every carbonate exposure in the project area, Paleozoic exposures in the southern NAFR are considered to have moderate potential for cement limestone as a group, certainty level B. Figure 8-44 shows the extent of these rock types.

Samples of Ordovician and Silurian dolomite from the southern NAFR (GSC 15 and GSC 42) have compositions similar to the dolomite mined at Sloan for dolime on the

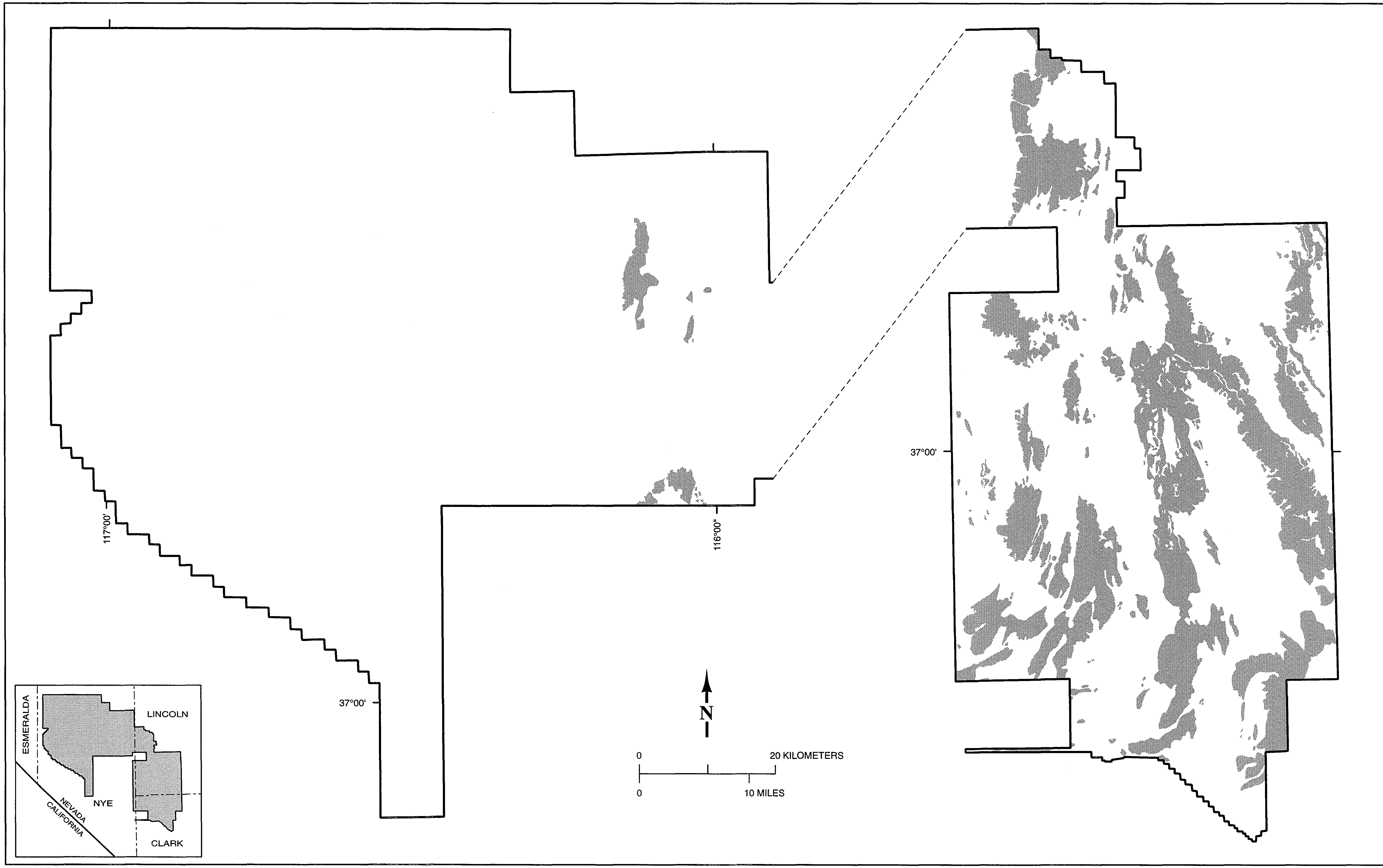


FIGURE 8-44 Areas with moderate potential, certainty level B, for cement limestone.

basis of similar magnesium oxide and calcium oxide contents (table 8-1). However, other samples from units of approximately the same age do not appear to be chemically suitable for dolime by comparison with Sloan dolomite. Examination and sampling of the Nopah Formation in the NAFR failed to establish the presence of the thick, pure dolomite in that formation that was found to have good potential for dolime on the Desert National Wildlife Refuge to the east (Tingley and others, 1993). On the whole, Paleozoic carbonate rocks on the southern NAFR are thought to have low potential for dolime, certainty level B.

Cement and lime plants are generally located along railroads; this is true for all four plants in Nevada. Although the southern NAFR probably contain significant resources of carbonate rock that is suitable for lime or cement production, they are remote from rail transport facilities. Therefore, regardless of the suitability of local raw materials, the potential for economic development of Nellis carbonate rock deposits for lime or cement is low in the foreseeable future. However, if rail access to the proposed nuclear waste repository at Yucca Mountain is constructed, the economic potential of these deposits could improve.

8.2.10 Lithium

Lithium is produced in small quantities from spodumene-bearing pegmatites in the United States and Australia, but most comes from brines that are pumped from beneath playas in the United States, Chile, and possibly China (Ober, 1995). Lithium is the lightest of all the metals. It is used in metallic form in light metal alloys and batteries, and as organic compounds in lubricants and pharmaceutical products. However, its main uses are as lithium carbonate, which is the form that is produced from brines, in ceramics, glass, and in aluminum reduction (Kunasz, 1994). Lithium prices have increased steadily in recent years, and production, which is mainly dependent on the health of the aluminum industry, is expected to grow modestly in the near future. In 1995, lithium carbonate sold for about $2.03 per pound, delivered in truckload lots in the continental United States (Industrial Minerals, 1995).

One of the world's premier lithium deposits, the Silver Peak brine in the subsurface of Clayton Valley, is located 50 km west of the NAFR (Kunasz, 1970; Papke, 1976).

Popular theories on the genesis of the lithium brines in Clayton Valley include three sources: influx of hot brines with lithium ultimately coming from a magmatic source, chemical weathering of lithium-rich pegmatites in the region, and leaching of lithium from volcanic rocks (e.g. Kunasz, 1970; Papke, 1976; Davis and others, 1986). Transport of lithium would thus come via either a hydrothermal fluid, surface water, or meteoric groundwater that leaches lithium from rocks and moves into the valley. Evaporation brings the concentration of lithium in the brine to economic grades or precipitates lithium in evaporite sediments, which are later dissolved by fresher water to make brine. Papke (1976) argued for an ultimate source of the lithium at the Silver Peak deposit to be volcanic rocks, particularly permeable tuffs, which are abundant in the Clayton Valley area and in the northern part of the NAFR and many others areas in Nevada. Lithium tends to be concentrated in highly evolved, rhyolitic igneous rocks. For example, the average lithium content of basalt is 17 ppm, whereas the average lithium content of rhyolite is 40 ppm (Rose and others, 1979). An obsidian from the hills south of Clayton Valley (sample J95-15) contains 105 ppm lithium.

Clayton Valley is topographically lower than nearby valleys (table 8-2). Rush (1968) hypothesized that considerable groundwater entered Clayton Valley through interbasin flow, beneath the surrounding surface-water divides. This could mean that Clayton Valley has been the terminus of fluid flow for considerable time, thereby allowing evaporation to progressively increase the lithium content of the water and sediments. In contrast, closed basins in the NAFR are topographically high (table 8-2) and would therefore not likely be the end point for interbasin groundwater flow. Stonewall Flat is not a closed basin; at times of high stream flow, surface water flows from Stonewall Flat southward, dropping in elevation approximately 230 m, into Sarcobatus Flat. Davis and others (1986) argued against interbasin flow and favored the evaporation of Pleistocene and Holocene lakes to form salt deposits in Clayton Valley sediments, from which modern groundwater would then obtain its high lithium concentration by dissolution. The hydrogen (deuterium) isotopic data of Davis and others (1986) indicate that the modern brines did not form through evaporation, but gained their sodium chloride and lithium concentrations by dissolving salts that were previously deposited within the valley.

At the Silver Peak lithium mining operation, halite is precipitated as lithium continues to be evaporatively concentrated in the brine (Papke, 1976), which initially is not saturated with respect to halite (Davis and others, 1986). Natural processes of evaporation that led to precipitation of halite probably also increased lithium concentration. The presence of beds of halite in sediments of Clayton Valley indicates evaporation of surface waters to or near dryness during Pleistocene and Holocene time (Davis and others, 1986). In addition, groundwater apparently flows upward, toward the surface in the center and on the margins of the playa, driven by higher heads in the surrounding highlands. Therefore, not only surface water but also groundwater has flowed into the playa, where evaporation has allowed lithium to be concentrated in sediments and remaining brines.

Lithium itself would be expected to occur in high concentrations in samples collected from the surface of playas that contain lithium-rich brines, if, as is hypothesized, groundwater

Table 8-2. Lithium concentrations and mineralogy of playa samples.

Locality and Sample Number		Li (ppm)	Mineralogy from X-ray Diffraction*									Elev. (m)	Other Features
			ha	gyp	cal	dol	qz	fs	zeo	ill	kao		
Clayton Valley	J95-10	780	x	x	x	x	x	x	x	x	x	1300	Bedded brown clayey sediment; 8-30 cm depth; slightly moist; thin, light-colored layers contain more calcite and dolomite than thicker, dark layers; possible trace of smectite.
	J95-11	470	x		x		x	x	t	t		1300	Efflorescent crust (mostly halite) on surface of playa.
	J95-12	1300	x	x	x		x	x	t	t		1300	Bedded brown clayey sediment, 10-30 cm depth; moist; same location as J95-11; unidentified peak in x-ray diffraction may be anatase.
	J95-13	440	x	x	x	x	x	x		t	t	1300	Bedded brown clayey sediment (mostly halite) with bed of sandy, porous gypsum; 5-30 cm depth.
Antelope Lake (Cactus Flat)	5819	75		x	x		X	x		x		1634	Clay and silt from 0-25 cm depth; hard clay surface with mud cracks; sample probably also contains volcanic glass.
	5820	83			x		x	x		x	t	1634	Hard clay and silt from 0-10 cm depth; contains volcanic glass; surface is broken into mud cracks.
Main lake in Cactus Flat	5821	90			x		x	x		x		1628	Hard clay, silt, and sandy clay; 0-20 cm depth; surface coated with 2-3 mm of clay over sandy clay.
	5822	95			x		x	x		x		1628	Hard clay-silt with sand grains; surface of buff clay, 1-2 mm thick, with mud cracks; contains volcanic glass.
Alkali Lake	5837	130			x		x	x		x	t	1464	Clayey sediment; 0-40 cm depth. contains volcanic glass.
	5838	120		t	x		x	x		x		1464	Clayey sediment; 0-40 cm depth; contains volcanic glass.
Stonewall Flat	5839	72		x	x	t	x	x		x		1435	Clayey sediment; 2-30 cm depth; probably also contains volcanic glass; dolomite peak on x-ray diffraction is masked by gypsum.
Kawich Valley	5847	85			x		x	x		x	t	1622	Clayey-silty sediment; 5-30 cm depth; contains volcanic glass.
Mud Lake	5910	120			x		x	x		x		1579	Clayey-silty sediment; 3-28 cm depth; contains volcanic glass.
	5911	130			x		x	x		x	t	1581	Clayey-silty sediment; 3-28 cm depth; contains volcanic glass.

*ha = halite; gyp = gypsum; cal = calcite; dol = dolomite; qz = quartz; fs = feldspar, definitely plagioclase, except in J95-10 through 13; zeo = zeolite; ill = illite or other 10-A clay; kao = kaolinite or other 7-A clay.
x = present; t = present in trace quantities, barely detectable by x-ray diffraction.

Table 8-3. Lithium concentrations from playas on and near Nellis Air Force Range.

		Li (ppm)	Depth (m)	Reference
1.	Alkali Lake	~ 80	0-3	Pantea and others (1981)
		730	85	Pantea and others (1981), maximum
		640	0-3	Bohannon and Meier (1976)
		120-130	0-0.4	this study
2.	Big Smoky Valley	~ 80	0-3	Pantea and others (1981)
		360	60	Pantea and others (1981), maximum
3.	Cactus Flat, Antelope Lake	75-83	0-0.25	this study
4.	Cactus Flat, main lake	90-95	0-0.20	this study
5.	Clayton Valley	>1700		Papke (1976), maximum
		16-300	0-~2	Bohannon and Meier (1976)
		440-1300	0.05-0.3	this study
6.	Fish Lake Valley	~ 55	0-3	Pantea and others (1981)
		115	84	Pantea and others (1981) , maximum
7.	Kawich Valley	85	0.05-0.3	this study
8.	Kibby Flat/Monte Cristo Valley	63-64	0-0.2	Bohannon and Meier (1976)
9.	Mud Lake	75	63	Pantea and others (1981)
		67-76	0-1	Bohannon and Meier (1976)
		120-130	0.03-0.28	this study
10.	Stonewall Flat	~ 45	0-3	Pantea and others (1981)
		121	10	Pantea and others (1981), maximum
		64-65	surface	Bohannon and Meier (1976)
		72	0.02-0.3	this study
11.	Teels Marsh	25-560	surface	Bohannon and Meier (1976)

flows upward toward the surface of the playa. That is, high lithium concentrations in playa-surface samples would result from the evaporative concentration of lithium in these sediments, either as lithium adsorbed by clays or other minerals in the sediments, lithium salts, or as other discrete lithium minerals. Although Kunasz (1970) reported the occurrence of hectorite (a lithium-bearing clay mineral) in the Clayton Valley sediments, hectorite was not detected in the surface samples collected during the present study. The near-surface playa samples from Clayton Valley are by far the most lithium-rich of all playas in the region (tables 8-2 and 8-3).

Geochemical analyses of playa samples do not indicate economically significant enrichments in elements other than lithium (table 8-4). Interestingly, gold, silver, copper, antimony, and bismuth are slightly enriched, relative to other playa samples, in samples 5837 and 5838 from Alkali Lake (not in the NAFR). Whether this is natural geochemical variation indicating proximity to gold-silver ore deposits (the playa receives drainage from the nearby Divide, Goldfield, Klondike, Lone Mountain, and Montezuma districts of Tingley, 1992) or the result of windblown contamination of tailings from the historic mining districts is uncertain.

8.2.10.1 Lithium in the NAFR

Although the geologic setting in the northern part of the NAFR is similar to that at nearby Clayton Valley, no lithium has been produced from the NAFR and lithium-rich brines are not known to exist within the NAFR.

To evaluate the potential for lithium resources in the NAFR samples from playas were collected and analyzed (table 8-2, table 8-4, and figure 7-1). Geochemical data on potential source rocks were also evaluated. Analyses of samples collected from the NAFR were compared with data from the literature (table 8-3) and with new data collected from sites in Clayton Valley, outside the NAFR. Results of geochemical analyses of the playa samples are presented in table 8-4. Most important in the evaluation of lithium resources are the lithium values, and these are repeated in tables 8-2 and 8-3. Also important is the mineralogy of the sediments,

Table 8-4. Chemical contents of samples from playas within the NAFR.

Area	Sample	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Fe INAA %	Ga ICP ppm	Hg ICP ppm
Antelope Lake	5819	527977	4171059	0.21	11.4	0.005	561	0.43	1	3	0.35	11	30	13	17.6	3.4	4.8	0.00
Antelope Lake	5820	529127	4169990	0.22	10.3	0.004	576	0.48	1	4	0.36	8	30	12	20.5	3.5	5.7	0.00
Main Lake, Cactus Flat	5821	524157	4189047	0.15	7.4	0.003	451	0.37	1	3	0.22	9	20	12	12.5	2.7	2.9	0.01
Main Lake, Cactus Flat	5822	524199	4188589	0.20	9.6	0.004	430	0.44	1	2	0.34	12	40	15	20.7	3.5	6.0	0.03
Alkali Lake	5837	466678	4190060	0.26	14.3	0.021	526	0.73	2	4	0.35	14	40	19	27.8	3.5	4.6	0.02
Alkali Lake	5838	466056	4189873	0.30	18.6	0.024	527	0.99	2	4	0.40	14	40	18	28.4	3.4	5.0	0.03
Stonewall playa	5839	486147	4153777	0.19	9.9	0.009	520	0.37	7	6	0.28	11	40	9	18.1	3.1	4.3	0.08
Kawich playa	5847	569340	4149788	0.09	8.1	0.002	374	0.42	3	<1	0.44	9	30	11	16.7	3.0	5.7	0.00
Mud Lake	5910	491911	4190993	0.10	22.3	0.002	507	0.50	2	3	0.22	10	20	15	16.7	3.0	4.7	0.00
Mud Lake	5911	491887	4192473	0.10	23.8	0.002	545	0.48	1	3	0.24	10	20	16	19.4	3.1	5.6	0.00

Area	Sample	UTM East	UTM North	MnO ICP %	Mo XRF ppm	Na ICP %	Ni INAA ppm	Pb XRF ppm	Sb ICP ppm	Se ICP ppm	Sn XRF ppm	Sr XRF ppm	Te ICP ppm	TiO_2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	Zn ICP ppm
Antelope Lake	5819	527977	4171059	0.11	1.9	1.1	28	16	1.37	0.40	<2	281	0.19	0.52	0.39	3.6	96	64.2
Antelope Lake	5820	529127	4169990	0.11	1.6	1.1	31	17	1.51	0.10	<2	228	0.14	0.52	0.63	2.7	89	72.6
Main Lake, Cactus Flat	5821	524157	4189047	0.09	1.0	1.6	25	10	1.10	0.25	<2	327	0.13	0.46	0.44	4.1	75	38.7
Main Lake, Cactus Flat	5822	524199	4188589	0.10	1.4	1.2	30	16	1.51	0.37	<2	252	0.18	0.51	0.60	3.2	77	69.5
Alkali Lake	5837	466678	4190060	0.11	2.2	2.4	35	16	2.15	0.00	<2	357	0.31	0.50	0.62	3.3	124	70.7
Alkali Lake	5838	466056	4189873	0.12	7.1	2.1	37	17	2.44	0.20	<2	319	0.53	0.49	0.58	4.1	93	75.9
Stonewall playa	5839	486147	4153777	0.09	1.6	1.0	32	12	1.87	0.77	4	306	0.28	0.52	0.35	3.2	75	51.2
Kawich playa	5847	569340	4149788	0.10	1.8	0.7	31	15	1.33	0.73	<2	262	0.18	0.51	0.63	2.9	76	65.1
Mud Lake	5910	491911	4190993	0.12	5.4	1.8	25	13	1.78	0.35	6	313	0.17	0.40	0.63	5.6	131	55.7
Mud Lake	5911	491887	4192473	0.12	5.7	1.9	27	14	1.94	0.43	4	320	0.16	0.40	0.52	5.7	117	62.6

which was determined by X-ray diffraction and is reported in table 8-2.

Although none of the samples from the NAFR have lithium concentrations as much as even one-third of the smallest value from Clayton Valley (table 8-2), lithium values are anomalously high (relative to average shales and rhyolites), and it is conceivable that groundwaters in the NAFR are locally enriched in lithium. Although probably not economically exploitable at this time, these brines could be low-grade resources for the future. The presence of halite is a favorable factor for the occurrence of lithium-bearing brines. Unlike samples from Clayton Valley, however, the samples from the NAFR do not contain significant amounts of halite (enough to be detectable by x-ray diffraction of bulk samples, table 8-2).

Tingley and Papke (1987) drilled two shallow auger holes into the northern playa (main lake) in Cactus Flat and determined that the clayey sediment is a mixed layer illite-smectite. Although they did not analyze these samples for lithium, they described the playa as a dry type (Papke, 1976, p. 6), and noted that these types generally do not contain valuable brines. That is, these types of playas show little evidence of shallow groundwater or evaporative concentration that would result in a lithium-rich brine.

Although a source for lithium clearly exists in the volcanic rocks of the NAFR, and the mechanisms for leaching and transport of lithium by groundwater and surface water could operate there as in Clayton Valley, none of the playas that were examined in the NAFR have evidence of significant evaporative concentration of lithium in near-surface samples. Unlike in Clayton Valley, halite is not abundant and, most importantly, lithium is not comparably enriched in the near-surface sediments of the playas in the NAFR. It is therefore unlikely that a lithium-bearing brine meeting today's criteria for economic recovery is present within the NAFR.

The NAFR as a whole is considered to have low potential, certainty level B, for lithium.

8.2.11 Perlite

Perlite is defined commercially as any naturally occurring siliceous volcanic glass that, when heated to temperatures of 1400°-2100°F (Kadey, 1983), or about 760°-1150°C, will expand to the point that its bulk density is as low as 30 kg/m^3, although more typically values are about 80 kg/m^3 (Allen, 1992). Laboratory-scale testing of perlite may be done in a lower temperature range, about 670°-820°C (Barker and Harris, 1990). Perlite expands or "pops" to form a low density cellular material because it contains 2 to 5 percent of chemical water held within the glass structure (Breese and Barker, 1994) that flashes into steam upon heating. Non-hydrated volcanic glass (obsidian) typically contains less than 1.0 weight percent total water bound in the silica framework, and perlite is thought to form by the incorporation of water in obsidian during post-emplacement hydration by meteoric water (Breese and Barker, 1994). Perlite may generally be distinguished from other types of volcanic glass by having a pearly luster, and fine (granular) or coarse (onion-skin) arcuate or perlitic fractures. However, some commercial perlite does not have pearly luster or megascopic perlitic fractures. Many perlite deposits contain remnants of black, non-hydrated glass (often referred to as "Apache tears"), spherulites or other devitrified masses, and phenocrysts of feldspar or other minerals. Perlite deposits that contain large amounts of such impurities are generally uneconomic.

Most commercially mined perlite deposits are in parts of silicic volcanic domes or lava flows that were subjected to rapid quenching. However, perlite deposits may also be found in the densely welded portions of ash-flow sheets or in high-level intrusions. According to Breese and Barker (1994), the perlite deposits at No Agua Peaks, New Mexico, are a model for most perlite deposits — they occur in an exterior mantle around partly devitrified rock that in turn surrounds an interior of crystallized felsite in an extrusive volcanic dome.

In the United States, perlite comes from mines in four western states, with New Mexico operations accounting for most of the production. In recent years, Nevada has been a relatively minor producer, but the state has large amounts of high-quality perlite resources. Nevada perlite is, or has been, produced from deposits in four counties in Nevada (Gemmill, 1964; Papke, 1973; Castor, 1995). In Lincoln County, which has had the largest production, perlite has been produced from three deposits. At present, about 4,000 tons of perlite are extracted annually from the Mackie (Delamar) deposit, which has been mined almost continuously since 1951 (Castor, 1988). In northern Nevada, expanded perlite is produced at plant with capacity of 15,000 short tons per year (Castor, 1995) from perlite mined from a deposit at least 10 m thick in a rhyolite flow.

The Hollinger Mine in Lincoln County has been the largest Nevada perlite producer, with total production of about 350,000 short tons (about 320,000 metric tons) between 1949 and 1971, when production ceased (Tingley and Castor, 1991). The Hollinger deposit consists of a flat-lying to shallowly dipping mass of nearly pure, granular perlite 50 m thick that is exposed over an 800 × 170 m long area. In Clark County, perlite was mined from two deposits: a flat-lying deposit about 1.6 by 3 km in area and 15 m thick, with reserves estimated at 200 million short tons; and at a site where two widespread perlite layers with thicknesses of 6 m and 30 m have reserves estimated at 10 million short tons (Longwell and others, 1965).

Although perlite is mined underground in Nevada, it is more typically mined by open-pit methods. Most perlite mines use either drilling and blasting or bulldozer ripping, or a combination of both. Crushing, drying, and screening are generally done near the mine because abundant unusable fines are produced, and most crude perlite is shipped to expansion plants near markets.

Annual international consumption of perlite was stable between 1988 and 1994, ranging between 1.44 and 1.59 million metric tons (U.S. Bureau of Mines, 1993a; 1995b). Annual production of processed perlite from domestic mines has been somewhat less stable than international production, ranging between about 400,000 and 650,000 metric tons in the 1980s and 1990s. During recent years, Nevada perlite production was small, ranging between 3,000 and 4,500 short tons (Nevada Department of Minerals, 1990-1994).

Although unexpanded perlite has a number of uses, expanded products comprise most of the international consumption of perlite. Construction products such as insulation, ceiling tile, textured paint, and lightweight aggregate in concrete and plaster are the most important uses for expanded perlite. Horticultural uses as soil conditioner and propagating medium have grown steadily in recent years. Milled expanded perlite is used in the filtration of food products, oils, industrial effluents, and other fluids; and as a filler in plastics.

The average price for all perlite sold or used by mining companies in the United States was about $30 per ton (U.S. Bureau of Mines, 1995b). Average prices for expanded perlite in the United States in 1994 ranged between $132 and $494, depending on application (U.S. Bureau of Mines, 1995b).

Because perlite is mainly consumed by the construction market, perlite demand is directly related to the general world economy. Domestic crude perlite, mined entirely in the western United States, has transportation cost disadvantages in parts of the eastern United States, where imported perlite, mainly from Greece, is consumed. In the near term, perlite sales are expected to experience modest growth (U.S. Bureau of Mines, 1995b).

8.2.11.1 Perlite in the NAFR

A single occurrence of potentially economic perlite was found during this study about 2 km east of Obsidian Butte in Tolicha Wash (fig. 8-37). The perlite was examined in detail at a site in Tolicha Wash (sample site 5081). Here it is flow-banded, light gray glass with perlitic fractures and pearly luster that contains locally abundant non-hydrated glass (apache tears) up to 2 cm in diameter and some devitrified and spherulitic layers and masses. The perlite is in the basal part of an 11-m-thick rhyolite flow, of which the upper 6 m is partly to completely devitrified with vapor phase minerals in cavities. Relatively pure perlite, which contains 5-10 percent combined devitrified rock and non-hydrated glass, is about 5 m thick. The perlite was observed to crop out at several places in an area about 1 km in diameter, but at all localities where the perlite was found, it was exposed in steep walls, rendering surface mining impractical because it would require removal of considerable amounts of overburden.

Glassy silicic volcanic rock in the form of domes or flows, which are the most likely sources for perlite, occur elsewhere on the northern NAFR, but no occurrences of material that appeared to be usable as commercial perlite were noted. Considering the large amount of domestic perlite resources, at both actively mined and inactive sites, the potential for perlite mining from the NAFR in the near or distant future is considered to be low, and the NAFR as a whole is thought to have low potential for economic deposits of perlite, certainty level B.

8.2.12 Pumice and Pumicite

Pumice is light colored, highly vesicular volcanic glass that typically has a bulk density of less than 1.0 g/cm^3, and is therefore light enough to float on water. The term "pumicite" refers to light colored, fine-grained pumice or glass shard deposits with individual fragments less than 2 mm in diameter. It is a commercial term for volcanic ash. Commercial pumice and pumicite deposits generally consist of unconsolidated fragments, although individual pumice fragments may be a meter or more in diameter.

Pumice deposits can be classified into four major types: flows and domes, air-fall deposits, pyroclastic flows, and reworked deposits. Rhyolitic flows and domes, which are typically only a few square kilometers in areal extent, may have rubbly carapaces of pumice. The pumice in such deposits is generally associated with nonvesiculated volcanic glass, and much of the pumice may be interlayered with nonvesiculated rock. The erratic nature of vesiculation can make exploration and development difficult, and the pumiceous material may only be usable as relatively low value lightweight aggregate. The Southern Nevada Lightweight operation in Clark County about 30 km south of Las Vegas mines pumiceous rhyolite that is used for lightweight concrete, building blocks, and stucco sand (Castor, 1989), but not for high-value pumice.

Air-fall deposits are well-sorted pumice or pumicite deposits formed by explosive eruptions of pyroclastic material, and range from deposits of relatively coarse pumice close to a volcanic vent to fine-grained pumicite deposits at greater distances from the vent. Most high-value pumice deposits are air-fall deposits. In northern California, pumice is mined by the Glass Mountain Pumice Co. from an air-fall deposit and sold as high-value stone-washing pumice and as low-value lightweight aggregate. In the Glass Mountain area, pumice has been mined from a coarse air-fall unit up to 18 m thick and 35 km^2 in areal extent and from block pumice deposits on the surface of a 3 km^2 rhyolite obsidian flow (Chesterman, 1956). In central Oregon, which is the leading state in pumice production, two companies mine pumice from 4.5- to 12-m-thick beds of air-fall tuff in pits with overburden ratios up to 1:1 (Geitgey, 1990).

Nonwelded pyroclastic flow deposits may be exploited for pumice, but such deposits are poorly sorted and likely to be partly to completely lithified. They are less frequently exploited for pumice or pumicite than are air-fall deposits. Reworked deposits are bedded pumice or pumicite accumulations that are formed by transport and redeposition of pyroclastic material by water. Reworked pumicite deposits are mined in California and Kansas (Geitgey, 1994). Pumicite in the area that contains the Friant, California deposit is said to be up to 45 m thick (Chesterman, 1956).

Pumice and pumicite mining is carried out at the surface, either by open pit mining or by removal of large blocks from pumice exposures. Most deposits have minimal overburden. Processing generally consists of air drying, crushing, and screening. Pulverization may be necessary to produce fine abrasive products, filtration aids, and pozzolan.

International production of pumice and related materials is about 11-12 million metric tons annually (U.S. Bureau of Mines, 1993b), most of which is probably sold into construction product markets as pozzolan and lightweight aggregate. Countries that produce and export large amounts of pumice are Turkey, Italy, and Greece. Domestic production ranges between 300,000 and 500,000 metric tons annually, and about 80 percent of this is low-value material that is used in lightweight building products (O'Driscoll, 1990). Most of the lightweight aggregate mined in Nevada is not light enough to qualify as pumice, and is referred to as pumiceous rhyolite (O'Driscoll, 1990).

Internationally and domestically, most pumice and pumicite is used in construction materials. Pumice is used as aggregate in cast portland cement concrete and in concrete blocks because it reduces weight, provides insulating value, enhances color, and promotes ease of construction. It is also used as base fill in special applications. Pumicite or finely ground pumice is added to concrete as pozzolan to promote strength and durability and to reduce cement consumption.

Significant amounts of pumice are used in high-value applications, such as abrasives which consume about 5 percent of domestic pumice (U.S. Bureau of Mines, 1993b). Pumice makes excellent abrasives because its vesicle walls make hard, sharp cutting edges, and fresh edges are continually exposed as the relatively friable material is used. Pumice abrasives include sawn and shaped blocks, lump pumice, pumicite or finely ground pumice granules or powders, and impregnated molded forms. Abrasive uses include scouring powders, soaps, and other home products; industrial polishing products, such as fine powders used for glass polishing; and lump pumice for stone washing denim clothing. Pumice that can be used for the latter brings a premium price. The average size for pumice stones used in stone washing is 3-5 inches (7.5-12.5 cm), and pure pumice of medium hardness is preferred because hard stone and impurities damage the cloth and soft pumice wears too quickly (McMichael, 1990). According to Geitgey (1994), pumice particles as small as 2 cm in diameter may be suitable for stone washing.

Other relatively high-value pumice and pumicite uses are varied. Pumicite mined in Kansas is used as a filtering media. Fine granular pumice is used in potting soils, and coarse granules and pebbles are used for ground cover. Pumicite and finely ground pumice are also used as absorbents, fillers, and in non-abrasive laundry applications. Large blocks of pumice from near Lee Vining, in eastern California, are used as landscape rock (Geitgey, 1994).

The average price for pumice in 1992 was about $31 per metric ton (U.S. Bureau of Mines, 1993b), but this price was dominated by low-value pumice used in construction products. Pumice used in abrasives is sold for approximately $130 per metric ton (U.S. Bureau of Mines, 1993b). Pumice for specific abrasive uses has sold for higher prices. For example, Turkish lump pumice used for stone washing brought as much as $300 per metric ton in the mid 1980s (McMichael, 1990).

The stone washing of denim strongly enhanced the international pumice market in the mid-1980s, particularly for high-value lump pumice, but demand and prices leveled off and began to decline in the early 1990s. Domestic pumice and pumicite production has been maintained at relatively steady levels since 1980. Lower value aggregate pumice markets, which constitute most domestic sales, depend on the amount of construction activity.

8.2.12.1 Pumice and Pumicite in the NAFR

Pumice deposits have not been reported in the NAFR; however, a deposit of pumicite about 6 km northeast of Beatty has had past production. According to Horton (1964), this deposit was mined at irregular intervals during the 1940s for use as aggregate in the manufacture of concrete blocks. No data are available on the size and reserves of the deposit.

Pumice-rich units of tuff are present in the northern NAFR in bedded tuff sequences that accompany many of the ash-flow tuff sheets. In addition, glassy, vesicular and pumiceous lava rock is present (see the section on perlite). During field work in the NAFR, neither bedded tuff sequences nor glassy flows were found to contain, or be associated with, unconsolidated fragments of glassy lump pumice suitable for high value pumice products. It is possible that the bedded tuffs may include thin beds of fine-grained glassy pumicite of sufficient quality for use as pozzolan or fine abrasive. The potential for commercial pumice or pumicite deposits in the NAFR as a whole is considered to be low, certainty level B.

Large resources of domestic pumice and pumicite are available for sale into a relatively stable, long-term market. Therefore, it is unlikely that new pumice or pumicite mines will be opened in the near future in the region around the NAFR.

8.2.13 Silica

Probably no other nonmetallic mineral has more diversified uses than silica. Most silica sand is used in the manufacture of glass, and in foundry sands used to cast iron-, aluminum-, and copper-base alloys (Bolen, 1992). Silica sand and lithified varieties of silica are used in refractory sands and abrasives, for metallurgical applications, and for filtration and oil well fracturing. Ground silica is used in fillers and extenders.

Silica is mainly mined from quartz sand, quartz pebble, sandstone, and quartzite deposits in the United States; minor production comes from chert or novaculite (cryptocrystalline quartz) deposits, quartz pegmatites, and quartz veins. About 70 stratigraphic units in the country are known to have potential for economic silica production (Bolen, 1992). Most domestic silica comes from deposits of sand or sandstone in the eastern and midwestern United States (Zdunczyk and Linkous, 1994). In the western United States, most production is from Tertiary sand or sandstone in California, but silica glass sand is produced from a Mesozoic sandstone deposit in Nevada.

Cryptocrystalline silica is mainly mined in minor amounts for abrasive applications such as whetstones, and for grinding media in pebble mills. Quartz veins are now mined in small amounts for optical and electronic quartz, but in the past large quartz vein deposits were mined for metallurgical and refractory silica.

Specifications for silica raw materials vary depending on the application and the user. Generally accepted values are summarized in table 8-5. Prices for western U.S. silica sand, FOB plant, range between $14 and $25 ton, depending on use and quality (Zdunczyk and Linkous, 1994). Prices for silica gravel used to make silicon and ferrosilicon range between $10 and $11 per ton, and high-quality silica for specialty abrasive uses brings as much as $60 per ton (Alsobrook, 1994).

Silica production in Nevada is mainly from the Simplot Silica Products operation near Overton, about 70 km northeast of Las Vegas. The sand is mined from an open pit in the Cretaceous Baseline Sandstone, beneficiated by washing in the pit, and piped as a slurry about 6 km to a screening plant and railhead near the town of Overton. The final product contains 99.2 percent silica with low alumina, iron oxide, and alkali contents (Castor, 1991).

Annual production of silica from domestic sources is 25-30 million metric tons, and two-thirds of this production is from east of the Mississippi River (Bolen, 1992). The Simplot Silica Products operation in Nevada produces about 500,000 metric tons of high-quality silica sand annually (Castor, 1995). Silica sand mines in California produce about 2 million tons per year (Bolen, 1992). In the United States, most lump silica is mined from deposits in the midwest or east, but metallurgical-grade quartzite has been mined in Oregon and Washington, and quartz vein material in New Mexico (Alsobrook, 1994).

The average value for domestic silica sand, f.o.b. plant, is about $17 per metric ton, but ground silica used in fillers is sold for about $95 per metric ton (Bolen, 1992). Arkansas whetstone rock sells for nearly $3 per kg, and grinding pebbles for as much as $2 per kg (Zdunczyk and Linkous,

Table 8-5. Specifications for major silica uses. Values, in weight percent, are from Zdunczyk and Linkous (1994), and Alsobrook (1994).

	Minimum		Maximum		
Use	SiO_2	Al_2O_3	Fe_2O_3	CaO+MgO	Other
Flint glass	98.5	0.50	0.035	0.20	TiO_2 = 0.03
Flat glass	99.5	0.30	0.040		TiO_2 = 0.1
Ground silica		0.38	0.10		Alkalies = 0.2
Silicon metal	99.0	0.15	0.10	0.40 (CaO)	LOI = 0.2
Ferrosilicon	98.0	0.40	0.55	0.04 (CaO)	

Table 8-6. Chemical contents of silica-rich samples from the NAFR. Analyses, reported in weight percent, were performed by XRF at the NBMG.

Sample	Formation	SiO_2	Al_2O_3	Fe_2O_3	CaO+MgO
GSC 18	Eureka Quartzite	85.6	2.9	0.35	6.24
GSC 44	Eureka Quartzite	98.3	0.4	0.23	0.33
GSC 52	Eureka Quartzite	98.1	1.3	0.19	0.25
GSC 60	Eureka Quartzite	97.8	1.8	0.27	0.17
GSC 35	Stirling Quartzite	94.0	2.3	0.84	0.37
GSC 36	Wood Canyon	96.3	1.6	0.64	0.23
GSC 37	Wood Canyon	82.5	6.9	2.49	1.01
GSC 48	Wood Canyon	95.4	0.7	1.00	0.98
GSC 49	Carrara	96.9	0.2	1.24	0.31
GSC 119	Zabriski	94.2	5.4	0.44	0.14
GSC 160	Emigrant	96.9	0.0	0.73	1.34
5091	Altered rhyolite	89.9	6.9	0.23	0.52
5092	Altered rhyolite	76.5	15.1	0.06	0.74

1994). Quartzite and quartz pebble used in silicon and ferrosilicon production sells for about $10 per metric ton (Alsobrook, 1994).Annual domestic demand for glass sand is about 12 million tons and has decreased since 1987 because glass for containers has been partly replaced by plastic and aluminum. Consumption of foundry sand is mainly dependent on automobile production, which has increased domestically in recent years. In general, future domestic consumption trends will probably be downward.

In the region around the NAFR, silica was produced intermittently in small amounts between 1918 and 1929 from the Silica Mine (or Monarch Group) north of Crater Flat about 16 km west of the southern NAFR boundary. Silica content of the rock was said to be 99.7-99.8 percent, and recorded production in 1929 was 890 tons for $3,452 (Kral, 1951). The silica is very fine-grained white material said to have formed by complete hydrothermal alteration of rhyolite (Cornwall, 1972). The silica was mined from small open pits along a ridge top and the rock was transported via aerial tram to a road in Beatty Wash. The material has been described as "ceramic silica" (Kral, 1951; Cornwall, 1972), but its exact use is unknown.

In 1994 mining of a vein silica deposit south of Goldfield in Esmeralda County was initiated (Castor, 1995), possibly producing lump silica for metallurgical uses. Production capacity for this operation is not known. In the past, rock containing 99.89 percent silicon dioxide was mined from a vein near Hawthorne that is nearly 850 m long and 95 m wide (Peterson, 1976). The Eureka Quartzite was mined prior to 1950 as a source of silica in the Arrow Canyon Range about 30 km northeast of Las Vegas. This quartzite contains 99.5 weight percent silicon dioxide and 0.27 weight percent Al2O3, along with very low contents of iron and other elements (Murphy, 1954).

8.2.13.1 Silica in the NAFR

The Eureka Quartzite is exposed in many parts of the southern NAFR. Samples taken for geochemical characterization of this unit (GSC 18, GSC 44, GSC 52, and GSC 60) indicate that it is generally unsuitable for most uses (compare tables 8-5 and 8-6). Quartzite samples taken from other units in the NAFR generally have higher amounts of impurities than the Eureka Quartzite. Large amounts of silica-rich rock that was formed by nearly complete replacement of rhyolite by hydrothermal quartz occurs in the Cactus Springs West mining district. However, this rock carries too much alumina, probably as kaolinite and/or alunite, for commercial silica (samples 5091 and 5092, table 8-6). The potential for silica deposits in the NAFR as a whole is considered to below, certainty level B.

8.2.14 Zeolites

Natural zeolites have been known for two centuries, but have only been of commercial interest for about four decades (although tuffaceous rocks now known to contain zeolite have been used for building purposes for millennia). For nearly 200 years the known sources of natural zeolites were in vugs and cavities in mafic igneous rocks, and deposits of zeolites were not thought to be of economic value, although synthetic zeolites were being developed for commercial uses beginning in the 1940s. Interest in the economic potential of natural zeolites began in the 1950s when geologists discovered that zeolites were present in large amounts in tuffs and volcanic sedimentary rocks in the western United States. Since this "rediscovery" of zeolites in the 1950s, more than 1,000 occurrences of zeolite minerals have been reported in rocks of volcanic origin in more than 40 countries (Mumpton, 1978).

Fleisher and Mandarino (1991) recognized 48 species of zeolite minerals, but only five have commercial potential: chabazite, clinoptilolite, erionite, mordenite, and phillipsite (Holmes, 1994), and only clinoptilolite and chabazite are mined in the United States (Eyde, 1995). Zeolites are hydrated aluminosilicates of alkali metal and alkali earth elements, in particular sodium, potassium, magnesium, calcium, strontium, and barium. The usefulness of zeolite minerals is mainly dependent on their ability of take up cations in their lattices.

Zeolite occurrences in sedimentary and tuffaceous volcanic rocks are categorized into deposits formed in "closed" saline lakes, deposits formed in "open" hydrologic systems, deposits formed in deep marine environments, deposits formed by burial diagenesis or low-grade metamorphism, deposits formed by hydrothermal activity, and deposits formed in soils. Commercial interest is mainly in deposits of first two types (Holmes, 1994), and both occur in Nevada. The purest concentrations of zeolites are found in tuff layers in the closed saline lake setting. Alkaline waters trapped during sediment diagenesis dissolve volcanic glass and other materials while precipitating zeolite. The most common zeolites formed in this way are erionite, chabazite, and phillipsite; and such deposits may include monomineralic or mixed beds up to a few meters thick of the large-pore zeolites erionite and chabazite, which are relatively uncommon in other environments (Holmes, 1994).

Zeolite deposits of the open-hydrologic system type are of considerable economic importance, and may be several hundred meters thick and several tens of kilometers in lateral extent. They result from the alteration of large masses of tuffaceous sediments by the action of subsurface water moving freely through the host material. Descending ground water alters vitric material to zeolites and clay minerals. Open-system deposits commonly show more-or-less horizontal zones of authigenic silicate mineral assemblages that reflect the compositions of circulating solutions. Deposits in the tuffaceous Oligocene Vieja Group in Texas were formed in this sort of system. The Vieja Group contains an upper glassy zone, followed at depth by montmorillonite, clinoptilolite, and analcite zones (Walton, 1975).

Although zeolitized tuffs have been quarried for many decades for use as building stone, mining for specific zeolite minerals in the United States began in the 1960s. Since then, domestic natural zeolite mineral production has increased slowly, reaching a maximum of 42,000-44,000 metric tons in 1993 (Eyde, 1995). Zeolite resources in the United States are conservatively estimated at 10 trillion tons, and the country probably has the world's largest potential resources of high-grade chabazite, erionite, and phillipsite (Sheppard, 1983). Zeolite deposits are particularly abundant in the western United States, which contains several hundred known occurrences that include deposits of all zeolite species with known commercial potential (Holmes, 1994).

Zeolitized tuffs have traditionally been used as lightweight dimension stone and in pozzolanic cements and concretes, but it has only been during the last few decades that the zeolite content of these materials has been recognized. Use in cement continues to be a major use of zeolite internationally. Zeolite is used in various types of waste treatment and in environmental clean up. as much as 1.5 million metric tons of zeolite was mined in one year in the former USSR to treat materials from the Chernobyl nuclear disaster (Eyde, 1990). Zeolites also have industrial and agricultural applications.

Zeolite commodities from some domestic deposits are relatively high-value industrial minerals. Activated chabazite from the Bowie deposit has sold for $1.50 to $1.60 per pound at production rates of about 1000 tons per year (Eyde, 1982). Although zeolite products for special applications such as radioactive waste treatment may bring high prices, natural zeolites are mostly sold into low-value industrial or agricultural markets as crushed or ground products that bring prices of $30 to $120 per ton (Holmes, 1994).

Zeolites are mined by open-pit methods because of low unit value, and such excavation is generally done using conventional earth moving equipment at costs of $3-6 per ton (Holmes, 1994). Zeolites for special high-value uses may be recovered by very selective open pit mining, such as that performed at the Bowie, Arizona, deposit (Mumpton, 1978; Eyde, 1982).

Although domestic natural zeolite production has increased over the last two decades, most of this increase has resulted from increased use in animal feed and pet litter, which require relatively low-value products. In high-value and high-volume uses, such as molecular sieve absorption and catalytic petroleum processing, synthetic zeolites offer much better performance, and will continue to dominate markets.

Increases in domestic sales and production of natural zeolites between 1988 and 1993 are not considered likely to continue into the future, and domestic consumption for the next few years should be between 35,000 to 45,000 metric tons per year (Virta, 1995).

Table 8-7. Samples from the NAFR with more than 50% zeolite. Zeolite content by XRD and petrographic analyses. Major oxides by XRF.

Sample	Zeolite Mineral	Zeolite Content (%)	SiO_2	Al_2O_3	CaO	Na_2O	K_2O	LOI
GSC 121	mordenite	88	67.5	13.0	2.4	1.9	2.6	9.9
GSC 125	clinoptilolite	78	67.6	11.9	2.8	0.9	3.8	9.8
GSC 126	mordenite	77	67.4	12.3	2.5	1.8	2.7	11.1
GSC 166	clinoptilolite	90+	67.3	11.7	2.5	1.5	3.4	12.3
GSC 254	clinoptilolite	97	69.9	11.4	1.9	1.0	4.9	9.6
5094A	clinoptilolite	90+						

An active zeolite mine and other known zeolite resources are present in the region around the NAFR, and similar deposits may be present in the NAFR. A deposit in Tertiary ash-flow tuff is mined in the Ash Meadows area in California about 50 km south of the NAFR. At the mine site the deposit is as much as 46 m thick and contains 90 percent clinoptilolite, and it extends into Nevada where it attains a thickness of 122 m (Santini and Shapiro, 1982). Ash Meadows clinoptilolite has high ammonia cation exchange capacity (Holmes, 1994) and most sales are to the aquaculture industry, but sewage and waste water treatment markets are promising (Castor, 1989).

Unmined zeolite resources in the region around the NAFR include zeolitized ash-flow tuff more than 60 m thick in Beatty Wash that typically contains 75 percent clinoptilolite, and Tertiary ash-flow tuffs on Beatty Mountain that contain as much as 70-85 percent clinoptilolite and mordenite (Holmes, 1994). These deposits are about 10 km west of the NAFR.

8.2.14.1 Zeolites in the NAFR

Samples of tuff with high zeolite content were collected from the northern NAFR during GSC sampling and evaluation of clay deposits. Samples that contain more than 50 percent of zeolite from the heulandite/clinoptilolite mineral group were collected from four sites in the NAFR (table 8-7). Based on XRD analysis and chemistry (high silica:aluminum ratio in whole rock analyses, table 8-7), the zeolite in all four cases is judged to be clinoptilolite. Two samples that contain more than 50 percent mordenite were also collected (table 8-7). The volume of zeolite-rich rock at locations reported in table 8-1 cannot be determined without further sampling and analytical work. However, at sample site GSC 166, clinoptilolite-rich rock occurs in the bedded tuff of Quartz Mountain, which has an exposed thickness of 300 m (Minor and others, 1993), so large volumes of clinoptilolite-rich rock are possibly present. Sample 5094A, which was taken from zeolitized nonwelded ash-flow tuff up to 12 m thick that occurs above the Pahute Mesa clay deposit (fig. 8-37), is mainly comprised of clinoptilolite with minor amounts of feldspar, quartz, and biotite phenocrysts, and traces of lithic fragments.

Units that are known to be typically or locally zeolitized in the NAFR include the tuff of Yucca Flat, older tunnel beds, bedded tuff of Quartz Mountain, Calico Hills Formation, Tunnel Formation, and tuffaceous sedimentary rocks (Tgu) in the Pahute Mesa 1:100,000 quadrangle (Minor and others, 1993). Other widespread zeolitic units in the NAFR are Miocene ash-flow tuff on the Indian Springs 1:100,000 quadrangle (Taf of Guth, in prep.) and undivided tuff on the Pahranaghat 1:100,000 quadrangle (Tv1 of Jayko, in press). Zeolitized units in the southern part of the northern NAFR include the Topopah Spring, Prow Pass, Bullfrog, and Tram Tuffs (Broxton and others, 1987) and the Grouse Canyon Tuff (Hoover, 1968). Strongly zeolitized units identified during the present study include the Shingle Pass Tuff (sample GSC 121), unit Ta on the Quartet Dome 7.5-minute quadrangle (sample GSC 125), ash-flow tuff of Cache Cave (sample GSC 126), bedded tuff of Quartz Mountain (sample GSC 166), rhyolite of White Ridge (sample GSC 254), and the Rainier Mesa Tuff (sample 5094A).

Because zeolite deposits are generally strongly controlled by stratigraphy, and because so many units in the NAFR are known to contain zeolites, for the purposes of this report all Tertiary exposures except for Tertiary sedimentary rocks that are predominantly composed of coarse clastic rocks (Tks of Jayko, in press; Tos of Guth, in prep.) are considered to have moderate potential, certainty level B, for zeolite deposits. Figure 8-45 shows exposures of Tertiary rock in the NAFR that may contain zeolites. In general, within the Tertiary exposures shown in figure 8-45, areas underlain by rhyolitic rocks have the highest potential, and mafic volcanic rocks the lowest (although thin basalt flows may overlie extensive zeolite deposits).

Zeolite deposits of the type that may be present in tuff in the NAFR are extensive in Nevada (Papke, 1972), and have economic potential for uses that require only impure materials of relatively low unit value. Given their low commercial value, it is not likely that zeolites in the NAFR area will be seen as a commercially attractive resource in the foreseeable future. Many high-grade zeolite deposits in the western United States have been evaluated by mining companies, oil companies, and chemical companies, and their commercial potential has been known to industry for years. Hundreds of millions of tons of zeolite have no commercial value if the total domestic market is only 35,000 to 45,000 tons per year.

8.3 ENERGY RESOURCES

8.3.1 Uranium

Uranium is an important energy source because one isotope, uranium 235, upon splitting (fission), releases large amounts of energy. This readily fissionable isotope makes up about 0.7 percent of natural uranium. Another isotope, uranium 238, is not readily fissionable, but can be converted to plutonium 239 by neutron bombardment. Plutonium 239 is fissionable.

Uranium is used to power nuclear reactors for the generation of electricity, and in nuclear weapons. Large portions of military inventories of highly enriched (in the fissionable isotope) uranium are expected to be converted to nuclear fuel over the next 20 years; it is likely that by the year 2000, these military inventories could fill 15 to 20 percent of the world nuclear fuel requirements (Pool, 1995).

The demand for uranium as a nuclear fuel is expected to be relatively flat for the next 15 years (Pool, 1995). Probably few new nuclear power plants will be built, due to considerable opposition in most countries and the formidable political, regulatory, and legal obstacles that such plants must overcome (Pool, 1995).

Except for a brief price rise in the 1970s, uranium (as uranium oxide) has generally been in the $7-$10 per pound range. A level or declining future demand combined with secondary sources of enriched uranium indicate that this price is unlikely to increase in the near future.

Production of uranium in the United States is presently limited to processing of stockpiled ore, in-situ leaching, and by-product production from phosphate minerals. No conventional production from mining of new ore has been recorded in the past two years (Pool, 1995). Additionally, if the security of supply of uranium for U.S. plants were to become an issue, Canada (the world's largest producer), is a nearby, friendly potential source of supply.

Thus, it is likely that few new uranium mines will be opened in the U.S. in the foreseeable future unless they are very low cost. Even then, political considerations may preclude their operation. The price is also likely to remain steady or decline.

The grades of uranium deposits are typically in the 0.1 percent uranium oxide range or higher. For deposits of the volcanogenic uranium type, similar to those that might be found in calderas and volcanic centers in Nevada, grades range from 0.05 to 0.25 percent (500 to 2500 ppm) (Bagby, 1986).

8.3.1.1 Uranium in the NAFR

There is no mention in the literature of uranium prospects in the NAFR. However, the area was withdrawn from the public domain before nearly all prospecting for radioactive elements was done in the 1950s (Garside, 1973). Although Nevada is known to have numerous naturally radioactive and/or uranium-bearing mineral localities, production for the state is only about 137,000 pounds of uranium oxide, mainly during the 1950s when the U.S. Atomic Energy Commission was active in procuring ore (Garside, 1973).

Most of the northern part of the NAFR is covered by silicic volcanic rocks, predominantly ash-flow tuffs. These have moderate to high amounts of uranium, based on this and other studies; this fact is confirmed by aerial radiometric maps of equivalent uranium (Duval and Pitkin, 1988). The crystallized portions of such rocks, here and elsewhere, have been shown to contain only 20 to 70 percent of their uranium relative to portions which have nonhydrated or hydrated glass (Rosholt and others, 1971), and the majority of these rocks in the NAFR are primarily crystallized or otherwise devitrified. The thorium:uranium ratio of glassy silicic to intermediate-composition volcanic rocks has been shown to vary in the range of 3:1 to 5:1 (Rosholt and others, 1971; Austin and D'Andrea, 1978, p. 105). The values of uranium and thorium in volcanic rocks of the NAFR collected during the Geochemical Sampling and Characterization Program (appendix A) are generally consistent with this view, although some glassy peralkaline rocks have thorium:uranium ratios >5:1. Non-glassy volcanic rocks of the NAFR have thorium:uranium ratios that suggest uranium may have been lost, either during crystallization or as a result of interaction with groundwater, in amounts up to about 50 percent; such a loss is consistent with that found elsewhere in similar volcanic terranes, including Nevada. The Gold Flat Tuff is considerably enriched in uranium, thorium, and the light rare-earth elements compared to other silicic volcanic units sampled during this study. Although the Gold Flat may have lost considerable uranium during devitrification and later leaching by groundwater, there are no reports (and no indications) that uranium has been concentrated in or near the Gold Flat Tuff. However, little research has been done in this regard.

Uranium that is released from silicic volcanic rocks may be concentrated at certain sites in the volcanic sequences themselves, or in adjacent sedimentary basins. Additionally, devitrified silicic ash in sedimentary units in lacustrine or basin-fill deposits (including caldera-fill sedimentary units) may be a source of uranium (Garside, 1973). Many such concentrations, mostly relatively small, are known from similar rocks elsewhere in Nevada (Garside, 1973).

Silicic volcanic rocks of the southwestern Nevada volcanic field include both peralkaline and metaluminous units (Sawyer and others, 1994). Peralkaline volcanic rocks are commonly enriched in incompatible elements, including uranium. Hydrothermal disseminated and vein-type uranium deposits may form in caldera environments, especially those of peralkaline affinity (e.g., the McDermitt caldera; Wallace and Roper, 1981). Silicic volcanic centers, including those that erupt alkali rhyolites, are also candidates for hydrothermal volcanic-hosted uranium deposits (e.g., Burt and Sheridan, 1981; Steven and others, 1981; Lindsey, 1981; Garside, 1973), and uranium mineralization is also likely in ash-flow tuffs if suitable concentrating mechanisms are present (e.g., faults or organic material; Garside, 1973).

A few sporadic anomalous values of uranium are found in samples of veins and mineralized rock from many of the mining districts of the NAFR (appendix C). These generally are in the 10-20 ppm range, although some values up to 38 ppm are observed from samples taken in the Mellan Mountain district, and over 40 ppm from the Wagner district. Occurrences of sparse uranium minerals, or anomalous amounts of uranium or radioactivity are not uncommon in Nevada's mining districts (Garside, 1973). It is likely that such sporadic uranium concentrations are related to redistribution by hydrothermal fluids

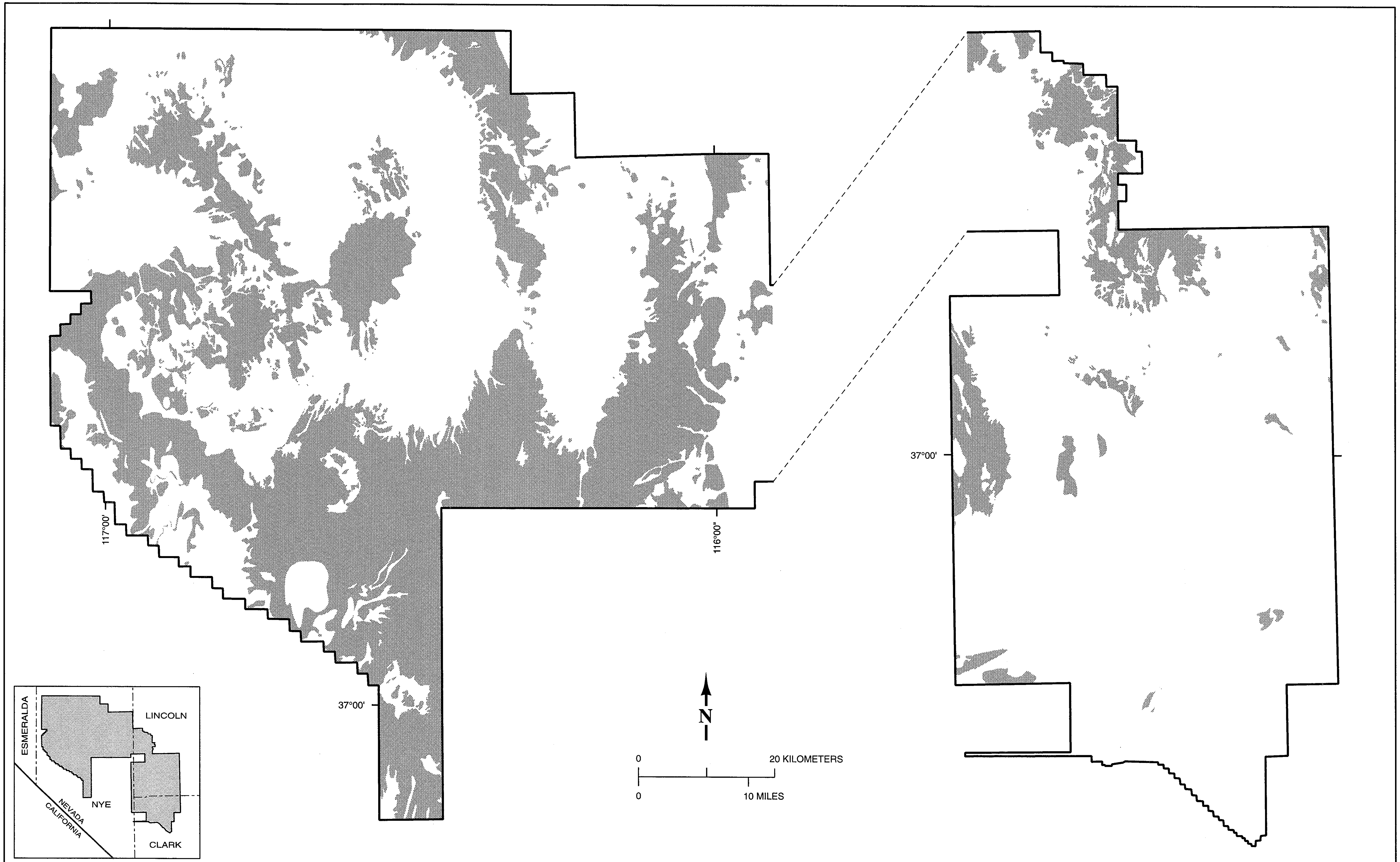


FIGURE 8-45 Areas in the NAFR with moderate potential, certainty level B, for zeolite.

in these districts, especially in those hosted by volcanic rocks that may have uranium available in amounts that could be moved and concentrated. The anomalous values from the Wagner district may be related to possible porphyry-copper style mineralization there (related to the polymetallic veins of the district), as some porphyry copper deposits are known to have anomalous amounts of uranium. No anomalous uranium concentrations are known to form uranium orebodies in Nevada mining districts; rather, they are considered a curiosity. The amounts of uranium found during this study are at least a level of magnitude below what would be considered ore in today's market and, therefore, are not considered to be indicators of uranium deposits; it is unlikely that any uranium deposits will be found in the precious- and base-metal mining districts of the NAFR.

Two samples of Tertiary lacustrine(?) or playa-deposited carbonate rock collected for geochemical characterization (GSC-89, GSC-97) have somewhat anomalous amounts of uranium (21.4 and 8.7 ppm, respectively; see appendix A). These sedimentary rocks and related units are exposed in the southern part of the NAFR, north of Indian Springs. Carbonate rocks are commonly very low in uranium; although certain gypsiferous limestone units of the Horse Spring Formation near Gold Butte, Nevada, are known to have carnotite as films on joints and bedding planes (Johnson and Glynn, 1982). The source of uranium and the mechanism of concentration in those deposits is unknown, although Johnson and Glynn speculate that the uranium may have been leached from nearby Precambrian granitic rock and concentrated in the Miocene playa deposits. Evaporative concentration (see Jones, 1978) of the uranium is also a possibility. A similar mechanism may be postulated for the anomalous uranium in the carbonate rocks sampled in this study. No uranium minerals were observed in these rocks, but detailed field surveys were not done.

A number of studies were done in the United States in the 1970s and early 1980s to evaluate certain areas for their potential for uranium deposits. This project, the National Uranium Resource Evaluation (NURE) program, resulted in several reports which include areas within and adjacent to the NAFR. The studies were based on the $1° \times 2°$ quadrangle format; for this report, the four quadrangles of concern are Las Vegas, Caliente, Goldfield, and Death Valley. For the Las Vegas and Death Valley quadrangles, geologic, geochemical, and aerial radiometric data are summarized in final evaluation reports (Johnson and Glynn, 1982; Berridge, 1981). For the Caliente and Goldfield quadrangles only aerial radiometric (Geodata International, Inc., 1979 and 1980) and hydrogeochemical and stream sediment (HSSR) data are available. Although aerial radiometric data were collected in much of the NAFR, it appears that no HSSR samples were collected there. Based on the NURE studies, no areas in the NAFR were identified as being favorable for uranium deposits, and it appears that radiometric anomalies observed in the area are related to higher levels of uranium associated with silicic (and especially peralkaline) volcanic rocks and the alluvial units derived from them.

Although silicic volcanic rocks and calderas are known to be favorable sites for certain types of uranium mineralization, there are many thousands of square kilometers of such rocks exposed in Nevada, outside of the NAFR, that have been prospected for radioactive minerals. Few deposits of any significance have been found in these large areas of exposure, and many areas of calderas and intracaldera ash-flows and moat sediments as well as the surrounding extracaldera ash-flows are essentially devoid of known uranium prospects (compare Garside, 1973 and the geologic map of Nevada; Stewart, 1978). Thus, the presence of uranium mineralization in economic concentrations is possible in many areas of outcrop of volcanic rocks of the NAFR, but it is considered unlikely. The areas of volcanic rocks in the NAFR and their adjacent sedimentary basins are estimated to have low potential for uranium deposits, certainty level B.

Much of the southern NAFR is underlain by carbonate and clastic marine sedimentary rocks. Epigenetic uranium mineralization in these rocks elsewhere in southern Nevada is rare, and where present is in very low amounts associated with lead-zinc deposits (e.g., the Goodsprings district - Garside, 1973; Sampson claims - Tingley and others, 1993). A few anomalous uranium values from the Groom and Southeastern districts and the Prospector Fault area may be very weak indications of similar occurrences. No uranium minerals were found to be associated with any nonvolcanic-hosted base-metal mineralization in the NAFR. Even if such occurrences were found, they would not be considered positive indications of the presence of economic concentrations of uranium, but rather, rare associated minerals. Uranium contents in stream-sediment and float-chip samples from the NAFR are uniformly low. The nonvolcanic portions of the NAFR are estimated to as have low potential, certainty level C, for uranium.

8.3.2 Coal

There are no commercial deposits of coal in Nevada, and there has been no significant mining of coal in the last 75 years. However, because coal was valuable for mining and milling, and for steam railroad locomotives, it was actively sought in the state from the earliest mining activity to about the 1920s. A number of coal beds were found during this period (Horton, 1964; Garside and others, 1980), although most were thin or of poor quality, and many were steeply dipping (requiring underground mining). Coal was produced during this period because of necessity; however, the ability of railroads to deliver coals from areas such as Utah, made Nevada coal deposits uneconomic. Early reports of many Nevada coal deposits were often quite glowing and generally overstated the quality, quantity, and production. This is similar to other promotional descriptions of mining properties of that era. Because of the active search for coal during Nevada's early days, there is a moderately extensive literature on Nevada coal during this period (see Garside and others, 1980). It seems likely that most significant outcrops of coal of any quality were found and reported on during that time.

The presence of coal in Nevada is confined to certain Tertiary lacustrine units, mainly in the northern part of the state, and Mississippian clastic rocks in eastern Nevada. The Chainman Shale and related rocks of eastern Nevada and western Utah contains beds of coal at several localities; most of these were discovered during the early mining development of the state.

8.3.2.1 Coal in the NAFR

There are no reports of coal from the NAFR. Because coal was actively sought during early mining and mineral exploration, it seems unlikely that any coal beds of significance were missed. Based on the present understanding of the environment of deposition of rock units of the NAFR, the only unit that is likely to have any coaly material in it is the Chainman Shale. No coals have been reported from Tertiary rocks in southern Nevada, which do have some coal in the northwestern part of the state. The area nearest to the NAFR where coal has been reported is about 10 km west southwest of the community of Crystal Springs (unsurveyed sec. 24 and 26, T5S, R59E) in west central Lincoln County (Poole and Claypool, 1984, p. 195, 217). This locality is about 21 km north of the northeast corner of the NAFR. It is likely that similar coal occurrences were investigated during very early work in the Pahranagat mining district, possibly in the vicinity of Mount Irish about 16 km to the north (see references in Garside and others, 1980). Coal Valley (located north of Mount Irish) is probably named for these coal prospects, although their exact location is unknown today, and they have not been described or reported on in the past 130 years.

The Chainman shale is present in a part of the eastern NAFR, and could conceivably have coal-bearing beds similar to those of the Pahranagat Range described above. However, mention of such units is not found in the literature, nor were any such units observed in outcrop during field work in the area for this study; their presence in the NAFR is considered to be unlikely. Moreover, based on information on other Chainman coals (see Garside and others, 1980), any similar material that might be in the NAFR would almost certainly be in thin, possibly steeply dipping beds, and of poor quality; such coal would certainly not be economic.

Based on the above discussion, there is low potential, certainty level D, for coal in the NAFR.

8.3.3 Petroleum Resources

The petroleum potential of Nevada has been predicted in a very general fashion (Garside and others, 1988, fig. 3) based on known production, shows of oil or gas in exploratory wells and at the surface, proximity to areas of potential source and reservoir rocks, and the thermal maturity of the source rocks (e.g., Sandberg, 1983, 1993). Areas of medium or high potential are located in the eastern part of the state, where the majority of the potential source rocks are found, and where these rocks have not been heated beyond the petroleum generation window to temperatures where hydrocarbons would be destroyed. Western Nevada consists predominantly of rocks which are not good source rocks, in part because of the common occurrence of intrusive igneous rocks. The source rocks that are present are overmature due to metamorphism or heating by igneous intrusions. Some Tertiary sedimentary units in this area are undermature due to lack of deep burial. Because the Basin and Range province is a structurally and stratigraphically complex region, its geology is relatively poorly understood in comparison to petroleum provinces in basins with simpler relationships and considerably more subsurface information. Because there are a great variety of potential reservoir types in the Basin and Range, petroleum potential is best evaluated by outlining areas containing source rocks which are within the petroleum generation window, and thus may have provided petroleum to adjacent reservoirs. Rocks which are thermally overmature are not known to be associated with preserved petroleum provinces elsewhere in the world. The presence of traps, by themselves, is not enough evidence to rate an area prospectively valuable for petroleum. It must first be demonstrated that adequate source rocks exist, and then that they may have been heated enough to generate petroleum. as reported by French (1994) the search for hydrocarbons in this region is essentially a source-rock driven play.

A variety of factors must be considered in an evaluation of the petroleum potential of the NAFR. For example, an area with oil or gas shows in exploration wells may be considered to have at least moderate potential even if the rocks in the well are thermally mature. Thus, consideration should be given to information on both source rocks and hydrocarbon shows in rocks within and adjacent to area of study.

Conodont Coloration

One method of assessing the thermal maturity of rock units, and thus the potential for the generation of petroleum, is the study of conodont coloration. The coloration of these microfossils is a direct measure of the maximum temperature that the enclosing sedimentary rocks have been subjected to, and the CAI (conodont coloration alteration index) is thus a measure of mineral and organic metamorphism (Harris and others, 1980). Conodont fossils are found in marine sedimentary rocks of Late Cambrian to Triassic ages, and can thus be used to evaluate the thermal maturity of rocks in that age range (fig.8-46). Rocks having a CAI of 1-2 are generally considered to be within the thermal window for oil generation. Those with a CAI 2.5-3 are in the range where gas

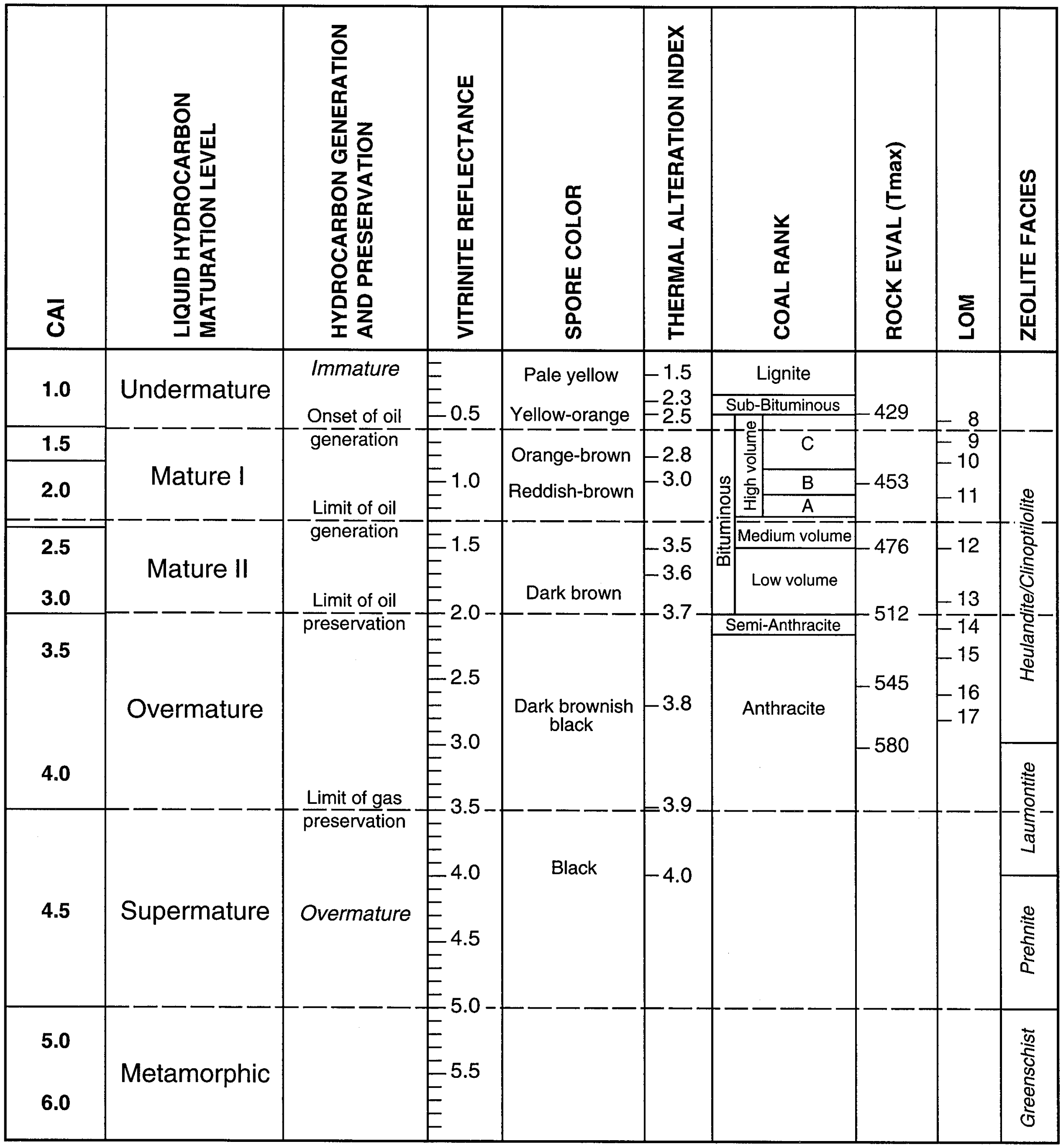


Figure 8-46 Chart showing correlation of thermal indices to oil and gas generation and stability fields (from Grow and others, 1994).

Table 8-8. ROCK-EVAL analyses (courtesy of C. E. Barker, U.S. Geological Survey)

Sample	Formation	TOC	S1	S2	S3	Tmax
5473	Horse Spring Formation	3.26	0.15	1.23	2.37	413
GSC7	Chainman(?) Shale	1.16	0.03	0.29	0.81	465
GSC77	Pilot Shale	0.17	0.04	0.13	0.38	327
GSC87	Chainman(?) Shale	0.26	0.04	0.16	0.37	340
GSC91	Mississippian siltstone	0.05	0.03	0.17	0.26	422
GSC100	Chainman Shale	0.00	0.02	0.07	0.22	370
GSC108	Chainman Shale	0.75	0.04	0.17	0.36	340

TOC in weight percent; S1, S2, and S3 in mg/g; and Tmax in C.

may be generated and where previously generated oil is converted to gas. The limit of oil preservation is at the upper limit of this range (see fig. 8-46). CAI values of 3.5-4 indicate that rocks are overmature for oil but still have potential for gas if suitable organic material is present. Rocks with a CAI >4.5 have been heated beyond the thermal limit for most hydrocarbon production (Grow and others, 1994).

A summary of CAI data and interpretations of rock thermal maturity for much of the NAFR and vicinity is available in Grow and others (1994). Additional information on these data and other sample sites in the vicinity of NAFR was provided by A. G. Harris (written commun., 1995, 1996) during this study. Also, CAI values and age determinations for 17 rock samples collected as part of the Geochemical Sampling and Characterization Program in the eastern part of the NAFR were provided by Harris (written commun., 1996). About 50 sample sites are within the NAFR area, and another 140 or so are within 25 km of the boundaries (fig. 8-47). In some cases, conodonts were studied from rock units of several ages at each sample site. If a range of CAI values was determined for a site, the lowest value was used in the following analysis in order to include all areas of potential.

Although the density of samples for conodont color analysis is low in some areas (fig. 8-47), there are enough data to draw general conclusions regarding the thermal potential for hydrocarbons in Paleozoic rocks of the NAFR. Figure 8-47 displays the location of these CAI values. No analyzed samples were found to have CAI values below 1.5; thus all analyzed rocks are at least mature. The area of CAI 1.5-3 values is considered to include an area where oil and gas might be preserved. Only natural gas is likely from areas of CAI of 3-4, and gas production is not probable from rocks with CAI values much above 4. In general, these data indicate that there is a rather narrow fairway of moderate oil and gas potential (in the vicinity of the Groom Range and Jumbled Hills), surrounded by a larger area that may have some thermal potential for gas generation. As described further below, commercial gas accumulations in the Great Basin may be unlikely.

ROCK-EVAL Analyses

The petroleum generative potential of rock units can be assessed by gradually heating small, pulverized samples in an inert atmosphere. This pyrolysis first frees organic compounds, then cracks the kerogen. The ROCK-EVAL method of pyrolysis provides information on the quantity, type, and thermal maturity of the organic matter in a rock sample (see Peters, 1986).

During this study, an attempt was made to collect samples from potential source rocks (particularly organic-rich shales) as part of the Geochemical Sampling and Characterization Program. However, to be effective, such a source-rock sampling program requires detailed mapping (to identify organic-rich units) and the examination of potential source rocks in a number of sections. Because of the reconnaissance nature of the Geochemical Sampling and Characterization Program, such detailed work was not possible. Seven samples collected during this study (those considered to be most likely to be useful for source-rock and thermal maturity studies) were provided to C. E. Barker (U.S. Geological Survey) for ROCK-EVAL analysis (table 8-8). Except for sample 5473, which was collected from the dump of a shaft, all samples are from surface outcrops. In general, shales should have greater than 0.5 percent Total Organic Carbon (TOC) to be considered potential source rocks (Tissot and Welte, 1984, p. 134). Tmax values are useful in estimating the thermal maturity of samples, and thus evaluating the possibility of petroleum generation. However, for rocks with low TOC values, Tmax values may be meaningless. Some researchers ignore such Tmax values for rocks with less than 0.55 TOC (Barker, 1994). Additionally, Poole and Claypool (1984) report that interpretation of Tmax where S2 yields are less than 0.5 mg/g is questionable. Based on these criteria, only three of the samples supplied for ROCK-EVAL can be considered as potential source rocks, and only one (from the Horse Spring Formation) provides a useable Tmax value.

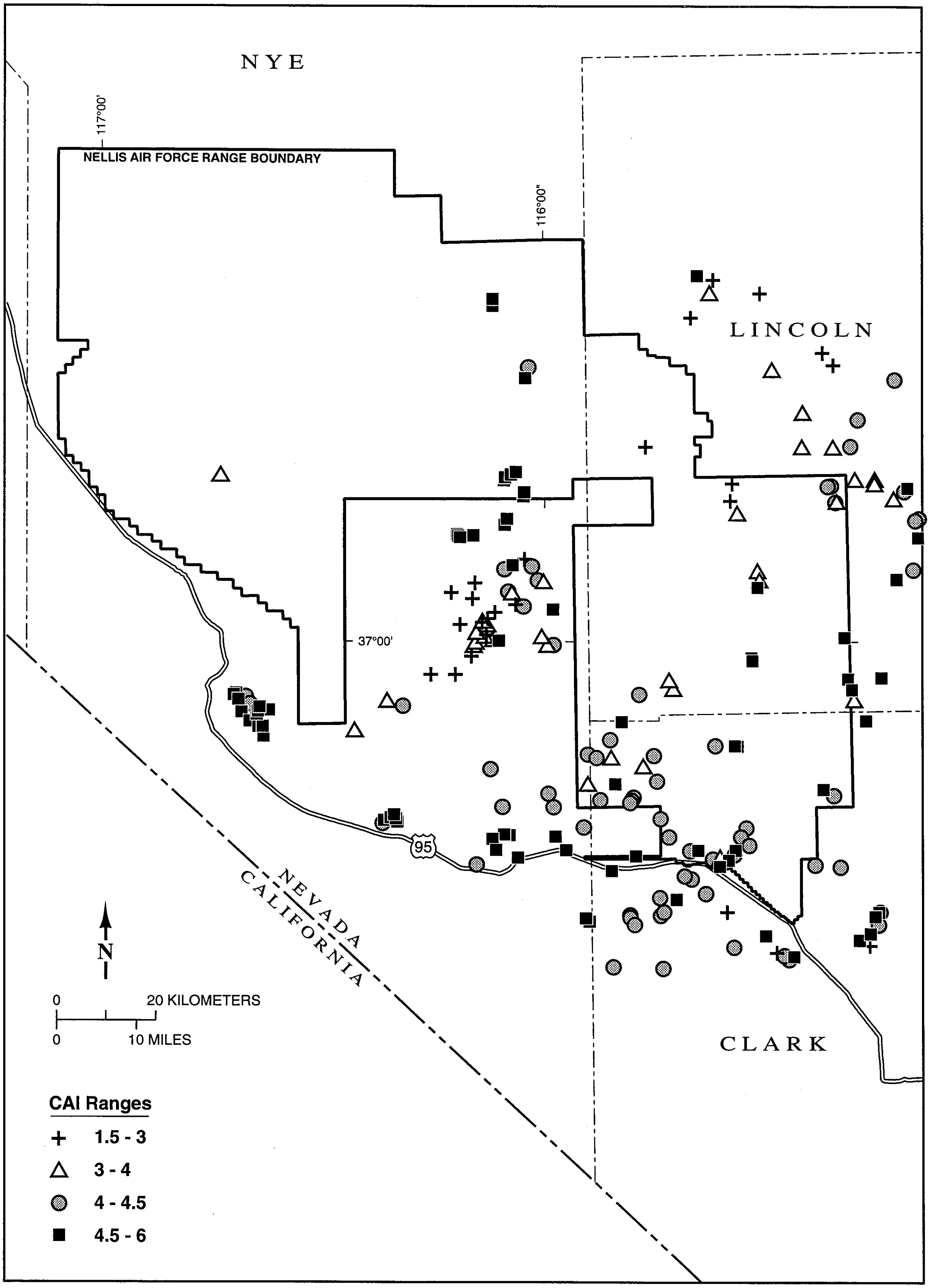


Figure 8-47 Conodont coloration alteration index (CAI) values for NAFR and within 25 km of boundary (data from A.G. Harris, written communication, 1995, 1996; see also Grow and others, 1994).

Source Rocks

Bedrock units make up less than 50 percent of the NAFR, as they do in much of Nevada. The majority of exposures of Paleozoic rocks are in the eastern NAFR, while Tertiary volcanic rocks and their caldera sources predominate in the western part of the NAFR. Paleozoic rocks do crop out in the western area, below Tertiary units in tilted fault-block ranges (e.g., the Belted and Kawich Ranges).

Proterozoic through Devonian rocks: The latest Proterozoic and Lower Cambrian rocks are predominantly terrigenous detrital rocks deposited in fluvial to shallow intertidal environments. They contain no likely source rocks, and are commonly metamorphosed to phyllitic rocks that are beyond the petroleum generation and preservation windows (metagenesis).

Upper Lower Cambrian through Devonian rocks are miogeoclinal, shallow water peritidal and subtidal platform carbonate deposits. The only significant shale, and thus possible source rock of any significance in this sequence is the Ordovician Dunderberg Shale. The Dunderberg is present in the eastern part of the NAFR, and at Yucca Flat on the Nevada Test Site (Tschanz and Pampeyan, 1970). The lithology of the Dunderberg is gray limestone and alternating greenish or brownish, fissile shale. Organic content in the Dunderberg is probably uniformly low, based on lithologic descriptions. A sample of Dunderberg from east of the NAFR was analyzed by the ROCK-EVAL method (Tingley and others, 1993) and found to contain only 0.04 percent total organic carbon (TOC). Most Upper Cambrian and Ordovician rocks of the eastern NAFR have CAI values above the level of oil preservation, but within the window for gas production (Grow and others, 1994). However, some Upper Cambrian and Ordovician rocks, especially in the northeastern part of the Nevada Test Site and to the northeast in the Groom and Pahranagat Ranges, have CAI values within the oil preservation window (Grow and others, 1994). Because there are no significant possible source rocks below the Mississippian, this area of somewhat favorable CAI values is not believed to represent any likely petroleum generation in the NAFR area for pre-Mississippian rocks. For the carbonate rocks of the NAFR area to be considered as possible source rocks, they should have a minimum of 0.3 percent total organic carbon (Tissot and Welt, 1984, p. 134). This type of rock is not likely to be formed in the oxic environment of the shallow water, bioturbated carbonate shelf deposits. The present level of knowledge suggests that most Paleozoic carbonate rocks of the NAFR are too low in total organic carbon to be considered as source rocks. However, such sources can not be completely ruled out because of the lack of information on their organic carbon content and the suggestion by some researchers that such Nevada Paleozoic carbonates hold promise (Hutter, 1994).

Devonian and Mississippian rocks: Locally, the Late Devonian and Early Mississippian Pilot Shale contains possible source beds in eastern Nevada and adjacent Utah (Peterson, 1988, fig. 14; Poole and Claypool, 1984; Sandberg and others, 1982); however, regionally it is not reported to contain rocks of either significant thickness or richness to be an adequate source rock for significant petroleum generation (Poole and Claypool, 1984). The Pilot Shale is a quite thin, light colored, and organic poor siltstone and silty limestone east of the NAFR in the eastern Desert Game Range (Tingley and others, 1993). It is not known from west of the Eleana Range on the Nevada Test Site, where age-equivalent rocks of the Eleana Formation are found. Near Mercury, in the southeastern part of the study area, rocks of equivalent age to the Pilot (Narrow Canyon Limestone) are limestone (Tschanz and Pampeyan, 1970). In the northern part of eastern NAFR (e.g., Jumbled Hills, Fallout Hills, Desert and Spotted Ranges) the Pilot contains relatively little shale, as it does elsewhere in Lincoln County (Tschanz and Pampeyan, 1970; this study). A thin, black shale (5-15 m) is reported to be present in the Pilot Shale in the Pahranagat and East Pahranagat Ranges (Reso and Croneis, 1959, p. 1252), but is not noted in described sections to the southwest in the NAFR (Tschanz and Pampeyan, 1970). Sandberg and others (1982, fig. 9) indicate that the lower member of the Pilot Shale (which contains an organic-rich mudstone in east-central Utah) is mostly represented by a dolomite-limestone-sandstone facies in the NAFR area. According to them, only a small part of the NAFR, extending from the Jumbled Hills northeast toward the Pahranagat Range, contains rocks equivalent to the lower member of the Pilot. Peterson (1988, fig. 14) suggests that the better source rocks of the Pilot are found about 200 km to the north in White Pine County. Thus, the Pilot Shale is only known from the northeastern part of the NAFR (fig. 8-48), in a more restricted part of the area of Mississippian Chainman Shale occurrence. Additionally, the Pilot found in the northeast NAFR is light colored, organic poor, and consists of mainly carbonate rocks. Thus it is not regarded as a likely source rock in the study area.

Mississippian rocks (e.g., Chainman Shale) in many parts of the eastern Great Basin are considered to be some of the most prolific hydrocarbon source rocks. The use of the term Chainman by most workers generally connotes a shale facies which is at least in part dark colored and organic rich. Rocks of the Chainman Shale and lithologic equivalents (e.g., Indian Springs Formation; Webster, 1969; Gordon and Poole, 1968) are believed to be present in much of the eastern part of the study area (fig. 8-48). A facies change from Mississippian limestone to quartzose rocks is known along a line from the southwestern Sheep Range to east of Meadow Valley Wash in eastern Lincoln County (Stevens and others, 1991). East of this line the Mississippian rocks equivalent in age to the Chainman Shale are predominantly a carbonate platform facies. Based on current studies and previous investigations (Jayko, in preparation; Guth, in

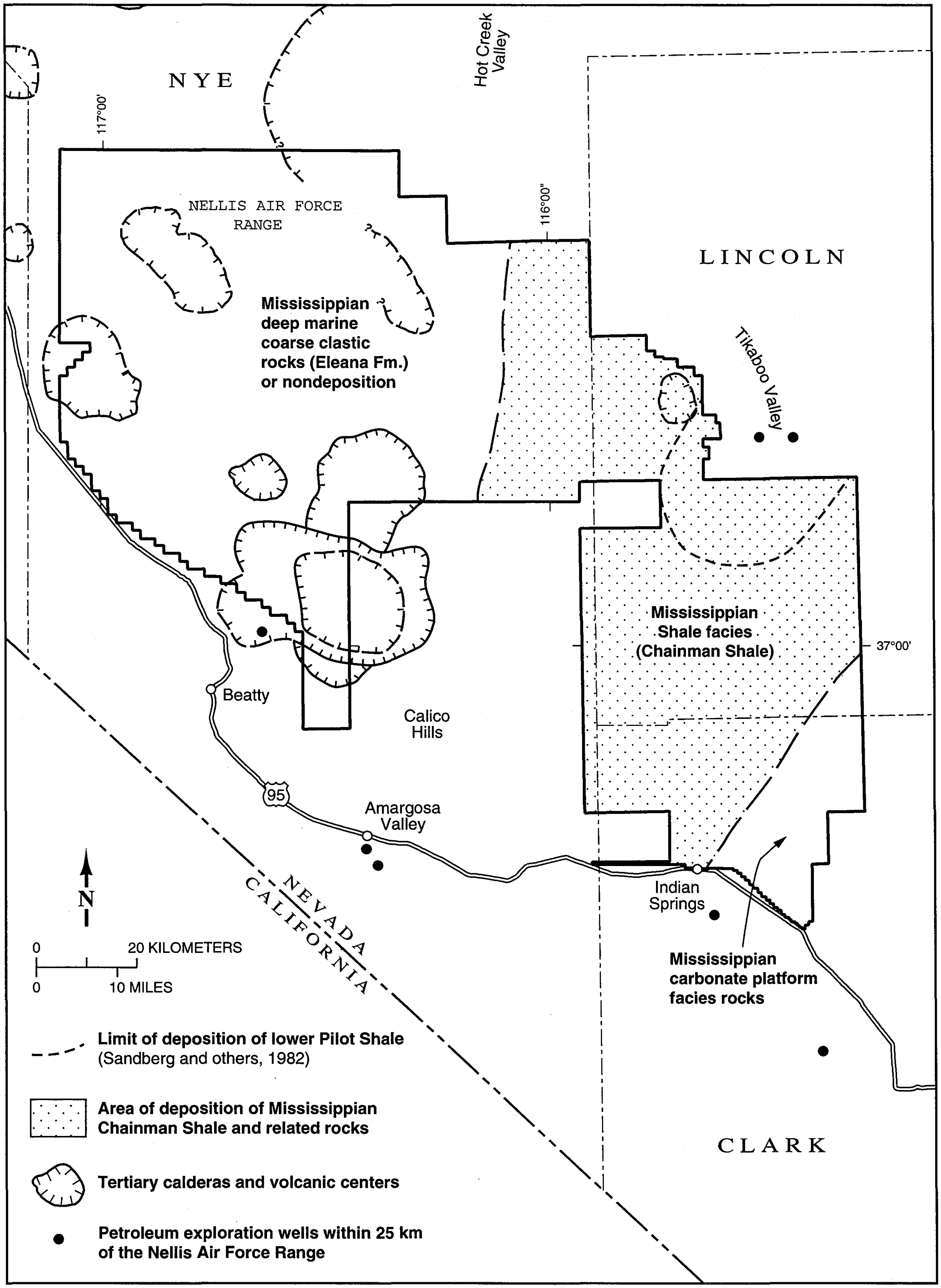


Figure 8-48 Map of Mississippian facies and other features related to petroleum potential of the Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

preparation; Tschanz and Pampeyan, 1970, Longwell and others, 1965; Tingley and others, 1993), it appears that dark colored Chainman shales are only likely to be found in an area northwest of a line extending from the vicinity of Indian Springs to Caliente. This rock type within the Chainman is known from outcrop and drill hole data only as far west as the eastern Eleana Range (fig. 8-48) on the Nevada Test Site, where some workers consider it to be equivalent to unit J of the Eleana (Trexler and Cashman, 1993; Herring and others, 1993; Cashman and Trexler, 1994). West of there, only coeval rocks of the Eleana Formation crop out. The Chainman and Eleana are believed to be separated by a low-angle, east vergent fault in the Eleana Range area (Trexler, 1995). This fault, interpreted by some workers as early Mesozoic in age, could have Chainman Shale in its footwall further to the west on the Nevada Test Site (Cole and others, 1994; Caskey and Schweickert, 1992). However, as there are no surface or subsurface indications of Chainman to the west, its presence there is highly speculative. Mississippian siliciclastic rocks of the Bare Mountain area to the southwest of the NAFR have been referred to the Eleana Formation (Monson and others, 1992); these rocks are not typical Chainman, although they could represent some western equivalent (P.H. Cashman, personal commun., 1996). The Paleozoic rocks of Bare Mountain are super mature, and are not favorable for hydrocarbon production (Grow and others, 1994). The western limit of outcrops of the Chainman and related rocks, shown in figure 8-48, allows for the presence of Chainman only a few kilometers west of its outcrops in the vicinity of the Eleana Range and the Calico Hills areas of the Nevada Test Site. Based on the above discussion, the present level of knowledge suggests that the western extent of the Chainman is an approximately N-S line from the Calico Hills to Hot Creek Valley (fig. 8-48) in north-central Nye County (Cashman and Trexler, 1994; Ekren and others, 1971; Kleinhampl and Ziony, 1985). With the exception of "unit J", which Cashman and Trexler (1994) refer to as the Chainman Shale, the Eleana Formation predominantly consists of sandstone and conglomerate overlain by carbonate turbidities and spiculitic chert (Trexler, 1995). It probably represents a submarine fan depositional environment where coarse foreland clastic rocks were deposited. In the Nevada Test Site area, the unit has low total organic carbon (Poole and Claypool, 1984, table 2), and is not considered to be a hydrocarbon source rock (Cashman and Trexler, 1993).

Post-Mississippian Paleozoic, Mesozoic, and Paleogene rocks: Appreciable thicknesses of potential source rocks are unlikely in post-Mississippian Paleozoic units or in the Mesozoic units of the NAFR area. Although possibly as much as 1,000-1500 m of Pennsylvanian and Permian rocks were deposited in the eastern part of the NAFR (Peterson, 1988), these rocks are primarily carbonates and significant, potentially organic-rich source beds are not reported. Additionally, no outcrops of Pennsylvanian or Permian rocks are known in the NAFR. However, there are limestones at Syncline Ridge in the Nevada Test Site (Frizzell and Shulters, 1990), and in the Timpahute Range north of eastern NAFR (Tschanz and Pampeyan, 1970). Presumably a considerable thickness of post-Mississippian rocks was stripped away during late Mesozoic and Tertiary time. Although Peterson (1988) suggests the possibility of approximately 2,000 m of Triassic rocks being deposited in the NAFR area, no outcrops of those rocks are known from the NAFR and vicinity today, and it is possible that none were ever deposited (Walker, 1988, fig. 14.6; Barker, 1994).

Jurassic and Cretaceous time was a period of non-deposition or erosion. Coarse-grained Cretaceous or lower Tertiary fluvial rocks are present in the Fallout Hills area. No possible source rocks have been reported from them, and none were observed in brief examinations during this study. Cretaceous to Eocene lacustrine rocks (e.g., Sheep Pass Formation) are apparently confined to areas further north (Peterson, 1988, fig. 21; Fouch and others, 1991, fig. 2); the coarse fluvial clastics in the Fallout Hills may be roughly equivalent in age to these lacustrine rocks to the north.

Neogene rocks: Neogene sedimentary rocks of the NAFR area are relatively poorly understood because their presence under later volcanic or alluvial cover is only speculative in many areas. Where exposed in the eastern part of the NAFR, two ages of such deposits have been recognized (Guth and others, 1988). The following discussion assumes the presence, at least locally, of such rocks, but in areas where they are not exposed, there is little hard evidence. Organic-rich lacustrine shales would be the most likely source rocks in these Neogene units. Neogene sedimentary rocks are confined to basins younger than Tertiary extension in the area, probably 20 to 30 Ma (Barker, 1994 and refs. therein). These Tertiary sedimentary units were only locally deposited and little is known concerning their distribution below valley filling alluvium and younger ignimbrites. Barker (1994) suggests that for the Nevada Test Site and vicinity, maximum cover for these potential source rocks is 0-2,000 m and 1,000 to 3,000 m for valley fill and volcanic rocks, respectively. Although it is possible that these maximum burial depths could heat older Neogene source rocks that might be present below younger Neogene cover, it seems likely that because most burial depths are less than this maximum, most speculative Neogene source rocks will be immature. For example, Tertiary source rocks of the Nevada Test Site are immature to marginally mature with respect to oil and gas generation (Barker, 1994) as is a Tertiary shale sample collected during this study from east of Mercury (see above and table 8-8). In the areas where these have been sampled, they have not generated significant oil or gas (Barker, 1994).

Lacustrine units within calderas (intracaldera fill) may include organic-rich beds; however, such beds have not been recognized in the NAFR area. Because intracaldera sediment deposition follows caldera collapse and ignimbrite eruption, deep burial of the calderas or later hydrothermal heating is necessary to mature any such possible source rocks. Most calderas of the NAFR area are presently exposed as mountain ranges (e.g., the southwest Nevada volcanic field), and previous burial deep enough to mature these sediments is unlikely. Local hydrothermal heating of caldera fill source rocks is likely, but no examples of petroleum generation from such rocks are known in Nevada, and thus the likelihood of petroleum resources in calderas is believed to be low.

In summary, a very significant amount of the total volume of rock in the western part of the NAFR consists of volcanic rocks having no source-rock potential. The presence of possible source rocks in the volcanic sequences is mainly unconfirmed, and requires considerable speculation. Tertiary source rocks are likely present in the NAFR area, as they are on the adjacent Nevada Test Site. Their occurrence is probably spotty and, based on analogy with those at the Nevada Test Site, most are not likely to have been heated to high enough temperatures to generate petroleum (see Barker, 1994).

Conclusions Regarding Source Rocks: Based on a thorough review of the pertinent geologic literature and studies carried out for this report (especially the Geochemical Sampling and Characterization Program), it is concluded that Paleozoic rocks likely include all of the probable source rocks (those that have both the sufficient hydrocarbon-generating organic matter and the level of maturity sufficient for generation and expulsion of commercial amounts of hydrocarbons) in the NAFR. Furthermore, the Mississippian Chainman Shale and equivalent units in the study area are the most significant probable source rocks, and the presence of these rocks, combined with other information, such as CAI thermal maturity (fig. 8-46), provide the best method of assessing the petroleum potential of the area (fig. 8-49).

Oil and Gas Shows

No petroleum exploration wells are known to have been drilled in the NAFR, either before or after its closing in the 1940s, and the nearby region is only sparsely explored by drilling. Only seven exploration wells are located within 40 km of the Nellis boundary (Garside and others, 1988; Nevada Bureau of Mines and Geology, 1995 and unpublished data). Additionally, Brady (1984) reports a gas show in a well or borehole from the vicinity of the north end of the Jumbled Hills two or three km north of the Nellis Air Force Base boundary. No other information is available on this well; because there is no record of an oil exploration well in the area, it is most likely a water well with a biogenic gas show. No oil or gas shows are known from surface outcrops or any other wells or drill holes in or adjacent to the NAFR.

Two wells drilled by Maxus Exploration Co. in Tikaboo Valley about 10 km north of the eastern part of the NAFR are probably the most significant. A few very minor gas shows and one very spotty brown oil stain were reported from one of the Maxus wells. Possible source beds noted include some dark brown dolomite units in the Devonian Guilmette Formation as well as the Mississippian Chainman Shale (D. M. Herring, personal commun., 1992). The presence of the Chainman and the shows tend to confirm the presence of source rocks and at least some petroleum generation in the Tikaboo Valley area.

A oil exploration well located about 30 km northwest of Las Vegas (Lichtenwalter and Turpin, Turpin No. 1) is within 40 km of the southeastern corner of the NAFR. The source of oil and gas shows in this and other wells in the vicinity of Las Vegas are problematical. The most likely sources are Tertiary or Permian sedimentary units nearby. These sources are not well represented in the NAFR, and are not considered significant to petroleum generation within the NAFR (see source rocks description above).

To the south of the NAFR, the Jayhawk Exploration Inc. Federal-Indian Springs No. 1, located about 16 km southeast of Indian Springs, has no reported shows based on records at the NBMG (see Garside and others, 1988). Brady (1984) reports a well with a gas show from this approximate location; it is not known if that reported show is from the Jayhawk well or a nearby water well.

Three exploration wells have been drilled to the southwest of the NAFR, two near the community of Amargosa Valley (Lathrop Wells), and one northeast of Beatty. The Myjo Coffer No. 1 well was drilled in Tertiary volcanic and volcaniclastic rocks within the Timber Mountain caldera northeast of Beatty; no oil or gas shows were reported (Harris and others, 1995; Grow and others, 1994). There is some dispute concerning the presence and significance of shows in the two wells drilled by Felderhoff Production Co. a few kilometers south of Amargosa Valley. Apparently low-level methane (and in one case, sparse ethane) shows were reported from Tertiary sedimentary rocks, and fragments of Mississippian Eleana Formation shale were noted in the Tertiary sedimentary rocks. The Eleana fragments contain thermally immature ichthyoliths (A.G. Harris, personal commun., Harris and others, 1995) indicating that at least some of the Eleana at the source of the fragments (possibly as far as 40 km to the north) was thermally immature. Methane and low amounts of ethane are not unusual in undermature source rocks (C.E. Barker, personal commun., 1995). Additionally, dead oil stains are reported from the well (Paul Smith, written commun., 1995).

In summary, oil and gas shows in petroleum exploration wells are not common in the area surrounding the NAFR, and those that are known tend to confirm an area of potential source rocks in a part of the eastern NAFR (fig. 8-49).

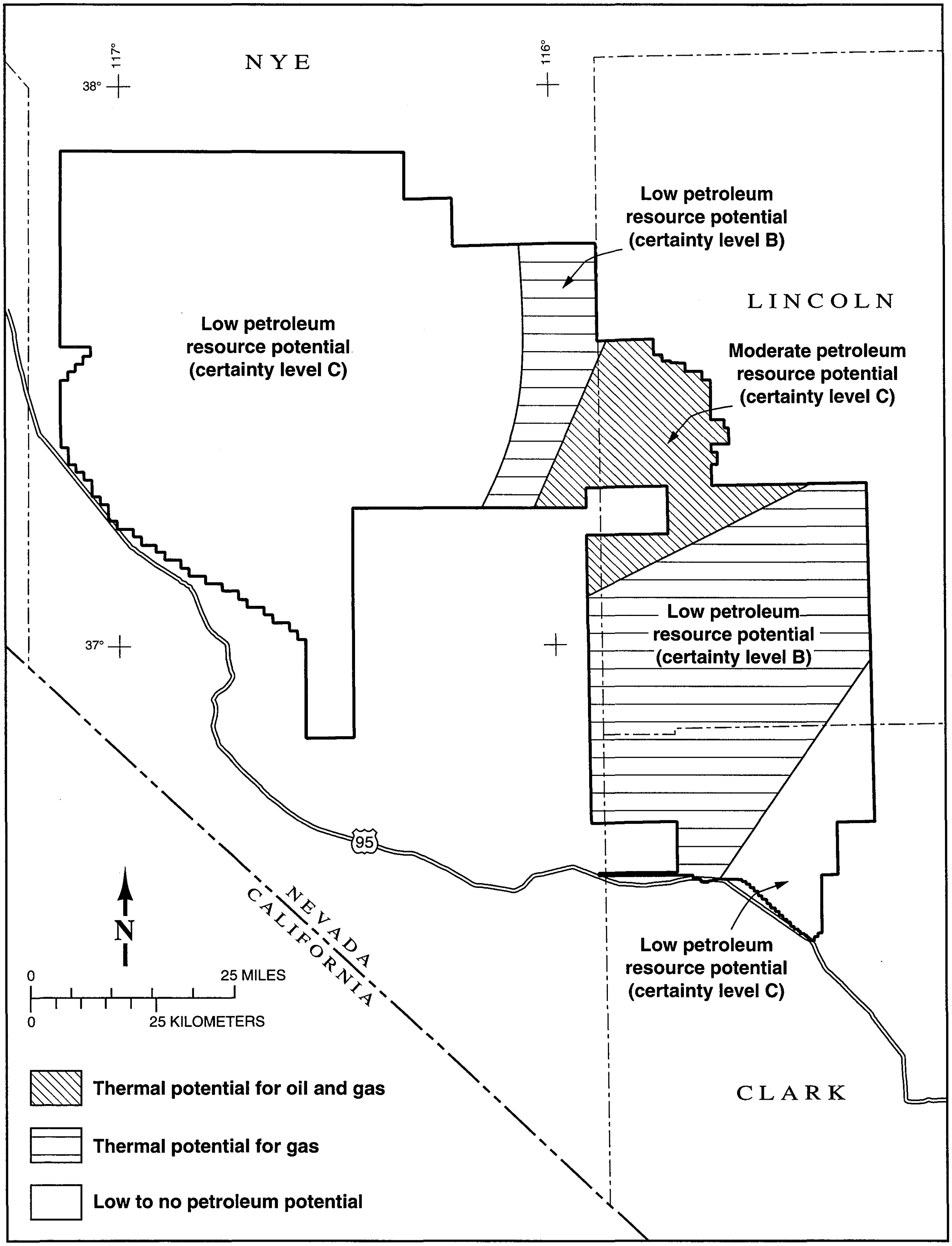


Figure 8-49 Interpretative map of petroleum resource potential for the Nellis Air Force Range. Boundaries of areas having low to no potential with areas of thermal potential for gas are defined by the limit of Mississippian shale facies (Figure 8-42). Boundaries of areas having potential for gas with those having potential for oil and gas are defined by conodont color alteration index (CAI) data (Figure 8-41; Grow and others, 1994).

Other Considerations

One method of estimating undiscovered petroleum resources is to make comparisons of the evaluated area with similar areas having petroleum production or reserves. This method identifies possible petroleum systems or "plays." A play is a group of undiscovered and discovered petroleum fields which share the same hydrocarbon sources, migration mechanisms, reservoir intervals, and trapping mechanisms. The more viable plays for eastern Nevada are within valley or graben blocks of the typical Basin and Range system of horsts and grabens (see Peterson, 1988; Gautier and Varnes, 1993). Neogene basins in the Basin and Range are often considered to have higher potential than the adjacent ranges. This is because to date all oil fields in the Great Basin have been found in the valleys or basins (Grabb, 1994), and most of the production in eastern Nevada occurs in traps that are sealed by basal valley fill material. Thus such oils have probably been generated and migrated to traps since the middle to late Miocene, following the onset of extension in the region. The horsts or ranges are not considered favorably in many plays, because they have undergone many complex tectonic events, and are broken by many faults which are likely to allow escape of migrating petroleum. Additionally, they have few good seals within the exposed rocks to prevent this escape (evaporite units are not present, for example). Although there have been several petroleum generation events in many areas of the Great Basin (French, 1994), the most recent one, in the Neogene, has the most potential for preserved petroleum concentrations. Thus, petroleum that has migrated to traps in the Neogene is most likely to be preserved, and is most commonly sought by explorationists. It follows that the shortest, and thus most likely petroleum migration paths are within the valley blocks themselves (French, 1994); thus, valley blocks that have buried source rocks to depths capable of generating petroleum (probably greater than 2 km) are most favorable. The thickness of Cenozoic cover has been estimated in Nevada from gravity data (Jachens and Moring, 1990). The only significant area of deep Cenozoic cover in the eastern part of the NAFR is Tikaboo Valley, which is mainly to the north and northeast of the NAFR. In the western part of the NAFR, large areas of thick Cenozoic deposits are present, based on the gravity data. These are most likely volcanic deposits related to a number of late Tertiary calderas in that area; as discussed above, such deposits have not yet been shown to have enough good source rocks to provide a significant amount of petroleum. Hydrothermal and magmatic heat sources in such volcanic areas can mature source rocks at shallow depths, but can also drive out hydrocarbons and overmature large areas of rock.

Some workers have suggested that eastern Nevada's oil fields may result from migration of hydrocarbons from much deeper, underlying traps in one or more thrust sheets related to the Sevier orogenic belt of late Mesozoic age (Chamberlain, 1986). There have likely been a number of periods of petroleum generation and migration in southern Nevada since the Paleozoic (Barker, 1994). A thermal and petroleum generation reconstruction indicates that regional burial (Barker, 1994) has overmatured much of the Paleozoic rock (at least beyond the oil preservation window) in this region, except for a rather narrow belt of rock extending northeast from the Calico Hills on the Nevada Test Site toward Tikaboo Valley in western Lincoln County (Grow and others, 1994; see fig. 8-47). Although there is potential for gas preservation over a larger area (Grow and others, 1994; see fig. 8-47), Nevada exploration experience to date suggests that adequate seals and traps for commercial gas accumulations are rare or non-existent in the Great Basin (Barker, 1994). If most of the Paleozoic source rock potential was lost or pushed into the late gas stage by the early Mesozoic (Barker, 1994), there is a considerably reduced chance that hydrocarbons could be generated from these rocks during the Sevier orogeny in the late Mesozoic. Also, thrust loading at this time would probably be sufficient to destroy any oil generating potential of lower plate rocks that remained after the Paleozoic burial (Barker, 1994). Thus, based on the above arguments, an overthrust play in the NAFR is not likely, and does not indicate increased petroleum potential for the area.

Conclusions

Estimates of undiscovered petroleum resources are very subjective. Such estimates are commonly based of the amount and quality of source rocks, the petroleum generating efficiency of such rocks, and the efficiency of traps. Because the mountain ranges are considered to have less potential for petroleum resources (see above), the valley areas must be considered as areas of possible hydrocarbon accumulation. For petroleum to accumulate in economic amounts in the valley areas of the NAFR, any thermally submature source rocks observed in the NAFR would have to be buried to depths in the valleys where higher temperatures could cause petroleum generation and migration. Traps are probably present in the valley areas in adequate amounts; thus the assessment of potential is based mainly on the availability of source rocks and indications that they may have attained a sufficient level of thermal maturity to have generated petroleum.

The preceding section of this report suggests that source rocks of suitable thermal maturity (figs. 8-47, 8-48) are found only in a limited area of the NAFR, and that much of the western part of the NAFR has low to no potential (fig. 8-49). Igneous intrusions related to calderas (figure 8-48) may have overmatured or cut out any possible source rocks there as well. Additionally, when the concept of "plays" or petroleum generating systems is applied to the area, it is seen that many features necessary for the viability of some types of plays which are important elsewhere in Nevada are lacking here. The majority of data supports a low petroleum resource potential for most of the NAFR, certainty levels B and C, with a limited area of moderate potential, certainty level C, as displayed in figure 8-49.

8.3.4 Geothermal Resources

Geothermal energy is the natural heat of the earth. Although the earth is a great reservoir of heat energy, most of it is buried too deeply or is too diffuse to consider as recoverable energy. In areas of certain hot spring systems geothermal energy is concentrated at depths shallow enough and temperatures high enough for use. Such use includes the generation of electric energy (high temperature applications) as well as low- and moderate-temperature uses such as for space heating and industrial process heat.

Nevada has a large number of hot springs and wells (Garside and Schilling, 1979) in more than 300 resource areas throughout the state (Garside, 1994). The Basin and Range is considered a favorable area for geothermal resources because it has higher than average heat flow and is an area of crustal extension, where faults can provide permeable reservoirs and conduits for deep circulation. Nevada's thermal springs and wells are widely distributed, with an increased concentration in the northwestern part of the state. The maximum spring and well temperatures are highest in this area as well. In fact, water temperatures above 75°C in springs and shallow wells are confined to this area of Nevada, as are the plants that generate electricity from geothermal energy or use it for moderate-temperature process heat (Garside and Hess, 1994). This pattern of spring temperatures and concentration closely follows that of heat flow (see Sass and others, 1971).

Most of the geothermal reservoirs in the northwestern part of the state having generally higher temperatures are usually interpreted as being related to circulation of groundwater to deep levels along faults in a region of higher-than-average heat flow (the Battle Mountain heat flow high, see fig. 8-44). In east-central and southern Nevada, low- to moderate-temperature geothermal resources there are generally believed to be related to regional groundwater circulation in fractured carbonate-rock aquifers. Discharge areas (such as warm springs) may be up to several hundred kilometers from the area of recharge, and the waters may have circulated for hundreds to thousands or tens of thousands of years to depths of several kilometers. Maximum temperatures attained during this journey could be 100°C or higher, but spring temperatures at discharge points are generally less than 65°C.

Hydrogeology

The NAFR lies entirely within the carbonate-rock province (fig. 8-50) of the eastern Great Basin. This area is typified by complex interbasin regional ground-water flow systems which include both basin-fill and carbonate-rock aquifers (Harrill and others, 1988). A large, multibasin system of regional flow, the Death Valley flow system, includes all of the NAFR (see Harrill and others, 1988). The large, multibasin flow systems in the carbonate rock province typically have little surface flow; instead, they may contain groundwater flow paths more than 150 km long that traverse several basins. The terminus of the Death Valley flow system is Death Valley; Ash Meadows to the south of the NAFR is an intermediate area of discharge (Harrill and others, 1988).

Heat Flow and Thermal Gradients

Heat flow is the product of the thermal gradient (°C/km, usually measured in drill holes) and the conductivity of the rocks present. Heat flow (commonly reported in milliwatts per square meter, mW/m^2) is a measurement of the amount of heat leaving the earth. Geothermal resource areas are commonly found in areas of anomalously high heat-flow; thus, such data may be used to regionally evaluate areas for geothermal potential.

The Eureka heat flow low (fig. 8-50), a region of less than about 60 mW/m^2 located in eastern Nye and northwestern Lincoln Counties, is centered on the Nevada portion of a large area of Middle Cambrian to Lower Triassic carbonate rocks (the carbonate rock province). This carbonate rock province underlies southern and eastern Nevada and northeastern Utah (Harrill and others, 1988). The NAFR is located in the southwest section of this heat flow low, having about one-half its area in the low and the remainder on the down-gradient side, between the low and hydrologic discharge areas at Indian Springs, Ash Meadows, and Death Valley. The Eureka Low is most likely a regional-scale hydrologic feature, representing the recharge of colder groundwater to regional aquifers. Groundwater flows through these aquifers toward the large springs found in the regional discharge areas of interbasin regional flow systems (Mifflin, 1988). For the Death Valley flow system, such areas would include the Ash Meadows area and Death Valley. As a result of these conditions, thermal springs within the Eureka Low are less common and cooler than in surrounding areas (Sass and others, 1971).

The regional heat flow beneath most of the hydrologic disturbance of the Eureka Low may be the same as that characteristic of the Great Basin in general (about 80 mW/m^2) or it could be as high as 100 mWm^{-2} (Sass and Lachenbruch, 1982). Beneath Pahute Mesa (north of the Nevada Test Site) temperature gradients in drill holes are fairly low, 20 to 25°C/km (Sass and Lachenbruch, 1982): however, one drill hole (PM2) in the Gold Flat area has a temperature of about 66°C at approximately 600 m. The thermal gradient in this drill hole would be over 50°C/km. This somewhat anomalous temperature may be due to local upwelling of con-

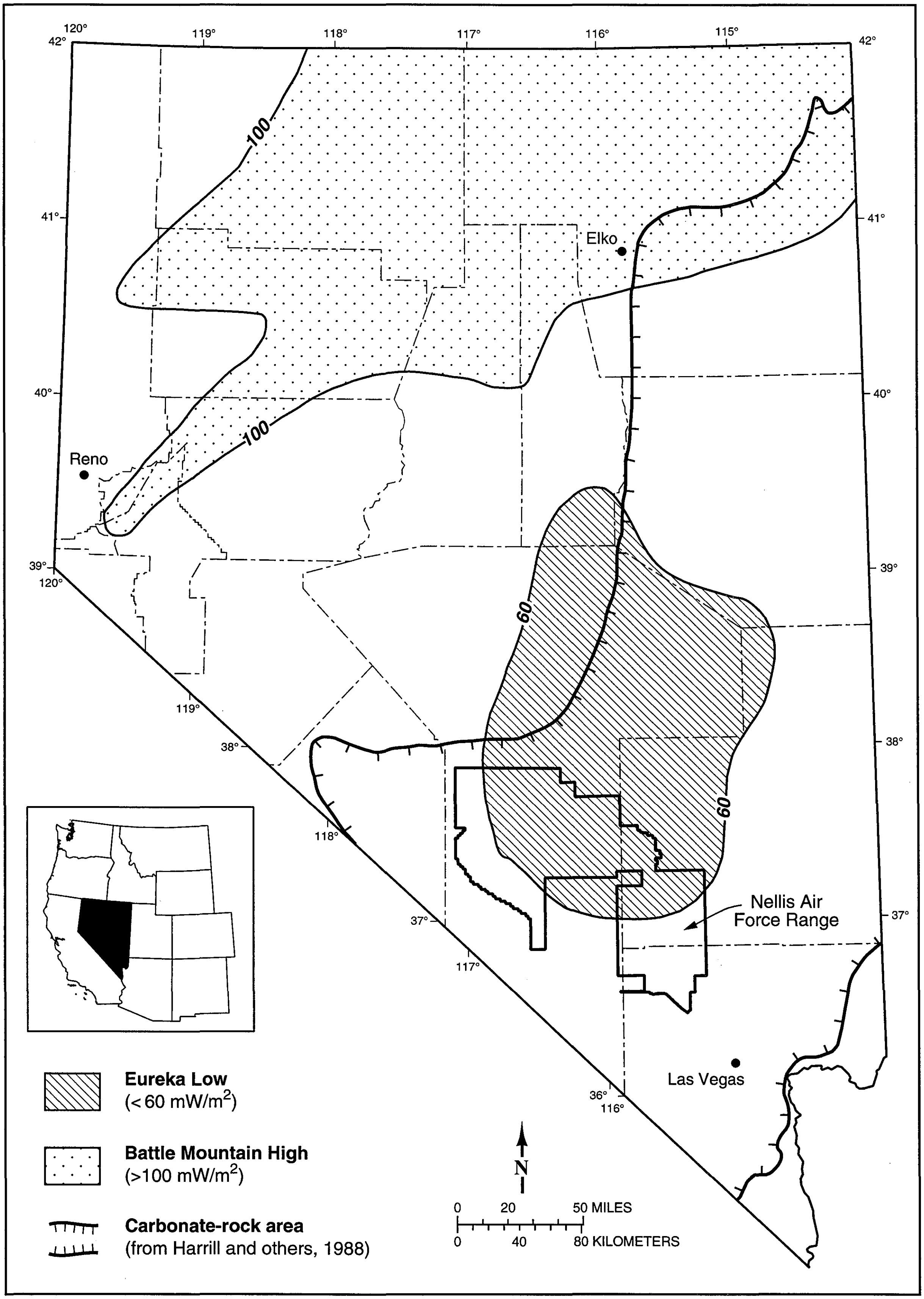


Figure 8-50 Heat flow extremes in Nevada (after Sass and others, 1971) and the area of carbonate-rock aquifers.

vecting water producing higher temperatures at shallower depths that those found in other drill holes of the Pahute Mesa area. It seems unlikely that such a gradient could be maintained to depths of 1 km or more, as other drill holes in the area do not reach such temperatures until about 1,500 m.

One method of evaluating the potential of such thermal waters is to make estimates of water temperatures that are likely to be encountered at depths of 1 km, the probable depth that low-temperature geothermal waters could be used in the foreseeable future (Sammel, 1979). The Pahute Mesa area, in the southwestern NAFR has a number of deep drill holes that provide useful information to estimate groundwater temperatures at this depth. At Pahute Mesa, the maximum subsurface temperatures that might be encountered, in areas of thermal upwelling, are slightly more than 70°C (see Sass and Lachenbruch, 1982, fig. 4). For most drill holes there, 40°C is a more likely temperature for 1 km depths. At Yucca Flat on the Nevada Test Site south of the NAFR, subsurface groundwater temperatures of 55 to 60°C at depths of 1 km are likely, based on temperature profiles in wells as deep as 800 m (Sass and Lachenbruch, 1982, fig. 6).

Temperature gradient studies in deep drill holes from the Pahute Mesa area indicate that for the first 1.5 km below the surface, the temperature gradient is about 26°C/km, which corresponds to a calculated heat flow of less than 40 mW/m^2. Below this, lies a complex zone of probable lateral and vertical flow to about 3 km. Below 3 km the linear temperature profile (37°C/km) suggests a heat flow of 80-100 mW/m^2. A logical interpretation of this data is that the regional ground-water flow in carbonate aquifers at depths of less than 3 km is carrying off much of the earth's heat in the area of the Eureka Low and transferring it elsewhere (Sass and Lachenbruch, 1982), probably to the south and southwest (to Death Valley and Ash Meadows). A deep drill hole on Pahute Mesa has a reported temperature of 125°C at 3,700 m (Sass and Lachenbruch, 1982). As a generalization, conditions at 3 km depth are probably similar to those in this well over much of the area of the Eureka Low (and thus much of the NAFR).

The source of heat in southern Nevada is believed to be entirely related to the heat conducting from the mantle through the earth's crust (which is believed to be relatively thin in the Basin and Range). There are no known shallow silicic igneous bodies in the NAFR that are young enough to be a local source of geothermal heat. Silicic volcanism in the NAFR ended about 11.5 Ma in the southwest Nevada volcanic field, and at about 7 Ma in the Stonewall and Black Mountain calderas on the western margin of the NAFR (Sawyer and others, 1994). Magma bodies below larger calderas (>10-km diameter) cool slowly and may be heat sources for up to 2 million years (Wohletz and Heiken, 1992). Calculations based on theoretical cooling models (Smith and Shaw, 1978) indicate that magma chambers associated any of these calderas would have completely crystallized and cooled to ambient temperature several million years ago. Late Tertiary and Quaternary basaltic volcanism is known from several areas in and adjacent to the NAFR (e.g., Reveille Valley, Buckboard Mesa, Kawich Valley, Crater Flat; see Cornwall, 1972). These basalt flows and associated small dikes and necks are believed to be the products of mantle-derived magma that rose quickly through the crust with little or no contamination. The absence of associated derivative rocks of more silicic affinity also suggests that long-lived magma chambers were not established in the crust; instead, the mafic melts seemingly rose directly from the mantle to the sites of eruption. The conduits for these high temperature (about 1,200°C), low-viscosity magmas are believed to be narrow pipes and fissures (e.g., Smith and Shaw, 1975). Such isolated basaltic vents in a continental setting do not have high-level magma chambers, and represent short-term events with little value as a heat source (e.g., Heiken, 1982). They thus are not believed to contribute significant amounts of heat to the upper crust. The dikes and pipes that feed such isolated, small volume centers do not provide sufficient long-term crustal heat to drive a geothermal system (Delaney, 1987; Wohletz and Heiken, 1992).

Estimates of Heat Flow from Silica Geothermometry

Swanberg and Morgan (1981) have constructed a regional "heat-flow" map of the United States based on the empirical relationship of the silica geothermometer and regional heat flow. For Nevada, this map does not show the Eureka Low, but rather shows an extension of the Battle Mountain High into southern Nevada. The technique is most useful where conventional heat-flow data are sparse or lacking, and has less applicability to local areas with more complete heat-flow data. Because the empirical relationship between heat flow and silica temperatures may be affected by increased silica from the leaching of volcanic rocks (Swanberg and Morgan, 1978), it seems likely that the area of silica geotemperature "heat flow" shown in southern Nevada is higher than conventional heat flow (e.g., Sass and others, 1981, fig. 13.4) because of the abundance of highly soluble volcanic glass in rocks of the region (Sass and others, 1988). Thus, for the area of the Eureka Low, interpretations based on conventional heat-flow data are favored over the silica geotemperatures.

Thermal Groundwater

For groundwater temperatures to be considered anomalous they should be 10°C or more higher than the average annual temperature for the area of the spring or well, and for wells, the gradient should increase by at least 25°C/km with depth (see Garside, 1994). For the northern two thirds or so of the NAFR (north of 37° latitude) shallow groundwater or spring temperatures of 20°C or greater would be considered thermal.

South of 37° the average annual temperature increases rapidly as you proceed south (Houghton and others, 1975). Springs in this area should probably only be considered as thermal if their temperatures are 25°C or above (Garside, 1994).

The NAFR is located in an area of the state where there are few thermal springs and wells, compared to surrounding areas (Garside and Schilling, 1979; Garside, 1994). As described above, this is likely related to the hydrologic regime and the related area of low heat flow. However, low-temperature but somewhat warmer springs are found within 10 to 30 km of the NAFR boundary, for example near Beatty (47.2°C), Indian Springs (26°C), Hiko (32°C), and Warm Springs (62°C). With the exception of a small spa at Hicks Hot Springs near Beatty, none of these springs are presently being used for their thermal energy. The few springs and wells in the NAFR or within 5 km of its boundary that have slightly anomalous water temperatures are further described below and shown on figure 8-51. In general, these springs have temperatures that are less than 30°C; there are few applications which can make use of such low-temperature geothermal fluids. The only likely use for waters in this temperature range is certain types fish farming (aquaculture), and most of those operating today have at least somewhat higher temperatures.

Stinking Spring: This spring, located in the Kawich Range just north of the northern NAFR boundary, has a reported temperature of 27.8°C. The water is cool, dilute, and potable (Gardner and others, 1980).

Cedar Spring: Cedar Spring in the southern Kawich Range has a reported temperature of 25°C.

Sand Spring Valley: Two wells in southern Sand Springs Valley a few kilometers outside the boundary of the NAFR near its northeast corner are anomalously warm (28.3°C and "warm" according to Garside, 1994).

Ash Creek Spring: This spring located in the northern part of the Desert Range has a temperature of 22°C (Garside and Schilling, 1979). This spring probably should not be considered thermal, based on the criteria listed above, as it is far enough south to be in an area of somewhat higher average annual temperature.

Climax Seep: A spring located northwest of Yucca Flat on the Nevada Test Site (a few kilometers south of the NAFR boundary) has a reported temperature of 41.5°C. The source of the data is the WATSTORE database of the U.S. Geological Survey (see Garside, 1994). This rather high temperature is not confirmed by any other data source, and is thus somewhat suspect. However, the 41.5°C value is too low to be a reporting error related to use of the Fahrenheit rather than Celsius scale. The site was not visited during this study.

Indian Spring: This spring is near the small community of Indian Springs near the south boundary of the NAFR. It has a temperature of 26.1°C.

Sarcobatus Flat: Several water wells that have somewhat elevated groundwater temperatures are located in Sarcobatus Flat just outside the southwest boundary of the NAFR. Five wells in the area are known to have groundwater temperatures of 22°C, and one has a temperature of 24°C. One data source lists a 42.2°C temperature for one well in the area (Garside and Schilling, 1979, p. 54 and appendix I). There is no confirmation of the higher temperatures, and the data source is known to have other water temperature reporting errors.

Geothermometry

Estimates of subsurface temperatures can be made based on the temperature-dependent solubility of silica and temperature-dependent exchange reactions of certain dissolved constituents (e.g., silicon dioxide, calcium, sodium, potassium, magnesium) in groundwaters (Fournier, 1981). These geothermometers can be affected by fluid dilution, and some have limited applicability in waters having high calcium or magnesium. In general, the use of chemical geothermometers to estimate maximum subsurface reservoir temperatures should be done with considerable caution when only analyses of low-temperature or nonthermal waters are available.

Geothermometers were developed to estimate subsurface temperatures by the use of cooler, but still thermal, waters collected further from the probable source of higher temperature fluids. Commonly, the best water to sample for geothermometer calculations is the hottest available. Several geothermometers are applicable only for fluids which have high temperature sources, or are useful only under somewhat restricted conditions. For low- to intermediate-temperature reservoirs (25 to 150°C) the chalcedony and possibly the sodium-potassium-calcium geothermometers are the most useful for fluids of the type considered during this study (see Flynn and others, in review, for a more complete discussion).

There are many uncertainties and potential problems with the use of geothermometers calculated from nonthermal and very low-temperature thermal waters. No one value can necessarily be considered indicative of geothermal resource potential; however, a complete resource appraisal requires consideration and evaluation of such equivocal data. Certainly, some generalizations can be made from the data as a whole.

Analyses of spring and well waters from the NAFR and vicinity are available from several sources in digital form. The sets of data used during this study include: GEOTHERM (U.S. Geological Survey), STORET (U.S.

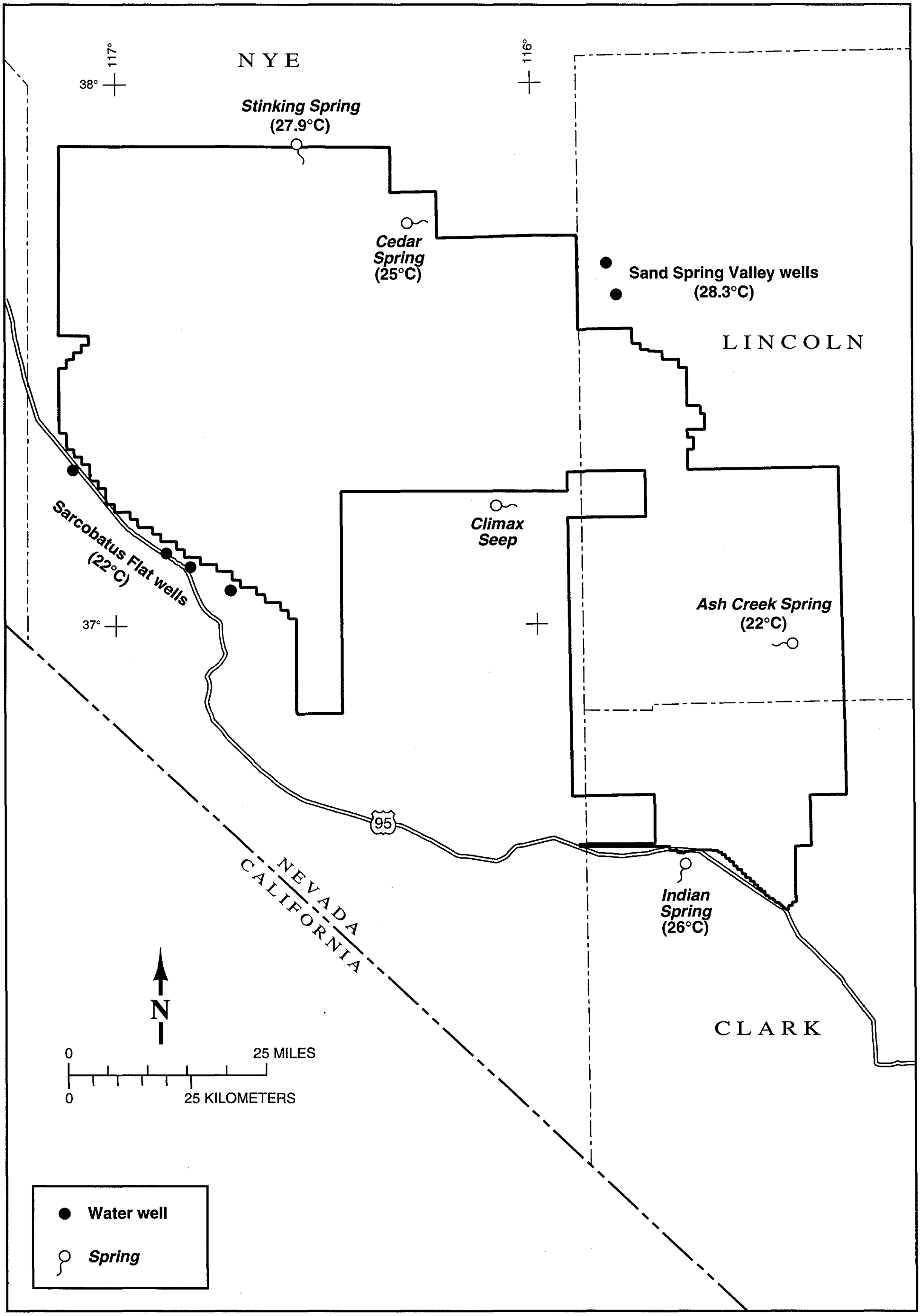


Figure 8-51 Thermal water in springs and wells in and within 5 km of the Nellis Air Force Range, Nye, Lincoln, and Clark Counties, Nevada.

Environmental Protection Agency), a database from D. Perfect of the U.S. Geological Survey, a database of the U.S. Department of Energy for the Yucca Mountain area, and database from T. Flynn of the Harry Reid Center, University of Nevada, Las Vegas. Lisa Shevenell at the NBMG used these sources of data to compile a set of water analyses and locations for the NAFR and vicinity. Duplicate records were eliminated as were those of poor quality (based on the absence of one or more major constituent analyses or a poor ion charge balance). Geothermometers were calculated for the remaining data records. The procedures for compiling the data for the area of this study are the same as those for a similar study of geothermometers for the Yucca Mountain area located at the southwest corner of NAFR. The data sets and compilation procedures are described in more detail in Flynn and others (in press).

In order to evaluate geothermometers and water temperature data from the above described data set, it was first reduced to those records for the NAFR and a buffer area of 5 km outside the boundary. The remaining records of analyses include both thermal and non-thermal waters from springs and wells (including deep drill holes which may have water temperatures of 30°C or higher due to a normal increase of temperature with depth). From this set records were eliminated that had both a water temperature and a chalcedony geothermometer temperature of 20°C or less.

Inspection of the remaining approximately 113 records shows that the sodium/potassium geothermometer is unreasonably high (as expected for high calcium waters), and that the geothermometer temperatures for chalcedony are nearly always somewhat greater than those for sodium-potassium-calcium. In the cases where the sodium-potassium-calcium values are higher, they are commonly only 10°C-20°C higher. Thus, the chalcedony geothermometer is considered to be the most useful and most likely to give a reasonable estimate of subsurface temperatures. When chalcedony geothermometer temperatures are compared with the maximum temperatures for the sampled fluids, it is seen that most are at least somewhat higher than the corresponding maximum measured temperature (i.e., above the slope=1 line on fig. 8-52). This suggests that reservoir temperatures are at least somewhat greater than measured temperatures, a condition to be expected in this area.

Calculated chalcedony geothermometer temperatures for the NAFR are mainly <100°C. Only about 4 percent of the values are between 100°C and 150°C, and one value exceeds 150°C (208°C for water from drill hole 20c Ring B, hole 4 on Pahute Mesa); about 10 percent of the chalcedony geothermometer temperatures are above 90°C. Based on the arguments in the section above on heat flow and thermal gradients from drill holes in the vicinity of drill hole 20c on Pahute Mesa (see above), a temperature of 208°C would not be likely at a depth of less than 6 km. The >90°C geotemperatures are mostly from the deeper drill holes on Pahute Mesa and the Nevada Test Site adjacent to the NAFR (fig. 8-53). Water from these deep drill holes more likely represents undiluted deep reservoir fluids, and the maximum fluid temperatures of sampled sites (fig. 8-54) are correspondingly high from these deep holes. Taken on average, these geothermometers may be a reasonable estimate of the overall reservoir temperatures in the carbonate aquifer which underlies the NAFR. The depth to such reservoirs can not be estimated from these calculations; however, based on the Pahute Mesa drill-hole gradient data described above, such temperatures (90 to 150°C) may only be found below approximately 4 km.

Conclusions

The NAFR is entirely within an area of abnormally low heat flow for the Basin and Range, and the few thermal springs and water wells in or near the study area have temperatures below 30°C. Based on thermal gradient information available for the Pahute Mesa and Nevada Test Site, and the extrapolation of that data elsewhere in the Eureka Low, most water temperatures at the economic depth for low-temperature use (1 km) are likely to be no higher than about 55°C, possibly 70°C in areas of local upwelling. At depths of 3 to 4 km, temperatures of 125 to 150°C are possible, based on chemical geothermometers and extrapolation of thermal gradients. Igneous-related high-temperature geothermal resources are unlikely in the NAFR.

Thus, the NAFR is estimated to have low potential (certainty level C) for intermediate-temperature (90-150°C) and high-temperature (>150°C; see Muffler and Guffanti, 1979) geothermal resources. If resources in these temperature ranges are locally available in the NAFR, they are believed to be at uneconomic depths.

In the few areas that geothermal fluids rise to the surface in the NAFR, temperatures are below the limit of practically all geothermal uses. The probable depth of drilling required to exploit potential subsurface thermal fluids makes their use economically unfeasible at present or in the foreseeable future. For temperatures of 70°C or less, the only practical uses are space heating, agriculture (greenhouse, soil heating) or aquaculture (fish farming, etc.). Drilling to 1 km for such fluids is not economical; there are many areas elsewhere in the Basin and Range where similar or hotter fluids are available at or very near the surface. Low temperature fluids can not be transported long distances without considerable heat loss. Thus, uses related to urban centers are restricted to their vicinity; such urban centers are not likely in the NAFR in the foreseeable future. Geothermal heat pumps that extract heat from groundwater of normal to elevated temperatures are feasible for many space-heating applications. However, the economics of such systems

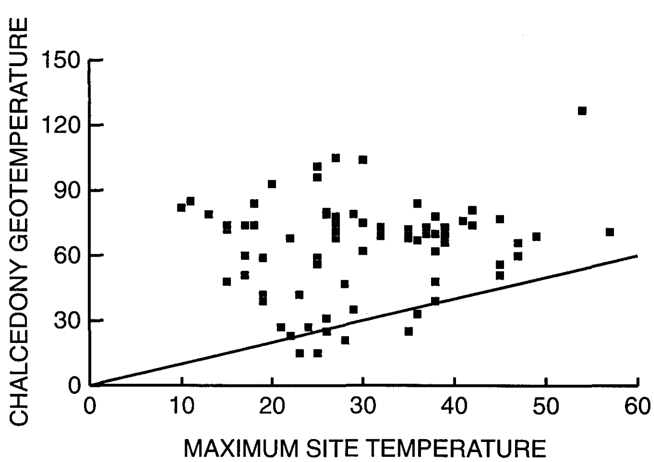


Figure 8-52 Plot of chalcedony geothermometer temperature versus maxiumum measured temperature at the sample site for water samples from the NAFR area. Line has a slope of 1.

require shallow depths for circulation of the heat-exchange fluid. Groundwater at these depths in the NAFR is likely to be near the average annual air temperature, and thus will provide no thermal advantage compared to any other area in southern Nevada. Thus, the area of the NAFR is determined to have less potential for low-temperature geothermal resources than most of the rest of Nevada. The potential for low-temperate geothermal resources is estimated to be low, certainty level B.

8.4 TURQUOISE

Turquoise (a hydrated copper-aluminum phosphate-hydroxide prized as a semiprecious gemstone) has been produced from section 6, T3S, R46E in the Cactus Spring mining district, west of Sleeping Column Canyon in the north half of the Cactus Range (Cornwall, 1972). Morrissey (1968) reported approximately $25,000 in turquoise production.

This turquoise occurs as irregular masses and veinlets in a sericitized quartz-feldspar rhyolite porphyry. The rock is variably cut by stockwork quartz veins and veinlets that are characteristic of porphyry copper deposits. Presumably copper in the turquoise came from supergene oxidation of hypogene copper-bearing sulfide minerals.

Colors of turquoise in the Cactus Spring district include blue, pale blue, pale green, and dark green, although pale blue varieties are more common in the material left behind by the earlier miners. Because masses thicker than 1 cm or larger than 10 cm in longest dimension are uncommon, only small pieces of pure turquoise could be worked from this material. Nonetheless, the rock (including the rhyolite porphyry matrix) can be formed into cabochons or cut with diamond saws and shaped into forms for jewelry, bookends, or paperweights.

Numerous prospect pits have been dug in this rock, and turquoise of variable quality can be found at many. The workings are largely surface scrapings. Only one deep shaft appears to have yielded much material, and this was a small volume (judging from the few tens of tons of material on the dump), as the production figure also indicates.

A high potential, level C, is estimated for turquoise resources amenable to selective, small-scale mining methods. Additional near-surface exploration (such as trenching and detailed mapping of turquoise concentration, size of turquoise masses, color, density of hypogene quartz veining, and distribution of limonite) would likely lead to the discovery of additional turquoise resources. Discovery of larger masses of pure turquoise would make the area more attractive. Prospective areas include the entire outcrop of the quartz-feldspar rhyolite porphyry.

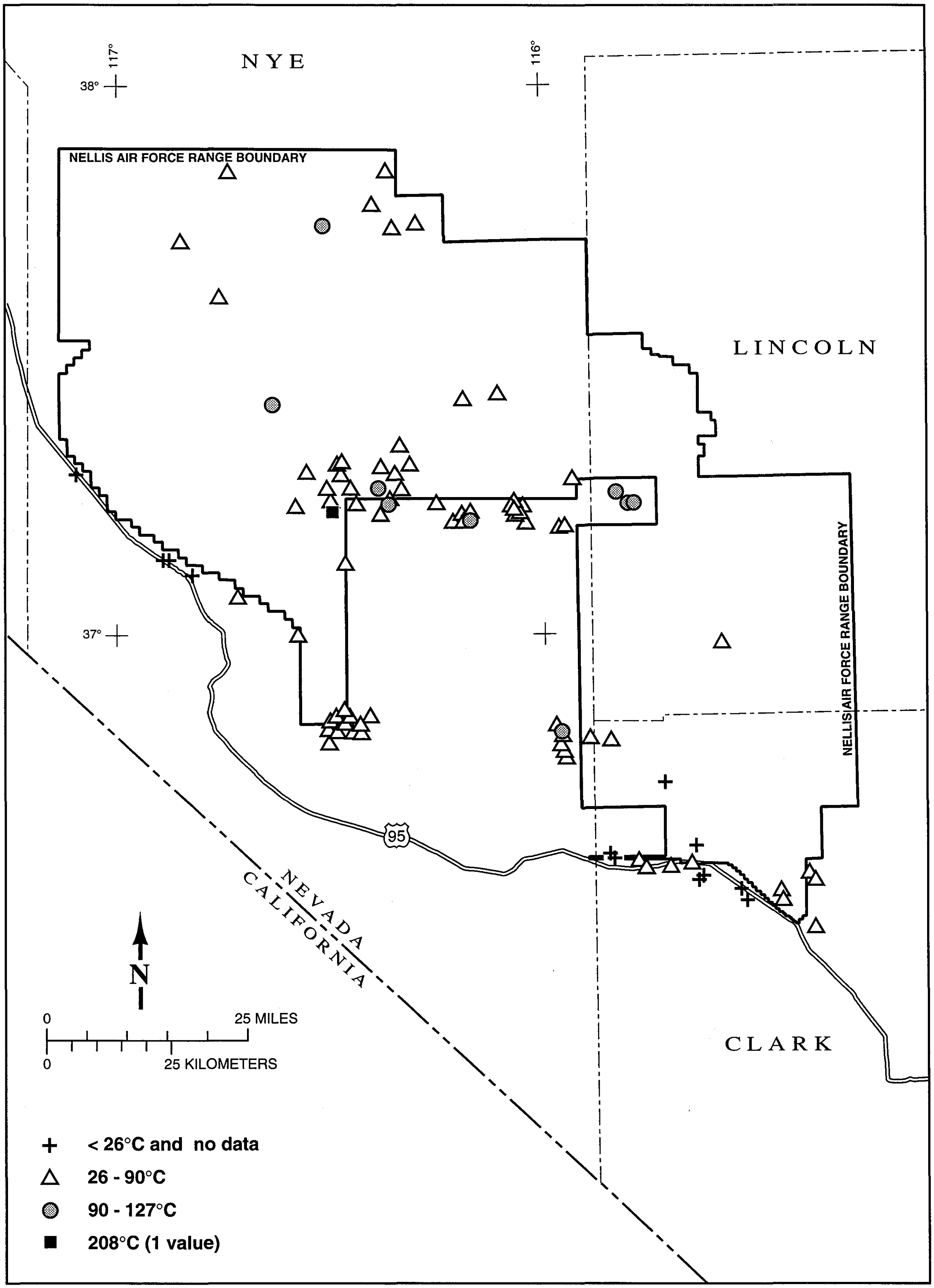


Figure 8-53 Chalcedony geothermometer temperatures for waters from springs and wells of the NAFR and vicinity.

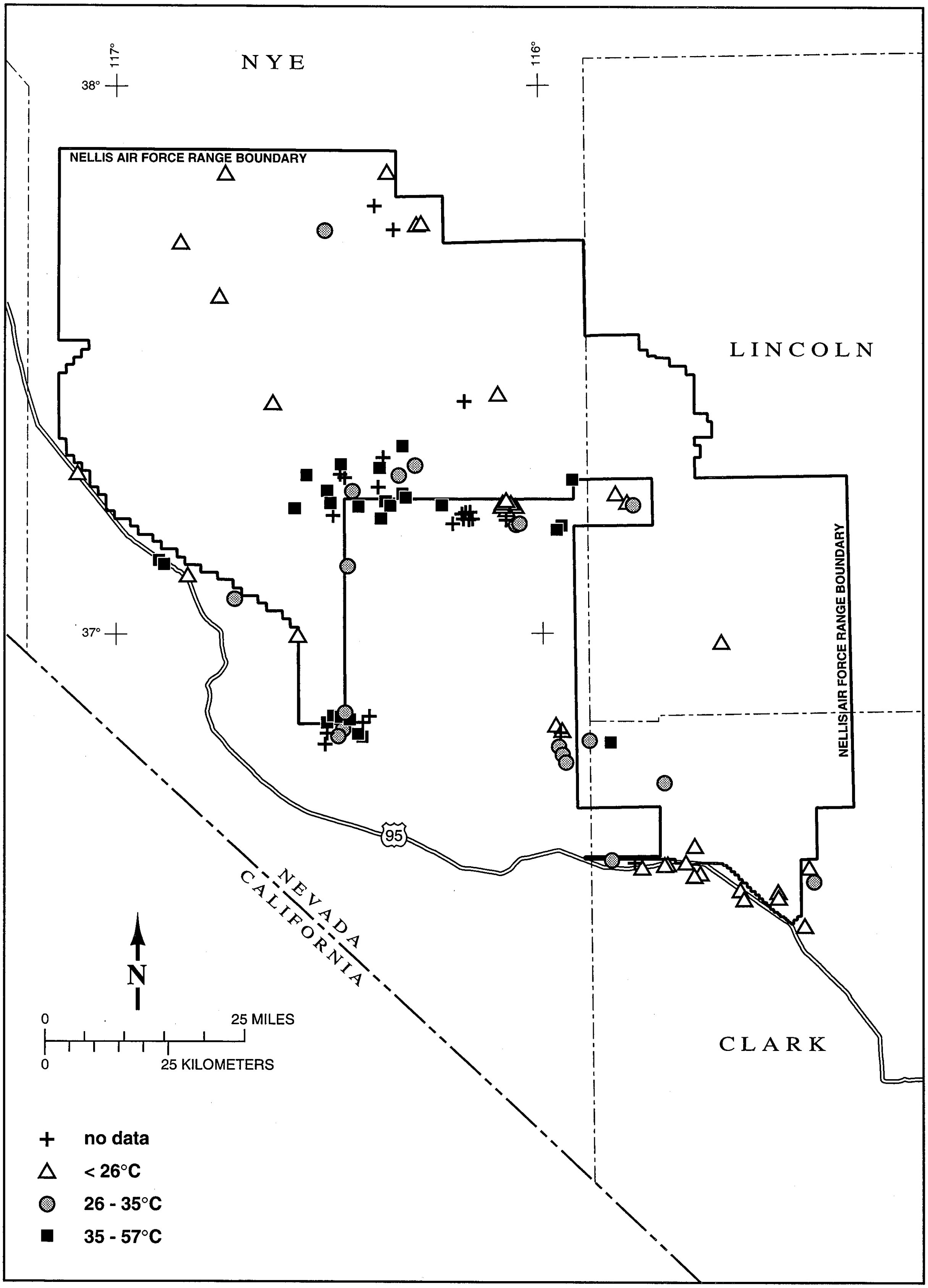


Figure 8-54 Maximum water temperatures for NAFR spring and well waters used in the geothermometry analysis (see fig. 8-47 and text).

9.0 RECOMMENDATIONS FOR ADDITIONAL WORK

The mandate of the NAFR mineral assessment program was to complete an intermediate-level assessment of mineral content and of potential for undiscovered mineral deposits on NAFR lands using surface evaluation methods. The assessment involved the collection, evaluation, and synthesis of large amounts of widely spaced geologic data from a broad area in order to identify regional geologic patterns, structures, and trends that could be critical to mineral evaluation. Additional detailed mapping and sampling of such features identified in this study are required to thoroughly evaluate their significance for undiscovered mineral resources.

Many of the mineralized areas on NAFR present obvious, attractive mineral exploration targets, which, if available for mineral exploration, would require only minimal additional sampling and/or mapping to justify immediate detailed exploratory drilling projects. Included in this prime group are the central Tolicha district, parts of the Antelope Springs district, the Mellan Mountain district, the Black Mule area of the Silverbow district, the central Jamestown district, the Fairday Mine area in the Cactus Springs district, parts of the Gold Crater district, and the extensive vein system in the Wilsons district. Delineation of resources by exploratory drilling is beyond the scope of an intermediate level mineral assessment and no recommendations for detailed work have been formulated for these areas.

For other areas within NAFR, however, mineral potential is not well defined. Many areas exhibit characteristics of high or moderate mineral potential but geologic data are sparse. The mineral assessment ratings given to these areas (tables ES-3 through ES-6), although suitable for the level of the assessment study, could be substantially upgraded with the collection of more data. In general, areas with high or moderate assessments and low confidence levels are most in need of additional work. In particular, these areas are in need of more detailed geologic mapping, structural analysis, and geochemical sampling.

There are also many areas within NAFR where general geologic information is either lacking or is at a level far below that available on the surrounding public lands. These areas would benefit from geologic mapping and other basic geologic studies.

9.1 GEOLOGIC MAPPING

A vital need in mineral resource assessment is placing known mineral deposits in the context of local geologic structure and history. On the NAFR, basic geologic mapping, stratigraphic studies, and district studies are critically needed. In particular, efforts should be made to identify centers of volcanism, intrusion, and potentially related mineralization in the northern part of the NAFR. Stratigraphic studies are also needed in the areas of carbonate rock outcrops in the southeastern portion of the NAFR to refine the assessment of oil and gas resources as well as metallic and industrial mineral resources.

9.1.1 Mapping at 1:24,000-scale

Preexisting, unpublished mapping should be compiled and updated, and new mapping should be done in selected areas. The geology of a large part of the Cactus Range was mapped in 1962-67 by R.E. Anderson of the U.S. Geological Survey. This mapping, covering most of three 15' quadrangles (Cactus Peak, Cactus Spring, and Mellan) was never published. The final field checking and correlation details remain to be worked out, but the maps are very close to being ready for publication. A limited amount of financial support would be required for the author to complete his work, and for map publication. Mapping at a similar level is available for part of the Goldfield Hills, on the western border of the NAFR. This mapping, covering the East of Goldfield 7.5' Quadrangle, could be brought to publication quality with a minimum expenditure. New mapping, in areas such as the Kawich Range, would require field support for data collection and later publication support.

9.1.2 Mapping at 1:100,000-Scale

Geologic maps at this scale are being prepared for many of the 30° by 60° quadrangles within and surrounding the NAFR. These maps will replace the present County geologic maps (1:250,000-scale) for new statewide geologic map coverage. At the present time, geologic maps of the Pahranagat Range and Indian Springs Quadrangles are being prepared for publication by NBMG, and plans are underway to map the Las Vegas 30° by 60° Quadrangle. The Pahute Mesa map has been completed and is available as a U.S. Geological Survey Open-File Report. The remaining maps of this series covering the NAFR (Cactus Flat, Beatty, Last Chance Range, Timpahute Range, and Goldfield) should be compiled and published. This work would be compiled from a combination of preexisting and new 1:24,000-scale geologic mapping. This is visualized as a long-term project that would begin with areas where mapping is largely completed and then move to new areas as time and funding permit.

9.1.3 Reconnaissance Geological Mapping of Calderas and Volcanic Centers

This mapping would define and clarify the relations of calderas and attendant structural features to known ore deposits and mineralization and would help identify areas with high potential for undiscovered mineralization of this type. The focus of the work would be in the Cactus, Kawich, and Belted Ranges, and in the Pahute Mesa-Yucca Mountain area.

9.2 STRATIGRAPHIC STUDIES

Studies of the Paleozoic rocks, including rock maturity analyses and provenance studies of Mississippian units, should be done. This work would aid in regional assessments of petroleum and base-metal potential in southern Nevada.

Detailed work on the Tertiary volcanic rocks throughout the northern part of NAFR, carried out in conjunction with geologic mapping or as a separate project, would result in better understanding of volcanic stratigraphy and caldera sources in light of new information on chronology of volcanic events and volcanic stratigraphy in the surrounding area.

Little is known about the Tertiary sedimentary rocks on the NAFR; most have not been studied in detail. Such rocks elsewhere in the region contain important deposits of clay, gypsum, and borate minerals, and have been the source of other saline commodities. Sedimentary rocks in the southwestern United States have been the most important source of domestic uranium in the past. Specific evaluation of Tertiary sedimentary rocks in the NAFR for uranium potential could be combined with the work recommended for industrial mineral commodities. Further detailed work on these rocks is recommended, and should include detailed mapping, age determinations, and exploration for industrial mineral commodities

9.3 GEOCHEMICAL SAMPLING, RECONNAISSANCE FIELD EXAMINATION

A regional stream sediment sampling program was used to assess mineral potential within the bedrock areas of the NAFR. Several anomalous areas were defined by wide-spaced sampling and, in some cases, inferred anomalies are open in one or more directions. Fill-in and limiting sampling is needed in these areas to refine the assessment of mineral potential. Locations that would benefit from additional sampling and/or follow-up reconnaissance examination would be determined by evaluating data depicted on figures 8-1 through 8-19.

9.4 METALLIC MINERAL STUDIES

During the course of the present study, many questions arose concerning mineral paragenesis, ore deposit zoning, element associations, and relationships between deposits on NAFR and deposits in similar geologic settings elsewhere in Nevada or the world. Detailed mapping, sampling, and study of rock alteration, structural relationships, and ore deposit types present in selected mining districts within NAFR would provide information critical to many of these questions. Data collected would also enable mineral assessments to be refined in many of the districts within the NAFR. Districts where such detailed studies would particularly benefit the mineral resource potential assessment are Cactus Springs, Antelope Springs, Silverbow, Gold Crater, Papoose, Southeastern, and Groom. Reconnaissance mapping completed as part of the NAFR mineral assessment would provide the basis for this work

Recommendations for further study are listed, with no priority of ranking, in table 9-1.

9.5 INDUSTRIAL MINERAL STUDIES

Assessment of industrial mineral resources comes largely from detailed information on the lithology, mineralogy, and geochemistry of rock units. Although major units within the NAFR have been analyzed as part of the GSC program (section 6.3), many smaller units, yet with volumes large enough to be of economic interest, have not been examined in detail.

9.5.1 Building Stone

The siltstone that has been quarried on the NAFR in the past as "slate" may have potential as flagstone or tile, although alternate sources of stone that can be used for such purposes are present in the region. In addition, Tertiary tuff in the NAFR may be usable for the types of building stone produced by Nevada Neanderthal Stone. Little published technical data are available on building stone mined and utilized regionally. As a baseline for determinations of potential for building stone deposits in the NAFR, further study is recommended on regional building stone deposits, particularly those that are located in southern Nevada and southern California.

9.5.2 Clay

Tertiary volcanic and sedimentary rocks in the NAFR are considered to have some potential, with low certainty level, for clay deposits. Specific exploration in altered areas in volcanic rocks identified by remote sensing and in areas of Tertiary sedimentary rock are recommended to upgrade potential certainty levels for the commodity.

9.5.3 Construction Aggregate

Because of its low unit value, construction aggregate potential is largely determined by market conditions. If specific markets are identified, such as DOD needs related to NAFR operations, it is recommended that construction aggregate studies, including quality determinations, be performed on a case-by-case basis.

Table 9-1. Recommendations for district/commodity studies, NAFR.

Area	Recommended Work	Purpose
Selected areas within the NAFR	Correlate TM imagery with alteration and geochemical anomalies outlined by stream sediment and mine site sampling and mine site sampling and reconnaissance mapping.	TM imagery was used as a reconnaissance tool to plan stream and prospect sampling. There are apparent correlations between patterns in the TM imagery and specific types of rock alteration; these correlations need investigation and documentation.
Northern NAFR	Study the association of Te with mineralization in mining districts within NAFR and in nearby districts, outside of NAFR.	Sampling has shown elevated Te values present in several districts in the Cactus and Kawich ranges, and in districts bordering Pahute Mesa. This association and its importance as an indicator of Au-Ag mineralization requires further investigation.
Northern NAFR	Sample groundwater and conduct chemical and mineralogical examination of playa clays.	Investigate Li concentration in groundwater and in potential source rocks for Li in NAFR.
Antelope Springs district	Sample silicified rock between the major veins at the Antelope View Mine.	This sampling would further evaluate the potential for stockwork precious metals mineralization.
Cactus Springs district	Map and sample alteration assemblage in the area including the Fairday Mine and Urania Peak.	Low-sulfidation precious metal vein deposits at the Fairday mine are spacially related to high-sulfidation mineralization exposed on Urania Peak. The genetic relationship between these occurrences needs to be investigated.
Cactus Springs West	Sample and map Paleozoic rocks about 2.5 km south of Urania Peak.	Geochemical sampling indicates potential for polymetallic replacement deposits in these rocks; further investigation is needed to confirm or disprove this potential.
Cactus Springs West	Map and sample the portion of the district centered on the turquoise occurrence in Sleeping Column Canyon.	Porphyry Cu-Mo mineralization is inferred to underly this area. Detailed geologic and alteration mapping would provide insight on depth to potential mineralization and would refine the mineral potential rating.
Don Dale district	Conduct reconnaissance geologic mapping of carbonate rocks north of Bald Mountain.	Investigate potential for Carlin-type Au mineralization in the area of the B.W. claims.
Eastern Goldfield district	Visit and sample prospects just off range, adjacent to favorable areas defined on NAFR.	Relate mineralization at Goldfield, to the west, with prospects within NAFR.
Gold Crater and Jamestown districts	Sample and map areas of alteration.	Investigate alteration zoning, investigate margins of districts and area between the two districts where altered rocks appear to be covered by post-mineral volcanic rocks; investigate altered areas to the south in the vicinity of Mount Helen, and to the west in the vicinity of Pack Rat Canyon.
Gold Range district	Map structures and alteration in vicinity of Red Rose shaft.	Investigate jasperoid lenses, relationship of structures to possible caldera margin.
Gold Range district	Map and sample Paleozoic rock outcrop in western part of district.	Verify stream sediment geochemical anomaly in this area; investigate carbonate rocks for signs of mineralization.
Groom and Don Dale districts	Mineralogic studies of ores from districts (polished section and S.E.M. work)	Ores from the Groom district are highly anomalous in Hg, but no Hg minerals have been identified in them. The relationship of Hg to the Pb ores of the district is unknown and should be investigated.
Limestone Ridge area	Map and sample jasperoid lenses and structures in the Paleozoic rocks of Limestone Ridge and in possibly related areas of altered Tertiary rocks to the east.	The inferred potential for Carlin-type Au deposits in this area needs investigation.
Oak Spring district	Reconnaissance geologic mapping and sampling between Carbonate Wash and the NTS boundary.	Investigate potential for polymetallic replacement deposits and skarn tungsten deposits in favorable carbonate units.
Papoose district	Geologic mapping and sampling in the northwestern part of the district.	Investigate the geologic setting of the Au-bearing gossan exposed in the one prospect in this area. Define potential for bulk-mineable Au.
Tolicha and Clarkdale districts	Mineralogic studies of ores from districts (polished section and S.E.M. work); additional sampling in selected areas.	Ores from these two districts are highly anomalous in Be and, locally, in Th. These elements are not commonly associated with low-sulfidation precious metals mineralization. This relationship requires investigation.

9.5.4 Fluorspar

During the NAFR mineral assessment, two new occurrences of fluorspar (fluorite) were identified. Further evaluation of these occurrences is needed to determine their potential.

9.5.5 Limestone

Paleozoic exposures in the southern NAFR are considered to have moderate potential for cement limestone. More specific determinations of potential would require detailed stratigraphic work, sampling, and chemical analyses on Paleozoic rocks in the NAFR. Given the presence of carbonate rock with cement rock potential elsewhere in the Las Vegas area, and the lack of rail transport into the NAFR, this should not be considered as high priority future work.

9.5.6 Lithium

Playas in the NAFR may have potential for saline commodities such as lithium, which is extracted in large amounts from brine pumped from beneath the Clayton Valley playa about 80 km west of the NAFR. There are no surface indications of potential for lithium in NAFR playas, and high certainty determination of potential would probably require drilling. However, further surface work on playas and surrounding geology on the NAFR and elsewhere in the region should provide information that would enhance potential determination. Analysis of groundwater for Li content, perhaps as part of routine water-quality analyses, could provide sufficient data for an inexpensive evaluation.

9.5.7 Zeolite

Potential for zeolite deposits in the northern NAFR is considered to be high, but market conditions for zeolite commodities are poor and large unmined resources are known in several places in Nevada. Further work on this commodity is not considered to be a high priority.

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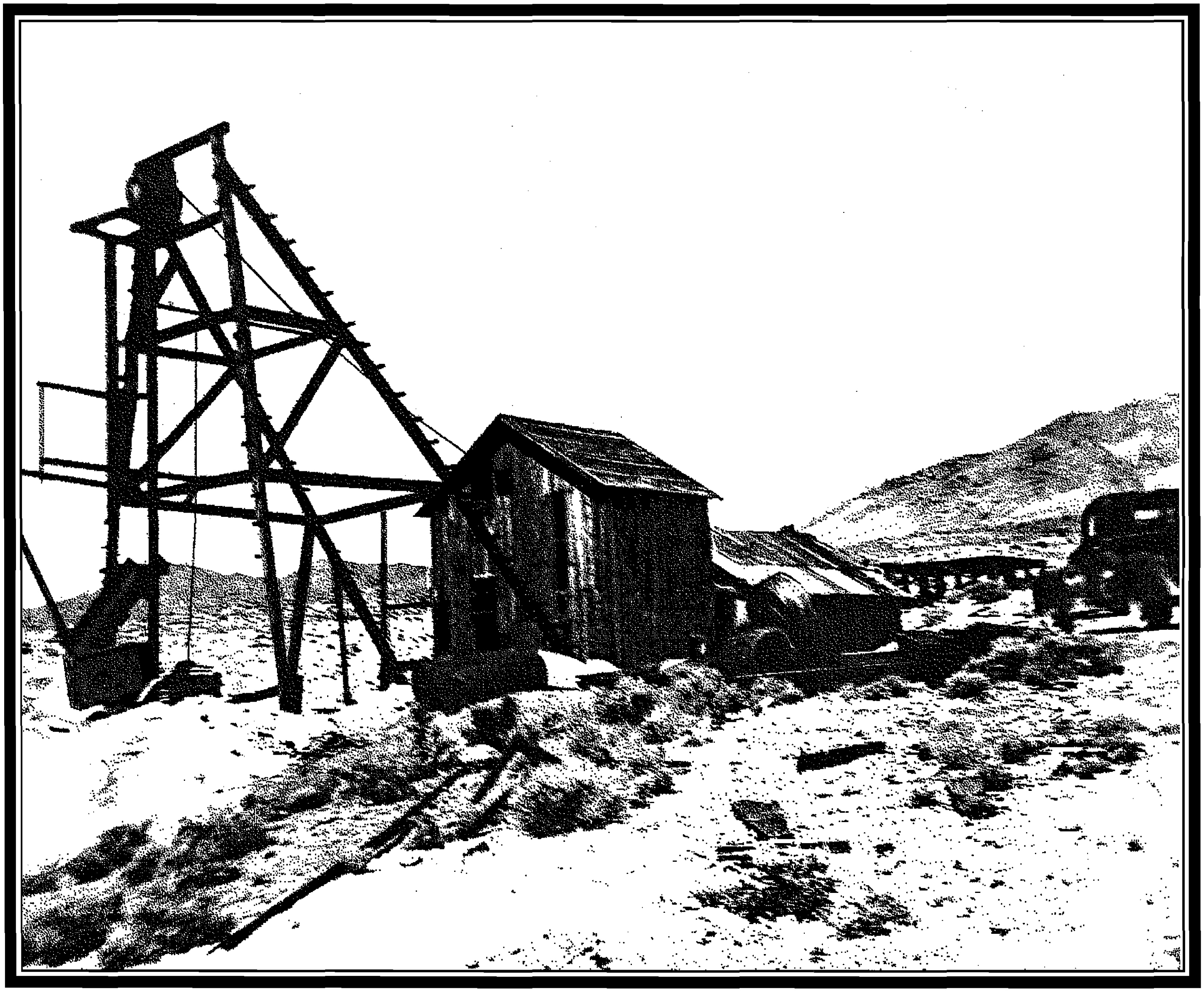

Mineral and Energy Resource Assessment of the Nellis Air Force Range

NEVADA BUREAU OF MINES AND GEOLOGY

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VOLUME 2

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Mineral and Energy Resource Assessment of the Nellis Air Force Range U.S. Air Force Air Combat Command

Clark, Lincoln, and Nye Counties, Nevada

NEVADA BUREAU OF MINES AND GEOLOGY

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This information should be considered preliminary.
It has not been edited or checked for completeness or accuracy.

CONTENTS VOLUME 2

APPENDIX A

CHARACTERIZATION SAMPLING DATA

SAMPLE NUMBER: 001

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4125752
UTM EAST: 646935
ROCK AGE: Ordovician

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcrop
ROCK UNIT: Pogonip Group

ROCK DESCRIPTION: Medium gray-weathering, dark gray medium bedded limestone. Unit contains oncolites and other fossil material, especially coiled cephalopods up to 3-4cm in diameter. Calcite veining along joints (not collected). Locally in the unit there are small blobs of reddish-brown weathering, light gray chert (also not sampled).

ROCK STRUCTURE: Bedding : N10W, 40E
REMARKS: Conodonts indicate that the sampled unit is in the lower part of the Antelope Valley Limestone (A. G. Harris, written communication, 1996).

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Dark gray, fine-grained compact rock, occasionally showing shiny cleavage surfaces of calcite grains.

TEXTURE: Biomicritic, clastic with bivalve fragments and other biological grains.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS: Bio-fragments (irregular variable size 75%), 1.0% quartz.
XRAY STUDY: Calcite, trace quartz.

CEMENT: calcite; 24%.
FEATURES: Local overgrowth of coarse calcite aggregate.
FULL ROCK NAME: Limestone (biomicrite).
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 002

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4127863
UTM EAST: 648722
ROCK AGE: Devonian

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcrop
ROCK UNIT: Guilmette Formation

ROCK DESCRIPTION: Light brownish weathering to tan weathering, light tannish gray, medium grained quartz sandstone with well rounded grains. Massive to indistinctly laminated. No calcareous cement noted.

ROCK STRUCTURE: Massive, see GSCN3
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Light brownish, medium-grained sandstone with local brown spots of iron oxides.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (65%, fine-medium equant, rounded).
XRAY STUDY: Quartz, dolomite, trace calcite.

CEMENT: Dolomite (34%), irregular iron oxide (1.0%), recrystallized cement.
FEATURES: Strain shadow in quartz grains, well-sorted, mature, no feldspar or rock fragments.
FULL ROCK NAME: Dolomitic sandstone or quartzite.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **003**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4127916
UTM EAST: 648694
ROCK AGE: Devonian

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcrop
ROCK UNIT: Guilmette Formation

ROCK DESCRIPTION: Light gray weathering, medium gray finely crystalline, thick bedded calcareous dolomite to dolomite. Sampled unit lies above quartz sandstone at GSCN2. Elephant-hide weathering on surface.

ROCK STRUCTURE: Bedding: N30E, 30SE
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Light gray, fine-grained compact dolomite with thin calcite veinlets.

TEXTURE: Mosaic, irregular intergrowth of dolomite crystals.
ESSENTIAL MINERALS: dolomite (98%, 0.05 X 0.06mm), anhedral.

ACCESSORY MINERALS: Quartz (1.0%), calcite (1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite, trace of quartz and calcite

CEMENT:
FEATURES: Veinlets of calcite, trace of detrital quartz grains
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **004**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4126375
UTM EAST: 650252
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcrop (float)
ROCK UNIT: Shingle Pass Tuff

ROCK DESCRIPTION: Light to medium brown weathering, light gray ignimbrite. Moderate amount of crystals of biotite (golden and black), and feldspar. Double ridge crest indicates at least 2 cooling units.

ROCK STRUCTURE: Bedding : (est.) N0W, 10E
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Light gray to brownish volcanic rock containing phenocrysts of feldspars and biotite in an aphanitic groundmass.

TEXTURE: Porphyritic
ESSENTIAL MINERALS: sanidine (15%, less than 1.5 X 1.0mm, subhedral), andesine (13%, less than 2 X 1.5mm, subhedral), biotite (5.0%, less than 1.5 X 0.3mm , subhedral). Groundmass 66%, aphanitic, cryptocrystalline.

ACCESSORY MINERALS: Diopside, apatite (1.0%).
SECONDARY: Partial resorption of biotite.
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, oligoclase, biotite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 005

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4124096
UTM EAST: 649849
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Float from outcrop
ROCK UNIT: Tbl(?) - basalt

ROCK DESCRIPTION: Black weathering, black basalt. Locally vesicular; sample is massive. Contains common 1mm fresh olivine phenocrysts.

ROCK STRUCTURE: Flow est N0W, 5E
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Dark gray, fine-grained and compact igneous rock with occasional larger phenocrysts of olivine.

TEXTURE: Porphyritic, phaneritic with spare olivine phenocrysts in a crystalline groundmass consisting of intergrown plagioclase and olivine.
ESSENTIAL MINERALS: Phenocryst olivine (5.0%, <15 X 1.0mm, anhedral). Groundmass: 95%. Labradorite (60%, <0.2 X 0.03mm, subhedral), olivine (17%, <0.05 X 0.04mm, anhedral), magnetite (10%, <0.03 X 0.03mm, anhedral).

ACCESSORY MINERALS:
SECONDARY: Iddingsite (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Plagioclase, olivine.

CEMENT:
FEATURES:
FULL ROCK NAME: Olivine basalt.
GENERAL ROCK NAME: Mafic igneous rock

SAMPLE NUMBER: 006

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4124216
UTM EAST: 649956
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcrop in wash
ROCK UNIT: Hiko Tuff

ROCK DESCRIPTION: Light tan weathering, white ignimbrite by biotite, feldspar, and slightly smoky quartz phenocrysts. Crystal rich, probably not strongly welded, no large pumice.

ROCK STRUCTURE:
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Light gray porphyritic igneous rock with abundant phenocrysts of feldspar and biotite.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: sanidine (30%, <20 X 1.8mm, subhedral), andesine (25%, <20 X 1.6mm, subhedral), biotite (7.0%, <1.0 X 0.5mm, subhedral), andesine (25%, <2.0 X 1.6mm, subhedral), biotite (7.0%, <1.0 X 0.5mm, subhedral), hornblende (5.0%, <2.0 X 1.0mm, subhedral). Groundmass: 28%, aphanitic with alteration partially to sericite.

ACCESSORY MINERALS: Sphene, magnetite (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES:
FULL ROCK NAME: Dacite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 007

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4126077
UTM EAST: 627230
ROCK AGE: Mississippian(?)

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE:
ROCK UNIT: Chainman(?) Shale

ROCK DESCRIPTION: Reddish and tan weathering, black siltstone with shaly platy parting. Float noted indicates some interbedded black chert in the shale unit.

ROCK STRUCTURE: Bedding: N55E, 30NW
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 8/29/94
HAND SPECIMEN STUDY: Pinkish brown, very fine-grained siltstone.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (65%, <0.05mm, subangular, equant), dolomite (15%, <0.05mm,rhombohedral).
XRAY STUDY:

CEMENT: Ferruginous (12%), calcareous (3.0%).
FEATURES:
FULL ROCK NAME: Ferruginous siltstone.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 008

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4126124
UTM EAST: 627265
ROCK AGE: Mississippian

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE: Outcrop
ROCK UNIT: Mississippian limestone

ROCK DESCRIPTION: Light gray limestone, massive to thick bedded, recrystallized coarsely crystalline limestone.

ROCK STRUCTURE:
REMARKS: Overlies black shale (GSCN7). Conodonts indicate that the sampled unit is equivalent to the Joana Limestone (A. G. Harris, written communication, 1996).

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 8/30/94
HAND SPECIMEN STUDY: Light gray, coarse-grained limestone.

TEXTURE: Mosaic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS: Calcite (99%, <2.0mm, irregular).
DETRITAL MINERALS:
XRAY STUDY: Calcite, trace quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 009

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4125064
UTM EAST: 629645
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE: outcrop
ROCK UNIT: Tvg(?) - rhyodacite ignimbrite

ROCK DESCRIPTION: Light brownish gray weathering, light gray ignimbrite with biotite, quartz, and feldspar. Moderately crystal rich; glassy ash matrix.

ROCK STRUCTURE: Compaction? foliation: N3SW, 25SW.
REMARKS: This unit could be Hiko. It is capped by basalt.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 8/30/94

HAND SPECIMEN STUDY: Light brownish volcanic rock with phenocrysts of feldspars, biotite, and hornblende embedded in light-colored groundmass.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: sanidine (15%, <1.3 X 1.0mm, anhedral), andesine (12%, <1.0 X 0.8mm, subhedral), hornblende (10%, <1.0mm X 0.5mm, subhedral), biotite (8.0%, <0.5mm, subhedral). Groundmass: glass (47%, irregular).

ACCESSORY MINERALS: Magnetite (2.0%), apatite (1.0%).
SECONDARY: Calcite (5.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES:
FULL ROCK NAME: Dacite tuff.
GENERAL ROCK NAME: Silicic igneous rock.

SAMPLE NUMBER: 010

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4125148
UTM EAST: 629289
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE: Outcrop
ROCK UNIT: Rhyolite ignimbrite

ROCK DESCRIPTION: Very light gray to white ignimbrite; unwelded with obvious parting. Nearby beds show surge features. Pumice and lithic rhyolite tuff. The lithic fragments are white to reddish rhyolitic flow rocks. This unit either lies above, or is more likely faulted against a biotite-quartz tuff like GSCN 9, which could be Hiko.

ROCK STRUCTURE: Bedding: N15E, 70SE
REMARKS: This is at proposed sample site 98.

REFERENCES: Jayko, in press
ANALYST: L. C. Hsu
LAB DATE: 3/7/95

HAND SPECIMEN STUDY: Light brown tuffaceous rock with crystals of feldspar and porous lithic fragments.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Sanidine (<7%, 2 mm, angular), sodic plagioclase (<2%, <1 mm, angular), lithic fragments (<2%, <1 mm, subrounded). Matrix: volcanic glass with perlitic cracks.

ACCESSORY MINERALS: Biotite (including altered) + magnetite (<1%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 012

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4125230
UTM EAST: 628707
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE: Outcrop
ROCK UNIT: Monotony Tuff

ROCK DESCRIPTION: Light brownish-gray weathering, light gray ignimbrite with common biotite and quartz, crystal rich; quartz is a hazy, white smoky color. Pumice is apparently sparse. Weathers to rounded boulders of decomposition with small pock-mark pits. Underlies GSCN 11 (Shingle Pass). Rather massive here; no obvious foliation.

ROCK STRUCTURE:

REMARKS: The Monotony Tuff was sampled during the Desert Game Range project (GSCGR72).

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 11/1/94

HAND SPECIMEN STUDY: Dark gray porphyritic igneous rock with coarse crystals of feldspars, biotite, and quartz.

TEXTURE: Porphyritic with glassy groundmass.

ESSENTIAL MINERALS: Sanidine (30%, < 3 X 2mm, subhedral), andesine (20%, < 1.5mm, euhedral to subhedral), biotite (15%, < 2mm, euhedral), hornblende (8.0%, < 1.5 X 1mm, euhedral). Groundmass: glassy (18%).

ACCESSORY MINERALS: Quartz (5.0%), magnetite (4.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, plagioclase, biotite, amphibolite, quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Dacite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 013

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4125152
UTM EAST: 627874
ROCK AGE: Tertiary Cretaceous

COLLECTOR: L.J. Garside, S.W. Kamber
QUADRANGLE NAME: Groom Range SE
OCCURRENCE: Outcrop
ROCK UNIT: TKs - conglomerate

ROCK DESCRIPTION: Gray and reddish-yellow weathering orangish and gray chert and limestone pebble conglomerate and interbedded sandstone (both included in sample). One of many beds of conglomerate with less resistant conglomerate and sandstone in between. Overlain by ignimbrite. Pebbles are rounded to well rounded. Some pebbles of quartzite also.

ROCK STRUCTURE: Bedding: N40E, 10SE

REMARKS: Thin section made of crushed rock fragments.

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 3/7/95

HAND SPECIMEN STUDY: Conglomerate with varying rock types.

TEXTURE: Clastic.

ESSENTIAL MINERALS: The following rock clasts were noted. Quartzite with minor ferruginous cement; chert - chalcedony accompanied by dolomite rhombs and calcite veins; carbonate - includes pure dolomite, dolomitic limestone, and limestone (all in mosaic texture), and biogenic limestone; breccia and conglomerates - clasts of angular or rounded chert, carbonate, and quartzite; and quartz grains cemented by carbonate.

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY:

CEMENT:

FEATURES:

FULL ROCK NAME: Conglomerate.

GENERAL ROCK NAME: Conglomerate

SAMPLE NUMBER: 014

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4118301
UTM EAST: 645259
ROCK AGE:

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Desert Hills NE
OCCURRENCE: Subdued Outcrop
ROCK UNIT: Dunderberg Shale

ROCK DESCRIPTION: Light gray weathering, brownish gray, chippy and platy weathering shale. Apparently interbedded here with limestone beds.

ROCK STRUCTURE: East dipping
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 10/26/94
HAND SPECIMEN STUDY: Grayish brown, silty rock broken into scaly pieces.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (20%, < 0.1mm, subangular to subrounded), muscovite (1.0%, <0.2 X .02mm, angular), tubular fossils (5.0%).

XRAY STUDY: Quartz, illite, chlorite.

CEMENT: Argillaceous matter (74%) consisting of illite and chlorite with limonitic staining.
FEATURES:
FULL ROCK NAME: Siltstone or very fine-grained sandstone.

GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 015

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4122520
UTM EAST: 648202
ROCK AGE: Silurian

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Desert Hills NE
OCCURRENCE: Outcrop
ROCK UNIT: Laketown Dolomite

ROCK DESCRIPTION: Light gray weathering, medium dark gray dolomitic limestone or calcareous dolomite. Medium and thick bedded, fine to medium crystalline.

ROCK STRUCTURE: Bedding: N5W, 25E
REMARKS:

REFERENCES: Jayko, in press **ANALYST:** L. C. Hsu **LAB DATE:** 11/1/94
HAND SPECIMEN STUDY: Gray, compact, medium-grained dolomite.

TEXTURE: Equigranular mosaic.
ESSENTIAL MINERALS: Dolomite (100%, mostly <0.5mm, occasionally up to 1.0mm, anhedral, interlocking).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 016

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4049199
UTM EAST: 624694
ROCK AGE: Devonian

COLLECTOR: L.J. Garside, P.M. Goldstrand
QUADRANGLE NAME: Indian Spring SE
OCCURRENCE: Outcrop
ROCK UNIT: Simonson Formation

ROCK DESCRIPTION: Light gray weathering, medium gray, thick bedded to massive dolomite; elephant-hide weathering texture.

ROCK STRUCTURE:
REMARKS:

REFERENCES: Guth, in prep. **ANALYST:** L. C. Hsu **LAB DATE:** 11/1/94
HAND SPECIMEN STUDY: Light gray, dense, and very fine-grained dolomite.

TEXTURE: Equigranular mosaic.
ESSENTIAL MINERALS: Dolomite (97%, <0.1mm, anhedral, interlocking).

ACCESSORY MINERALS: Quartz (3.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite, trace quartz.

CEMENT:
FEATURES: A band of finer dolomite containing more quartz grains. Irregular veinlets containing coarser dolomite.
FULL ROCK NAME: Dolomite. **GENERAL ROCK NAME:** Dolomite

SAMPLE NUMBER: 017

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4105299
UTM EAST: 631925
ROCK AGE: Ordovician

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Southeastern Mine
OCCURRENCE: Outcrop
ROCK UNIT: Pogonip Group

ROCK DESCRIPTION: Medium gray weathering, medium gray, medium crystalline dolomite. Finely laminated and thinly wavy bedded locally. The Pogonip in this area is a homoclinal sequence of thick bedded and massive, alternating light and medium- to dark-gray weathering units, each several meters thick.

ROCK STRUCTURE: Bedding: N40W, 30SW
REMARKS: Iron staining or fractures difficult to avoid in sample.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/1/94
HAND SPECIMEN STUDY: Dark gray, compact, fine-grained dolomite with irregular pods consisting of coarser dolomite.

TEXTURE: Equigranular, mosaic.
ESSENTIAL MINERALS: Dolomite (100%, <0.2mm, anhedral, interlocking).

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite.

CEMENT:
FEATURES: White irregular pods or lenses containing much coarser dolomite up to 1.5mm.
FULL ROCK NAME: Dolomite. **GENERAL ROCK NAME:** Dolomite

SAMPLE NUMBER: 018

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4106287
UTM EAST: 632971
ROCK AGE: Ordovician

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Southeastern Mine
OCCURRENCE: Outcrop on ridge crest
ROCK UNIT: Eureka Quartzite

ROCK DESCRIPTION: Brown and light tan weathering, light gray to white quartzite.

ROCK STRUCTURE:
REMARKS: Sample site is 1-2m stratigraphically below the Ely Springs-Eureka contact.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/1/94
HAND SPECIMEN STUDY: Whitish gray, medium-grained, compact sandstone.

TEXTURE: Clastic, interlocking.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (96%, <0.4mm, rounded to subrounded, well-sorted).
XRAY STUDY: Quartz, dolomite.

CEMENT: Dolomite (4.0%).
FEATURES: Strain shadows of quartz grains.
FULL ROCK NAME: Quartz sandstone.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 019

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4119796
UTM EAST: 628161
ROCK AGE: Devonian

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Fallout Hills NE
OCCURRENCE: Outcrop
ROCK UNIT: Guilmette Formation

ROCK DESCRIPTION: Medium gray weathering, medium gray, medium thick bedded, well bedded limestone

ROCK STRUCTURE: Bedding: near horizontal
REMARKS: Photo 27 is of sample site, with purple pack; more well-bedded Guilmette in background. Photo 28 is of a brown 1.0m diameter lag boulder of Eureka Quartzite; which apparently was derived from the Tkg unit which occurs in small patches near this ridge. Apparently there was a lot of relief on the pre-Tkg surface. Photo 29 looking East from the site; Guilmette overlain by orange Tkg, overlain by several ash-flow tuffs (red and white ridges in middle distance).
REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/1/94
HAND SPECIMEN STUDY: Gray compact limestone

TEXTURE: Clastic with fossil fragments and sandy quartz grains in microcrystalline micrite matrix.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Fossil fragments (65%, irregular shape and size), quartz (5.0%, <0.5mm, rounded).
XRAY STUDY: Calcite, quartz.

CEMENT: Calcite (30%).
FEATURES: Irregular calcite veinlets.
FULL ROCK NAME: Sandy limestone (biomicrite).
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **020**

FIELD DATE: 7/9/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4122851
QUADRANGLE NAME: Desert Hills NE
UTM EAST: 648023
OCCURRENCE: Outcrop
ROCK AGE: Ordovician
ROCK UNIT: Ely Springs Limestone

ROCK DESCRIPTION: Gray weathering dolomitic limestone, seen to be bioclastic on weathered surfaces. Blocky, lower part of unit (cliff former) has layers rich in chert. Top where sample taken has little or no chert. Looks sparry (not micritic). Overlain by slope forming unit and at least one more cliff forming unit.

ROCK STRUCTURE:

REMARKS: The outcrop was found near top of lowest cliff former which is about 50 feet thick and overlies transition to Oe.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94

HAND SPECIMEN STUDY: Gray, compact dolomite

TEXTURE: Clastic with fossil fragments in fine crystalline matrix of dolomite.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Fossil fragments (50%, irregular shape and size), quartz (5.0%, <0.05mm, rounded).

XRAY STUDY: Dolomite, quartz.

CEMENT: Dolomite (45%).

FEATURES:

FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **021**

FIELD DATE: 7/9/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4049898
QUADRANGLE NAME: Indian Springs SE
UTM EAST: 624628
OCCURRENCE: Outcrop
ROCK AGE: Devonian
ROCK UNIT: Dsca - Simonson Dolomite

ROCK DESCRIPTION: Chert and dolomite overlain by blocky dolomite with little chert. The chert is black to gray and occurs as irregular masses in specific beds. The dolomite is gray, sparry, and fine-grained. No shale seen in section.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94

HAND SPECIMEN STUDY: Dark gray, dense and very fine-grained dolomite.

TEXTURE: Microcrystalline, mosaic with dolomite grains <20 micrometers.

ESSENTIAL MINERALS: Dolomite (92%, <20 micrometers, interlocking).

ACCESSORY MINERALS:

SECONDARY: Iron oxide (1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (7.0%, <0.1mm, rounded), trace feldspar.

XRAY STUDY: Dolomite, quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Sandy dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **022**

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4105446
UTM EAST: 632535
ROCK AGE: Ordovician

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Southeastern Mine
OCCURRENCE: Outcrop on ridgetop
ROCK UNIT: Pogonip Formation, upper part

ROCK DESCRIPTION: Gray dolomite in section mainly with or without chert (a few ten-foot thick horizons contain chert) and minor dark gray limestone. Horizons with chert and minor dark gray limestone. Sample is of gray sparry dolomite with minor black chert. Sample appears to be representative of at least 100 feet of section.

ROCK STRUCTURE:

REMARKS: Conodont data indicate that the sampled unit is from the very lowest Pogonip or possibly lower in the stratigraphic section (A. G. Harris, written communication, 1996).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94

HAND SPECIMEN STUDY: Light gray, medium to fine-grained dolomite.

TEXTURE: Mosaic with interlocking anhedral dolomite grains. Occasional detrital quartz grains also observed.

ESSENTIAL MINERALS: Dolomite (97%, <0.5mm, anhedral).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (3.0%, <0.1mm, rounded).

XRAY STUDY: Dolomite, trace quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Sandy dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **023**

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4079867
UTM EAST: 632328
ROCK AGE: Tertiary

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Tim Spring
OCCURRENCE: Lower hills pediment
ROCK UNIT: Dacite tuff

ROCK DESCRIPTION: Crystal tuff, tan, fine grained crystals (approximately 10%) consist mostly of biotite with minor amounts of quartz and hornblende, no good outcrops. Moderately indurated, nonwelded.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 8/30/94

HAND SPECIMEN STUDY: Light brownish porphyritic volcanic rock with phenocrysts of feldspars, biotite, hornblende, and probably quartz.

TEXTURE: Porphyritic

ESSENTIAL MINERALS: Phenocrysts: andesine (7.0%, <1.5 X 0.5mm, anhedral), sanidine (5.0%, <1.0 X 0.5mm, anhedral), quartz (8.0%, <2.0 X 1.5mm, anhedral), biotite (9.0%, <1.5 X 0.6mm, subhedral), hornblende (5.0%, <1.0 X 0.6mm, subhedral). Groundmass glass (50%), other groundmass minerals (8.0%).

ACCESSORY MINERALS: Magnetite (2.0%), sphene (1.0%).

SECONDARY: Calcite (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Feldspar, quartz, glass.

CEMENT:

FEATURES:

FULL ROCK NAME: Dacite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **024**

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4083372
UTM EAST: 646097
ROCK AGE: Cambrian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Burro Basin
OCCURRENCE: Steep Slope
ROCK UNIT: Carrara Formation

ROCK DESCRIPTION: Green siltstone with interbeds of quartzite. Platy, laminated.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 8/30/94

HAND SPECIMEN STUDY: Brownish gray, very fine-grained, silty to clayey rock with mica flakes.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS: Kaolinite (5.0%).

DETRITAL MINERALS: Quartz (35%, <0.05 X .04mm, subrounded), plagioclase (10%, <0.05 - 0.03 mm, subangular), mica (8.0%, <0.2 X .005mm, angular).

XRAY STUDY: Quartz, mica, kaolinite, feldspar.

CEMENT: Ferruginous and argillaceous matter (47%).
FEATURES:
FULL ROCK NAME: Siltstone.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: **025**

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4118302
UTM EAST: 646099
ROCK AGE: Cambrian

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Desert Hills NE
OCCURRENCE: Outcrop
ROCK UNIT: Nopah Formation

ROCK DESCRIPTION: Gray fine grained dolomitic limestone, locally a breccia with calcrete. Gray mottled weathering surface. Sandy looking on weathered surface. Sparry.

ROCK STRUCTURE:
REMARKS: Sample on ridge top difficult to get to.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94

HAND SPECIMEN STUDY: Gray, fine-grained dolomite

TEXTURE: Mosaic, with interlocking anhedral dolomite grains.
ESSENTIAL MINERALS: Dolomite (>99%, <0.1mm, anhedral)

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (<1.0%, <0.02mm, rounded).

XRAY STUDY: Dolomite, trace quartz.

CEMENT:
FEATURES: Growth of dolomite crystals in voids.
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 026

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4125828
UTM EAST: 647065
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Outcropping approx. 2-3 inches
ROCK UNIT: Pogonip Formation (upper)

ROCK DESCRIPTION: Limestone, dark gray to light gray bands, thin to thick bedded, bioclastic, intraformational breccia. Wispy yellow-orange micritic interbeds, very fine crystalline fossils - brachiopods, gastropods, oncolites.

ROCK STRUCTURE: Well bedded, thin & thick bedded.

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 8/30/94

HAND SPECIMEN STUDY: Gray, dense carbonate.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Calcite as biofragments (10%, irregular), quartz (5.0%, <0.05 X .04mm, subrounded).

XRAY STUDY: Calcite, quartz, dolomite.

CEMENT: Carbonate matter, calcite (82%), dolomite (3.0%).

FEATURES:

FULL ROCK NAME: Limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 027

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4127666
UTM EAST: 648579
ROCK AGE: Devonian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Badger Spring
OCCURRENCE: Ledge and bench forming
ROCK UNIT: Simonson Dolomite

ROCK DESCRIPTION: Dolomite, interbedded medium to dark gray, thickly bedded, aphanitic to finely crystalline, fetid. Bioclastic beds rare, but oncolites (up to 5cm diameter) abundant. Also possible stromatolitic rip-ups. Chert nodules weathered, (approximately 5.0%) orange with black (fresh) 5cm diameter associated with oncolites and rarely concentrated along fractures. Several thick beds of algal/stromatolite rip-up clasts up to 25cm long with oncolites mottled dark and light gray.

ROCK STRUCTURE: Thin (2-3mm) calcite veinlets throughout, but not abundant. Major vein orientations: trends N70E and N10E.

REMARKS: Photo Dev.. outcrop. Small fault just to north, approximately 20 m displacement. South side up.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 9/1/94

HAND SPECIMEN STUDY: Gray, dense carbonate.

TEXTURE: Mosaic

ESSENTIAL MINERALS: Calcite (100%, 0.1 X 0.2mm, locally irregular areas of coarser crystals 0.5 X 0.5mm).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **028**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Badger Spring
UTM NORTH: 4124475
UTM EAST: 648972
OCCURRENCE: Small benches and slopes.
ROCK AGE: Devonian
ROCK UNIT: Sevy Dolomite

ROCK DESCRIPTION: Very light gray to medium gray, very finely crystalline dolomite, laminated (horizontal) to thin bedded, interbedded very light gray and darker gray. Beds of oncolites present but not abundant.

ROCK STRUCTURE: N20W, 40NE strike and dip
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/1/94
HAND SPECIMEN STUDY: Light brownish, fine-grained dolomite.

TEXTURE: Mosaic
ESSENTIAL MINERALS: Dolomite (99%, <0.05 X 0.04mm)

ACCESSORY MINERALS:
SECONDARY: Iron oxides (1.0%)
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **029**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Badges Spring
UTM NORTH: 4124637
UTM EAST: 649494
OCCURRENCE: Resistant cliff
ROCK AGE: Tertiary
ROCK UNIT: Harmony Hills tuff

ROCK DESCRIPTION: Crystal tuff; light pink (fresh), brown-orange (weathered) andesitic, 30% crystals. Black subhedral biotite books, quartz and plagioclase.

ROCK STRUCTURE:
REMARKS: The resistant cliff listed above was approximately 6 to 8 meters high.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/1/94
HAND SPECIMEN STUDY: Grayish brown, porphyritic volcanic cracks with biotite, hornblende, and feldspar as phenocrysts.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: andesine (15%, <2.5 X 1.5mm, subhedral), biotite (12%, <1.0 X 0.5mm, euhedral), hornblende (8.0%, <1.0 X 0.5mm, euhedral), diopside (7.0%, <1.5 X 1.0mm, subhedral), quartz (2.0%, <0.05 X 0.05mm, subhedral), sanidine (1.0%). Groundmass: glass (47%).

ACCESSORY MINERALS: Magnetite (5.0%).
SECONDARY: Calcite (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES:
FULL ROCK NAME: Dacite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **030**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4052199
UTM EAST: 630804
ROCK AGE: Devonian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Indian Springs SE
OCCURRENCE: low (1-2m) ledges
ROCK UNIT: Sevy and Laketown Dolomites (undifferentiated)

ROCK DESCRIPTION: Dolomite, tan (weathered surface), tan and light gray (fresh), medium to finely crystalline, rare (orange weathering), chert nodules, small (2-10mm) vugs common, fetid beds 0.2 to 0.5m thick. No sedimentary structures observed. No fossils observed, recrystallized.

ROCK STRUCTURE: N30E, 67SE strike and dip
REMARKS: Brecciated dolomite with no alteration in this area.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/1/94
HAND SPECIMEN STUDY: Whitish gray, coarse-grained dolomite.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Dolomite (less than 98%, less than 2.0 X 2.0mm, anhedral).

ACCESSORY MINERALS: Quartz (less than 2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **031**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4069324
UTM EAST: 641026
ROCK AGE: Tertiary

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Dog Bone Lake South
OCCURRENCE: Low ledges, blocky
ROCK UNIT: Tys - younger basin sedimentary rock

ROCK DESCRIPTION: Conglomerate, medium to dark gray, massive to faint (thick) bedding. Clast supported. Clasts: 95% dark gray limestone with laminations (possibly derived from lower Paleozoic carbonates); 5.0% quartzite and calcareous sandstone very fine-grained, laminated, black-brown weathered surface, tan on fresh. Clasts subangular, pebble to cobble size. No sedimentary structure observed (structureless). Limestone clasts and sandstone clasts appear in separate beds. Matrix: sandy limestone.

ROCK STRUCTURE:
REMARKS: Interpretation: fanglomerate from Pz carbonate and quartzite.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/1/94
HAND SPECIMEN STUDY: Dark gray carbonate fragments, recemented by lighter-colored carbonate.

TEXTURE: Mosaic, brecciated fragments
ESSENTIAL MINERALS: Calcite (greater than 95%, less than .01 X .01 mm, anhedral).

ACCESSORY MINERALS: Dolomite (<5.0%, >.002 X .02mm).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Calcite, dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Limestone breccia.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 032

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4073927
UTM EAST: 645899
ROCK AGE: Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Dead Horse Ridge
OCCURRENCE: Benches and slopes
ROCK UNIT: Johnnie Formation

ROCK DESCRIPTION: Interbedded gray and tan limestone, beds thin to thick, bed of coarse quartz in carbonate matrix, brown calcareous sandstone; and black brown (weathered), white (fresh) quartzite sample: limestone. Medium to dark gray, laminated, dolomite medium crystaline, white (4-5mm) calcite veins common throughout.

ROCK STRUCTURE: Outcrop: beds folded
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94

HAND SPECIMEN STUDY: Brownish gray, fine-grained calcareous sandstone with white, irregular veinlets of calcite.

TEXTURE: Clastic
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (50%, <0.2 X 0.2mm, subangular to subrounded), feldspars (5.0%), muscovite (3.0%).
XRAY STUDY: Calcite, quartz, dolomite, feldspar

CEMENT: Calcareous matter: calcite (33%), dolomite (2.0%).
FEATURES: Calcite veinlets (7.0%).
FULL ROCK NAME: Calcareous sandstone.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 033

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4073918
UTM EAST: 645908
ROCK AGE: Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Dead Horse Ridge
OCCURRENCE: Benches and slopes
ROCK UNIT: Johnnie Formation

ROCK DESCRIPTION: See description GSCN 32 Sample: Quartzite interbeds of shale and calcareous sandstone laminated, trough and tabular cross stratification black and orange on weathered surface, pink to tan on fresh, some micaceous beds. Sandstone/quartzite very fine to fine grained. Well sorted.

ROCK STRUCTURE: Folded
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94

HAND SPECIMEN STUDY: Brownish gray, fine-grained carbonate with mica flakes.

TEXTURE: Mosaic, interlocking of irregular mineral grains.
ESSENTIAL MINERALS: Calcite (45%, <0.1mm, irregular), quartz (30%, <0.1mm, irregular),dolomite (18%, <0.05mm, rhombic), sodic plagioclase (6.0%, <0.1mm,irregular), muscovite (3.0%) .

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Calcite, quartz, dolomite, feldspars, muscovite.

CEMENT:
FEATURES:
FULL ROCK NAME: Siliceous dolomitic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 034

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4074077
QUADRANGLE NAME: Dead Horse Ridge
UTM EAST: 647018
OCCURRENCE: Steep benches and slopes.
ROCK AGE: Late Proterozoic
ROCK UNIT: Johnnie Formation

ROCK DESCRIPTION: Interbedded quartzite and siltstone. Sample: Quartzite, green, platy, very fine grained, well sorted, ripple marks, horizontal stratification, micaceous. Well bedded, thinly bedded.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94

HAND SPECIMEN STUDY: Green, finely-laminated shale with tiny shining specks of mica.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS: Goethite (3.0%), chlorite (25%).

DETRITAL MINERALS: Quartz (40%, <0.1mm, angular), chlorite (15%, <0.4 X 0.1mm, angular), muscovite (5.0%, <0.3 X 0.6mm, angular), plagioclase (5.0%).

XRAY STUDY: Quartz, chlorite, muscovite, feldspar.

CEMENT: Argillaceous matter (7.0%)

FEATURES: Interlaminar growth of chlorite and mica.

FULL ROCK NAME: Green silty shale.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 035

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4074284
QUADRANGLE NAME: Dead Horse Ridge
UTM EAST: 648639
OCCURRENCE: 2-3m ledge
ROCK AGE: Cambrian to Late Proterozoic
ROCK UNIT: Stirling Quartzite

ROCK DESCRIPTION: Quartzite: weathers black, brown, and pink. Pink (fresh). Coarse to very coarse grained, well to moderately sorted, few beds of quartz pebbles. Beds 1 to 2m thick, structureless.

ROCK STRUCTURE: N25E, 45SE, strike and dip

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94

HAND SPECIMEN STUDY: Light brownish, pebbly, coarse sandstone with druses developed from where less resistant minerals or aggregates occupy.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS: Goethite (18%).

DETRITAL MINERALS: Quartz (70%, <1.5 X 1.5mm, subangular), quartzite grains (15%, <4. X 4.0mm, subangular), feldspars (0.4%, <1.0mm).

XRAY STUDY: Quartz, feldspar, trace mica.

CEMENT: Sericitic matter (6.0%).

FEATURES: Strain shadows in quartz grains and quartzite grains.

FULL ROCK NAME: Pebbly sandstone.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 036

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4074510
UTM EAST: 649738
ROCK AGE: Cambrian to Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Dead Horse Ridge
OCCURRENCE: Ledges and slopes
ROCK UNIT: Wood Canyon Formation

ROCK DESCRIPTION: Quartzite: brown-pink (weathered surface); pink (fresh). Fine grained (mostly) but some coarse grained. Beds 1-2m thick, horizontal laminations, tabular cross stratification, well sorted.

ROCK STRUCTURE: N10W 45E strike and dip
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94
HAND SPECIMEN STUDY: Pinkish coarse sandstone with rounded grain boundaries.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

DETRITAL MINERALS: Quartz (50%, 1.0mm rounded; 37%, 0.15mm, subrounded), quartzite (5.0%, 1.0mm, rounded), feldspar (2.0%, 1.0mm, rounded), chert (3.0%, 1mm, rounded).
AUTHIGENIC MINERALS:
XRAY STUDY: Quartz.

CEMENT: Micaceous matter (3.0%).
FEATURES: Two size populations in quartz grains, strain shadows of some quartz and quartzite grains.
FULL ROCK NAME: Sandstone.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 037

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4074593
UTM EAST: 650079
ROCK AGE: Cambrian to Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Dead Horse Ridge
OCCURRENCE: Ledge and slope
ROCK UNIT: Wood Canyon Formation

ROCK DESCRIPTION: Interbedded quartzite (dark purple, weathered) and gray (fresh), with purple siltstone. Very thin to medium thick laminated (horizontal). Quartzite well sorted, very fine-grained. Siltstone slightly micaceous.

ROCK STRUCTURE: N101W 65E strike and dip
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/6/94
HAND SPECIMEN STUDY: Reddish brown, compact sandstone.

TEXTURE: Clastic
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

DETRITAL MINERALS: Quartz (45%, approx. 0.1mm, subangular), K-feldspar (25%, 0.1mm, subangular sodic plagioclase (15%, 0.1mm, subangular), calcite (3.0%), iron oxide (6.0%), mica, sphene (2.0%).
AUTHIGENIC MINERALS:
XRAY STUDY: Quartz, feldspars

CEMENT: Micaceous matter (2.0%)
FEATURES: Fine lamination due to accumulation of iron oxides.
FULL ROCK NAME: Arkose.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **038**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4064997
UTM EAST: 644092
ROCK AGE: Cambrian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Black Hills NW
OCCURRENCE: outcrop
ROCK UNIT: Bonanza King Formation

ROCK DESCRIPTION: Limestone, mottled dark gray and medium gray, bed 0.5 to 1.0 meters thick. No sedimentary structures observed, white calcite veins (5-6 mm thick) throughout.

ROCK STRUCTURE:
REMARKS: Outcrop- Dark gray steep ledges and cliffs.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 9/8/94
HAND SPECIMEN STUDY: Dark gray, fine and compact carbonate rock with variation in shade of color.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Calcite (49%, <5.0mm, anhedral), dolomite (47%, <50 microns, rhombohedral).

ACCESSORY MINERALS: Quartz (1.0%, detrital).
SECONDARY: Limonitic matter (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Calcite, dolomite, trace quartz.

CEMENT:
FEATURES: Local irregular zone of compositional variation.
FULL ROCK NAME: Dolomitic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **039**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4064823
UTM EAST: 644863
ROCK AGE: Cambrian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Black Hills NW
OCCURRENCE: Cliff forming
ROCK UNIT: Bonanza King Formation

ROCK DESCRIPTION: Limestone, medium gray, well bedded, beds approximately 1 to 1.5m thick. Very coarsely recrystallized, abundant calcite veins.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 9/8/94
HAND SPECIMEN STUDY: Light gray fossiliferous limestone with irregular calcite veinlets.

TEXTURE: Clastic, biomicritic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS: Calcite (65%, irregular).
XRAY STUDY: Calcite

CEMENT: Calcite (32%).
FEATURES: Fossil fragments consisting of calcite are held together by extremely fine-grained calcite cement. Veinlets of calcite (2.0%).
FULL ROCK NAME: Biomicritic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 040

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4064182
QUADRANGLE NAME: White Sage Flat
UTM EAST: 645373
OCCURRENCE: Steep benches
ROCK AGE: Cambrian
ROCK UNIT: Nopah Formation

ROCK DESCRIPTION: Dolomite and limestone, mottled dark gray and medium gray, medium to coarse crystalline. Beds 0.5 to 2.0m thick, abundant calcite veins.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/8/94

HAND SPECIMEN STUDY: Dark gray carbonate rock with white veinlets of calcite.

TEXTURE: Clastic, biomicritic, mosaic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS: Detrital quartz (1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Calcite granules (55%, 0.4mm, rounded).

XRAY STUDY: Calcite, trace dolomite, trace quartz.

CEMENT: Calcite (35%).

FEATURES: Rounded granular calcite aggregates in coarse calcite matrix, vein calcite (10%).

FULL ROCK NAME: Limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 041

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4063829
QUADRANGLE NAME: White Sage Flat
UTM EAST: 645723
OCCURRENCE: Cliff formed
ROCK AGE: Cambrian
ROCK UNIT: Nopah Formation

ROCK DESCRIPTION: Dolomite, light gray to tan, 0.5m thick beds, faint laminations, bioclastics, very coarsely recrystallized.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/8/94

HAND SPECIMEN STUDY: Gray, granular dolomite.

TEXTURE: Mosaic

ESSENTIAL MINERALS: Dolomite (98%, variable size from 1.0mm to 0.03mm, irregular interlocking).

ACCESSORY MINERALS: Detrital quartz, iron oxide (2.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Dolomite, quartz, trace calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **042**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4063641
UTM EAST: 645862
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: White Sage Flat
OCCURRENCE: Cliff- forming
ROCK UNIT: Goodwin Limestone

ROCK DESCRIPTION: Dolomite: light gray to brown on weathered surface. Very dark gray to light gray (fresh); medium to coarsely crystalline, few 1.0cm vugs, beds 0.2 to 0.5m thick.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/8/94
HAND SPECIMEN STUDY: Light gray to white dolomite.

TEXTURE: Mosaic
ESSENTIAL MINERALS: Dolomite (100%, two size populations of average of 0.5mm and 0.1mm, irregular shapes).

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES: Two populations of different grain sizes irregularly distributed.
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **043**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4063255
UTM EAST: 647593
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: White Sage Flat
OCCURRENCE: Cliff- forming, massive
ROCK UNIT: Ely Springs Dolomite

ROCK DESCRIPTION: Dolomite: black to dark gray, massive, bioclastic (recrystallized), medium to coarse crystalline bedding approximately 1.0 to 1.5m thick, slightly fetid.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/13/94
HAND SPECIMEN STUDY: Dark gray dolomite with local crystals above. 1-2mm size.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Dolomite (>99%, mostly 0.1mm, with occasional size >1.0mm, irregular shape).

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite, trace quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **044**

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: White Sage Flat
OCCURRENCE: Yellow-orange benches
ROCK UNIT: Eureka Quartzite

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4063312
UTM EAST: 647429
ROCK AGE: Ordovician

ROCK DESCRIPTION: Quartzite: weathered orange, white (fresh), fine to very fine-grained, some laminations, thin to medium bedded.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu **LAB DATE:** 9/13/94

HAND SPECIMEN STUDY: White, medium-grained orthoquartzite.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (>99%, 0.2mm, rounded).

XRAY STUDY: Quartz.

CEMENT: Micaceous matter (<1.0%).

FEATURES:

FULL ROCK NAME: Orthoquartzite.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **045**

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: White Sage Flat
OCCURRENCE: Steep benches
ROCK UNIT: Antelope Valley Limestone

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4063690
UTM EAST: 646998
ROCK AGE: Ordovician

ROCK DESCRIPTION: Limestone: medium gray, massive, partly dolomitic, fine to medium crystalline, possible bioturbation, white calcite-filled vugs common. Possible laminations. Gastropod fossils 20-30cm diameter and recrystallized.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu **LAB DATE:** 9/13/94

HAND SPECIMEN STUDY: Dark gray, medium-grained dolomite

TEXTURE: Mosaic.

ESSENTIAL MINERALS: Dolomite (95%, size variable from 0.05 to 1.0mm).

ACCESSORY MINERALS: Hematite (3.0%), quartz and calcite (2.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Dolomite, trace quartz and calcite.

CEMENT:

FEATURES: Rhombic grain boundaries often filled with limonitic matter;

FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **046**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4063348
UTM EAST: 646552
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: White Sage Flat
OCCURRENCE: Tan-orange cliffs
ROCK UNIT: Ops - limestone

ROCK DESCRIPTION: Limestone: medium gray, well bedded, beds 20cm to 50cm thick, some laminations in silty limestone beds, and intraformational conglomerate. Elongate chert nodules up to 0.5m long by 20cm thick along bedding planes, also some dolomitic limestone beds.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 9/13/94
HAND SPECIMEN STUDY: Light gray limestone.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Calcite (approximately 98%, 0.3mm, irregular, also as fine-filling in fossil fragments).

ACCESSORY MINERALS: Dolomite and quartz (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Calcite, trace dolomite and quartz.

CEMENT:
FEATURES: Spherical granules with radial calcite fibers, possibly of biologic origin.
FULL ROCK NAME: Limestone. **GENERAL ROCK NAME:** Limestone

SAMPLE NUMBER: **047**

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4083524
UTM EAST: 645396
ROCK AGE: Cambrian and Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Burro Basin
OCCURRENCE:
ROCK UNIT: Wood Canyon Formation

ROCK DESCRIPTION: Siltstone: green, platy, lightly micaceous, horizontal laminations thin interbeds of quartzite. Quartzite: fine grained, weathered surface red-brown, pink-gray (fresh), some tabular cross-beds. Sample: green siltstone.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 9/13/94
HAND SPECIMEN STUDY: Gray, very fine-grained sandstone with tiny specks of shining mica.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (45%, 0.1mm, angular), feldspars (20%, 0.1 X 0.2mm, angular, chlorite (12%, 0.2mm, angular), iron oxide (4.0%), muscovite (1.0%).
XRAY STUDY: Quartz, chlorite, feldspars, mica.

CEMENT: Sericitic matter (18%).
FEATURES:
FULL ROCK NAME: Arkosic siltstone. **GENERAL ROCK NAME:** Mudstone

SAMPLE NUMBER: 048

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4083517
UTM EAST: 645404
ROCK AGE: Cambrian and Late Proterozoic

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Burro Basin
OCCURRENCE:
ROCK UNIT: Wood Canyon Formation

ROCK DESCRIPTION: Siltstone: green, platy, slightly micaceous, horizontal laminations, thin interbeds of quartzite. Quartzite: fine grained, weathered surface red-brown, pink-gray (fresh) some tabular cross-beds. Sample: quartzite.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/16/94

HAND SPECIMEN STUDY: Reddish brown, fine-grained sandstone with reddish black laminae.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

DETRITAL MINERALS: Quartz (87%, <0.2mm, subrounded), K-feldspar and chert grains (5.0%, <0.1mm), rutile (<1.0%).

AUTHIGENIC MINERALS:

XRAY STUDY: Quartz, trace feldspar, mica and hematite.

CEMENT: Hematitic (4.0%), sericitic (3.0%).

FEATURES: Local laminae rich in hematitic cement.

FULL ROCK NAME: Sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 049

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4083354
UTM EAST: 645885
ROCK AGE: Cambrian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Burro Basin
OCCURRENCE: Steep benches
ROCK UNIT: Carrara Formation

ROCK DESCRIPTION: Quartzite with interbeds of green shale and siltstone, quartzite brown-purple (weathered), tan (fresh). Abundant tabular cross-stratification. Horizontal burrows on shale planes.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/16/94

HAND SPECIMEN STUDY: Reddish brown sandstone with white, rounded specks of clayey matter.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

DETRITAL MINERALS: Quartz (83%, 2.0 to 0.1mm, subrounded), clay granules (5.0%, <0.4mm rounded), rock grains (4.0%, <0.3mm, subrounded), K-feldspars (3.0%).

AUTHIGENIC MINERALS:

XRAY STUDY: Quartz, trace feldspar.

CEMENT: Ferruginous (5.0%).

FEATURES: Rounded granules of probably clayey matter as detritus.

FULL ROCK NAME: Sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 050

FIELD DATE: 6/27/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4083497
QUADRANGLE NAME: Burro Basin
UTM EAST: 646293
OCCURRENCE: Steep slopes
ROCK AGE: Cambrian
ROCK UNIT: Bonanza King Formation

ROCK DESCRIPTION: Shale, quartzite, and limestone interbeds. Does not look like Bonanza King--more likely Carrara. Shales: olive green, platy. Abundant horizontal burrows. Sample: limestone interbeds 0.5m thick mottled dark gray and tan. Oncolitic.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 9/16/94

HAND SPECIMEN STUDY: Gray limestone with fossil.

TEXTURE: Mosaic-biomicritic.

ESSENTIAL MINERALS: Calcite (90%, irregular size distribution and shape, 1.0mm to 0.01mm).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Plagioclase (7.0%, <0.05 X 0.04mm, angular), quartz (3.0%, 0.04 X 0.03mm, angular).

XRAY STUDY: Calcite, plagioclase, quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 051

FIELD DATE: 7/9/94
SCALE: 1:24,000
COLLECTOR: P.M. Goldstrand
UTM NORTH: 4118181
QUADRANGLE NAME: Desert Hills NE
UTM EAST: 645170
OCCURRENCE: Outcrop
ROCK AGE: Cambrian
ROCK UNIT: Bonanza King Formation

ROCK DESCRIPTION: Limestone, dark gray, coarse to very coarse crystalline, bioclastic, possible oolitic beds (thin and medium thick), stylolitic. Trilobite fragments present.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94

HAND SPECIMEN STUDY: Dark gray limestone with fossil fragments.

TEXTURE: Clastic with fossil fragments and detrital quartz grains in microcrystalline carbonate matrix.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Fossil fragments (65%, irregular shape and size), quartz (15%, <0.1mm, subrounded).

XRAY STUDY: Calcite, quartz.

CEMENT: Microcrystalline calcite (20%).

FEATURES:

FULL ROCK NAME: Limestone (biomicrite).

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **052**

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4122771
UTM EAST: 647942
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Desert Hills NE
OCCURRENCE: Outcrop
ROCK UNIT: Eureka Quartzite

ROCK DESCRIPTION: Quartzite, white to red-orange (weathered), white (fresh), fine-grained, thin to medium bedded, tabular cross-stratification common.

ROCK STRUCTURE:
REMARKS: Sample taken approximately 3 meters below Eureka Ely Springs contact. Site location plotted later by L.J. Garside

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/2/94
HAND SPECIMEN STUDY: White, compact, medium-grained sandstone.

TEXTURE: Clastic to mosaic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Quartz (>90%, <0.4mm, subrounded).
XRAY STUDY: Quartz

CEMENT: Quartz (>9.0%, calcite (<1.0%).
FEATURES: Occasional voids left during lithification.
FULL ROCK NAME: Orthoquartzite.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **053**

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4104826
UTM EAST: 631710
ROCK AGE: Ordovician

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: SE Mines
OCCURRENCE: Outcrop
ROCK UNIT: Nopah Formation, Smoky Member

ROCK DESCRIPTION: Limestone-medium gray, thin bedded 10% orange chert nodules. Very fine crystalline. Thin interbeds of fine to medium crystalline, dolomite (medium gray). Horizontal laminations in dolomites. In limestone units; bedding faint. Chert nodules scattered throughout, up to 1.0cm diameter, few elongate chert nodules concentrated along bedding planes.

ROCK STRUCTURE: N85W, 28N strike and dip
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/4/94
HAND SPECIMEN STUDY: Gray dense limestone with irregular calcite veinlets and occasional fossil fragments.

TEXTURE: Biomicritic with occasional fossil fragments in microcrystalline calcite matrix.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Fossil fragments (25%, irregular), quartz (<1.0%, <.01mm).
XRAY STUDY: Calcite, trace dolomite and quartz.

CEMENT: Microcrystalline calcite (>72%), dolomite (<2.0%).
FEATURES: Irregular calcite veinlets, locally iron-stained.
FULL ROCK NAME: Limestone (biomicrite).
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 054

FIELD DATE: 7/10/94

SCALE: 1:24,000

COLLECTOR: P.M. Goldstrand

UTM NORTH: 4106364

QUADRANGLE NAME: SE Mines

UTM EAST: 632942

OCCURRENCE: Outcrop

ROCK AGE: Ordovician

ROCK UNIT: Ely Springs Dolomite

ROCK DESCRIPTION: Dolomite, medium gray, fine crystalline structureless to thick bedded, possible bioclastics, 10% black chert nodules (1.0 to 5.0cm diameter) some concentrated along bedding, possible bioturbation. Brachiopods and crinoids observed.

ROCK STRUCTURE:

REMARKS: Sample collected approximately 10m from contact with Oe.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/4/94

HAND SPECIMEN STUDY: Dark gray, dense, very fine-grained dolomite.

TEXTURE: Mosaic, interlocking dolomite grains with minor to trace detrital quartz grains.

ESSENTIAL MINERALS: Dolomite (>97%, <0.1mm, anhedral).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (<3.0%, <0.1mm, rounded).

XRAY STUDY: Dolomite, trace quartz.

CEMENT:

FEATURES: Local patches of coarser grains up to 0.2mm.

FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 055

FIELD DATE: 7/10/94

SCALE: 1:24,000

COLLECTOR: P.M. Goldstrand

UTM NORTH: 4108172

QUADRANGLE NAME: SE Mines

UTM EAST: 632469

OCCURRENCE: Outcrop

ROCK AGE: Devonian

ROCK UNIT: Sevy Dolomite

ROCK DESCRIPTION: Dolomite, light gray, very fine crystalline, laminated to thin bedded, horizontal laminations with micrite interbeds. Rare tabular cross-stratification.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/4/94

HAND SPECIMEN STUDY: Grayish white, compact, very fine-grained dolomite.

TEXTURE: Mosaic, interlocking.

ESSENTIAL MINERALS: Dolomite (100%, <0.1mm, anhedral).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Dolomite.

CEMENT:

FEATURES:

FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 056

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4122750
UTM EAST: 626893
ROCK AGE: Mississippian

COLLECTOR: P.M. Goldstrand
QUADRANGLE NAME: Fallout Hills NE
OCCURRENCE: Outcrop
ROCK UNIT: Unnamed Mississippian limestone (Joana?)

ROCK DESCRIPTION: Limestone, medium to light gray, fossiliferous, crinoid columns and stems, rugose corals and brachiopods, also blastoid columns. Columns up to 1cm diameter and stems up to 5cm long. Slight petroliferous smell. Bedding not distinct; approximately medium to thickly bedded.

ROCK STRUCTURE:

REMARKS: Conodont data indicate that the sampled unit is Joana Limestone or equivalent (A. G. Harris, written communication, 1996).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/4/94

HAND SPECIMEN STUDY: Brownish white coarse-grained limestone with fossil fragments.

TEXTURE: Clastic, micric.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Fossil fragments (35%, irregular shape and size).

XRAY STUDY: Calcite

CEMENT: Calcite (65%).

FEATURES:

FULL ROCK NAME: Limestone (biomicrite).

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 059

FIELD DATE: 7/27/94
SCALE: 1:24,000
UTM NORTH: 4088819
UTM EAST: 613592
ROCK AGE: Miocene?/Oligocene

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Quartz Peak NW
OCCURRENCE: Cuesta forming ledges/O.C.
ROCK UNIT: Tvu of Indian Springs 1:100K

ROCK DESCRIPTION: Light pinkish brown, densely welded devitrified ash-flow tuff crystal-rich sanidine, plagioclase, quartz. Trace green sphene. Very abundant biotite to approximately 2mm; Hornblende; relict oxidized pyroxene. Probably not Tmr Rainier Mesa Member, too much biotite. Tuff of Pahranagat Lakes? Hiko?

ROCK STRUCTURE: Flat-lying to approximately 5E dip

REMARKS: No vitrophyre here; unit approximately 15m thick with upper dense part approximately 8m thick over porous vapor phase tuff, then porous glassy tuff covered by Qac. Same unit forms several cuestas in this part of quad; overlies TOS.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/4/94

HAND SPECIMEN STUDY: Reddish brown porphyritic igneous rock with phenocrysts of feldspars, quartz, biotite, and amphibole.

TEXTURE: Porphyritic, cryptocrystalline groundmass.

ESSENTIAL MINERALS: Sanidine (15%, <1.0 X 1.0mm, subhedral to anhedral), andesine (20%, <1.5 X 1mm, subhedral), quartz (7.0%, <1.0 X 1.0mm, anhedral), biotite (8.0%, <2mm, subhedral). Groundmass: 35%, brown cryptocrystalline, partly devitrified to cristobalite.

ACCESSORY MINERALS: Hornblende (4.0%), magnetite (3.0%).

SECONDARY: Iron oxides (8.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, plagioclase, cristobalite, biotite, quartz, amphibole.

CEMENT:

FEATURES: Mafic minerals are strongly rimmed with dark, black iron oxides.

FULL ROCK NAME: Dacite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 060

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4083966
QUADRANGLE NAME: Aysees Peak
UTM EAST: 608376
OCCURRENCE: Outcrop-see below
ROCK AGE: Ordovician
ROCK UNIT: Eureka Quartzite

ROCK DESCRIPTION: White to light gray, fine to medium grained, clean quartzite interbedded. Finely bedded to massive. More resistant and dark brown weathering layers are silicified and limonitic. <1.0% disseminated hematite after pyrite occasional <1mm quartz veinlets.

ROCK STRUCTURE: Strikes N S , dip approximately 35E

REMARKS: Sample is from white resistant and ledge, very hard, probably in upper-most 200' of unit. Outcrop, forms dip slopes with small, meter sized steps.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/4/94

HAND SPECIMEN STUDY: White, medium to fine-grained quartzite with brown spots of iron oxides.

TEXTURE: Clastic, mosaic.

ESSENTIAL MINERALS: Quartz (>97%, <0.4 X 0.3mm, rounded to anhedral, well-sorted).

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS: Local brown ferruginous matter (<3.0%).

DETRITAL MINERALS:

XRAY STUDY: Quartz

CEMENT:

FEATURES:

FULL ROCK NAME: Orthoquartzite.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 061

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4089035
QUADRANGLE NAME: Aysees Peak
UTM EAST: 602530
OCCURRENCE: Outcrop forms large cuesta
ROCK AGE:
ROCK UNIT: Tbi - basalt

ROCK DESCRIPTION: Black, porphyritic olivine basalt, glassy. Comprises thick sill or plug; non-vesicular.

ROCK STRUCTURE:

REMARKS: May be intruding or overlying volcanic vent complex of gray to red oxidized mafic pyroclastic deposits(?) or just oxidized lower margin of sill(?). Definitely intrudes Paleozoic carbonate rocks and Tertiary volcanic rocks (tuffs) beneath mafic pyroclastic rocks.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/4/94

HAND SPECIMEN STUDY: Dark gray to black basaltic rock with yellowish brown phenocrysts of olivine.

TEXTURE: Porphyritic, aphanitic crystalline groundmass.

ESSENTIAL MINERALS: Olivine (25%, <3.5 X 2.0mm, subhedral), labradorite (4.0%, <1.5 X 1mm). Groundmass (79%), crystalline, consisting of plagioclase laths , magnetite grains, irregular grains of augite and olivine.

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, olivine.

CEMENT:

FEATURES: The rock owes its black color to micrograins of magnetite evenly distributed in groundmass.

FULL ROCK NAME: Olivine basalt.
GENERAL ROCK NAME: Mafic igneous rock

SAMPLE NUMBER: 062

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4086852
QUADRANGLE NAME: Plutonium Valley
UTM EAST: 596400
OCCURRENCE: Outcrop-see below
ROCK AGE: Miocene 12.8 Ma
ROCK UNIT: Paintbrush Tuff, Topopah Spring Member (Tpt)

ROCK DESCRIPTION: Black vitrophere (medial or caprock vitrophyre). Faintly crystal rich at 10% phenocrysts; underlain by crystal-poor, dense, devitrified ash-flow tuff.

ROCK STRUCTURE: Flat lying but locally brecciated; with fine-grained, clear drusy quartz along fractures where brecciated.

REMARKS: Essentially same as crystal rich caprock at YM. Outcrop = ledge forming resistant band

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/7/94

HAND SPECIMEN STUDY: Dark gray to black volcanic rock with pinkish feldspar phenocrysts and black glassy groundmass.

TEXTURE: Porphyritic, glassy groundmass with flow bands.

ESSENTIAL MINERALS: Sanidine (15%, <2 X 2.0mm, subhedral), andesine (8.0 %, <2.5 X 1mm, subhedral to euhedral). Groundmass: (70%), with flow bands.

ACCESSORY MINERALS: Diopside (3.0%), biotite (3.0%), magnetite (1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Glass, feldspar.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 064

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: M.O. Desilets
UTM NORTH: 4085840
QUADRANGLE NAME: Quartz Peak NW
UTM EAST: 614345
OCCURRENCE: Outcrop
ROCK AGE: Devonian
ROCK UNIT: Guilmette Formation

ROCK DESCRIPTION: Massive gray to dark gray limestone, abundant calcite veins with some iron staining along fractures with calcite veins. Limestone appears to be somewhat recrystallized and there were no apparent fossils.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/7/94

HAND SPECIMEN STUDY: Fractured brownish limestone with irregular white veinlets of calcite.

TEXTURE: Mosaic.

ESSENTIAL MINERALS: Calcite (90%, irregular size and shape).

ACCESSORY MINERALS: Dolomite (8.0%).
SECONDARY: Limonitic matter (2.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Calcite, dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomitic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **065**

FIELD DATE: 7/27/94
SCALE: 1:24,000
UTM NORTH: 4089878
UTM EAST: 613623
ROCK AGE:

COLLECTOR: M.O. Desilets
QUADRANGLE NAME: Quartz Peak NW
OCCURRENCE: Outcrop
ROCK UNIT: Tvu

ROCK DESCRIPTION: Andesite, weathers red-brown, fresh surface tan. Abundant biotite phenocrysts with lesser quartz and feldspar. Some quartz with nice crystal habit filling vugs. Some large vugs filled with fine-grained unknown white mineral and quartz. No obvious banding. Forms cliffs in outcrop.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/7/94

HAND SPECIMEN STUDY: Brownish porphyritic volcanic rock with phenocrysts of feldspars, quartz, and biotite in brownish aphanitic groundmass.

TEXTURE: Porphyritic with glassy groundmass.

ESSENTIAL MINERALS: Andesine (15%, <2.0 X 0.8mm, subhedral), sanidine (12%, <1.0 X 1.0mm, subhedral), biotite (11%, <2.0 X 0.03mm, euhedral), quartz (8.0%, <2.5 X 2.0mm, anhedral). Groundmass: (54%), mostly glass with flow bands and partially devitrified to form cristobalite.

ACCESSORY MINERALS: Magnetite (3.0%).

SECONDARY: Iron oxides (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, plagioclase, sanidine, biotite, quartz.

CEMENT:

FEATURES: Biotite invariably oxidized to have tiny aggregates of iron oxides along rims and cleavages.

FULL ROCK NAME: Dacite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **066**

FIELD DATE: 7/27/94
SCALE: 1:24,000
UTM NORTH: 4089987
UTM EAST: 597763
ROCK AGE:

COLLECTOR: M.O. Desilets
QUADRANGLE NAME: Plutonium Valley
OCCURRENCE: Outcrop
ROCK UNIT: Tbi

ROCK DESCRIPTION: Vitrophyre. Dark groundmass with abundant equigranular quartz and feldspar phenocrysts. Some areas have a deep weathering rind up to an inch thick. Weathered and fresh samples are black. Isolated banding seen in weathered surfaces. Dip: N10W, 15E.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/7/94

HAND SPECIMEN STUDY: Dark gray to black porphyritic volcanic rock with phenocrysts of feldspar and biotite in black obsidian-like groundmass.

TEXTURE: Porphyritic with glassy groundmass showing flow bands.

ESSENTIAL MINERALS: Sanidine (12%, <1.5 X 1.0m, subhedral). Groundmass: (79%), glassy with flow bands.

ACCESSORY MINERALS: Biotite (3.0%), diopside and magnetite (2.0%), andesine (4.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Feldspar, glass.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **067**

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: M.O. Desilets
QUADRANGLE NAME: Plutonium Valley
UTM NORTH: 4087474
UTM EAST: 596042
OCCURRENCE: Outcrop
ROCK AGE:
ROCK UNIT: Rainier Mesa Formation

ROCK DESCRIPTION: Rainier Mesa Formation; tan welded tuff with phenocrysts of quartz, also some pumice shards. Weathers darker brown; forming cliff faces.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/7/94

HAND SPECIMEN STUDY: Brownish pyroclastic rock with pumiceous rock fragments and crystal fragments of quartz, feldspar, and biotite in brown matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments (20%, irregular shape and size), quartz (10%, <1.5 mm, anhedral). Matrix: (62%), consisting of irregular glass shards and devitrified cristobalite.

ACCESSORY MINERALS: Biotite and magnetite (2.0%), sanidine (4.0%), plagioclase (2.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, cristobalite, feldspar.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **069**

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4086154
QUADRANGLE NAME: Quartz Peak NW
UTM EAST: 612784
OCCURRENCE: Outcrop,grab sample from ledge
ROCK AGE: Tertiary
ROCK UNIT: Tos

ROCK DESCRIPTION: Ochre-tan medium grained sandstone ledge approximately 2 foot thick of sandstone with some conglomerate. Only sandstone was sampled.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/9/94

HAND SPECIMEN STUDY: Brown, medium-grained calcareous sandstone.

TEXTURE: Clastic with carbonate cement as mosaic calcite crystals and dolomite rhombs.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (33%, <0.4mm, equant, subrounded), chert (25%, <0.5mm, equant to subelongate, subangular), biotite (3.0%).

XRAY STUDY: Quartz, calcite, dolomite.

CEMENT: Calcite (30%), dolomite (9.0%).

FEATURES:

FULL ROCK NAME: Calcareous sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 070

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4086146
QUADRANGLE NAME: Quartz Peak NW
UTM EAST: 612793
OCCURRENCE: Outcrop, just below GSCN69
ROCK AGE: Tertiary
ROCK UNIT: Tos

ROCK DESCRIPTION: Conglomerate with minor sandstone layers, pebble-cobble size clasts, all Paleozoic (no Tertiary volcanic rock seen). Sample represent s about 1 foot of section about 1 foot below GSCN 69.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/9/94

HAND SPECIMEN STUDY: Brownish conglomerate with rounded pebbles, mostly carbonate rocks in light brown matrix.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Pebbles (65%, up to 15mm, oval shape, rounded, mostly carbonate rocks).

XRAY STUDY: Quartz, calcite, dolomite in the matrix.

CEMENT: 5.0%, mixture of mosaic calcite and dolomite rhombs and clastic rounded quartz and subangular chert grains, <0.3mm .

FEATURES: Compositionally, the matrix in this conglomerate is very similar to the calcareous sandstone in sample GSCN 69.

FULL ROCK NAME: Conglomerate.
GENERAL ROCK NAME: Conglomerate

SAMPLE NUMBER: 071

FIELD DATE: 7/27/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4083487
QUADRANGLE NAME: Aysees Peak
UTM EAST: 607910
OCCURRENCE: Outcrop, grab from ledge
ROCK AGE: Ordovician
ROCK UNIT: Oa(?) or Oe

ROCK DESCRIPTION: Light gray medium sparry limestone, some round grains (pellets?), flaggy to blocky, laminated to thin bedded. Gray to light gray mottled surface.

ROCK STRUCTURE:

REMARKS: Part of a limestone sequence (no dolomite, minor chert) that is underlain and overlain by quartzite. Near top of limestone sequence is some dolomite. Limestone sequence estimated thickness about 80 feet. Dips approximately 35 degrees to the east. Contact with upper quartzite could be a fault. (normal, downthrown to W ?). Conodont data indicate that the sampled unit is from the uppermost part of the Antelope Valley limestone (A. G. Harris, written communication, 1996).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/9/94

HAND SPECIMEN STUDY: Gray, fine-grained limestone.

TEXTURE: Clastic with mosaic carbonate matrix.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (15%, <0.2mm, equant to elongate rounded).

XRAY STUDY: Calcite, dolomite, quartz.

CEMENT: 85%, calcite (55%), dolomite (30%).

FEATURES:

FULL ROCK NAME: Impure dolomitic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 072

FIELD DATE: 7/27/94
SCALE: 1:24,000
UTM NORTH: 4089892
UTM EAST: 598407
ROCK AGE:

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Plutonium Valley
OCCURRENCE:
ROCK UNIT: Tos

ROCK DESCRIPTION: Light purplish gray tuffaceous sandstone and siltstone in bedded tuff sequence with ash flow tuff on top. GSCN-72A overlying ash-flow tuff 30 feet up section.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 3/7/95

HAND SPECIMEN STUDY: Light brown, coarse- to fine-grained tuffaceous rock showing clear transition between grain sizes.

TEXTURE: Pyroclastic with angular crystal grains.

ESSENTIAL MINERALS: Plagioclase (25%, <0.4 x 0.2 mm, irregular), quartz (10%, <0.1 x 0.1 mm, irregular), hornblende (8%. <0.3 x 0.1 mm, irregular), biotite (6 %, <0.5 x 0.02 mm, irregular), lithic fragments (5%, <0.8 x 0.7 mm, irregular). Matirx; glassy, amorphous, 47%.

ACCESSORY MINERALS: Magnetite (4%)

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, quartz, amphibole, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Crystal tuff

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 073

FIELD DATE: 7/27/94
SCALE: 1:24,000
UTM NORTH: 4089889
UTM EAST: 598427
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Plutonium Valley
OCCURRENCE: Outcrop grab
ROCK UNIT: Bedded Tuff unit (Tos)

ROCK DESCRIPTION: Very light gray or white coarse air-fall tuff from a bed approximately 2 foot thick about 50 feet below sample GSCN-72.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/9/94

HAND SPECIMEN STUDY: Whitish pyroclastic rock with crystals of feldspar and biotite and occasional rock fragments.

TEXTURE: Pyroclastic with glassy matrix which shows flow bands.

ESSENTIAL MINERALS: Andesine (13%, <0.2 X 0.2mm, subhedral), biotite 8.0%, <0.2 X 0.07mm, subhedral), all show sign of fragmentation. Matrix (74%), glassy, with flow bands.

ACCESSORY MINERALS: Sanidine (1.0%), magnetite (1.0%), rock fragments (3.0%), trace augite, amphibole.

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: .

XRAY STUDY: Plagioclase, biotite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 074

FIELD DATE:
SCALE: 1:24,000
UTM NORTH: 4086584
UTM EAST: 596715
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Plutonium Valley
OCCURRENCE: Outcrop, low, grab
ROCK UNIT: Tuff of Pavits Spring

ROCK DESCRIPTION: Very light brownish gray nonwelded ash-flow tuff, phenocrysts of quartz, sanidine, biotite (and plagioclase?). Sparse fine lithics(<1 cm in diameter). Porous, light pumice, non-flattened.

ROCK STRUCTURE:
REMARKS: Unit is at least 100ft thick, light brown near top (upper 30ft), overlain by bedded tuff unit.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/9/94
HAND SPECIMEN STUDY: Light pinkish volcanic tuff with rock fragments and crystals of feldspar.

TEXTURE: Pyroclastic with crystals and rock fragments in glassy matrix.
ESSENTIAL MINERALS: Sanidine (15%, <0.2mm, irregular), rock fragments (5.0%, irregular size and shape).

ACCESSORY MINERALS: Andesine (2.0%), magnetite (2.0%), trace biotite.
SECONDARY: Clinoptilolite (8.0%), derived mostly from rock fragments of pumiceous nature.
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, clinoptilolite, trace biotite and chlorite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dacite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 076

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4107127
UTM EAST: 632618
ROCK AGE: Silurian

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Southeastern Mine
OCCURRENCE: Outcrop on ridge
ROCK UNIT: Laketown Dolomite

ROCK DESCRIPTION: Very light gray sparry dolomite, blocky to massive, no chert, looks very pure. Representative of about 500 feet of ridgetop.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/9/94
HAND SPECIMEN STUDY: Whitish, medium to fine-grained carbonate rock.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Dolomite (>99%, <0.4mm, anhedral, interlocking).

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **077**

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4122994
UTM EAST: 627446
ROCK AGE: Mississippian-Devonian

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Fallout Hills NE
OCCURRENCE: Outcrop in slope
ROCK UNIT: Pilot Shale

ROCK DESCRIPTION: Highly fissile black shaly limestone that breaks into sheets 2cm to 0.3 cm thick. Weathers to buff and orange brown. Most of unit does not crop out. Underlain by gray limestone which is underlain by Oe(?). Possible fault, gray limestone very thin (10 feet thick). Must be a fault between limestone and MDp.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/9/94

HAND SPECIMEN STUDY: Laminated silty-size carbonate rock with alternating dark gray and light brown laminae.

TEXTURE: Clastic with mosaic carbonate matrix.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (20%, <0.08mm, subangular).

XRAY STUDY: Calcite, dolomite, quartz.

CEMENT: (80%), mosaic calcite (55%), and dolomite rhombs (25%).

FEATURES: Brown iron oxide staining on carbonate rich laminae.

FULL ROCK NAME: Laminated impure dolomitic limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: **078**

FIELD DATE: 7/11/94
SCALE: 1:24,000
UTM NORTH: 4107701
UTM EAST: 531860
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Thirsty Canyon SW
OCCURRENCE: Outcrop
ROCK UNIT: Type - basalt

ROCK DESCRIPTION: Gray olivine basalt, olivine altered to iddingsite. Fine grained,possibly diabase texture. Contains abundant gas vesicles in upper part of flow. Material sampled has some vesicles filled with white zeolite.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/9/94

HAND SPECIMEN STUDY: Dark grayish brown basaltic rock with occasional vesicles filled by zeolitic matter.

TEXTURE: Porphyritic, with intersertal groundmass.

ESSENTIAL MINERALS: Olivine (7.0%, <0.5mm, anhedral to subhedral), calcic plagioclase (3.0%, <1.0 X 0.5mm, subhedral). Groundmass: 80%, calcic plagioclase laths (<0.3 X 0.05mm) with intersertal magnetite and partially devitrified glass.

ACCESSORY MINERALS: Magnetite (3.0%).

SECONDARY: Magnetite (4.0%), smectite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, smectite.

CEMENT:

FEATURES: Locally vesicular, with vesicles filled probably by zeolitic mineral.

FULL ROCK NAME: Basalt.

GENERAL ROCK NAME: Mafic igneous rock

SAMPLE NUMBER: 079

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4110630
QUADRANGLE NAME: Thirsty Canyon
UTM EAST: 533848
OCCURRENCE:
ROCK AGE: Approximately 9 Ma
ROCK UNIT: Thirsty Canyon Tuff, Trail Ridge Member

ROCK DESCRIPTION: Densely welded ash-flow tuff; dense devitrified uppermost ledge; phenocrysts of feldspar and mafics- cpx? approximately 10%. Pumice rich.

ROCK STRUCTURE: Nearly flat lying.

REMARKS: No dense glassy tuff anywhere near here.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/10/94

HAND SPECIMEN STUDY: Brown, compact welded tuff with rock fragments and feldspar crystals in more or less elongated form.

TEXTURE: Pyroclastic, glassy matrix with flow bands.

ESSENTIAL MINERALS: Sanidine (28%, <3.5 X 1.2mm, subhedral to anhedral), rock fragments (20%, irregular size and shape). Matrix (74%), glassy, stained by iron oxides.

ACCESSORY MINERALS: Augite, apatite, magnetite, hematite.
SECONDARY: Calcite (7.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte tuff.
GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 080

FIELD DATE: 7/16/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4058712
QUADRANGLE NAME: Heavens Well
UTM EAST: 624847
OCCURRENCE: Outcrop in gully, grab.
ROCK AGE: Tertiary (Miocene?)
ROCK UNIT: Tys

ROCK DESCRIPTION: White-black salt and pepper crystal rich air-fall tuff or reworked tuff bed approximately 1 foot thick in sandstone and pebble conglomerate section. Bedding N30E, 30SE.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/10/94

HAND SPECIMEN STUDY: Light colored porphyritic rock with crystals of feldspar, biotite and amphibole.

TEXTURE: Porphyritic with glassy groundmass mostly replaced by calcite.

ESSENTIAL MINERALS: Andesine (25%, <1.0 X 0.5mm, subhedral to euhedral), biotite (10%, <1.0 X 0.2mm, euhedral), hornblende (7.0%, <0.7 X 0.2mm subhedral), magnetite (6.0%, <0.3 X 0.3mm, subhedral). Groundmass: (50%) , glassy, about half replaced by calcite.

ACCESSORY MINERALS: Orthoclase and quartz (2.0%), diopside.
SECONDARY: Calcite (25%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite, plagioclase, amphibole, biotite, quartz.

CEMENT:

FEATURES: The rock's light color is due to calcite.

FULL ROCK NAME: Tuffaceous sandstone.
GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **081**

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4058657
UTM EAST: 624870
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Heavens Well
OCCURRENCE: Outcrop in gully, grab.
ROCK UNIT: Tys

ROCK DESCRIPTION: Very light pink tuffaceous sandstone with sparse pebble-cobble clasts of volcanic rock and Paleozoic sedimentary rock interbedded with conglomerates composed mostly of pebble-size Paleozoic sedimentary clasts.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/10/94

HAND SPECIMEN STUDY: Brownish pyroclastic rock.

TEXTURE: Pyroclastic with most of glassy matrix replaced by calcite.

ESSENTIAL MINERALS: Quartz (15%, irregular shape and size), sanidine (7.0%, irregular size and shape), plagioclase (5.0%, irregular shape and size), rock fragments (30%, including limestone, quartzite, glass shards, etc.). Matrix: (40%), glassy, about half being replaced by calcite and much less dolomite.

ACCESSORY MINERALS: Magnetite, hornblende, and biotite (3.0%).

SECONDARY: Iron oxide.

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite, quartz, feldspar, dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Tuffaceous sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **082**

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4059282
UTM EAST: 624723
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Heavens Well
OCCURRENCE: Outcrop in wash, grab.
ROCK UNIT: Tys

ROCK DESCRIPTION: Very light buff limestone with wavy layering, sandy with local sparry patches and possible algal structures; very limited, occurs in sandstone, conglomerate and tuff unit.

ROCK STRUCTURE: Bedding N20E, 60SE
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/10/94

HAND SPECIMEN STUDY: Pinkish white, fine-grained limestone.

TEXTURE: Mosaic.

ESSENTIAL MINERALS: Calcite (>99%, irregular interlocking; two different size groups: one around 0.1mm, the other much finer).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite.

CEMENT:
FEATURES: Bioturbation as manifested by irregular patches of darker and exceedingly finer material.
FULL ROCK NAME: Limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 083

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Heavens Well
OCCURRENCE: Outcrop in wash, grab.
ROCK UNIT: Tys

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4059339
UTM EAST: 624669
ROCK AGE: Tertiary

ROCK DESCRIPTION: Pink ash-flow tuff strongly welded, glassy, contains black obsidian fragments, biotite and sanidine.

ROCK STRUCTURE:
REMARKS: Possibly datable.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/10/94

HAND SPECIMEN STUDY: Brown tuffaceous rock with crystals of feldspar and biotite and rock fragments.

TEXTURE: Pyroclastic with glassy matrix.

ESSENTIAL MINERALS: Sanidine (6.0%, <2.0 X 1.0mm, irregular), andesine (4.0%, <1.5 X 1mm, subhedral), rock fragments (15%, irregular size and shape). Matrix: (70%), glass, locally replaced by tiny calcite.

ACCESSORY MINERALS: Biotite and quartz (3.0%).
SECONDARY: Calcite (2.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Feldspar, biotite, trace calcite.

CEMENT:
FEATURES:
FULL ROCK NAME: Vitric rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 084

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Quartz Peak SW
OCCURRENCE: Outcrop, grab.
ROCK UNIT: Ely Springs Limestone

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4070448
UTM EAST: 622045
ROCK AGE: Ordovician

ROCK DESCRIPTION: Very light brownish gray sparry dolomite, individual crystals approximately 1mm. Blocky, but thin beds etched on surface in places. Weathers tan to gray.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/14/94

HAND SPECIMEN STUDY: Brownish white, medium-grained dolomite.

TEXTURE: Mosaic, interlocking grains with irregular open pore spaces.

ESSENTIAL MINERALS: Dolomite (>99%, <0.5mm, interlocking).

ACCESSORY MINERALS:
SECONDARY: Limonitic matter (51%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite.

CEMENT:
FEATURES: Irregular open pore spaces.
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 085

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4072799
UTM EAST: 627502
ROCK AGE: Ordovician

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Tim Spring
OCCURRENCE: Outcrop, grab.
ROCK UNIT: Ops

ROCK DESCRIPTION: Gray finely sparry to micritic limestone, massive with some chert (chert not sampled). The sampled rock is cut by calcite veins that are common in the rock at this locality; they are roughly braided veins. This sample also contains limonitic/hematitic fractures which are also representative of this site.

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/14/94

HAND SPECIMEN STUDY: Brownish gray, fine-grained limestone.

TEXTURE: Mosaic, intermixture of clear, coarser calcite with cloudy, finer calcite.

ESSENTIAL MINERALS: Calcite (>97%, <0.2mm, interlocking).

ACCESSORY MINERALS:

SECONDARY:

DETRITAL MINERALS:

AUTHIGENIC MINERALS:

XRAY STUDY: Calcite, trace quartz.

CEMENT:

FEATURES: Veinlets of calcite.

FULL ROCK NAME: Limestone.

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 086

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4060983
UTM EAST: 607697
ROCK AGE: Mississippian

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Joana Limestone

ROCK DESCRIPTION: Medium gray weathering, thick-bedded limestone with sparse crinoid stems. Locally abundant milky to light tan calcite veins to 6cm wide (veins not included in sample).

ROCK STRUCTURE: Bedding: approximately N40E, gently to NW. Abundant epigenetic calcite veins, large open folds in nearby outcrops.

REMARKS: Sample site on edge of well-used tank target. Abundant shrapnel and pock marks on ledges at sample site.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/14/94

HAND SPECIMEN STUDY: Dark gray compact limestone.

TEXTURE: Biomicritic, fossil fragments with coarse calcite in finer calcite matrix.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Coarse calcite from fossil fragments (55%, irregular size and shape), quartz (<7.0%).

XRAY STUDY: Calcite, trace quartz.

CEMENT: Fine-grained calcite (43%).

FEATURES:

FULL ROCK NAME: Limestone (biomicrite).

GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 087

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4061167
UTM EAST: 607522
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Mc(?) - Chainman(?) Shale

ROCK DESCRIPTION: Platy weathering non-calcareous black shale; Distinctive rusty weathering color.

ROCK STRUCTURE: Dips gently to NW.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/14/94
HAND SPECIMEN STUDY: Dark brown siltstone with fine bands of less ferruginous matter.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

DETRITAL MINERALS: Quartz (55%, <0.05mm, subrounded), muscovite (5.0%, 0.06 X 0.01mm, platy, subangular).
AUTHIGENIC MINERALS:
XRAY STUDY: Quartz, calcite, muscovite.

CEMENT: Ferruginous matter (18%), dolomitic matter (22%).
FEATURES:
FULL ROCK NAME: Dolomitic siltstone.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 088

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4061129
UTM EAST: 607186
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Tertiary sedimentary rocks (Tys)

ROCK DESCRIPTION: Thinly wavy laminated limestone. Light tan to white weathering; cream to light tan when fresh. Thickness not determined.

ROCK STRUCTURE: N-striking, gently W-dipping (20 degrees).
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/14/94
HAND SPECIMEN STUDY: Light brown, compact and dense limestone with molds of bivalves.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Calcite (>99%, >20 micrometers, interlocking).

ACCESSORY MINERALS:
SECONDARY:

DETRITAL MINERALS:
AUTHIGENIC MINERALS:
XRAY STUDY: Calcite.

CEMENT:
FEATURES: Bivalve shells, locally molds.
FULL ROCK NAME: Limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 089

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4061164
UTM EAST: 607140
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Tertiary sedimentary rocks (Tys)

ROCK DESCRIPTION: Light cream colored, medium to thick-bedded limestone. Contains common small gastropod fossils. Possibly pumiceous. Stratigraphically above GSCN-88.

ROCK STRUCTURE: Dips gently west
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/14/94
HAND SPECIMEN STUDY: Yellowish white fossiliferous limestone.

TEXTURE: Biomicritic, fossil fragments with coarser calcite in cloudy carbonate mud.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Fossil fragments (18%, irregular size and shape).
XRAY STUDY: Calcite.

CEMENT: Carbonate mud (82%).
FEATURES:
FULL ROCK NAME: Limestone (biomicrite).
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 090

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4061382
UTM EAST: 606336
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Tertiary sedimentary rocks (Tys)

ROCK DESCRIPTION: Massive, rubbly to thin bedded coarse brown calcite, tufa deposits with fallen tufa tubes and rubble; breccia. Sample from moderately N-dipping ledge.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/14/94
HAND SPECIMEN STUDY: Brown, porous fossiliferous limestone.

TEXTURE: Biomicritic, fossil fragments with coarse calcite in fine-grained, cloudy matrix.
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY: Limonitic matter (2.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS: Coarse calcite in fossil fragments (60%, irregular size and shape).
XRAY STUDY: Calcite.

CEMENT: Fine-grained carbonate mud (38%).
FEATURES: High porosity due to irregular solution pores.
FULL ROCK NAME: Limestone (biomicrite).
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 091

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4065443
UTM EAST: 603438
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Mu - Mississippian undivided

ROCK DESCRIPTION: Rusty weathering (black-dark gray on fresh break) Thinly laminated, platy weathering limestone.

ROCK STRUCTURE: Dip is gentle to SE; broad open fold plunging NE?
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/14/94
HAND SPECIMEN STUDY: Dark gray laminated calcareous siltstone.

TEXTURE: Clastic.
ESSENTIAL MINERALS:

ACCESSORY MINERALS: Hematite, feldspar, and muscovite (composite-5.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (60%, <0.05mm, equant, subangular).

XRAY STUDY: Quartz, calcite, dolomite, trace muscovite.

CEMENT: Calcite (25%), dolomite (10%).
FEATURES:
FULL ROCK NAME: Calcareous siltstone.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 092

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4065257
UTM EAST: 602217
ROCK AGE: Devonian

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury NE
OCCURRENCE: Outcrop
ROCK UNIT: Dg- Guillmette Limestone

ROCK DESCRIPTION: Thinly bedded but massive weathering dark gray limestone and dark banded gray limestone; sample from coherent, thinly bedded outcrop.

ROCK STRUCTURE: Folded; open, to brecciated near tight(?) fold hinges. Dips gently to SW.
REMARKS: Ubiquitous 1-3mm white calcite veins too closely spaced to avoid in collecting sample. Separate bag (not cleaned for geochem) taken for possible conodont separation.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 11/14/94
HAND SPECIMEN STUDY: Dark gray, very fine-grained carbonate rock.

TEXTURE: Microcrystalline.
ESSENTIAL MINERALS: Calcite (55%, <10 micrometers, anhedral, interlocking), dolomite (37%, <50 micrometers, euhedral rhombs).

ACCESSORY MINERALS: Calcite veinlets (8.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite, dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomitic limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 093

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4064172
UTM EAST: 599380
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury
OCCURRENCE: Outcrop
ROCK UNIT: Tertiary sedimentary rocks (Tys)

ROCK DESCRIPTION: Greenish gray, medium to light red, fine-grained, well-parted volcanic sandstone; highly calcareous. Alternating green and pink-red beds approximately 3-20cm thick. Composite of red and green sands tone.

ROCK STRUCTURE: Dips to SE at 5 degrees

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 11/14/94

HAND SPECIMEN STUDY: Light brown, fine-grained clastic rocks with loosely cemented quartz, carbonate and biotite grains.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS: Biotite and chlorite (4.0%).

SECONDARY:

DETRITAL MINERALS: Quartz (35%, <0.2mm, subrounded), chert (10%, <0.2mm, subangular), dolomite (30%, <0.2mm, angular), calcite (10%).

AUTHIGENIC MINERALS:

XRAY STUDY: Quartz, calcite, dolomite, smectite, biotite.

CEMENT: Argillaceous as smectite (11%).

FEATURES:

FULL ROCK NAME: Dolomitic sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 094

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4064698
UTM EAST: 598416
ROCK AGE:

COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury
OCCURRENCE: Outcrop
ROCK UNIT: Dsca?

ROCK DESCRIPTION: Light brown, mottled cherty very fine grained quartzite. Mottled texture due to either healed breccia texture or to incomplete modular chertification. Sample from brown ledge just (approximately 1m) above contact with Sevy and Simonson Dolomites.

ROCK STRUCTURE: Gently dipping

REMARKS: Quartzite and cherty argillaceous unit between Sevy and Simonson Dolomites.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/26/94

HAND SPECIMEN STUDY: Brownish fine-grained siliceous rock.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY: Goethite (2.0%).

DETRITAL MINERALS: Quartz (40%, <0.1mm, subrounded), alkali feldspars (5.0%, <0.1mm, subangular).

AUTHIGENIC MINERALS:

XRAY STUDY: Quartz, calcite.

CEMENT: Siliceous cement as microcrystalline quartz, occasionally with calcareous cement as microcrystalline calcite (53%).

FEATURES: Unidentifiable isotropic rhombs in matrix.

FULL ROCK NAME: Siliceous siltstone.

GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: **095**

FIELD DATE: 7/16/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury
UTM NORTH: 4064407
UTM EAST: 598406
OCCURRENCE: Outcrop
ROCK AGE: Devonian
ROCK UNIT: Simonson Dolomite-Ds

ROCK DESCRIPTION: Medium gray, coarsely crystalline (recrystallized?) Partially sanded dolomite, in part thinly bedded but all massive-weathering. Sample from within a few meters of contact with underlying argillaceous sandstone unit that overlies brown quartzite of GSCN-94.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/15/94
HAND SPECIMEN STUDY: Gray, coarse-grained dolomite.

TEXTURE: Mosaic with local irregular solution pores.
ESSENTIAL MINERALS: Dolomite (>98%, <1.0mm, anhedral interlocking).

ACCESSORY MINERALS: Quartz (<2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite, trace quartz.

CEMENT:
FEATURES: Irregular solution pores locally.
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: **096**

FIELD DATE: 7/16/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss, L.J. Garside
QUADRANGLE NAME: Mercury
UTM NORTH: 4064787
UTM EAST: 597983
OCCURRENCE: Outcrop
ROCK AGE: Devonian
ROCK UNIT: Laketown/Sevy Dolomites undivided

ROCK DESCRIPTION: Medium gray, massive to brecciated and rubbly weathering dolomite, highly fractured.

ROCK STRUCTURE: Dips gently to S at sample site.
REMARKS: Conodont data indicate that the sampled unit is most likely part of the Sevy Dolomite (A. G. Harris, written communication, 1996).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/15/94
HAND SPECIMEN STUDY: Brownish gray, dense and fine-grained dolomite.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Dolomite (>99%, 0.2mm to 0.03mm, anhedral).

ACCESSORY MINERALS:
SECONDARY: Limonitic matter.
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Dolomite.

CEMENT:
FEATURES: Rare irregular solution pores.
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 097

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4072266
UTM EAST: 627320
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Tim Spring
OCCURRENCE: Subdued outcrop, Grab
ROCK UNIT: Tys

ROCK DESCRIPTION: White marl, blocky, slightly porous. Associated rocks: well rounded pebble-cobble conglomerate (fan material is angular) and very light gray tuff (see GSCN-87).

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/15/94

HAND SPECIMEN STUDY: Light brownish, porous and extremely fine-grained dolomite.

TEXTURE: Microcrystalline.

ESSENTIAL MINERALS: Dolomite (>98%, <2.0 microns, anhedral).

ACCESSORY MINERALS:

SECONDARY: Limonitic matter.

DETRITAL MINERALS:

AUTHIGENIC MINERALS:

XRAY STUDY: Dolomite.

CEMENT:

FEATURES: Irregular solution pores up to 4.0 mm size.

FULL ROCK NAME: Dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 098

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4072259
UTM EAST: 627328
ROCK AGE: Tertiary

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Tim Spring
OCCURRENCE: Subdued outcrop, Grab
ROCK UNIT: Tys

ROCK DESCRIPTION: Very light gray tuff with abundant feldspar, quartz and biotite crystals. Thickness unknown, but at least 6 inches (same location as GSCN-86).

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Light-colored medium to coarse grained sandstone with dark colored biotite and lithic fragments and light colored quartz and feldspars, calcareous cement.

TEXTURE: Clastic with calcareous cement.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Lithic fragments (38%, <1mm, subangular), plagioclase (18%, <1mm., subangular), quartz (14%, <0.7mm, subangular), biotite (7.0%, <0.8mm, angular), chlorite (1.0%).

XRAY STUDY: Calcite, quartz, plagioclase, mica, glass.

CEMENT: Calcite (24%).

FEATURES: Lithic fragments include volcanic rocks, volcanic glass, limestone.

FULL ROCK NAME: Calcareous lithic sandstone.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 099

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4073677
UTM EAST: 623667
ROCK AGE: Devonian-Silurian

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Tim Spring
OCCURRENCE: Outcrop
ROCK UNIT: DS siltstone

ROCK DESCRIPTION: Blocky gray micritic dolomite. Weathers light buff.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Light gray, very fine-grained dolomite. Locally with veinlets or pods of coarser dolomite.

TEXTURE: Mosaic.
ESSENTIAL MINERALS: Dolomite (>98%, anhedral, <20micrometers).

ACCESSORY MINERALS:
SECONDARY: Limonitic matter (<24%).

DETRITAL MINERALS:
AUTHIGENIC MINERALS:
XRAY STUDY: Dolomite.

CEMENT:
FEATURES:
FULL ROCK NAME: Dolomite.
GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 100

FIELD DATE: 7/16/94
SCALE: 1:24,000
UTM NORTH: 4085385
UTM EAST: 614001
ROCK AGE: Mississippian

COLLECTOR: S.B. Castor
QUADRANGLE NAME: Quartz Peak NW
OCCURRENCE: Outcrop- see remarks below
ROCK UNIT: Chainman Shale

ROCK DESCRIPTION: Gray non-calcareous siltstone with minor pyrite and some limonite on fractures. Thin bedded to blocky. About 40 feet below contact with overlying carbonate.

ROCK STRUCTURE: Folded into chevrons (photo #18 of chevron folded limestone above Mc).
REMARKS: Chip across approximately 1 foot section.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Brownish, cherty rock with numerous veinlets of quartz and limonitic matter.

TEXTURE: Microcrystalline, mosaic.
ESSENTIAL MINERALS: Chalcedonic quartz (68%, <5microns).

ACCESSORY MINERALS: Sericite flakes (2.0%).
SECONDARY: Veinlet quartz (25%), limonitic matter (5.0%).

DETRITAL MINERALS:
AUTHIGENIC MINERALS:
XRAY STUDY: Quartz, mica.

CEMENT:
FEATURES: Numerous irregular veinlets, mostly <0.1mm wide, filled with quartz.
FULL ROCK NAME: Chert.
GENERAL ROCK NAME: Chert

SAMPLE NUMBER: 101

FIELD DATE: 7/17/94
SCALE: 1:24,000
COLLECTOR: S.B. Castor
UTM NORTH: 4061310
QUADRANGLE NAME: Mercury NE
UTM EAST: 605811
OCCURRENCE: Outcrop
ROCK AGE: Tertiary
ROCK UNIT: Tys

ROCK DESCRIPTION: Pink ash-flow tuff with quartz, sanidine, and biotite phenocrysts. Devitrified. Associated with light greenish gray volcanic sandstone.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Reddish brown pyroclastic rock with crystals and lithic fragments in brown to reddish matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <3.5 X 1mm, angular), lithic fragments (8.0%, <0.3mm, irregular), quartz (5.0%, <1.0mm), plagioclase (1.0%, <2.0mm). Matrix: (61%, devitrified glass to cristobalite).

ACCESSORY MINERALS:
SECONDARY: Iron oxides (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, k-feldspar, quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 108

FIELD DATE: 7/17/94
SCALE: 1:24,000
COLLECTOR: L.J. Garside
UTM NORTH: 4084141
QUADRANGLE NAME: Quartz Peak NW
UTM EAST: 615297
OCCURRENCE: Outcrop
ROCK AGE: Mississippian
ROCK UNIT: Chainman Shale

ROCK DESCRIPTION: Rust weathering, very dark gray to black, blocky to platy weathering siltstone.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Dark gray, dense and microfractured siltstone.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (33%, <0.03mm, angular), dolomite (32%, <0.03mm, angular), plagioclase (7.0%, <0.03mm), muscovite (1.0%).

XRAY STUDY: Quartz, dolomite, mica, plagioclase, pyrophyllite (?).

CEMENT: Ferruginous and argillaceous (27%).

FEATURES: Microveinlets partially filled by pyrophyllite (?).

FULL ROCK NAME: Dolomitic siltstone.
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 114

FIELD DATE: 7/17/94
SCALE: 1:24,000
UTM NORTH: 4084203
UTM EAST: 615375
ROCK AGE:

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Quartz Peak NW
OCCURRENCE: Outcrop
ROCK UNIT: Mississippian limestone

ROCK DESCRIPTION: Dark gray, thick bedded to massive weathering limestone. Fetid; abundant white calcite veinlets, (veinlets not included in sample).

ROCK STRUCTURE:

REMARKS: Near E-W fault and only a few tens of meters below contact with overlying Mississippian Chainman Shale. Conodont data indicate late Kinderhookian-early Osagean age; this unit may thus be the unnamed limestone of Tschanz and Pampeyan (1970) which overlies the Joana Limestone (A. G. Harris, written communication, 1996).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/4/95

HAND SPECIMEN STUDY: Gray, extremely fine-grained limestone.

TEXTURE: Micromosaic.

ESSENTIAL MINERALS: Calcite (>95%, <5microns), quartz (<3.0%), dolomite (<2.0%).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Calcite, trace quartz, dolomite.

CEMENT:

FEATURES: Microveinlets of calcite, local patches of coarse crystals.

FULL ROCK NAME: Limestone.
GENERAL ROCK NAME: Limestone

SAMPLE NUMBER: 117

FIELD DATE: 7/8/95
SCALE: 1:24,000
UTM NORTH: 4073399
UTM EAST: 552381
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Busted Butte
OCCURRENCE: Wall of excavation in hillside
ROCK UNIT: Topopah Spring Tuff

ROCK DESCRIPTION: Light brown, stony, phenocryst-poor, rhyolitic ash-flow tuff with sparse small phenocrysts of sanidine and rare biotite. Densely welded with vapor-phase mineral development in pumice.

ROCK STRUCTURE:

REMARKS: Sample collected from outside the Nellis boundary but represents unit present inside the study area on Yucca Mountain.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/8/96

HAND SPECIMEN STUDY: Bownish tuffaceous rock with crystals of feldspar; pumice fragments in a matrix of brown glass shards.

TEXTURE:

ESSENTIAL MINERALS: Sodic plagioclase (5%, <1 mm, irregular shape).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, quartz, orthoclase.

CEMENT: Originally glass shards (95%), mostly devitrified to magnetite (1%), cristobalite (44%), quartz (15%), potassium feldspar (35%).

FEATURES: Large pumice fragments; spherules with radial fibers, probably as cristobalite.

FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **118**

COLLECTOR: L.J. Garside
QUADRANGLE NAME: Busted Butte
OCCURRENCE: Outcrop
ROCK UNIT: Tiva Canyon Tuff

FIELD DATE: 7/8/95
SCALE: 1:24,000
UTM NORTH: 4079056
UTM EAST: 553413
ROCK AGE: Tertiary

ROCK DESCRIPTION: Light pinkish gray rhyolitic ash-flow tuff. Densely welded with moderate amounts of white pumice and clear, glassy sanidine. Small manganese oxide(?) specks in groundmass.

ROCK STRUCTURE:

REMARKS: Sample collected from hill south of Yucca Wash on the Nevada Test Site, but representative of unit present in Nellis area of Yucca Mountain.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/8/96

HAND SPECIMEN STUDY: Brownish gray tuffaceous rock with crystals of feldspar and pumice fragments in an aphanitic matrix.

TEXTURE:

ESSENTIAL MINERALS: Sanidine (15%, <1.5 mm; irregular, rarely euhedral), pumice fragments (30%, <7X2 mm, oval shape).

ACCESSORY MINERALS: Magnetite (<2%)

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, potassium feldspar, quartz, calcite.

CEMENT: Glass matrix (>53%, mostly devitrified to cristobalite)

FEATURES: Most pumice fragments altered to fine crystal aggregates of adularia, quartz, and occasional calcite.

FULL ROCK NAME: Rhyolite tuff

GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **119**

COLLECTOR: L.J. Garside, H.F. Bonham
QUADRANGLE NAME: Belted Peak
OCCURRENCE: Outcrop
ROCK UNIT: Zabriskie Quartzite

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4151312
UTM EAST: 577512
ROCK AGE: Lower Cambrian

ROCK DESCRIPTION: Brown, reddish brown, and brownish gray orthoquartzite. Well cemented, hard, medium grained, thick bedded to massive. Cut by relatively common 1-3 mm wide white quartz veinlets which ere excluded from the collected sample. Worm burrows in nearby quartzite beds.

ROCK STRUCTURE: N10E, 90

REMARKS: Unit sampled is a quartzite unit in the Wood Canyon Formation according to Minor, et al (1993) -OF 93-299

REFERENCES: Ekren and others, 1967 (GQ 606)
ANALYST: L. C. Hsu
LAB DATE: 1/9/96

HAND SPECIMEN STUDY: Reddish brown iron-stained quartzite.

TEXTURE: Clastic; medium grained quartz with rare ferruginous cementing matter.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz (95%), <0.5 mm, subrounded to rounded); trace sphene, magnetite, and biotite.

XRAY STUDY: Quartz, trace mica?

CEMENT: Ferruginous matter (<5%).

FEATURES: Strain shadow in many quartz grains.

FULL ROCK NAME: Quartzite, medium grained

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: 120

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4150453
UTM EAST: 577793
ROCK AGE: Cambrian

COLLECTOR: L.J. Garside, H.F. Bonham
QUADRANGLE NAME: Wheelbarrow Peak
OCCURRENCE: Outcrop
ROCK UNIT: Carrara Fm

ROCK DESCRIPTION: Olive weathering, medium gray siltstone; breaks into pencils. Commonly poorly exposed.

ROCK STRUCTURE: Strike: Northerly
REMARKS:

REFERENCES: Ekren and others, 1967 **ANALYST:** L. C. Hsu **LAB DATE:** 1/8/96
HAND SPECIMEN STUDY: Greenish gray shale with local small, irregular brown limonite.

TEXTURE: Clastic
ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS: Calcite.
DETRITAL MINERALS: Quartz (50%, <2 mm< irregular), chlorite (20%, <3x1 mm), white mi... (15%, <5X2 mm), limonite (5%).
XRAY STUDY: Quartz, chlorite, mica, calcite.

CEMENT: argillaceous (5%).
FEATURES:
FULL ROCK NAME: Shale
GENERAL ROCK NAME: Mudstone

SAMPLE NUMBER: 121

FIELD DATE: 10/22/95
SCALE:
UTM NORTH: 4148689
UTM EAST: 577914
ROCK AGE: Tertiary

COLLECTOR: L.J. Garside, H.F. Bonham
QUADRANGLE NAME:
OCCURRENCE: Outcrop
ROCK UNIT: Tes (Shingle Pass Tuff)

ROCK DESCRIPTION: Brownish weathering, tan hydrated vitrophyre at base of ash-flow tuff. Contains phenocrysts of sanidine, plagioclase, quartz (sparse) and biotite. The unit above the vitrophyre is purple, pumice rich ash-flow tuff with similar phenocryst composition.

ROCK STRUCTURE: Compaction foliation: N30E, 15SE
REMARKS:

REFERENCES: Minor and others, 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 1/9/96
HAND SPECIMEN STUDY: Brown tuffaceous rock with white crystals of feldspar and rare dark brown biotite in a brown matrix.

TEXTURE: Pyroclastic
ESSENTIAL MINERALS: Potassium feldspar (6%, <3.5 mm, irregular), plagioclase (2%, <1 mm, irregular), magnetite?, biotite (1%), rock fragments (1%).

ACCESSORY MINERALS:
SECONDARY: Volcanic glass altered to mordenite (88%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Mordenite, trace mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Altered dacite tuff.
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **122**

FIELD DATE: 10/22/95
SCALE: 1:24,000
COLLECTOR: L.J. Garside, H.F. Bonham
UTM NORTH: 4146914
QUADRANGLE NAME: Wheelbarrow Peak
UTM EAST: 578034
OCCURRENCE: Outcrop
ROCK AGE: Tertiary
ROCK UNIT: Tour (older undivided rhyolitic lavas)

ROCK DESCRIPTION: Reddish brown weathering light pinkish gray rhyolite intrusive rock. Finely crystalline groundmass contains moderate amounts of small quartz and sanidine phenocrysts and sparse specks of iron oxides. The elongate iron oxide specks may represent original biotite. Based on an examination of rhyolitic rocks at the south end of Limestone Ridge and others south of the wash at the south end of Limestone Ridge, there is no difference between the sampled unit a this locality and the rocks immediately south of the wash. Thus ,we support the map of Sargent and Orkild (1973) who map it all as unit Tob. Thus, this sample represents unit Tour and Tuk in this are a. It is unlikely that the range-capping flow dome(?) unit is exactly the same, but in our brief visit we see no convincing proof that at Tour and Tuk should be differentiated in this area.

ROCK STRUCTURE: Dike

REMARKS: Unit Tour of Minor and others (1993); Tob unit of Sargent and Orkild (1973).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/9/96

HAND SPECIMEN STUDY: Light gray, slightly altered volcanic rock; crystals of quartz and feldspar in gray matrix; slightly vuggy due to leaching.

TEXTURE: Pyroclastic

ESSENTIAL MINERALS: Quartz (20%, <1 mm, euhedral to irregular), potassium feldspars including sanidine (8%, <1 mm, euhedral to irregular).

ACCESSORY MINERALS: Magnetite (1%).

SECONDARY: Kaolinite (5%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, orthoclase, kaolinite.

CEMENT: Altered matrix; fine intergrowth of quartz and potassium feldspar (62%).

FEATURES: Vuggy locally due to leaching.

FULL ROCK NAME: Altered rhyolite.

GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **123**

FIELD DATE: 10/22/95
SCALE: 1:24,000
COLLECTOR: L.J. Garside
UTM NORTH: 4145257
QUADRANGLE NAME: Wheelbarrow Peak
UTM EAST: 578698
OCCURRENCE: Outcrop
ROCK AGE: Tertiary
ROCK UNIT: Tod (older diacitic lavas)

ROCK DESCRIPTION: Medium dark brownish gray weathering gray and pinkish gray, hornblende plagioclase dacite. Hornblende commonly deuterically altered to clay. Sample is of freshest available, with black hornblende present.

ROCK STRUCTURE: Platy flow jointing

REMARKS: Photo 13 is of unit Tour (peak north of Wheelbarrow Peak) with tuff of White Blotch Spring on lower slopes.

REFERENCES: Minor and Others, 1993
ANALYST: L. C. Hsu
LAB DATE: 1/9/96

HAND SPECIMEN STUDY: Dark gray porphyritic igneous rock with phenocrysts of feldspar, hornblende, and biotite in aphanitic groundmass.

TEXTURE: Porphyritic

ESSENTIAL MINERALS: Plagioclase (27%, <3x2 mm, subhedral), hornblende (10%, <2X1 mm, subhedral). Groundmass - 43%, intergrown microlaths of plagioclase and tridymite.

ACCESSORY MINERALS: Biotite (5%), augite (3%), magnetite (2%).

SECONDARY: Magnetite (5%), montmorillonite (5%)

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, tridymite, amphibole, montmorillonite.

CEMENT:

FEATURES: All hornblende and biotite crystals show thick black alteration rims of magnetite, while augite crystals remain fresh.

FULL ROCK NAME: Andesite

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **124**

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4133560
UTM EAST: 573235
ROCK AGE:

COLLECTOR: J.G. Price
QUADRANGLE NAME: Quartet Dome
OCCURRENCE: Outcrop
ROCK UNIT: Rhyolite of Quartet Dome = Trq

ROCK DESCRIPTION: Sanidine rich (2-5 mm crystals) rhyolite lava flow. Light gray on unweathered surface. Mafics altered (deuteric?) to Fe oxides (hematite).

ROCK STRUCTURE: Steeply dipping flow banding - see geologic map
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu **LAB DATE:** 1/10/96
HAND SPECIMEN STUDY: Light gray porphyritic igneous rock with phenocrysts of feldspar and quartz in a light-colored aphanitic matrix.

TEXTURE: Porphyritic
ESSENTIAL MINERALS: Sanidine (30%, <3X2 mm, subhedral), quartz (8%, <1 mm, subhedral to euhedral). Groundmass: 58%, microaggregates of quartz and radial fibers.

ACCESSORY MINERALS: Magnetite (2%)
SECONDARY: Epidote (2%)
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, quartz

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **125**

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4133340
UTM EAST: 572964
ROCK AGE:

COLLECTOR: J.G. Price
QUADRANGLE NAME: Quartet Dome
OCCURRENCE: Outcrop
ROCK UNIT: Ta on geologic map

ROCK DESCRIPTION: Air-fall(?) tuff, non welded. Zeolitized(?), with volcanic rock fragments and 5-10 mm pumice.

ROCK STRUCTURE: Layer more or less follows contour of hill - not steeply dipping.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu **LAB DATE:** 1/10/96
HAND SPECIMEN STUDY: Whitish altered tuffaceous rock with feldspar and biotite crystals visible. The matrix appears to have altered to patches of greenish-white matter.

TEXTURE: Pyroclastic
ESSENTIAL MINERALS: Plagioclase (10%, <1.5 mm, irregular), sanidine (5%, <1 mm), quartz (2%, <1 mm), biotite (3%, < 1.5 mm), hornblende (2%).

ACCESSORY MINERALS: Magnetite
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Heulandite, plagioclase, mica, quartz.

CEMENT: Matrix (78%) entirely altered to heulandite.
FEATURES:
FULL ROCK NAME: Altered (zeolitized) rhyolite tuff
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **126**

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4133554
UTM EAST: 572273
ROCK AGE:

COLLECTOR: J. G. Price
QUADRANGLE NAME: Quartet Dome
OCCURRENCE: 2 m boulder near outcrop.
ROCK UNIT: Tcc on geologic map = ash-flow tuff of Cache Cave Draw

ROCK DESCRIPTION: Rhyolite ash-flow tuff. Pumice (10%) fragments up to 5 cm, mostly 1-2 cm. Rhyolite rock fragments up to 1 cm. Few crystals.

ROCK STRUCTURE: Outcrops nearby appear to dip gently.
REMARKS: Photo of Ocher Ridge from E looking W.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/11/96
HAND SPECIMEN STUDY: Pinkish altered tuffaceous rock with pumice fragments and minor crystals of quartz and feldspar.

TEXTURE: Pyroclastic
ESSENTIAL MINERALS: Quartz (3%, <0.5 mm, irregular), sanidine + plagioclase (4%, 0.8 mm, irregular), pumice fragments (20%, <7 mm, irregular).

ACCESSORY MINERALS:
SECONDARY: Mordenite
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Mordenite, quartz, feldspar, gypsum.

CEMENT: Glass shards altered to mordenite (77%).
FEATURES: Vuggy locally due to leaching
FULL ROCK NAME: Altered (zeolitized) rhyolitic tuff
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **127**

FIELD DATE: 10/22/95
SCALE: 1:24,000
UTM NORTH: 4133557
UTM EAST: 571821
ROCK AGE:

COLLECTOR: J. G. Price
QUADRANGLE NAME: Quartet Dome
OCCURRENCE: Outcrop
ROCK UNIT: To=Rhyolite of Ocher Ridge

ROCK DESCRIPTION: Quartz porphyry with fragments of silicified pumice (?) This sample is not as silicified as other outcrops on this ridge.

ROCK STRUCTURE: Appears to be massive flow from valley to west.
REMARKS: Photo from valley to W.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/11/96
HAND SPECIMEN STUDY: Pinkish brown tuffaceous rock with quartz crystals and pumice fragments.

TEXTURE: Pyroclastic
ESSENTIAL MINERALS: Quartz (20%, <2mm, irregular), potassium feldspar (5%, <1 mm, irregular), pumice fragments (15%, <3 mm, irregular).

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, orthoclase

CEMENT: Matrix (60%) recrystallized to intimate growth of quartz and potassium feldspar.
FEATURES:
FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **128**

FIELD DATE: 10/22/95
SCALE: 1:24,000
COLLECTOR: J. G. Price
UTM NORTH: 4142267
QUADRANGLE NAME: Gold Flat East
UTM EAST: 554442
OCCURRENCE: Outcrop
ROCK AGE: Miocene
ROCK UNIT: Tac (?) Crater Flat Group

ROCK DESCRIPTION: White, nonwelded biotite- bearing tuff. Pumice up to 2 cm. Volcanic rock fragments up to 3 cm. Overlying this unit is a gray lava flow that makes this unit red at its top. Overlying the lava flow are several welded ash-flow tuffs with small (<5 cm) flattened pumice fragments.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/12/96

HAND SPECIMEN STUDY: Light brown tuffaceous rock with pumice fragments and crystals of quartz and feldspar.

TEXTURE: Pyroclastic

ESSENTIAL MINERALS: Quartz (5%, <0.1 mm, irregular), sanidine (7%, <0.1 mm, irregular), pumice fragments (15%, <4 mm, irregular).

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, glass

CEMENT: Matrix: volcanic glass (73%).

FEATURES: Trace biotite; both matrix and pumice fragments are glassy, noncrystalline.

FULL ROCK NAME: Rhyolitic tuff
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **129**

FIELD DATE: 10/22/95
SCALE: 1:24,000
COLLECTOR: J. G. Price
UTM NORTH: 4123152
QUADRANGLE NAME: Trail Ridge
UTM EAST: 535674
OCCURRENCE: Outcrop
ROCK AGE: Miocene
ROCK UNIT: Tgm- Post-caldera moat fill

ROCK DESCRIPTION: Crystal (sanidine up to 7 mm) rich ash flow tuff. Volcanic rock fragments up to 2 cm. Holes (pumice?) up to 20 cm.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/12/96

HAND SPECIMEN STUDY: Reddish brown porphyritic volcanic rock with crystals of quartz an feldspar and flow bands in matrix.

TEXTURE: Porphyritic

ESSENTIAL MINERALS: Sanidine (38%, <6x2 mm, subhedral). Groundmass: 55% bands of glass and devitrified matrix as extremely fine grained intergrowth of quartz and potassium feldspar.

ACCESSORY MINERALS: Hornblende (3%), magnetite + augite (<1%).
SECONDARY: Epidote (2%), calcite (2%)

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, amphibole, trace calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **130**

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Big Dune
OCCURRENCE: Outcrop
ROCK UNIT: Bullfrog Tuff (Tcb)

FIELD DATE: 5/11/95
SCALE: 1:24,000
UTM NORTH: 4059914
UTM EAST: 541446
ROCK AGE: 13.3 Ma

ROCK DESCRIPTION: Densely welded glassy (vitric) rhyolite ash-flow tuff (vitrophere). From exposure on east side of gully at south end of Yucca Mtn. Vitrophyre here overlies porous glassy ash-fall, surge and ash-flow tuffs. Bullfrog Member of Crater Flat Tuff.

ROCK STRUCTURE: Dip: 15NE

REMARKS: Specimen is from "Raven Canyon" section discussed by Peterman 1991? or 1992? paper in High-level waste management conference proceedings.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 1/17/96

HAND SPECIMEN STUDY: Gray porphyritic rock with phenocrysts of white feldspar and quartz and brownish black biotite in a dark groundmass.

TEXTURE: Porphyritic with brown groundmass which shows fine bands.

ESSENTIAL MINERALS: Sodic plagioclase (25%, <1 mm, subhedral), sanidine (7%, <0.8x0.5 mm, subhedral). Groundmass (57%) amorphous.

ACCESSORY MINERALS: Quartz (5%), biotite (5%), magnetite (3%), hornblende (2%), rock fragments (1%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, quartz, mica, amphibole, amorphous matter, magnetite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite tuff.

GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **131**

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Big Dune
OCCURRENCE: Outcrop
ROCK UNIT: Bullfrog Tuff (Tcb)

FIELD DATE: 11/5/95
SCALE: 1:24,000
UTM NORTH: 4059937
UTM EAST: 541476
ROCK AGE: 13.3 Ma

ROCK DESCRIPTION: Densely welded devitrified interior of rhyolite ash-flow tuff unit. Block collected from slope about 200' NE of GSCN-130.

ROCK STRUCTURE: Dip: 15NE

REMARKS: See Peterman et al (1991? or 1992?) papers of geochemistry and Sr isotopic composition of rocks from this locality.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 1/17/96

HAND SPECIMEN STUDY: Brownish porphyritic rock with light-colored crystals of feldspar and quartz and dark-colored hornblende and biotite in light brown groundmass.

TEXTURE: Porphyritic, with groundmass devitrified and altered.

ESSENTIAL MINERALS: Sanidine (20%, <1.5 mm, subhedral), quartz (15%, <1 mm, subhedral), plagioclase (7%, <1 mm, subhedral to euhedral). Groundmass (50%, devitrified and altered to cristobalite and calcite).

ACCESSORY MINERALS: Biotite (3%), hornblende (2%), magnetite (3%), sphene (<1%)

SECONDARY: Calcite (15%), cristobalite (35%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, quartz, feldspar, amphibole, calcite, mica, magnetite.

CEMENT:

FEATURES: Cristobalite shows radial or dog-toothed rods in devitrified groundmass.

FULL ROCK NAME: Rhyolite tuff.

GENERAL ROCK NAME: Silicic volcanic rock

SAMPLE NUMBER: **151**

FIELD DATE: 6/25/94

SCALE: 1:24,000

COLLECTOR: C.D. Henry

UTM NORTH: 4153829

QUADRANGLE NAME: Packrat Canyon

UTM EAST: 502576

OCCURRENCE: West flank of hill 6251

ROCK AGE:

ROCK UNIT: Tsr - rhyolite of Stonewall Mountain

ROCK DESCRIPTION: Moderately porphyritic, flow banded rhyolite lava dome; pervasively oxidized, miarolitic; local chalcedony along fractures. Phenocrysts: Alkali feldspar to 4mm a few adularescent; quartz to 3mm, oxidized amphibole 1.0%, needles to 3mm long. Locally spherulitic; rare fine mafic to intermediate igneous inclusions. Massive to coarsely bedded lithic tuff along lower flank of dome, clasts of Tsr to 40cm in pumiceous matrix. Tuff attitude is N10W 23W.

ROCK STRUCTURE: Coarse flow banding dips steeply inward to steeply outward around flank of hill.

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Grayish brown porphyritic rock with white phenocrysts of feldspar and quartz.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: sanidine (20%, 1.5 X 1.2mm, subhedral), sodic plagioclase (3.0%, 1.2 X 1.0mm, subhedral), quartz (2.0%, 1.0 X 1.0mm, anhedral). Groundmass: microspherulite (18%, <0.5mm diameter), microcrystals of cristobalite (35%), microcrystals of sanidine (13%).

ACCESSORY MINERALS: Magnetite (2.0%).

SECONDARY: Calcite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: cristobalite, sanidine, trace calcite and quartz.

CEMENT:

FEATURES: Microspherules in groundmass consisting of radial fibers, perhaps of sanidine.

FULL ROCK NAME: Rhyolite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **152**

FIELD DATE: 6/25/94

SCALE: 1:24,000

COLLECTOR: C.D. Henry

UTM NORTH: 4149007

QUADRANGLE NAME: Tolicha Peak NW

UTM EAST: 502048

OCCURRENCE: Hill 6455, NW part of quad

ROCK AGE:

ROCK UNIT: Tsr - rhyolite of Stonewall Mountain

ROCK DESCRIPTION: Moderately porphyritic rhyolite lava dome, indistinguishable from GSCN-151. Phenocrysts; alkali feldspar, a few adularescent; quartz amphibole <10% needles to 3mm; mostly oxidized. Top of 6455 commonly spherulitic; very rare inclusions of porphyritic mafic igneous; vesicular with 10% Ca-anorthoclase ? to lcm.

ROCK STRUCTURE: Coarsely flow banded.

REMARKS: NW part of quad. E flank, just below top

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Reddish white porphyritic rock with hematitic staining.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: sanidine (20%, 1.2 X 1.0mm, subhedral), quartz (8.0%, 1.0 X 1.0mm, anhedral), plagioclase (2.0%, 0.8 X 0.6mm, subhedral). Groundmass: microspherules (72%, <0.6mm diameter); intergrained microcrysts of quartz, cristobalite and feldspar (42%).

ACCESSORY MINERALS: Magnetite (3.0%), partial alteration to goethite and hematite.

SECONDARY: Calcite, goethite(3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, cristobalite.

CEMENT:

FEATURES: Microspherules with radial fibers of sanidine.

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 153

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: C.D. Henry
UTM NORTH: 4145915
QUADRANGLE NAME: Tolicha Peak NW
UTM EAST: 504024
OCCURRENCE: Saddle SE of 5484; NW central
ROCK AGE:
ROCK UNIT: Tsr - rhyolite of Stonewall Mountain

ROCK DESCRIPTION: Moderately porphyritic felsic lava dome; very hydrated vitrophyre from upper carapace of lava dome. Coarsely flow banded with variations in vesicularity between bands. Phenocrysts: approximately 10%, alkali feldspar to 7mm, <1.0%, 1mm amphibole needles. No quartz.

ROCK STRUCTURE: Flow banded.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Brownish gray volcanic rock with flow banding and whitish phenocrysts.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: sanidine (15%, <3.0 X 2.0mm, euhedral), ferroaugite (3.0 %, <1.0 X 0.2mm, euhedral). Groundmass: glass (77%), clear.

ACCESSORY MINERALS:
SECONDARY: Calcite, goethite, hematite (5.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:

XRAY STUDY: Sanidine, glass.

CEMENT:

FEATURES: Flow banding and perlitic crack in glassy groundmass.

FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 154

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: C.D. Henry
UTM NORTH: 4145845
QUADRANGLE NAME: Tolicha Peak NW
UTM EAST: 504614
OCCURRENCE: See remarks below
ROCK AGE:
ROCK UNIT: Tsc Civet Cat Canyon Mbr Stonewall Flat Tuff

ROCK DESCRIPTION: Black densely welded vitrophyre of moderately pumice rich, sparse lithic tuff. Phenocrysts: 20%, alkali feldspar to 3mm; rare biotite to 3mm; mafics. Poorly exposed less welded zone with black glass in brown vitrophyre matrix, less porphyritic than sample. Tsc makes low "dome" with gentle outward dips less than or equal to 10 degrees away from low core of tuff. Tuff does not crop out, but lag of mafic and felsic igneous and quartzite. This may be lower nonwelded zone of Tsc or tuff from Tsr dome.

ROCK STRUCTURE:

REMARKS: Distinct ledge wrapping around conglomerate?

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Dark gray to black porphyritic rock with white phenocrysts of feldspar.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: sanidine (30%, <2.0 X 1.0mm, subhedral), andesine (4.0%, <2.0 X 1.0mm, subhedral), ferroaugite (3.0%, <1.5 X 1.0mm, anhedral), biotite (2.0%, <1.0 X 0.5mm, subhedral). Groundmass: glass (51%), flow band.

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS:

XRAY STUDY: Feldspar, trace mica.

CEMENT:

FEATURES: Welded shards in groundmass.

FULL ROCK NAME: Trachyte tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 155a

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4126304
UTM EAST: 531387
ROCK AGE:

COLLECTOR: C.D. Henry
QUADRANGLE NAME: Black Mountain
OCCURRENCE: See remarks below
ROCK UNIT: Tth - Trachyte of Hidden Cliff

ROCK DESCRIPTION: Finely vesicular, porphyritic trachyte lava. Scoriaceous rubble zones between approximately flat lying flows. Sample is slightly oxidized and minor silica vesicle lining. Phenocrysts: plagioclase-abundant 1mm laths; rarely to 8mm. Cpx and Olivine; 1-2mm; many oxidized.

ROCK STRUCTURE: Approximately flat lying with common scoria rubble zones between flows.

REMARKS: Occurs approximately 100 feet below top of Black Mountain; sample from rubble blasted to make equipment pad. Sample labeled as 155a(in lab) is one described above. An alternative sample labeled 155b was also submitted for analysis.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Gray porphyritic rock with feldspar phenocrysts, spotty rutile and groundmass with reddish tint.

TEXTURE: Porphyritic, holocrystalline.

ESSENTIAL MINERALS: Phenocrysts: andesine (20%, <3.0 X 1.0mm, euhedral to subhedral). Groundmass: holocrystalline, largely subhedral granular orthoclase <0.05 X 0.04mm and less), plagioclase (59%).

ACCESSORY MINERALS: Rutile (7.0%), augite (4.0%), magnetite (5.0%).

SECONDARY: Goethite (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY:

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 155b

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4126304
UTM EAST: 531387
ROCK AGE:

COLLECTOR: C.D. Henry
QUADRANGLE NAME: Black Mountain
OCCURRENCE: See remarks below
ROCK UNIT: Tth - trachyte of Hidden Cliff

ROCK DESCRIPTION: Finely vesicular, porphyritic trachyte lava. Scoriaceous rubble zones between approximately flat lying flows. Sample is slightly oxidized and minor silica? vesicle lining. Phenocrysts: Plagioclase-abundant 1mm laths; rarely to 8mm. Cpx and olivine; 1-2mm; many oxidized.

ROCK STRUCTURE: Approximately flat-lying with common scoria rubble zones between flows.

REMARKS: Occurs approximately 100 feet below top of Black Mountain; sample from rubble blasted to make equipment pad. Sample labeled as 155b (in lab) was collected as an alternative sample for 155a; both were submitted for analysis.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94

HAND SPECIMEN STUDY: Gray porphyritic rock with feldspar phenocrysts, spotty rutile and groundmass with reddish tint.

TEXTURE: Porphyritic, holocrystalline.

ESSENTIAL MINERALS: Phenocrysts: andesine (20%, <3.0 X 1.0mm, euhedral to subhedral).Groundmass: holocrystalline, largely subhedral granular orthoclase <0.05 X 0.04mm and less), plagioclase (59%).

ACCESSORY MINERALS: Rutile (7.0%), augite (4.0%), magnetite (5.0%).

SECONDARY: Goethite (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY:

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **156**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4121925
UTM EAST: 535909
ROCK AGE:

COLLECTOR: C.D. Henry
QUADRANGLE NAME: Thirsty Canyon
OCCURRENCE: See remarks below
ROCK UNIT: Ttc-comendite flow of Ribbon Cliff, above Thirsty Canyon

ROCK DESCRIPTION: Moderately porphyritic, coarsely flow banded comendite lava. Platy fracturing parallel to flow bands; nodular rubbly weathering. Phenocrysts: alkali feldspar to 5mm; minor mafics. Very difficult to get fresh sample.

ROCK STRUCTURE: Edge of post Spearhead caldera.
REMARKS: NW part of quadrangle-near base of flow above Thirsty Canyon.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94
HAND SPECIMEN STUDY: Black porphyritic rock with feldspar phenocrysts and obsidian groundmass.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: sanidine (20%, <3.0 X 1.6mm, subhedral to euhedral). Groundmass: black obsidian glass (50%), cristobalite (20%).

ACCESSORY MINERALS: Biotite (2.0%), magnetite (5.0%).
SECONDARY: Sericite (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Feldspar, cristobalite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite obsidian.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **157**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4121858
UTM EAST: 535779
ROCK AGE:

COLLECTOR: C.D. Henry
QUADRANGLE NAME: Thirsty canyon
OCCURRENCE:
ROCK UNIT: Ttc-comendite (trachyte) of Ribbon Cliff

ROCK DESCRIPTION: Hydrated vitrophyre of abundantly porphyritic quartz trachyte; trachytic. Phenocrysts (30%), 1-4mm trachytic laths of alkali feldspar and plagioclase.

ROCK STRUCTURE: Edge of post Spearhead caldera.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/20/94
HAND SPECIMEN STUDY: Black porphyritic rock with large phenocrysts of feldspar.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: sanidine (35%, <3.0 X 1.0mm, sub to euhedral), augite (8.0%, 0.8 X 0.6mm, anhedral). Groundmass:: obsidian glass.

ACCESSORY MINERALS: Magnetite (4.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY:

CEMENT:
FEATURES: Flow bands in obsidian glass groundmass.
FULL ROCK NAME: Trachyte.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **158**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4137001
UTM EAST: 499355
ROCK AGE:

COLLECTOR: C.D. Henry, K. Connors
QUADRANGLE NAME: Scotty's Junction NE
OCCURRENCE: See remarks below
ROCK UNIT: Tsp-Spearhead Member

ROCK DESCRIPTION: Densely welded, devitrified, pumiceous ash-flow tuff. Pinkish buff. Very sparsely porphyritic. Lower part with large (to 30cm) light-colored pumice below dark-pumice part.

ROCK STRUCTURE:
REMARKS: Densely welded interior along fault scarp.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Reddish brown volcanic rock with feldspar crystals and pumiceous fragments in brown glassy matrix.

TEXTURE: Porphyritic with flow bands.

ESSENTIAL MINERALS: Phenocrysts: sanidine (15%, <2.0 X 1.5mm, euhedral to subhedral), devitrified pumice fragments probably cristobalite and quartz (30%). Banded glassy groundmass (50%).

ACCESSORY MINERALS: Magnetite, rutile (3.0%), plagioclase (1.0%).
SECONDARY: Hematite (1.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Feldspar, cristobalite, quartz.

CEMENT:
FEATURES: Flow banding.
FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **159**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4139923
UTM EAST: 497977
ROCK AGE:

COLLECTOR: C.D. Henry
QUADRANGLE NAME: Scotty's Junction NE
OCCURRENCE: See remarks below
ROCK UNIT: Tsc-Civet Cat Canyon Member Stonewall Flat Tuff

ROCK DESCRIPTION: Densely welded devitrified, pumiceous, moderately porphyritic ash-flow tuff. Phenocysts (20%) alkali feldspar, sparse biotite 1-2mm.

ROCK STRUCTURE:
REMARKS: Near base of unit along slope into canyon.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/26/94

HAND SPECIMEN STUDY: Fragments of pyroclastic rock with various shades of color and crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <2.5 X 2.0mm, irregular), plagioclase (12%, <2.0 X 2.0mm, irregular), augite (4.0%, <1.0 X 1.0mm, subhedral), devitrified glass shards (5.0%, irregular). Matrix, devitrified (53%).

ACCESSORY MINERALS: Magnetite (3.0%).
SECONDARY: Calcite (3.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, plagioclase, quartz, cristobalite, calcite.

CEMENT:
FEATURES: Glomerophyric clustering and zoning of plagioclase.
FULL ROCK NAME: Trachyte tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **160**

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: C.D. Henry
UTM NORTH: 4139784
QUADRANGLE NAME: Scotty's Junction NE
UTM EAST: 498144
OCCURRENCE: See remarks below
ROCK AGE: Cambrian
ROCK UNIT: Emigrant Formation

ROCK DESCRIPTION: Massive gray quartzite, poorly exposed along east face of ridge just above canyon floor.

ROCK STRUCTURE:

REMARKS: Poorly exposed quartzite and limestone (Limestone is GSCN 183).

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Brownish white siliceous rock with veinlets of quartz and hematite staining.

TEXTURE: Intergranular, mosaic.

ESSENTIAL MINERALS: Quartz (95%, <0.01mm, graphic).

ACCESSORY MINERALS: Dolomite (5.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, dolomite.

CEMENT:

FEATURES: Microveins of quartz with size up to 0.1mm.

FULL ROCK NAME: Silicified rock.

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **161**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4149226
QUADRANGLE NAME: Tolicha Peak NE
UTM EAST: 516818
OCCURRENCE:
ROCK AGE:
ROCK UNIT: Tea - tuff of Antelope Spring

ROCK DESCRIPTION: Densely welded sub-horizontal ash-flow tuff; entire hill is hydrothermally altered with light buff silicified and adularized or albitized feldspar phenocrysts and abundant discontinuous silica veinlets. Main fracture set approximately N20E, steeply E and W dipping with chalcedonic silicification. Locally limonitic weathering on facts may been pyritic. Medium reddish gray where not so silicified. 2 pieces: 1) Light buff very altered, 2) Reddish, less altered.

ROCK STRUCTURE:

REMARKS: Not suitable for baseline but good for comparison/evaluation of stream sediments. Essentially a large rock-chip sample. Photos taken include view of Gold Crater and Stonewall Mountain to NW.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/26/94

HAND SPECIMEN STUDY: Fragments of pyroclastic rocks with two different colors; whitish and brown, both have crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Brown: sanidine (15%, <1.0 X 1.0mm, angular), felsic rock fragments (10%, <1.5 X 1.0mm, angular), matrix (61%, devitrified, locally spherulitic).

ACCESSORY MINERALS: Magnetite (4.0%), biotite (2.0%), trace brown.

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, brown fragments shear calcite, kaolinite and mica in addition.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **162**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4149599
UTM EAST: 517792
ROCK AGE:

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Tolicha Peak NE
OCCURRENCE:
ROCK UNIT: Toqb of Minor et al. (1993); Tqh of Ekren et al. (1971).

ROCK DESCRIPTION: Light purplish-gray, massive devitrified crystal rich lava. No sign of eutaxitic structure or foliation. Abundant large biotite, sparse oxidized hornblende. Scattered large quartz phenocrysts, embayed, as large as 0.7cm.

ROCK STRUCTURE:
REMARKS: Fairly fresh

REFERENCES: Ekren et al. '71, USGS PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 10/26/94
HAND SPECIMEN STUDY: Light colored pyroclastic rock with various rock fragments and crystals of quartz, feldspar and biotite.

TEXTURE: Pyroclastic
ESSENTIAL MINERALS: Quartz (15%, <1.5 X 1.0mm, rounded), sodic plagioclase (10%, <3.0 X 2.0mm, subhedral), biotite (8.0%, <2.0 X 0.5mm, subhedral), rock fragments (10%, <4.0 X 3.0mm, irregular). Matrix (36%), microcrystals of quartz and feldspars.

ACCESSORY MINERALS: Magnetite (2.0%).
SECONDARY: Calcite (5.0%), kaolinite (4.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, plagioclase, biotite, kaolinite.

CEMENT:
FEATURES: Oxidation margins of biotite.
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **163**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4146576
UTM EAST: 515147
ROCK AGE: Oligocene/early Miocene?

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Tolicha Peak NE
OCCURRENCE:
ROCK UNIT: Tea Tuff of Antelope Spring

ROCK DESCRIPTION: Crystal-rich, extremely densely welded, devitrified ash-flow tuff. Light to reddish-gray. Abundant smoky quartz phenocrysts, some embayed; Minor bio, largely oxidized plagioclase and now white, hard to soft sparse volcanic lithics <2.0cm. Nice dark reddish brown silica veinlets and chalcedonic quartz veinlets in many outcrops but fresh compared to GSCN-161. GSCN-163 thin section labeled in bag.

ROCK STRUCTURE: Difficult to see compositional foliation but probably not steeply dipping.
REMARKS: Local pumice (devitrified) 2.0cm X 15cm long. Rounded slopes, subdued, small outcrops.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/26/94
HAND SPECIMEN STUDY: Brown pyroclastic rock with crystal and rock fragments in a brown matrix.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Sanidine (25%, <2.0 X 1.0mm, euhedral to subhedral), quartz (20%, <2.0 X 1.5mm, rounded to subhedral), rock fragments (15%, <4.0 X 3.0mm , irregular). Matrix (28%), micro- to cryptocrystalline iron staining.

ACCESSORY MINERALS: Biotite (3.0%).
SECONDARY: Calcite (6.0%), kaolinite (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 164

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4146241
QUADRANGLE NAME: Tolicha Peak NE
UTM EAST: 513780
OCCURRENCE:
ROCK AGE:
ROCK UNIT: See rock structure below.

ROCK DESCRIPTION: No outcrop. Rreddish colored slopes covered with a lag of broken clasts which were apparently rounded. Now mainly angular fragments 1cm to 1m. Heterolithic. Dark gray to light brown, massive to finely bedded limestone and dolomite; shale or siltstone. At least two major quartzite types: dark red brown quartzite-meta conglomerate and light green, white to pink medium to fine-grained quartzite with scolithus trace; probably equivalent to Zabriskie Quartzite. Blocks >1m but <2m, red weathering "soil" sample is a grab of small fragments plus red dirt; largely meaningless.

ROCK STRUCTURE: Tec of minor et al. (1993); "early conglomerate", pre-volcanic, no volcanic clasts.

REMARKS: Many quartzite fragments contain "metamorphic-looking" white-clear granular quartz units. No bedding in unit exposed or seen.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/26/94

HAND SPECIMEN STUDY: Rock chips mainly of two different colors; black and brown, both appear to be sedimentary rocks.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Quartz, feldspar, dolomite, calcite.

XRAY STUDY: Black fragments: calcite, quartz, dolomite. Brown fragments: quartz, mica.

CEMENT: Sericitic, carbonate.

FEATURES:

FULL ROCK NAME: Limestone, arkosic sandstone, dolomitic limestone.
GENERAL ROCK NAME: Conglomerate

SAMPLE NUMBER: 165

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: S.I. Weiss
UTM NORTH: 4149864
QUADRANGLE NAME: Mount Helen
UTM EAST: 522828
OCCURRENCE:
ROCK AGE:
ROCK UNIT: Trh/Tqh rhyolite of Mt. Helens; silicic lava flowdome.

ROCK DESCRIPTION: Light brown-gray to dark gray-brown weathering; phenocryst-rich, massive to flow-banded, devitrified silicic lava. Probably rhyolitic. Approximately 15% phenocrysts. Quartz to approximately 3-4mm, rarely as large as 1.2 cm. In part smoky. Sanidine, partly white--sericitized? Oxidized biotite abundant, up to approximately 3mm. Possibly relict hornblende and pyroxene--destroyed during crystallization.

ROCK STRUCTURE: Flow-banding indistinct here.

REMARKS: Fresh except for local fracture-controlled silicification with cloudy, hard feldspar. Sample site nearly fresh--slight sericitization of feldspar phenocrysts.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 10/26/94

HAND SPECIMEN STUDY: Porphyritic rock with phenocrysts of feldspar, quartz, and biotite in light brownish matrix.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Sanidine (20%, <7.0 X 4.0mm, euhedral), biotite (7.0%, <1.5 X 0.4 mm, euhedral), quartz (4.0%, <1.5 X 1.0mm, subhedral to rounded). Matrix (58%), cryptocrystalline.

ACCESSORY MINERALS: Magnetite (2.0%).
SECONDARY: Calcite (5.0%), smectite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, biotite, calcite, smectite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **166**

FIELD DATE: 6/25/94

SCALE: 1:24,000

COLLECTOR: S.I. Weiss

UTM NORTH: 4148687

QUADRANGLE NAME: Mount Helen

UTM EAST: 525251

OCCURRENCE:

ROCK AGE:

ROCK UNIT: Toqb of Minor et al. (1993). Could be related to Mt. Helen.

ROCK DESCRIPTION: Light creamy yellow unwelded, zeolitized? Previously glassy rhyolitic tuff (ash-flow tuff). Phenocysts small, hard to see, probably <10% pumice fragments up to 3-4cm but mainly <2cm; slightly opalized. Crumbly weathering; impossible to get chunks with unweathered areas, would need to put in a mini jaw crusher . All fractured and crumbly (as altered glassy tuff usually is). Not uncommon lithic fragments-dark purplish-gray siliceous lava fragments <3.0cm, usually <1.0 cm.

ROCK STRUCTURE:

REMARKS: View of Mt. Helen to N; view of GSCN 166 sample outcrop. Forgot to leave tag.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/26/94

HAND SPECIMEN STUDY: Fragments of yellowish white altered tuffaceous rock with surviving crystals, surface appears porous by presence of many voids.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS: Sodic plagioclase (6.0%), quartz (2.0%).

SECONDARY: Clinoptilolite.

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Clinoptilolite.

CEMENT:

FEATURES:

FULL ROCK NAME: Zeolitized tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **167**

FIELD DATE: 6/25/94

SCALE: 1:24,000

COLLECTOR: S.I. Weiss

UTM NORTH: 4146315

QUADRANGLE NAME: Mount Helen

UTM EAST: 522208

OCCURRENCE:

ROCK AGE:

ROCK UNIT: Tot-Tolicha Peak Tuff * Hydrothermally altered.

ROCK DESCRIPTION: White to light yellowish-gray, devitrified; partially to densely welded ash-flow tuff with eutaxtic structure stratification from abundant cm-length pumice fragments. Phenocryst-poor, (<2.0%), small quartz, feldspar. Trace altered biotite to sericite. Strongly to weakly silicified. Chalcedonic quartz veins, fracture coatings; limonitic fracture surfaces. Feldspar phenocrysts largely altered to soft white phyllosilicate.

ROCK STRUCTURE: Compaction foliation. Eutaxitic structure suggests unit dips W approximately 15 degrees here.

REMARKS: E and N sides of ridgecrest bounded by fractures/faults approximately N-S and N40W respectively. Faults apparently control silica veining. Hydrothermal breccia present in silicified tuff on upper east slope.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/27/94

HAND SPECIMEN STUDY: Light brownish tuffaceous rock with irregular fragments of whitish tuffaceous rock.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments of devitrified glass shards (20%, irregular size and shape). Matrix: devitrified to microcrystalline aggregates of quartz and orthoclase (75%).

ACCESSORY MINERALS: Quartz (3.0%) as crystal fragments.

SECONDARY: Calcite (2.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, orthoclase.

CEMENT:

FEATURES:

FULL ROCK NAME: Devitrified rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **168**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4148323
UTM EAST: 526948
ROCK AGE:

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Mount Helen
OCCURRENCE:
ROCK UNIT: Tea-tuff of Antelope Springs

ROCK DESCRIPTION: Medium reddish-brown, crystal-rich, densely welded, devitrified ash-flow tuff. Not very lithic-rich. Phenocrysts approximately 20%. Quartz large, abundant. Sanidine, plagioclase, biotite. Dateable per Chris Henry.

ROCK STRUCTURE:
REMARKS: Freshest "Tea" seen today.

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94
HAND SPECIMEN STUDY: Brown pyroclastic rocks with crystals of quartz and feldspars and rock fragments in iron-stained brown matrix.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Quartz (25%, <3.5 X 2.0mm, subhedral), sanidine and orthoclase (15%, <3.0 X 2.0mm, subhedral), rock fragments (18%, irregular size and shape). Matrix: microcrystalline aggregates of quartz and feldspar (37%).

ACCESSORY MINERALS: Biotite (2.0%), magnetite (<1.0%).
SECONDARY: Calcite (2.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, orthoclase, mica.

CEMENT:
FEATURES: Iron stained matrix.
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **169**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4154076
UTM EAST: 512001
ROCK AGE: 7.5 Ma

COLLECTOR: S.I. Weiss
QUADRANGLE NAME: Civet Cat Cave
OCCURRENCE:
ROCK UNIT: Tsc- Civet Cat Canyon Member; Stonewall Flat Tuff

ROCK DESCRIPTION: Pale-reddish brown, densely welded, devitrified, shard and pumice-rich ash-flow tuff = "caprock" of Civet Cat Canyon member in this area. Contains approximately 5.0% small phenocrysts of sanidine, plagioclase; Unit is about 5m thick here; overlies porous, vapor phase Tss; from base upwards: porous glassy pumice-rich unwelded ash-flow tuff up into partly welded to moderately welded glassy pumice-rich AFT; dense devitrified ash-flow tuff. Cap rock only approximately 2m thick here.

ROCK STRUCTURE:
REMARKS:

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94
HAND SPECIMEN STUDY: Dark brown tuffaceous rock with rock fragments and crystals of feldspar.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Sanidine (15%, < 1 X 1mm, angular), rock fragments (5.0%, irregular shape and size). Matrix: partially devitrified to yield cristobalite.

ACCESSORY MINERALS: Biotite (2.0%), augite, magnetite, and quartz (2.0%).
SECONDARY: Calcite, iron.
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, cristobalite, calcite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **170**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4139323
QUADRANGLE NAME: Tolicha Peak NE
UTM EAST: 518887
OCCURRENCE: Outcrop, resistant ledge.
ROCK AGE: Approximately 14 Ma
ROCK UNIT: Tuff of Tolicha Peak-Tot

ROCK DESCRIPTION: Glassy, crystal poor vitrophyre with occasional pebble size lithics-hydrated (1.0-2.0%), phenocrysts: k-feldspar +/- plagioclase, no mafic phenocrysts evident, some spherulitic devitrified in spots.

ROCK STRUCTURE: Crude columnar jointing at vitrophyre ledge but cross-structures are nearly vertical.

REMARKS:

REFERENCES: Miner, et al, 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Black, vitreous obsidian with rare tiny rock fragments and crystals.

TEXTURE: Glassy.

ESSENTIAL MINERALS: Fragments of siliceous rocks and quartz and feldspars (10%, <3.0 X2.0mm, angular), brownish obsidian glass (90%).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Trace feldspar, quartz, cristobalite.

CEMENT:

FEATURES: Arcuate and circular cracks in obsidian glass.

FULL ROCK NAME: Obsidian.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **171**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4139337
QUADRANGLE NAME: Tolicha Peak NE
UTM EAST: 518975
OCCURRENCE: Slope, poor ledge outcrop
ROCK AGE: Approximately 14 Ma
ROCK UNIT: Tot- devitrified above 170

ROCK DESCRIPTION: Flaggy to fine blocky, devitrified. Crystal poor tuff, nice eutaxtic structure, patchy pumice (same as 171), crystal poor minor plagioclase, quartz, and K-feldspar. No mafics, pale brown.

ROCK STRUCTURE: Flaggy parting along eutaxtic structure.

REMARKS: Sample of devitrified rock above location of GSCN-170.

REFERENCES: Minor et al. ,1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94

HAND SPECIMEN STUDY: Brownish gray tuffaceous rock with lighter colored rock fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments (10%, irregular shape and size). Matrix (85%), brown glass partially devitrified to form microcrystalline aggregates of quartz and orthoclase.

ACCESSORY MINERALS: Sanidine and sodic plagioclase (5.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, K-feldspar.

CEMENT:

FEATURES: Matrix shows minor spherulites.

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **172**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak NE
UTM NORTH: 4141031
UTM EAST: 519980
OCCURRENCE: Outcrop
ROCK AGE: Approximately 14 Ma
ROCK UNIT: Tuff of Tolicha Peak

ROCK DESCRIPTION: Devitrified Tolicha Peak tuff, flaggy to crumbly, hard to get clean sample. Fractures are limonite stained very crystal poor, some fine felsic phenocrysts--sanidine? Nice flattened pumice for white lenses in a cocoa brown tuff.

ROCK STRUCTURE: Crude columnar jointing and flaggy parting along eutaxitic structure.

REMARKS:

REFERENCES: Minor et al, 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94

HAND SPECIMEN STUDY: Grayish brown tuffaceous rock with lighter colored rock fragments and feldspar crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments (10%, irregular). Matrix (85%), brown glass, partially devitrified to yield microcrystalline aggregates of quartz and K-feldspar.

ACCESSORY MINERALS: Sanidine (5.0%), biotite (<1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, K-feldspar.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **173**

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak NE
UTM NORTH: 4140734
UTM EAST: 520747
OCCURRENCE: Outcrop
ROCK AGE: 13.7 Ma
ROCK UNIT: Grouse Canyon Member-Tbg

ROCK DESCRIPTION: Bluish-green welded tuff with vapor phase crystallization in elongate lythophysal cavities and rare phenocrysts of K-feldspar +/- trace quartz. Greenish cast probably due to peralkaline chemistry of the rhyolite tuff, but no sodic amphiboles were observed.

ROCK STRUCTURE: Densely welded layer forms slightly south dipping (approximately 5 degrees) ridge.

REMARKS:

REFERENCES: Minor et al., 1993; Sawyer et al., 1994 (in ess) **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Grayish pyroclastic rock with coarse volcanic rock fragments and fine crystal fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments (15%, <5.0 X 4.0mm, anhedral), sanidine fragments (10%, <1.5 X 1.0mm, subhedral), biotite (2.0%, 1.0 X 0.8mm, subhedral), quartz (2.0%, <1.0mm, anhedral). Glass shards (69%, partly devitrified to form cristobalite and quartz).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, cristobalite.

CEMENT:

FEATURES: Glass shards forming flow bands.

FULL ROCK NAME: Lithic rhyolite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 174

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4143293
QUADRANGLE NAME: Tolicha Peak NE
UTM EAST: 519351
OCCURRENCE: Outcrop
ROCK AGE: ~14 Ma
ROCK UNIT: Togb - tuff breccia

ROCK DESCRIPTION: Tuff breccia--slightly altered, zeolitized to slightly argillic - very lithic rich in some zones - tends to have a porcelaneous break and is generally rich in tiny crystals in the matrix material. Looks similar to the base of the slope where sample GSCN-172 was collected. May interfinger with tuff at Tolicha Peak.

ROCK STRUCTURE:

REMARKS:

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94

HAND SPECIMEN STUDY: Light colored breccia with fragments of rocks cemented by similar matter, local clusters of hematitic matter.

TEXTURE: Clastic.

ESSENTIAL MINERALS:

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS: Rock fragments (70%, irregular shape and size), consisting of microcrystalline aggregates of quartz and K-feldspar.

XRAY STUDY: Quartz and K-feldspar.

CEMENT: Felsic matter derived from devitrification.

FEATURES:

FULL ROCK NAME: Felsic breccia.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 175

FIELD DATE: 6/25/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4140008
QUADRANGLE NAME: Mt. Helen
UTM EAST: 529062
OCCURRENCE: Outcrop - subcrop
ROCK AGE: 9.8 - 6.3 Ma
ROCK UNIT: Tyb - basalt

ROCK DESCRIPTION: Dense to vesicular basalt, generally fresh but with some zeolites infilling vesicles, brittle; tends to break in blocks which have weathered rinds that are difficult to remove. Phenocryst poor but some crystals of plagioclase, pyroxene and small glassy brownish spots which may be relict olivine.

ROCK STRUCTURE: Very slight south dip to flat-lying.

REMARKS: Very poor exposure, scree of basalt covers low hill, but one has to dig for outcrop. Better exposure to the south underlying GSCN-176.

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/27/94

HAND SPECIMEN STUDY: Black basaltic rock with sparse phenocrysts of plagioclase and olivine.

TEXTURE: Porphyritic with intergranular groundmass.

ESSENTIAL MINERALS: Phenocrysts: olivine (4.0%, <0.5 X 0.4mm, subhedral), calcic plagioclase (6.0%, <1.0 X 0.1mm, euhedral to subhedral). Groundmass: (76%), plagioclase laths and augite in interspaces.

ACCESSORY MINERALS: Magnetite (5.0%).

SECONDARY: Iddingsite (6.0%), calcite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Olivine basalt.

GENERAL ROCK NAME: Mafic igneous rock

SAMPLE NUMBER: **176**

FIELD DATE: 6/25/94
SCALE: 1:24,000
UTM NORTH: 4139526
UTM EAST: 529991
ROCK AGE: 9.15 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Mt. Helen
OCCURRENCE: Outcrop
ROCK UNIT: Ttg - Gold Flat

ROCK DESCRIPTION: Pale gray-green with patchy white pumice and large phenocrysts (up to ~1/2 inch long) of feldspar (anorthoclase?), densely welded, devitrified. Some red and black (basaltic) lithics generally phenocryst poor, but the large anorthoclase phenocrysts are dominant. Greenish color probably due to peralkaline nature - no mafics crystals observed, with light pinkish to white fiamme. Contains some dark (almost black) glassy phenocrysts that may be quartz (smoky due to U-Th?), no cleavage but quartz is not reported in this unit in Minor et al. (1993).

ROCK STRUCTURE: Nearly flat-lying with virtually no columnar jointing--large scale fractures.

REMARKS:

REFERENCES: Miner et al., 1994 **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Light gray pyroclastic rock with fragments of volcanic rocks and mineral grains.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Rock fragments (35%, <15mm, angular), sanidine fragments (10%, <2.5mm, angular), quartz (3.0%, <1.0 X 0.8mm, angular). Glassy matrix partially devitrified to cristobalite, quartz.

ACCESSORY MINERALS:

SECONDARY: Calcite.

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, amphibole, calcite, cristobalite.

CEMENT:

FEATURES:

FULL ROCK NAME: Lithic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **177**

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4128598
UTM EAST: 512600
ROCK AGE: between 9.15 & 7.5 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Outcrop
ROCK UNIT: Tyr - rhyolite of Obsidian Butte

ROCK DESCRIPTION: Devitrified, flow banded crystal poor rhyolite, chocolate brown with white stripes and lenses. Spherulitic to axiolitic devitrification structures in places.

ROCK STRUCTURE: Flow banding and ramp structures.

REMARKS:

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 11/17/94

HAND SPECIMEN STUDY: Volcanic rock chips containing irregular white patches and bands in brownish matrix.

TEXTURE: Microporphyritic.

ESSENTIAL MINERALS: Sanidine (15%, <0.1 X 0.04mm, euhedral to subhedral). Matrix: devitrified to form cristobalite (40%) mainly in the white and tridymite (38%) mainly in the brown portion.

ACCESSORY MINERALS: Opaques (2.0%).

SECONDARY: Calcite (4.0%, mainly on white portion).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, tridymite, sanidine, calcite.

CEMENT:

FEATURES: Cristobalite as coarser clear crystals, white tridymite as cloudy intergrowth.

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **178**

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
UTM NORTH: 4128547
UTM EAST: 512813
OCCURRENCE: Cliff face
ROCK AGE: 9.15 to 7.5 Ma
ROCK UNIT: Tyr - rhyolite of Obsidian Butte

ROCK DESCRIPTION: Obsidian lens and obsidian breccia from Obsidian Butte. "Obsidian breccia" looks like an auto brecciated flow lens with pebbles of obsidian in a frothy, hydrated, pinkish devitrified matrix around pebbles of dark bluish to black hydrated and non-hydrated obsidian.

ROCK STRUCTURE: Flow banding, auto brecciation, ramping; multiple flow layers show different features.

REMARKS:

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Brownish gray breccia with clasts of black obsidian in brownish matrix.

TEXTURE: Volcanoclastic.

ESSENTIAL MINERALS: Obsidian clasts (85%, 15 X 10mm to 0.1 X 0.08mm, angular). Matrix: dark brownish glass (15%).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Glass, cristobalite, feldspar.

CEMENT:

FEATURES: Growth of microlites in glassy clasts, possibly intergrown cristobalite and feldspar.

FULL ROCK NAME: Obsidian breccia. **GENERAL ROCK NAME:** Silicic igneous rock

SAMPLE NUMBER: **179**

FIELD DATE: 6/26/94
SCALE: 1:24,000
COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak SW
UTM NORTH: 4124340
UTM EAST: 510484
OCCURRENCE: Outcrop - ledge
ROCK AGE: ~9-9.5 Ma
ROCK UNIT: Tfa

ROCK DESCRIPTION: Basalt, large plagioclase crystals vesicular fine grained with white coating in vugs--zeolites plagioclase phenocrysts up to 1/4" long, small crystals of possibly clinopyroxene or orthopyroxene.

ROCK STRUCTURE: Flat-lying flow forms top of ridge.

REMARKS:

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Dark gray porphyritic rock with vesicles.

TEXTURE: Porphyritic with intergranular groundmass.

ESSENTIAL MINERALS: Phenocrysts: labradorite (25%, <3.0 X 1.5mm, euhedral to subhedral). Groundmass: 75% consisting of plagioclase laths and interstitial grains of augite, magnetite, and hematite.

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, augite.

CEMENT:

FEATURES: Vesicles appear to have been filled with calcite as judged from lining of calcite in the open spaces of vesicles.

FULL ROCK NAME: Basalt. **GENERAL ROCK NAME:** Mafic igneous rock

SAMPLE NUMBER: 180

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4126748
UTM EAST: 514376
ROCK AGE: ~14 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Outcrop
ROCK UNIT: Togb (?)

ROCK DESCRIPTION: Rhyolite, flow banded lava, fine crystalline with 10% phenocrysts of quartz, K-feldspar, and altered (relict) plagioclase. No mafic phenocrysts evident, some spherulitic devitrification.

ROCK STRUCTURE: Very good cliff former - columnar jointed section beautifully exposed above low knobs.

REMARKS: Mapped as Togb - which is bedded and nonwelded crystal/lithic-rich tuff. At this location there is a thick sequence of lavas underlying what appears to be tuff of Tolicha Peak - possibly this is the pre-Tolicha Peak Toq - Rhyolite of Quartz Mountain.

REFERENCES: Minor et al., 1993 OFR 93-299 **ANALYST:** L. C. Hsu **LAB DATE:** 11/17/94

HAND SPECIMEN STUDY: Light brown, somewhat porous volcanic rock with pores lined with radial prisms. Phenocrysts of feldspar are observed.

TEXTURE: Porphyritic with groundmass locally spherulitic and locally granular intergrowths of quartz.

ESSENTIAL MINERALS: Phenocrysts: sanidine (10%, <1.0 X 0.5mm, euhedral). Groundmass: quartz (35%, <0.05mm, anhedral, intergranular), spherules (55%, radial, acicular, cryptocrystalline).

ACCESSORY MINERALS: Biotite (<1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite (spherulitic).

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 181

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4122497
UTM EAST: 512050
ROCK AGE: 9.15 to 7.5 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Base of cliff outcrop
ROCK UNIT: Tyr - rhyolite of Obsidian Butte

ROCK DESCRIPTION: Glassy flow banded rhyolite lava; hydrated, brittle, with up to 10% phenocrysts of quartz and K-feldspar but difficult to see in the dark matrix glass.

ROCK STRUCTURE: Flow banding and ramp structures.

REMARKS: Sample 182 is cleaner material.

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 11/17/94

HAND SPECIMEN STUDY: Dark gray obsidian with sparse white feldspar crystals.

TEXTURE: Porphyritic with sparse phenocrysts, vast glassy groundmass.

ESSENTIAL MINERALS: Groundmass: (>95%), mostly glass with local tiny cryptocrystallites probably feldspar.

ACCESSORY MINERALS: Alkali feldspar (<5.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Glass, trace feldspar.

CEMENT:

FEATURES:

FULL ROCK NAME: Obsidian.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 182

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4122570
UTM EAST: 511968
ROCK AGE: 9.15 to 7.5 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Subcrop of vitrophyre ledge.
ROCK UNIT: Tyr

ROCK DESCRIPTION: Pale blue gray vitrophyre, hydrated with phenocrysts of quartz and K-feldspar but difficult to see in the glassy matrix so percentage estimate is very roughly 10%.

ROCK STRUCTURE: Flow banding, ramping, some autobrecciation in lens below sample.

REMARKS: Slightly better vitrophyre material than in 181, from lower slope of knob where 181 was collected - still hydrated but more massive. Good sample for GSCN.

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 11/17/94

HAND SPECIMEN STUDY: Light gray pitchstone with rare crystals of feldspar and biotite.

TEXTURE: Porphyritic with rare phenocrysts in vast glassy groundmass showing micro-flow lines.

ESSENTIAL MINERALS: Groundmass: (>95%, micro-flow lines and cryptocrystallites of probably feldspar).

ACCESSORY MINERALS: Alkali feldspar and biotite (<4.0%).

SECONDARY: Calcite (<1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Glass.

CEMENT:

FEATURES:

FULL ROCK NAME: Pitchstone.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 183

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4139783
UTM EAST: 498156
ROCK AGE: Cambrian

COLLECTOR: K. Connors
QUADRANGLE NAME: Scotty's Junction NE
OCCURRENCE: Outcrop - subcrop
ROCK UNIT: Emigrant Formation

ROCK DESCRIPTION: Limestone breccia, reddish stained silicified in part. No good sample material, the outcrop is poor and the sample material is altered and variable in composition.

ROCK STRUCTURE: Brecciated.

REMARKS:

REFERENCES: Weiss, 1987 - Master's Thesis **ANALYST:** L. C. Hsu **LAB DATE:** 11/17/94

HAND SPECIMEN STUDY: Reddish brown, compact dolomitic rock.

TEXTURE: Mosaic with chert nodules.

ESSENTIAL MINERALS: Dolomite (67%, <.05mm, mosaic), chert (30%, irregular shape and size).

ACCESSORY MINERALS: Calcite (<3.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Dolomite, quartz, trace calcite.

CEMENT:

FEATURES: Chert consists of chalcedonic quartz and much less dolomite rhombs, hematitic staining imparts the rock its color.

FULL ROCK NAME: Cherty dolomite.

GENERAL ROCK NAME: Dolomite

SAMPLE NUMBER: 184

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4124375
UTM EAST: 517278
ROCK AGE: ~14 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Outcrop - blasted top of peak.
ROCK UNIT: Tuff of Tolicha Peak

ROCK DESCRIPTION: Densely welded devitrified tuff of Tolicha Peak, very phenocryst poor - rare quartz, K-feldspar, and biotite (fairly abundant for this unit), fractured and SiO2 veining, silica alteration.

ROCK STRUCTURE:

REMARKS:

REFERENCES: Minor et al., 1993
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Reddish brown tuffaceous rock with sparse crystals and some lithic fragments.

TEXTURE: Pyroclastic with sparse crystals of sanidine and plagioclase and some lithic fragments.

ESSENTIAL MINERALS: Sanidine (6.0%, <0.5 X 0.4mm, angular), plagioclase (3.0%, <0.4 X 0.3mm, angular), lithic fragments (10%, irregular size and shape). Matrix (81%, local spherules, recrystallization to quartz, feldspar, cristobalite).

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, cristobalite, sanidine.

CEMENT:

FEATURES: Dark reddish brown spherules in matrix.

FULL ROCK NAME: Devitrified rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 185

FIELD DATE: 6/27/94
SCALE: 1:24,000
UTM NORTH: 4124378
UTM EAST: 517291
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Tolicha Peak
OCCURRENCE: Construction rubble
ROCK UNIT: Tot-tuff of Tolicha Peak

ROCK DESCRIPTION: Brecciated ash-flow tuff with limonitic cement; Host rock same as GSCN-185. Densely welded ash-flow tuff, sparsely porphyritic, scattered small (less than 2cm long) pumice, and minor lithic fragments to 1cm.

ROCK STRUCTURE:

REMARKS: Sample at top of sub peak east of Tolicha Peak at microwave tower site.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Brown breccia with light brown angular lithic fragments in reddish brown matrix.

TEXTURE: Clastic with angular lithic fragments.

ESSENTIAL MINERALS: Lithic clasts (85%, variable size and shape of rhyolitic tuff). Matrix: (15%), siliceous as chalcedonic quartz and hematitic matter.

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine.

CEMENT:

FEATURES:

FULL ROCK NAME: Brecciated rhyolite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **186**

FIELD DATE: 6/28/94

SCALE: 1:24,000

COLLECTOR: K. Connors

UTM NORTH: 4136371

QUADRANGLE NAME: Silent Butte

UTM EAST: 550109

OCCURRENCE: Outcrop

ROCK AGE: 11.45 Ma

ROCK UNIT: Ammonia Tanks Member?

ROCK DESCRIPTION: Rhyolite ash-flow tuff, poorly welded, vapor phase altered with some glassy pumice phenocrysts of quartz, sanidine, biotite, trace sphene. Some lithics.

ROCK STRUCTURE: Nearly flat-lying.

REMARKS: Some problem with mapping in this area. Shows a basalt or ridge to the south of Silent Butte, but the ledge former is a rhyolite tuff--looks like the Thirsty Canyon unit Ttp.

REFERENCES: Minor et al., 1993, Saywer et al., 1994. **ANALYST:** L. C. Hsu **LAB DATE:** 11/18/94

HAND SPECIMEN STUDY: Light reddish gray volcanic tuff with feldspar crystals and whitish lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (10%, <1 X 0.5mm, subhedral), lithic fragments (20%, irregular size and shape, mostly rhyolitic tuff with local devitrification to cristobalite). Matrix (67%, local devitrification to fine intergrowth of feldspar, quartz and cristobalite.

ACCESSORY MINERALS:

SECONDARY: hematite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, plagioclase, cristobalite, quartz.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **187**

FIELD DATE: 6/28/94

SCALE: 1:24,000

COLLECTOR: K. Connors

UTM NORTH: 4135028

QUADRANGLE NAME: Silent Butte

UTM EAST: 550832

OCCURRENCE: Subcrop at start of ridge

ROCK AGE: 11.4

ROCK UNIT: Tmr Rainier Mesa Member of Timber Mtn Tuff

ROCK DESCRIPTION: Moderately to densely welded ash flow tuff - pale gray to bluish gray. Quartz and sanidine phenocrysts, biotite, large pumice, light colored, predominantly minor lithics. No sphene observed, but no clear cooling break was recognized between this site and the site of GSCN-186. Should use petrography to verify both unit identifications.

ROCK STRUCTURE: Nearly flat-lying.

REMARKS: See 186 remarks.

REFERENCES: Minor et al., 1993; Sawyer et al, 1994 **ANALYST:** L. C. Hsu **LAB DATE:** 10/21/94

HAND SPECIMEN STUDY: Light brownish tuff with crystal and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <1.5 X 1.0mm, subhedral). Devitrified glass shards (15%, 5.0 X 1.0mm or less, anhedral), (mostly to cristobalite), glass (45%, irregular).

ACCESSORY MINERALS: Quartz (3.0%), andesite (1.0%), biotite (1.0%)

SECONDARY: Calcite (15%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Feldspar, cristobalite, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic crystal tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **188**

FIELD DATE: 6/27/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4141682
QUADRANGLE NAME: Gold Flat West
UTM EAST: 538402
OCCURRENCE: Outcrop
ROCK AGE: Unknown
ROCK UNIT: Tod-Tertiary. Older dacite.

ROCK DESCRIPTION: Dark colored rock with abundant plagioclase phenocrysts up to 1/4 inch long - oxidized and vugs filled with zeolites - minor biotite+/- amphibole; poor outcrop. Columnar jointing and flow structures evident--Dacite lava flow sequence.

ROCK STRUCTURE: Columnar jointed, nearly flat-lying hill of a sequence of lava flows.

REMARKS:

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 11/18/94

HAND SPECIMEN STUDY: Dark gray vesicular basalt with white clear phenocrysts of feldspar.

TEXTURE: Porphyritic with intersertal groundmass.

ESSENTIAL MINERALS: Phenocrysts: labradorite (35%, <3.0 X 2.0mm, euhedral to subhedral), augite (20%, <1.0 X 0.5mm, subhedral to anhedral). Groundmass: (40%), intersertal with microcrystals of plagioclase and intersertal glass.

ACCESSORY MINERALS: Magnetite (5.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, trace augite.

CEMENT:

FEATURES:

FULL ROCK NAME: Andesite.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **189**

FIELD DATE: 6/27/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4140979
QUADRANGLE NAME: Gold Flat West
UTM EAST: 535108
OCCURRENCE: Outcrop
ROCK AGE: 9.4 to 9.15 Ma
ROCK UNIT: Ttt(?)-Trail Ridge Tuff of Thirsty Canyon Group

ROCK DESCRIPTION: Pale brown to grayish devitrified rhyolite ash-flow tuff with abundant sanidine and lithics. Pumice is reddish brown and there are large mafic blobs (some may be lithics?) with wispy edges indicating they were hot. The base (break in slope) is a gray glassy zone.

ROCK STRUCTURE: Flat lying - ridge former

REMARKS: There seems to be a problem with the mapping at 1 degree scale of Minor et al. They show two units at this hill and there are three exposed units with two well exposed cooling breaks. Unit identification is uncertain for the sequence 189-202-203. See subsequent notes.

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94

HAND SPECIMEN STUDY: Brown pyroclastic rock with crystal and lithic fragments.

TEXTURE: Pyroclastic with mostly sanidine fragments.

ESSENTIAL MINERALS: Sanidine (25%, 3.0 X 2.0mm, subhedral), lithic fragments (15%, 4.0X 3.0mm or less, irregular), glass matrix, brownish, stained by iron oxide (53%).

ACCESSORY MINERALS: Augite (3.0%), magnetite (5.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine.

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte crystal tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 190a

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4127698
UTM EAST: 536878
ROCK AGE: Tertiary

COLLECTOR: S. Weiss
QUADRANGLE NAME: Trail Ridge
OCCURRENCE: Outcrop
ROCK UNIT: Spearhead Member, Stonewall Flat Tuff

ROCK DESCRIPTION: Weakly welded, glassy ash-flow tuff of the Spearhead Member from about 5cm below very poorly crystallized part. The overlying light purplish gray, entirely very poorly crystallized and partly to weakly welded ash-flow tuff was also sampled (as GSCN 190b) and submitted for chemical analysis. The tuff has approximately 5% phenocrysts, mainly lath-shaped sanidine, in part chatoyant. The Spearhead forms a cuesta with a flat-lying upper surface. Vague compaction foliation and cuesta outcrops show the unit to be flat-lying to sub-horizontal here.

ROCK STRUCTURE:

REMARKS: Sample GSCN 190b taken of very poorly crystallized tuff.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Yellowish white volcanic tuff with sparse, clear feldspar crystals and whitish lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (8.0%, <2.0 x 0.8mm, subhedral), lithic fragments 4.0%, irregular size and shape, mainly devitrified tuff). Matrix (83%), glassy, mainly as glass shards.

ACCESSORY MINERALS: Augite

SECONDARY: Calcite (12%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Glass, trace sanidine.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 190b

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4127698
UTM EAST: 536878
ROCK AGE: Tertiary

COLLECTOR: S. Weiss
QUADRANGLE NAME: Trail Ridge
OCCURRENCE: Outcrop
ROCK UNIT: Spearhead Member, Stonewall Flat Tuff

ROCK DESCRIPTION: Light purplish gray, very poorly crystallized and partly to weakly welded ash-flow tuff. The tuff has approximately 5% phenocrysts, mainly lath-shaped sanidine, in part chatoyant. Mafic accessories are destroyed to rusty spots by vapor phase crystallization. The Spearhead forms a cuesta with a flat-lying upper surface. Vague compaction foliation and cuesta outcrops show the unit to be flat-lying to sub-horizontal here.

ROCK STRUCTURE:

REMARKS: Sample GSCN 190a was taken of glassy tuff.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Pinkish volcanic tuff with sparse, clear crystals of feldspar and lithic fragments, locally porous.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (10%, <4.0 x 0.8mm, subhedral), lithic fragments (7.0%), irregular, mainly devitrified tuff. Matrix: (70%, mainly devitrified to micro-laths of feldspar, with tridymite mainly as pore filling).

ACCESSORY MINERALS: Hornblende, augite (<2%)

SECONDARY: Hematite (3%), calcite (8%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, tridymite, plagioclase, calcite.

CEMENT:

FEATURES: Tridymite crystals line and partially fill pore spaces.

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 191

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4121611
UTM EAST: 531847
ROCK AGE: ~9 Ma

COLLECTOR: S. Weiss
QUADRANGLE NAME: Thirsty Canyon NW
OCCURRENCE:
ROCK UNIT: Ttg - Gold Flat Member - Thirsty Canyon Tuff

ROCK DESCRIPTION: Densely welded, devitrified lithic-rich and pumice-rich ash-flow tuff, dark brown weathering but medium-orangey brown on fresh surfaces. Large (~1 cm) anorthoclase phenocrysts. Devitrified pumice phenocrysts commonly green. Smaller sanidine, quartz. Characteristic dark, black smoky quartz. Thickness probably >100 feet here, all dense devitrified, no sign of dense glassy tuff.

ROCK STRUCTURE: Nice subhorizontal composition foliation.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Brownish, somewhat porous volcanic tuff with clear crystals of feldspar and irregular lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (22%, <2.0 X 1.0mm, angular), lithic fragments (32%, irregular, devitrified glass shards). Matrix: (35%), devitrified to aggregates of tiny quartz and feldspar.

ACCESSORY MINERALS:
SECONDARY: Limonitic matter (6.0%), kaolinite (5.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, quartz, kaolinite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 192

FIELD DATE: 6/26/94
SCALE: 1:24,000
UTM NORTH: 4121658
UTM EAST: 531752
ROCK AGE: ~9

COLLECTOR: S. Weiss, C. Henry
QUADRANGLE NAME: Thirsty Canyon NW
OCCURRENCE:
ROCK UNIT: Tts-lavas of Pillar Spring

ROCK DESCRIPTION: Dark gray to black hydrated, somewhat vesicular vitrophyre glassy lava. Crumbly weathered surfaces due to hydration. Abundant large (1.5 cm) sanidine - smaller biotite. Pyroxene and/or fayalitic olivine. Rock is underlain by better exposed, massive, brown, weathering devitrified, slightly foliated lava forming walls down canyon from here. Sample is from float apparently from poorly exposed vitrophyre below vesicular upper surface of lava.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/18/94

HAND SPECIMEN STUDY: Dark gray to black volcanic tuff with clear sanidine crystals and less lithic fragments in black obsidian matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (28%, <5.0 X 2.0mm, angular), lithic fragments (10%, irregular), Matrix: (60%), obsidian.

ACCESSORY MINERALS: Magnetite and augite (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine

CEMENT:
FEATURES: Obsidian locally vesicular.
FULL ROCK NAME: Trachyte tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **193**

FIELD DATE: 6/28/94

SCALE: 1:24,000

COLLECTOR: S. Weiss, C. Henry

UTM NORTH: 4148767

QUADRANGLE NAME: Gold Flat West

UTM EAST: 537056

OCCURRENCE:

ROCK AGE:

ROCK UNIT: Tbg - Grouse Canyon Member Belted Range Tuff

ROCK DESCRIPTION: Partly to moderately welded, glassy ash flow tuff; pumice and lithic rich. Weathers dark chocolate brown; slightly greenish gray on fresh surfaces. Abundant black pumice fragments are finely vesicular. ~10% medium grained phenocrysts mainly sanidine, access green pyroxene. Sample from main ledge which is most densely welded portion, ~3m thick and underlain and overlain by several meters of glassy porous to completely unwelded ash-flow tuff.

ROCK STRUCTURE: Compaction foliation ~350 degrees, 9 degrees W

REMARKS: No vitrophyre, all is porous to moderately welded glassy ash-flow tuff.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 10/25/94

HAND SPECIMEN STUDY: Gray pyroclastic rock with fragments of rocks and minerals.

TEXTURE: Pyroclastic

ESSENTIAL MINERALS: Sanidine (20%, <2.0 X 2.0mm, subhedral), rock fragments and glassy shards (15%, irregular). Glass matrix (62%, wavy flow line and with sparse microlites).

ACCESSORY MINERALS: Plagioclase (1.0%), augite (2.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **194**

FIELD DATE: 6/28/94

SCALE: 1:24,000

COLLECTOR: S. Weiss, C. Henry

UTM NORTH: 4148784

QUADRANGLE NAME: Gold Flat West

UTM EAST: 537001

OCCURRENCE:

ROCK AGE: ~9 Ma

ROCK UNIT: Ttp - Pahute Mesa member of Thirsty Canyon Tuff

ROCK DESCRIPTION: Medium grayish brown, densely welded, entirely devitrified ash-flow tuff, ~0.5 m above porous partly welded devitrified tuff.~3-5% phenocrysts of platy sanidine. Trace accessory mafics (oxidized).

ROCK STRUCTURE: Essentially conformable on underlying Tbg so unit here is oriented at about N-S to N10W.

REMARKS:

REFERENCES: Vogel et al. 1989.

ANALYST: L. C. Hsu

LAB DATE: 11/21/94

HAND SPECIMEN STUDY: Brown, somewhat porous volcanic tuff with clear crystals of feldspar and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (<15%, <2.0 X 1.0mm, angular), lithic fragments (10%, irregular size and shape). Matrix (78%), glassy, locally devitrified to yield cristobalite.

ACCESSORY MINERALS: Hedenbergitic pyroxene (<3.0%).

SECONDARY: Limonitic matter (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, cristobalite.

CEMENT:

FEATURES: Pores with cristobalite linings.

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 195

FIELD DATE:
SCALE: 1:24,000
UTM NORTH: 4148444
UTM EAST: 537923
ROCK AGE:

COLLECTOR: S. Weiss, C. Henry
QUADRANGLE NAME: Gold Flat West
OCCURRENCE: Low rounded hills above alluvium
ROCK UNIT: Tour - "older tuffs" unit of Minor et al 1993

ROCK DESCRIPTION: Moderately welded, very light gray where fresh (cream where weathered) devitrified and vapor phase crystallized, pumice-rich ash-flow tuff. Phenocrysts (~15%). Sanidine, hornblende, biotite, quartz--in part rosy. Strongly vapor-phase crystallized but otherwise fresh.

ROCK STRUCTURE: Probably sub-horizontal but difficult to see attitude due to lack of relief.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/21/94

HAND SPECIMEN STUDY: White, crystal-rich volcanic tuff with crystals of feldspar, biotite, and hornblende.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Sanidine (25%, <2.0 X 1.5mm, angular), sodic plagioclase (8.0%, <1.0 X 0.7mm, angular), lithic fragments (5.0%, irregular size and shape). Matrix (52%), glass shards of devitrified cristobalite and quartz.

ACCESSORY MINERALS: Biotite (6.0%), hornblende (4.0%), magnetite (2.0%), pyroxene (2.0%), sphene (<1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, plagioclase, cristobalite, quartz, biotite.

CEMENT:
FEATURES:
FULL ROCK NAME: Crystal tuff (rhyolitic).
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 196

FIELD DATE: 6/28/94
SCALE: 1:24,000
UTM NORTH: 4148049
UTM EAST: 539304
ROCK AGE:

COLLECTOR: S. Weiss, C. Henry
QUADRANGLE NAME: Gold Flat West
OCCURRENCE:
ROCK UNIT: Tour -"older rhyolitic" lavas of Minor et al 1993.

ROCK DESCRIPTION: Light greenish gray pumiceous/vesicular glassy rhyolite; aphyric. Subcrop below dark brownish-gray weathering devitrified flow and flow breccia rock. No dense glassy lava anywhere near here; pumiceous part is rich in caliche along hydration fractures and filling original gas vesicles. CaO and LOI will be too high unless treated in HCl or acetic acid prior to bake out.

ROCK STRUCTURE: None
REMARKS: Devitrified overlying rock appear to be silicified with opaline silica from devitrification (not hydrothermal).

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/21/94

HAND SPECIMEN STUDY: White, somewhat porous vitric tuff with rare feldspar crystals.

TEXTURE: Pyroclastic with porous vitric matrix, local wavy bands.
ESSENTIAL MINERALS: Glass matrix (>92%).

ACCESSORY MINERALS: Sanidine (<5.0%).
SECONDARY: Calcite (<3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Glass, trace sanidine and calcite.

CEMENT:
FEATURES:
FULL ROCK NAME: Vitric tuff (rhyolitic).
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 197

FIELD DATE: 6/28/94
SCALE: 1:24,000
UTM NORTH: 4137707
UTM EAST: 539015
ROCK AGE:

COLLECTOR: S. Weiss, C. Henry
QUADRANGLE NAME: Gold Flat West
OCCURRENCE: Low rounded knolls
ROCK UNIT: Tour - older rhyolite lava of Minor et al 1993

ROCK DESCRIPTION: Light pinkish gray massively flow banded, finely vesicular, devitrified rhyolite; aphyric. Much of outcrop area is of spherulitic, porous, vapor phase-crystallized, flow banded rock. Flow banding approximately 340 degrees, 65 degrees NE

ROCK STRUCTURE: Flow banding on 340, 65 NE
REMARKS: No glassy rock available in this vicinity.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/21/94
HAND SPECIMEN STUDY: Light brownish, somewhat porous felsic rock

TEXTURE: Microfelsitic.
ESSENTIAL MINERALS: Quartz (55%, <2.0 X 0.1mm, interlocking), K-feldspar (20%, <0.2 X 1mm, interlocking). Matrix: (25%), as dark wavy bands of extremely fine cryptocrystalline material.

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine.

CEMENT:
FEATURES: Devitrification of lava forming interlocking aggregates of quartz and feldspar as oval clusters occasionally leaving centers void.
FULL ROCK NAME: Devitrified rhyolitic lava.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 198

FIELD DATE: 6/28/94
SCALE: 1:24,000
UTM NORTH: 4137350
UTM EAST: 538859
ROCK AGE:

COLLECTOR: S. Weiss, C. Henry
QUADRANGLE NAME: Gold Flat West
OCCURRENCE: Cliff forming devitrified part
ROCK UNIT: Tbg - Grouse Canyon Member of the Belted Range Tuff

ROCK DESCRIPTION: Dark grayish-green, densely welded glassy ash-flow tuff (vitrophyre). Abundant perlitic collapsed pumice fragments. Sparse phenocrysts, sanidine, amphibole, pyroxene. Well developed eutaxitic structure.

ROCK STRUCTURE: Unit is basically flat-lying but thickens to the north. Compaction dip against an old valley or paleo-depression.
REMARKS: Cliff forming devitrified part above poorly exposed dense, glassy ash-flow tuff.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/21/94
HAND SPECIMEN STUDY: Gray lithic tuff with lithic fragments in gray, pitchstone-like matrix.

TEXTURE: Pyroclastic, with wavy bands in glassy matrix.
ESSENTIAL MINERALS: Lithic fragments (35%, irregular shape and size), sanidine (7.0%, <1.0mm, angular). Matrix (>63%), pitchstone like glass with wavy bands.

ACCESSORY MINERALS: Quartz (<5.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Lithic tuff (rhyolitic).
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 199

FIELD DATE: 6/29/94
SCALE: 1:24,000
COLLECTOR: M. Desilets
QUADRANGLE NAME: Trappman Hills
UTM NORTH: 4153298
UTM EAST: 529059
OCCURRENCE: Outcrop
ROCK AGE: Precambrian
ROCK UNIT: Granite of Trappman Hills

ROCK DESCRIPTION: Medium to coarse grained quartz monzonite, feldspars slightly cloudy, biotite slightly weathered, rimmed by Fe-oxide staining.

ROCK STRUCTURE: Wide spaced N10W, near vertical jointing.

REMARKS: Crops out in low round hills some quartz veining, small prospect cuts within 200 ft of site. Rock foliation is N60W-vertical.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 11/21/94

HAND SPECIMEN STUDY: Light-colored granitic rock with minor, somewhat weathered biotite.

TEXTURE: Granitoid.

ESSENTIAL MINERALS: Orthoclase (35%, 2.5 X 2.0mm, subhedral to anhedral), oligoclase (30%, 2.0 X 1.5mm, subhedral), quartz (26%, <1.5 X 1mm, anhedral).

ACCESSORY MINERALS: Apatite zircon (<1.0%), biotite (5.0%).
SECONDARY: Kaolinite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Oligoclase, orthoclase, quartz, biotite, kaolinite.

CEMENT:

FEATURES: Strongly deformed quartz, local myrmekite, microperthic of orthoclase, micro-quartz vein in plagioclase.

FULL ROCK NAME: Two-feldspar granite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 200

FIELD DATE: 7/6/94
SCALE: 1:24,000
COLLECTOR: C. Henry, H. Bonham
QUADRANGLE NAME: Cactus Spring
UTM NORTH: 4176012
UTM EAST: 517167
OCCURRENCE: Good outcrop along wash.
ROCK AGE:
ROCK UNIT: Tws-Tuff of White Blotch Spring, Tuff of Lunar Cuesta?

ROCK DESCRIPTION: Densely welded vitrophyre (perlitic), moderately porphyritic ash-flow tuff. Black glassy pumice to 8cm long; few small lithics. Phenocrysts, quartz and feldspar, both to 2mm. Passes upward on small hill to welded, devitrified but pumice still glassy. Possibly draping irregular topography on rhyolite of Cactus Peak. Some fat pumice blobs 10cm x 4cm. Definitely mapped as TWS (USGS PP 651) but outcrop and petrographic characteristics unlike those in PP 251. Possibly tuff of Lunar Cuesta.

ROCK STRUCTURE: E-W, 10 degrees N West of small hill is fault in brecciated rhyolite: N38W, 81W; R=70S.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Brownish rhyolitic rock with pronounced welded shards and pumice and crystals of quartz, feldspar, biotite, and lithic inclusions.

TEXTURE: Porphyritic flow banding.

ESSENTIAL MINERALS: Phenocrysts: quartz (20%, <1.5mm, subhedral), sanidine (12%, <1.5mm, subhedral), plagioclase (8.0%, <1.0mm, subhedral). Groundmass: (52%, glass shards, obsidian glass).

ACCESSORY MINERALS: Biotite (3.0%, <1.5 X 0.5mm, euhedral).
SECONDARY: Lithic inclusions (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, plagioclase, k-feldspar, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 201

FIELD DATE: 7/6/94
SCALE: 1:24,000
UTM NORTH: 4174869
UTM EAST: 515850
ROCK AGE:

COLLECTOR: C. Henry, H. Bonham
QUADRANGLE NAME: Cactus Spring
OCCURRENCE: Ash flow tuff on S hill 6845
ROCK UNIT: Tws-Tuff of White Blotch Spring

ROCK DESCRIPTION: Thick, densely welded, devitrified ash-flow tuff. Pumice (1.0-5.0%), 1 cm to 20 cm long; few (if any) lithics. Moderately porphyritic: Quartz 10% to 4mm, embayed bi-pyramidal. Alkali feldspar (10%), 4-5mm, mostly altered. Plagioclase to 2mm.

ROCK STRUCTURE: Dips gently SW. Ekren et al. (1971) shows 25 degrees SW.

REMARKS: Different unit from GSCN 200.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/94

HAND SPECIMEN STUDY: Light-gray porphyritic igneous rock with phenocrysts of quartz and feldspars and lithic inclusions.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: quartz (15%, <2.5mm, subhedral), orthoclase (10%, <2.5mm, subhedral), plagioclase (7.0%, <2.0mm, subhedral), lithic inclusions (5.0%). Groundmass: (56%, microcrystalline, local flow banding).

ACCESSORY MINERALS: Muscovite (2.0%).
SECONDARY: Sericite and kaolinite (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, plagioclase, K-feldspar, mica, kaolinite.

CEMENT:

FEATURES: Many quartz phenocrysts show resorption nature, most feldspars show alteration to sericite and kaolinite, groundmass shows flow bands.

FULL ROCK NAME: Granitic porphyry.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 202

FIELD DATE: 6/28/94
SCALE: 1:24,000
UTM NORTH: 4141294
UTM EAST: 535134
ROCK AGE: 9.4-9.15 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Gold Flat West
OCCURRENCE: Outcrop
ROCK UNIT: Ttp(?) - Pahute Mesa or possibly Trail Ridge (see remarks)

ROCK DESCRIPTION: Dark, rich gray, devitrified welded ash-flow tuff with large dark (basaltic) blobs and black fiamme; moderately crystal rich with sanidine abundant - very similar to sample 189 except in color, but there is a thin porous glassy zone between them which may be a cooling break between units or a partial break. This zone is distinct in the way the blocks break. As does 189, this unit has very large mafic blobs with wispy edges (see photo).

ROCK STRUCTURE: Flat-lying ridge former - forms giant blocks approximately 15 feet high.

REMARKS: See remarks for 189; this unit underlies the tuff sampled in GSCN-189. There is a poorly to non-welded, gray glassy zone between them. Unit correlation uncertain (see subsequent notes).

REFERENCES: Minor et al. 1993
ANALYST: L. C. Hsu
LAB DATE: 10/25/94

HAND SPECIMEN STUDY: Pyroclastic rock with dark brown matrix of fragments of rocks and crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (25%, <3.0 X 2.0mm, subhedral), rock fragments (30%, >1cm, irregular), including basaltic rocks, pumiceous rocks, etc. Glassy matrix (40%).

ACCESSORY MINERALS: Plagioclase (<1.0%), augite (<1.0%), magnetite (1.0%).
SECONDARY: Calcite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 203

FIELD DATE: 6/28/94
SCALE: 1:24,000
UTM NORTH: 4141469
UTM EAST: 535088
ROCK AGE: 9.4 to 9.15 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Gold Flat West
OCCURRENCE: Outcrop
ROCK UNIT: Ttp(?) Pahute Mesa (Probably Rocket Wash)

ROCK DESCRIPTION: Pale pinkish brown, densely welded devitrified ash-flow tuff with purplish fiamme and large sanidine phenocrysts very similar to 189 and 202, but has fewer and smaller matrix blobs and sanidine phenocrysts may be slightly larger and slightly less abundant.

ROCK STRUCTURE:

REMARKS: See remarks for 189; possibly the lowest unit (203) is Rocket Wash, overlain by Pahute Mesa (202) (lumped as Ttp on map) and then by Trail Ridge (189) but I'm uncertain if unit variations support this.

REFERENCES: Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94

HAND SPECIMEN STUDY: Light brownish gray, pyroclastic rock with brownish matrix and fragments of rocks and minerals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <2.0 X 2.0mm, subhedral), rock fragments (16%, irregular size and shape) including devitrified glass shards, felsic rocks, etc. Glassy matrix, partially altered (54%).

ACCESSORY MINERALS: Magnetite (4.0%), augite (3.0%).

SECONDARY: Calcite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 204

FIELD DATE: 6/29/94
SCALE: 1:24,000
UTM NORTH: 4096221
UTM EAST: 535910
ROCK AGE: 11.4 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Thirsty Canyon SE
OCCURRENCE: Quarry (upsection from outcrop
ROCK UNIT: Tfb (Tuff of Cutoff Road) Beatty Wash Formation.

ROCK DESCRIPTION: Moderately to densely welded, blue-gray, devitrified rhyolite tuff. Phenocrysts of sanidine, plagioclase, biotite and minor sphene. Pale bluish gray, fairly fine grained phenocrysts, minor dark colored lithics.

ROCK STRUCTURE:

REMARKS:

REFERENCES: Minor et al., 1993;-Noble et al., 1991. **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94

HAND SPECIMEN STUDY: Light brown pyroclastic rock with light brown matrix with rock and mineral fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, 3.0 X 2.0mm or less, subhedral), rock fragments (15%), mostly partly dissolved carbonate rock, matrix (54%), dense, devitrified cristobalite and possibly feldspar.

ACCESSORY MINERALS: Biotite (5.0%), magnetite (2.0%), plagioclase (1.0%).

SECONDARY: Calcite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, cristobalite, biotite, calcite

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 205

COLLECTOR: K. Connors
QUADRANGLE NAME: Thirsty Canyon SE
OCCURRENCE: Outcrop
ROCK UNIT: Tma - Ammonia Tanks Member Timber Mtn Tuff

FIELD DATE: 6/29/94
SCALE: 1:24,000
UTM NORTH: 4099560
UTM EAST: 536662
ROCK AGE: 11.45

ROCK DESCRIPTION: Moderately welded rhyolite ash-flow tuff, slightly altered, pumice--clay or sericite. Phenocrysts of quartz, K-feldspar, plagioclase, biotite, no definite sphene observed in sample.

ROCK STRUCTURE:

REMARKS:

REFERENCES: Byers et al., 1976 **ANALYST:** L. C. Hsu **LAB DATE:** 11/21/94

HAND SPECIMEN STUDY: Pinkish to yellowish, porous volcanic tuff with lithic fragments and crystals of feldspar and quartz.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <2.0 X 1.5mm, anhedral), quartz, (5.0%, <1.0 X 1.0mm, anhedral), lithic fragments (35%, variable size and shape). Matrix (38%, cryptocrystalline to partial devitrification to cristobalite).

ACCESSORY MINERALS:

SECONDARY: Calcite (<2.0%), biotite (<1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, cristobalite, sanidine

CEMENT:

FEATURES: Local spherulitic structures in matrix.

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 206

COLLECTOR: K. Connors
QUADRANGLE NAME: Thirsty Canyon SE
OCCURRENCE: Outcrop-subcrop
ROCK UNIT: Tmr - Rainier Mesa Member Timber Mtn Tuff

FIELD DATE: 6/29/94
SCALE: 1:24,000
UTM NORTH: 4099684
UTM EAST: 537090
ROCK AGE: 11.6 Ma

ROCK DESCRIPTION: Densely welded, red-brown rhyolite ash-flow tuff, devitrified with poorly developed eutaxitic structure. Phenocrysts of quartz, sanidine, biotite (partly oxidized), and minor plagioclase.

ROCK STRUCTURE: Shallowly west dipping - undetermined

REMARKS: Abundant chalcedonic quartz appears to be fracture controlled, botryoidal, open space banded chalcedony.

REFERENCES: Byers et al., 1976 **ANALYST:** L. C. Hsu **LAB DATE:** 11/21/94

HAND SPECIMEN STUDY: Reddish brown, compact (welded?) volcanic tuff with clear crystals of feldspar and quartz and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (15%, <1.5 X 1.0mm, anhedral), quartz (8.0%, <1.0 X 1.0mm, anhedral), lithic fragments (25%, variable size and shape).Matrix (52%, iron stained cryptocrystalline glass, local devitrification to cristobalite.

ACCESSORY MINERALS:

SECONDARY: Magnetite (<2.0%), biotite (<2.0%), oligoclase (<1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, cristobalite, quartz, biotite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic (welded) tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **207**

FIELD DATE: 6/29/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4101232
QUADRANGLE NAME: Thirsty Canyon SE
UTM EAST: 540783
OCCURRENCE: Outcrop
ROCK AGE: ~11.4 Ma
ROCK UNIT: Ttp-Thirsty Canyon Formation

ROCK DESCRIPTION: Porous, glassy ash-flow tuff, medium gray with dark glassy pumice, sanidine phenocrysts, oxidized biotite. Some vapor phase crystallization of pumice.

ROCK STRUCTURE: ~5 degrees west dipping (nearly flat-lying).

REMARKS:

REFERENCES: Byers et al., 1976; Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94

HAND SPECIMEN STUDY: Brownish gray pyroclastic rock with gray dense matrix and crystal and rock fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <2.0 X 1.5mm, subhedral); rock fragments, mainly devitrified glass shards (15%, irregular size and shape). Matrix: 55%, iron stained cryptocrystalline material.

ACCESSORY MINERALS: Magnetite (4.0%), augite (2.0%), biotite (<1.0%).

SECONDARY: Calcite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, trace calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Trachyte tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **208**

FIELD DATE: 6/29/94
SCALE: 1:24,000
COLLECTOR: K. Connors
UTM NORTH: 4100793
QUADRANGLE NAME: Thirsty Canyon SE
UTM EAST: 541306
OCCURRENCE: Outcrop
ROCK AGE: ~11.4 Ma
ROCK UNIT: Tff - Rhyolite of Fleur de Lis Ranch

ROCK DESCRIPTION: Devitrified flow banded rhyolite lava, cocoa-brown, devitrified, crystal-poor with light colored bands. Biotite and hornblende present, no felsic spherulitic phenocrysts evident. Spherulitic devitrification in part, vapor phase crystals in vesicles, some thin needle-like crystals with reddish color--possibly hematite in vugs over white coating.

ROCK STRUCTURE: Some columnar jointing, nearly flat-lying but with nice ramp-flow structures.

REMARKS:

REFERENCES: Minor et al., 1993; Byers et al., 1976 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94

HAND SPECIMEN STUDY: Whitish brown pyroclastic rock with leached whitish pumiceous fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Pumiceous fragments (20%, irregular shape and size). Matrix: devitrified dense aggregates of cristobalite and alkali feldspar (71%).

ACCESSORY MINERALS: Biotite (2.0%), magnetite(2.0%).

SECONDARY: Calcite (2.0%), sericite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY:

CEMENT:

FEATURES: Rock fragments mostly as hollow voids only with lining left.

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 209

FIELD DATE: 6/29/94
SCALE: 1:24,000
UTM NORTH: 4100883
UTM EAST: 541507
ROCK AGE: ~11.4 Ma

COLLECTOR: K. Connors
QUADRANGLE NAME: Thirsty Canyon SE
OCCURRENCE: Outcrop
ROCK UNIT: Tff - Rhyolite lava of Fleur de Lis Ranch

ROCK DESCRIPTION: Vitrophyre of flow banded lava in 208.

ROCK STRUCTURE: Flow banded, ramped, some jointing.
REMARKS: Very good, clean vitrophyre - good GSCN sample.

REFERENCES: Minor et al., 1993; Byers et al., 1976 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94
HAND SPECIMEN STUDY: Dark gray pitchstone with whitish feldspar crystals.

TEXTURE: Hypocrystalline with crystals embedded in glassy matrix.
ESSENTIAL MINERALS: Andesine (8.0%, <4.0 X 2.0mm, euhedral), sanidine (5.0%, <2.0 X 1.5mm, euhedral), biotite (6.0%, <1.0 X 0.8mm, euhedral). Glass matrix: 80%, locally iron stained, rarely with microlites.

ACCESSORY MINERALS: Augite (<1.0%), magnetite (1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Feldspars, biotite, glass.

CEMENT:
FEATURES: Perlitic cracks in glass matrix.
FULL ROCK NAME: Rhyolite pitchstone.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 210

FIELD DATE: 6/29/94
SCALE: 1:24,000
UTM NORTH: 4101026
UTM EAST: 541715
ROCK AGE: 11.45

COLLECTOR: K. Connors
QUADRANGLE NAME: Thirsty Canyon SE
OCCURRENCE: Outcrop
ROCK UNIT: Tmaw - Tuff of Buttonhook Wash

ROCK DESCRIPTION: Densely welded devitrified blue-gray rhyolite ash-flow tuff. Phenocrysts of quartz, K-feldspar, biotite, and nicely preserved sphene. Large pumice, generally pale tan to white. Some pinkish patches may indicate auto-oxidation during devitrification, nice orange biotite supports this.

ROCK STRUCTURE: Slightly west dipping ledge with crude jointing.
REMARKS:

REFERENCES: Byers et al., 1976; Minor et al., 1993 **ANALYST:** L. C. Hsu **LAB DATE:** 10/25/94
HAND SPECIMEN STUDY: Light, pinkish pyroclastic rock with crystal and rock fragments.

TEXTURE: Pyroclastic with microcrystalline matrix.
ESSENTIAL MINERALS: Sanidine (23%, 2.0 X 1.5mm, subhedral to euhedral), quartz (20%, 1.5 X 1.0mm, subhedral to euhedral), rock fragments (10%, mostly lenticular form with microcrystals). Matrix: microcrystalline with cristobalite (45%).

ACCESSORY MINERALS: Biotite, magnetite, and augite (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, cristobalite, sanidine, trace biotite.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **211**

FIELD DATE: 7/6/94
SCALE: 1:24,000
COLLECTOR: C. Henry, H. Bonham
UTM NORTH: 4176483
QUADRANGLE NAME: Cactus Spring
UTM EAST: 514458
OCCURRENCE: Low outcrop along side of wash
ROCK AGE:
ROCK UNIT: Tws, Tuff of White Blotch Spring

ROCK DESCRIPTION: Densely welded devitrified ash-flow tuff. Moderately porphyritic and pumiceous, sparse 1-2cm lithics. Phenocrysts: quartz (10%), to 4mm; alkali feldspar (<10%), unaltered; plagioclase (10%), altered to 3mm; biotite (1.0%), 1-2 mm.

ROCK STRUCTURE: Flat lying to gently dipping.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Grayish brown pyroclastic rock with crystals of quartz, feldspars, and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (30%, <3.0 X 2.0mm, angular to rounded), sanidine (10%, <2.0 X 1.0mm, angular), plagioclase (5.0%, <3.0 X 2.0mm, mostly altered), lithic inclusions (5.0%, <4.0 X 3.0mm, angular). Matrix (39%, dense, fine aggregates of glassy to cryptocrystalline).

ACCESSORY MINERALS: Biotite (4.0%), iron oxide (2.0%).
SECONDARY: Sericite (5.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **212**

FIELD DATE: 7/6/94
SCALE: 1:24,000
COLLECTOR: C. Henry, H. Bonham
UTM NORTH: 4179462
QUADRANGLE NAME: East of Cactus Peak
UTM EAST: 513989
OCCURRENCE: Blocky outcrop
ROCK AGE:
ROCK UNIT: Trcp Rhyolite of Cactus Peak (Tob ?)

ROCK DESCRIPTION: Moderately porphyritic; commonly brecciated, rarely flow banded, rhyolite lava or lava dome. Phenocrysts of quartz, sanidine (fresh, glassy) to 5mm; plagioclase - altered, biotite. Mapped as Trcb petrographically like Tob (Rhyolite of O'Brien's Knob).

ROCK STRUCTURE:

REMARKS: Blocky outcrop that may be lava from feeder to NW.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Brownish, fine-grained tuffaceous rock with abundant voids.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (15%, <1.5 X 1.0mm, angular), biotite (7.0%, <0.5 X 0.4mm, angular), quartz (5.0%, <1.0 X 1.0mm, angular). Matrix: (70%, mostly dense, fine aggregates of quartz and possibly feldspar).

ACCESSORY MINERALS: Magnetite (3.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **213**

FIELD DATE: 7/6/94

SCALE: 1:24,000

COLLECTOR: C. Henry, H. Bonham

UTM NORTH: 4180468

QUADRANGLE NAME: Cactus Peak

UTM EAST: 510134

OCCURRENCE: Outcrops along Endless Draw

ROCK AGE:

ROCK UNIT: Tau, Tuff of Antelope Springs, Upper Unit

ROCK DESCRIPTION: Abundantly porphyritic, densely welded devitrified ash-flow tuff. Phenocrysts: (40%), quartz, smoky to 8mm; alkali feldspar; plagioclase; biotite. Distinctive brown pumice with feldspar and biotite but little quartz.

ROCK STRUCTURE: N60E, 54NW

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Grayish brown pyroclastic rock with lithic fragments, crystals of quartz, feldspars, and biotite in dense matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (25%, <3.0mm, angular), sanidine (15%, <2.0 X 1.0mm, angular), plagioclase (8.0%, <1.5 X 1.0mm, angular), biotite (8.0%, <3.0 X 1.0mm, angular), lithic fragments (6.0%). Matrix: (30%, brownish cryptocrystalline intergrowths of quartz and feldspar.

ACCESSORY MINERALS: Magnetite (4.0%).

SECONDARY: Sericite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **214**

FIELD DATE: 7/6/94

SCALE: 1:24,000

COLLECTOR: C. Henry

UTM NORTH: 4181371

QUADRANGLE NAME: Cactus Peak

UTM EAST: 510271

OCCURRENCE: Talus on W flank of Cactus Pk.

ROCK AGE:

ROCK UNIT: Trcpi Rhyolite of Cactus Peak

ROCK DESCRIPTION: Flow banded, sparsely and finely porphyritic rhyolite lava dome. Phenocrysts: quartz (~3.0%), 1mm; sanidine (1.0%), 1mm. Some limonitic pyrite?

ROCK STRUCTURE:

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Brownish pyroclastic rock with brown banding in the matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (5.0%, <1.0mm, rounded), sanidine (3.0%, <1.0mm, rounded). Matrix: (88%, microcrystaline aggregates.

ACCESSORY MINERALS:

SECONDARY: Calcite (2.0%), sericite (2.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 215

FIELD DATE: 7/7/94
SCALE: 1:24,000
UTM NORTH: 4170144
UTM EAST: 519110
ROCK AGE:

COLLECTOR: C. Henry, H. Bonham
QUADRANGLE NAME: Cactus Spring
OCCURRENCE: Small knobs along wash
ROCK UNIT: Ti (intrusive rock of Cactus Range)

ROCK DESCRIPTION: Propylitically altered porphyritic andesite. Phenocrysts: plagioclase to 6mm; mafic (hornblende or pyroxene) altered to chlorite and Feox, some epidote and calcite along fractures. Freshest rock available.

ROCK STRUCTURE: Massive.

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Gray, porphyritic rock with phenocrysts of feldspar.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: plagioclase (30%, <6.0 X 2.0mm, sub to euhedral), augite (5.0%, <2.0 X 1.0mm, subhedral), magnetite (8.0%, <0.8 X 0.6mm). Groundmass: (39%, microlite of feldspars and quartz).

ACCESSORY MINERALS: Hornblende (3.0%).

SECONDARY: Chlorite (8.0%), calcite (7.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, plagioclase, chlorite, calcite.

CEMENT:

FEATURES: Pyroxene and hornblende altered to calcite and chlorite, plagioclase (labradorite).

FULL ROCK NAME: Pyroxene dacite.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 216

FIELD DATE: 7/7/94
SCALE: 1:24,000
UTM NORTH: 4168006
UTM EAST: 519238
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Spring
OCCURRENCE:
ROCK UNIT: "Tls"-lacustrine sedimentary rocks.

ROCK DESCRIPTION: Complex, highly altered bedded tuff. Moderately coarse to fine tuff with small pumice to 1cm long and common rock and mineral fragments in fine silicified groundmass. Biotite replaced by chlorite; calcite in small nodules. Large clasts or nodular replacement of fine shale with epidote and limonite after pyrite.

ROCK STRUCTURE: N50E 25NW

REMARKS:

REFERENCES: Ekren et al., 1971

ANALYST: L. C. Hsu

LAB DATE: 1/5/95

HAND SPECIMEN STUDY: Yellowish, light-colored porphyritic rock.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: plagioclase (25%, <1.5 X 1.0mm, subhedral). Groundmass: (52%, microlites of feldspars and quartz).

ACCESSORY MINERALS: Biotite (2.0%).

SECONDARY: Epidote (15%), chlorite (6.0%), calcite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, plagioclase, chlorite, mica, epidote.

CEMENT:

FEATURES:

FULL ROCK NAME: Hornblende andesite.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 217

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4172547
UTM EAST: 518397
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Spring
OCCURRENCE: Outcrop along edge of drainage
ROCK UNIT: Tgp -Porphyritic rhyolite intrusion

ROCK DESCRIPTION: Highly altered, sparsely porphyritic rhyolite lava dome? Sparse phenocrysts of feldspar (probably sanidine) altered to clay. Groundmass: finely spherulitic, locally flow banded, also clay altered. Minor limonitic staining. Highly altered rock but whole area altered; representative of Tgp outcrop. Many outcrops highly limonitic and source of limonitic chips in floatchip sample 117576.

ROCK STRUCTURE:
REMARKS: Outcrop along edge of drainage south of 6274

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/95
HAND SPECIMEN STUDY: White altered rock, probably volcanic glass, with local brown patches of jarosite.

TEXTURE: Porphyritic with perlitic cracks of originally glassy groundmass.
ESSENTIAL MINERALS:

ACCESSORY MINERALS: Sericite (55%), quartz (30%), potassium-feldspar (10%), jarosite (5.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, mica, potassium-feldspar(?).

CEMENT:
FEATURES:
FULL ROCK NAME: Altered volcanic glass.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 218

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4167348
UTM EAST: 524288
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Roller Coaster Knob
OCCURRENCE: Talus
ROCK UNIT: Trc Rhyolite of Cactus Range

ROCK DESCRIPTION: Sparsely porphyritic, devitrified, massive to flow banded rhyolite or rhyodacite, locally spherulitic. Phenocrysts: quartz (a few percent), 3mm.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/5/95
HAND SPECIMEN STUDY: Light-brown, porphyritic rock with phenocrysts of quartz.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Quartz (8.0%, <2.0mm, anhedral). Groundmass: (92%) replaced by fine aggregates of quartz and alunite and trace jarosite).

ACCESSORY MINERALS:
SECONDARY: Quartz (47%), alunite (30%), jarosite (5.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, alunite.

CEMENT:
FEATURES:
FULL ROCK NAME: Altered volcanic rock.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 219

FIELD DATE: 7/8/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4168431
QUADRANGLE NAME: Roller Coaster Knob
UTM EAST: 522192
OCCURRENCE:
ROCK AGE:
ROCK UNIT: Tic - Intrusive rock of Cactus Range

ROCK DESCRIPTION: Coarsely crystalline granodiorite, abundant plagioclase, mostly cloudy, minor alkali feldspar, biotite, hornblende--slightly altered, minor interstitial quartz is fine grained matrix. Massive speckled rock.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95

HAND SPECIMEN STUDY: Light-colored porphyritic rock with coarse phenocrysts of feldspar and altered mafic minerals. Black magnetite crystals are also observed.

TEXTURE: Porphyritic with phaneritic groundmass.

ESSENTIAL MINERALS: Phenocrysts: plagioclase (35%, <5.0 X 3.0mm, subhedral), augite (8.0%, <2.0 X 2.0mm, subhedral). Groundmass: (29%, aggregates of quartz and k-feldspar).

ACCESSORY MINERALS: Magnetite (5.0%), biotite (2.0%).

SECONDARY: Chlorite (12%), epidote (8.0%), calcite (1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, plagioclase, potassium-feldspar, chlorite, mica.

CEMENT:

FEATURES: Mafic minerals altered to chlorite, white plagioclase to epidote and calcite.

FULL ROCK NAME: Granodiorite porphyry.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 220

FIELD DATE: 7/8/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4164422
QUADRANGLE NAME: Cactus Spring
UTM EAST: 521364
OCCURRENCE: Roadcut.
ROCK AGE:
ROCK UNIT: Tam - Middle unit tuff of Antelope Springs

ROCK DESCRIPTION: Sparse to moderately porphyritic, devitrified densely welded ash-flow tuff. Few small flattened pumice to 2cm and <<1% lithics of quartz-phyric volcanic to 2cm. Phenocrysts of plagioclase (8.0%), to 2mm, all cloudy, and altered mafics. Top most unit on Antelope Peak probably ash flow tuff, but units below ~150ft of top are probably lavas, or possibly densely welded intracaldera tuff. Can see at least 6 flow units on N flank.

ROCK STRUCTURE:

REMARKS: Photo 34 of Antelope Peak section.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95

HAND SPECIMEN STUDY: Light-gray, porphyritic volcanic rock with feldspar phenocrysts.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Phenocrysts: sanidine (8.0%, <2.0 X 1.0mm, subhedral), plagioclase (<2.0%), quartz (<1.0%). Groundmass: (>74%, microlites of quartz and K-feldspar).

ACCESSORY MINERALS:

SECONDARY: Sericite (10%), limonite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, potassium-feldspar, mica.

CEMENT:

FEATURES: Remnants of perlitic cracks in groundmass. Feldspar phenocrysts altered to sericite.

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 221

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4163670
UTM EAST: 522226
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Trappman Hills
OCCURRENCE: Outcrop (see remarks)
ROCK UNIT: Tal - lower unit tuff of Antelope Springs

ROCK DESCRIPTION: Densely welded, devitrified, hydrothermally altered ash-flow tuff. Moderately porphyritic; Phenocrysts of quartz (5.0%), to 3mm; sanidine (10%), to 5mm (most <3mm); plagioclase (5.0%), to 3mm, commonly altered; biotite (1.0%), to 2mm, mostly altered to sericite; lithics (5.0%), to 3cm. Common flattened pumice to 8cm long.

ROCK STRUCTURE: N 10 E, 47 E
REMARKS: Moderately east-dipping outcrop along wash.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95
HAND SPECIMEN STUDY: Grayish pyroclastic rock with irregular-shaped crystals of feldspars and quartz and lithic fragments in cryptocrystalline matrix.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Sanidine (10%, <2.5 X 2.0mm, angular), quartz (6.0%, <2.0 X 1.5mm, angular), plagioclase (5.0%, <2.0 X 1.0mm, angular), lithic fragments (4.0%). Matrix: (61%), cryptocrystalites of quartz and potassium-feldspar.

ACCESSORY MINERALS:
SECONDARY: Sericite (8.0%), epidote (4.0%), iddingsite (2.0%
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 222

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4164482
UTM EAST: 521169
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Springs
OCCURRENCE: Outcrop (see remarks)
ROCK UNIT: Tam - middle unit tuff of Antelope Springs

ROCK DESCRIPTION: Sparse porphyritic dacite lava or very densely welded, intracaldera ash-flow tuff. Phenocrysts: plagioclase (6.0%), to 3mm, long laths, some altered; biotite (1.0%), to 2mm, commonly altered.

ROCK STRUCTURE:
REMARKS: Outcrop approximately 150 feet below top of Antelope Peak.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95
HAND SPECIMEN STUDY: Grayish pyroclastic rock with irregular crystals of feldspar and banding in matrix.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Feldspars (10%, <1.5 X 1.0mm, angular), muscovite (3.0%, <1.5 X 0.5mm). Matrix: (76%), cryptocrystalites of quartz and k-feldspar spherulitic fibers in matrix.

ACCESSORY MINERALS:
SECONDARY: Sericite (8.0%), calcite (3.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 223

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4161030
UTM EAST: 523614
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Trappman Hills
OCCURRENCE: Outcrop on ridge (see remarks)
ROCK UNIT: Tau - upper unit tuff of Antelope Peak

ROCK DESCRIPTION: Densely welded, moderately lithic and pumiceous, devitrified ash-flow tuff. Propylitic alteration. Phenocrysts of quartz to 3mm, sanidine partly to entirely dissolved, plagioclase altered to clay, biotite altered to chlorite. All Tau in this area is altered.

ROCK STRUCTURE: N 10 E, 43 E
REMARKS: Approximately 0.6 miles south of Antelope View Mine.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95
HAND SPECIMEN STUDY: Light brown pyroclastic rock with crystals of feldspars and quartz, porous due to leaching of clayish pseudomorphs of feldspar.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Quartz (11%, <2.5 X 2.0mm, angular), K-feldspar (15%, <3.0 X 2.0mm, angular), lithic fragments (5.0%, <4.0 X 3.0mm). Matrix: (74%), glass shards and devitrified extremely fine aggregates of possibly quartz and K-feldspar.

ACCESSORY MINERALS: Muscovite (1.0%).
SECONDARY: Sericite (4.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 224

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4166028
UTM EAST: 523067
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Roller Coaster Knob
OCCURRENCE: Block knocked out or road cut
ROCK UNIT: Tic - granodiorite of Cactus Range

ROCK DESCRIPTION: Granodiorite

ROCK STRUCTURE: Massive, jointed
REMARKS: Block knocked out of roadcut, Antelope Peak road.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95
HAND SPECIMEN STUDY: Grayish porphyritic rock with megacrysts of feldspar. Most phenocrysts are plagioclase and hornblende.

TEXTURE: Porphyritic with intergranular groundmass.
ESSENTIAL MINERALS: Phenocrysts: plagioclase (45%, <4.0 X 3.0mm, subhedral), hornblende (15%, <2.5 X 1.0mm, subhedral). Groundmass: 25%, granular intergrowths of quartz and k-feldspar.

ACCESSORY MINERALS: Magnetite (5.0%), biotite (3.0%).
SECONDARY: Chlorite (4.0%), epidote (2.0%), calcite (1.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, plagioclase, amphibole, chlorite.

CEMENT:
FEATURES:
FULL ROCK NAME: Granodiorite porphyry.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **225**

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4180667
UTM EAST: 507219
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Peak
OCCURRENCE: Massive outcrop of ridge 6536
ROCK UNIT: Tro Rhyolite of O'Brien's Knob

ROCK DESCRIPTION: Moderately abundant porphyritic rhyolite lava dome. Phenocrysts: quartz (15%), 1-2mm; sanidine (10%), 6mm; plagioclase to 3mm; biotite (1.0%), 2mm, commonly oxidized. Rock is generally oxidized brick red, biotite only partly preserved.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95

HAND SPECIMEN STUDY: Brown porphyritic rock with phenocrysts of feldspar and hematite-stained groundmass, somewhat vesicular.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Phenocrysts: sanidine (30%, <3.0 X 2.0mm, sub to euhedral). Groundmass: (56%), spherulitic fibers of chalcedonic quartz and K-feldspar.

ACCESSORY MINERALS: Quartz (5.0%), biotite (2.0%), plagioclase (2.0%).
SECONDARY: Hematite (5.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, sanidine, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **226**

FIELD DATE: 7/9/94
SCALE: 1:24,000
UTM NORTH: 4180603
UTM EAST: 507998
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Peak
OCCURRENCE: Boulder log on low hills
ROCK UNIT: Tp - Quartz latite porphyry

ROCK DESCRIPTION: Moderately porphyritic, shallow intrusion? Light red weathering; slightly vesicular. Phenocrysts: plagioclase (15%), 1-5mm, mostly altered to clay; quartz (1-2%), up to 1cm; alkali feldspar (1.0%), as 1-3 cm megacrysts. Makes brown weathering low hills.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/6/95

HAND SPECIMEN STUDY: Light-greenish porphyritic rock with feldspar phenocrysts, somewhat vesicular appearance.

TEXTURE: Porphyritic.
ESSENTIAL MINERALS: Plagioclase (30%, <3.0 X 2.0mm, sub to euhedral), quartz (3.0%, <3.0 X 1.0mm, subhedral). Groundmass: 43%, intergranular mass of quartz and K-feldspar.

ACCESSORY MINERALS: Magnetite (7.0%).
SECONDARY: Chlorite (10%), epidote (5.0%), calcite (2.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Plagioclase, quartz, chlorite.

CEMENT:
FEATURES: Appears to be propylitized.
FULL ROCK NAME: Granodiorite porphyry.
GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **227**

FIELD DATE: 7/9/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4158336
QUADRANGLE NAME: Civet Cat Canyon
UTM EAST: 519870
OCCURRENCE: Bouldery outcrop on top knob.
ROCK AGE:
ROCK UNIT: Tro Rhyolite of O'Briens Knob

ROCK DESCRIPTION: Moderately porphyritic, devitrified, locally flow banded, vesicular rhyolite lava dome. Phenocrysts: sanidine (8.0%); lithics to 4mm long, quartz (few percent), to 1mm; plagioclase (few percent), 1-2mm laths; biotite (2.0%), 1mm, generally black, fresh. Although generally NNW elongate, north nose forms series of approximately concentric bands, perpendicular to general strike. Carapace breccia in creek bottom at N end.

ROCK STRUCTURE: Massive to flow banded and folded. Flow bands generally NNW parallel to dome elongation. Dips steeply NE.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95

HAND SPECIMEN STUDY: Brown porphyritic rock with phenocrysts of feldspar, biotite, and quartz.

TEXTURE: Porphyritic with aphanitic groundmass.

ESSENTIAL MINERALS: Phenocrysts: sanidine (15%, <1.0 X 0.5mm, sub to euhedral), biotite (6.0%, <1.0 X 0.4mm euhedral), quartz (8.0%, <0.7 X 0.6mm, anhedral). Groundmass: 65%, partial devitrification to spherulitic fibers of cristobalite.

ACCESSORY MINERALS: Magnetite (2.0%), plagioclase (3.0%), sphene and apatite (<1.0%).
SECONDARY:

AUTHIGENIC MINERALS:
DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, cristobalite, mica.

CEMENT:

FEATURES: Resorbed nature of quartz phenocrysts; devitrified glassy groundmass to spherulitic fibers of cristobalite.

FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **228**

FIELD DATE: 7/9/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4156969
QUADRANGLE NAME: Packrat Canyon
UTM EAST: 501534
OCCURRENCE: Blocky outcrop (see remarks)
ROCK AGE:
ROCK UNIT: Tsr2 Rhyolite of Stonewall Mtn.

ROCK DESCRIPTION: Porphyritic rhyolite lava dome; pronounced massive flow structures as well as fine internal flow bands. All outcrop highly oxidized with few (if any) preserved mafic minerals. Phenocrysts of quartz and sanidine.

ROCK STRUCTURE: Massive, radially inward dipping flow structure; probably indicates vent approximately in center of dome.

REMARKS: High on flank of 6332.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95

HAND SPECIMEN STUDY: Gray porphyritic rock with phenocrysts of feldspar and quartz.

TEXTURE: Porphyritic with phenocrysts mostly in glomeroporphyritic clustering.

ESSENTIAL MINERALS: Phenocrysts: sanidine (14%, <5.0 X 2.0mm, sub to euhedral), quartz (5.0%, <2.0 X 1.0mm, anhedral). Groundmass: 78%, partial devitrification to a mixture of cristobalite spherules, alkali-feldspar and glass.

ACCESSORY MINERALS: Magnetite (2.0%), augite (<1.0%).
SECONDARY: Calcite (2.0%).

AUTHIGENIC MINERALS:
DETRITAL MINERALS:

XRAY STUDY: Sanidine, quartz, cristobalite.

CEMENT:

FEATURES: Glomeroporphyritic clustering of sanidine, spherulitic fibers of cristobalite.

FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **229**

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4139395
UTM EAST: 558697
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Apache Tear Canyon
OCCURRENCE: Ragged outcrop (see remarks)
ROCK UNIT: Tbd - Peralkaline rhyolite (comendite) lava

ROCK DESCRIPTION: Very sparsely porphyritic, strongly flow banded and folded, devitrified, oxidized comendite lava. Miarolitic cavities are common. Groundmass spotted with opaque oxides that may have been arfvedsonite. Phenocrysts: sanidine (1.0%), to 2mm. Flow is covered by poorly exposed, bedded, pyroclastic deposits containing vitrophyric, nearly aphyric pumice.

ROCK STRUCTURE:
REMARKS: Near top of flow on side of ridge.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95
HAND SPECIMEN STUDY: Gray tuffaceous rock with alternate lighter and darker layers. The lighter layers are porous and composed of feldspar and quartz.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Lighter layers: 35%, intergrown quartz and sanidine, porous. Darker layers: 65%, mostly cryptocrystalline chalcedonic quartz with spherulitic fibers, dense.

ACCESSORY MINERALS: Magnetite and pyroxene (<4.0%), biotite (<1.0%).
SECONDARY: Epidote (<1.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **230**

FIELD DATE: 7/10/94
SCALE: 1:24,000
UTM NORTH: 4141353
UTM EAST: 558529
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Apache Tear Canyon
OCCURRENCE: Massive outcrop, interior flow
ROCK UNIT: Tbd comendite lava

ROCK DESCRIPTION: Very sparsely porphyritic, massive to flow banded, slightly miarolitic, blue-gray. Crystalline groundmass with scattered vapor-phase arfvedsonite. Stony rhyolite. Phenocrysts 1% sanidine 1-2mm. Much less oxidized than sample GSCN 229; probably same lava flow.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95
HAND SPECIMEN STUDY: Gray, compact porphyritic rock with clustering of feldspar and quartz phenocrysts.

TEXTURE: Porphyritic with glomeroporphyritic cluster of phenocrysts.
ESSENTIAL MINERALS: Phenocrysts: sanidine (7.0%, <1.0 X 0.5mm, sub to euhedral), quartz (5.0%, <0.8 X 0.6mm, anhedral). Groundmass: graphic intergrowth of alkali feldspar and quartz (80%), hornblende (4.0%) and glass (1.0%).

ACCESSORY MINERALS: Pyroxene (1.0%), magnetite (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Sanidine, quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **231**

FIELD DATE: 7/10/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4141655
QUADRANGLE NAME: Apache Tear Canyon
UTM EAST: 557658
OCCURRENCE: Basal pumiceous vitrophyre
ROCK AGE:
ROCK UNIT: Tbd Deadhorse Flat Fm Comendite lava

ROCK DESCRIPTION: Basal pumiceous vitrophyre. Flow banded; vesicularity varies between bands. Hydrated. Also glassy pumiceous tuff with Apache Tears.

ROCK STRUCTURE:

REMARKS: From wall of Apache Tear Canyon.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95

HAND SPECIMEN STUDY: Dark gray to black vesicular obsidian.

TEXTURE: Microporphyritic to aphyric.

ESSENTIAL MINERALS: Phenocrysts: feldspar (5.0%, <0.15 X 0.05mm, euhedral as crystallites). Groundmass: 90%, mostly glass with trace of cristobalite.

ACCESSORY MINERALS: Magnetite (<2.0%).
SECONDARY: Calcite (32%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Glass, trace cristobalite and feldspar.

CEMENT:

FEATURES: Flow lines and perlitic marks of glass.

FULL ROCK NAME: Obsidian.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **232**

FIELD DATE: 7/10/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4158300
QUADRANGLE NAME: Trappman Hills
UTM EAST: 524907
OCCURRENCE: Massive outcrop (see remarks)
ROCK AGE:
ROCK UNIT: Tro-Rhyolite of O'Briens Knob.

ROCK DESCRIPTION: Moderately and finely porphyritic, flow banded, rhyolite intrusion or lava dome. Phenocrysts: quartz (1.0-2.0%), 1mm; sanidine mostly altered to 2mm; plagioclase (~10%); biotite (1.0-2.0%), 1-2mm, mostly altered to chlorite. Rock is generally oxidized and has Fe stains along all fractures. Unlike other Tro, which are more coarsely and abundantly porphyritic.

ROCK STRUCTURE: Flow bands N10E, 75 degrees E

REMARKS: On flank of hill SW of 6301

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95

HAND SPECIMEN STUDY: Whitish porphyritic rock with slight alteration.

TEXTURE: Porphyritic with aphanitic groundmass.

ESSENTIAL MINERALS: Phenocrysts: sanidine (10%, <2.0 X 1.5mm, subhedral), oligoclase (8.0%, <2.5 X 2mm, sub to euhedral), quartz (4.0%, <1.0 X 0.8mm, anhedral), biotite (5.0%, <2.0 X 0.5mm, euhedral). Groundmass: 70%, micro to cryptocrystalline intergrowths of quartz and feldspar.

ACCESSORY MINERALS:
SECONDARY: Sericite (3.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, plagioclase, mica.

CEMENT:

FEATURES: Plagioclase invariably alters to sericite.

FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **233**

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4156598
QUADRANGLE NAME: Triangle Mtn.
UTM EAST: 536895
OCCURRENCE: Boulder lag on top of hill
ROCK AGE:
ROCK UNIT: Tod - older intermediate lavas

ROCK DESCRIPTION: Porphyritic dacite. Trachytic phenocrysts of plagioclase 15% 1-7mm, hornblende 5.0% 1-5mm, biotite 1% 1-2mm. In fine red groundmass.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/21/95

HAND SPECIMEN STUDY: Dark gray, porphyritic rock with phenocrysts of plagioclase and mafic minerals.

TEXTURE: Porphyritic with glassy groundmass.

ESSENTIAL MINERALS: Phenocrysts: andesine (23%, <2.0 X 1.0mm, sub to euhedral), hornblende (13%, <1.5 X 1.0mm, euhedral to subhedral), biotite (11%, <0.5 X 0.3mm, euhedral to subhedral), augite (8.0%, <1.2 X 0.4mm euhedral to subhedral). Groundmass: 42%, glass-rich dark matrix stippled with microlites of plagioclase.

ACCESSORY MINERALS: Magnetite and apatite (3.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, amphibole, mica.

CEMENT:

FEATURES: Brown, oxidized hornblende.

FULL ROCK NAME: Hornblende-biotite dacite.
GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **234**

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4158052
QUADRANGLE NAME: Triangle Mtn.
UTM EAST: 537650
OCCURRENCE: Roadcut-road to top of Gold Mt
ROCK AGE:
ROCK UNIT: Tod - older intermediate lavas

ROCK DESCRIPTION: Highly porphyritic dacite; 50% phenocrysts in light red groundmass, slightly more oxidized that GSCN 233. Phenocrysts: plagioclase (40%) 1-5mm; biotite (4.0%) 1-3mm; hornblende (5.0%), 1-4mm long.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Brownish porphyritic rock with phenocrysts of feldspar, biotite, and amphibole.

TEXTURE: Porphyritic with vitric groundmass.

ESSENTIAL MINERALS: Phenocrysts: andesine (30%, <5.0 X 3.0mm, sub to euhedral), biotite (16%, <1.5 X 0.5mm, euhedral). Groundmass: 42%, glass-rich dark matrix, stippled with tiny microlites of feldspar and devitrified cristobalite.

ACCESSORY MINERALS: Hornblende (6.0%), magnetite (5.0%), augite and apatite (1.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Mica, plagioclase, cristobalite, amphibole.

CEMENT:

FEATURES:

FULL ROCK NAME: Biotite andesite.
GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: 235

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4156990
QUADRANGLE NAME: Triangle Mtn.
UTM EAST: 537653
OCCURRENCE: Low outcrop along drainage
ROCK AGE:
ROCK UNIT: Twc - tuff of Wilsons Camp

ROCK DESCRIPTION: Poorly to non-welded ash-flow tuff; moderately porphyritic, glassy (hydrated), pumiceous and lithic rich. Glassy pumice to 5cm. Lithics (intermediate lava) to 15cm. White to very light pink groundmass. Phenocrysts: quartz (5.0%) 1-4mm; sanidine (12%) to5mm; plagioclase (few percent) to 3mm, biotite (1.0-2.0%) to 3mm, hornblende (<1.0%) to 3mm.

ROCK STRUCTURE: Appears to dip gently W.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Light colored tuffaceous rock with lithic fragments, crystals of feldspars and biotite.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (10%, <1.5 X 1.0mm, angular), oligoclase (8.0%, <1.5 X 1.0mm, angular), biotite (4.0%, <1.0 X 0.8mm, angular), quartz (3.0%, <1.0 X 1.0mm, angular), hornblende (2.0%, <1.5 X 0.7mm, angular), lithic fragments (35%, <1.6 X 5mm, irregular). Matrix 38%, mostly amorphous glass shards and cristobalite.

ACCESSORY MINERALS:
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Glass, sanidine, plagioclase, cristobalite, quartz, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 236

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4157686
QUADRANGLE NAME: Triangle Mtn.
UTM EAST: 538883
OCCURRENCE:
ROCK AGE:
ROCK UNIT: Tzwc - zeolitic tuff of Wilsons Camp

ROCK DESCRIPTION: Poorly welded but indurated ash-flow tuff. Moderately porphyritic, pumice and lithic rich, mottled cream and white matrix-weathers cream. Looks more silicified than zeolitic. Pumice to 5cm, mostly altered to clay. Lithics of porphyritic, intermediate lava. Phenocrysts: quartz (5.0%) 1-3mm; sanidine (15%) to 1mm, plagioclase, biotite (1.0%) 1-2mm.

ROCK STRUCTURE:

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Light colored, altered tuffaceous rock with lithic fragments and crystals of feldspars and quartz; somewhat porous due to leaching of altered crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Lithic fragments (30%, <11 X 6.0mm, irregular), sanidine (8.0%, <1.0 X 0.8mm, angular), oligoclase (5.0%, <1.0 X 0.6mm, angular). Some feldspar crystals appear to have altered and been leached out. Matrix: 50%, a mixture of zeolite and much less cristobalite.

ACCESSORY MINERALS: Quartz (3.0%), biotite (2.0%), magnetite (2.0%).
SECONDARY: Zeolite as mordenite (<50%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Mordenite, feldspar, cristobalite, quartz, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Altered rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **237**

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4166131
QUADRANGLE NAME: Mellan
UTM EAST: 541393
OCCURRENCE:
ROCK AGE:
ROCK UNIT: Tdi - intrusion of older intermediate

ROCK DESCRIPTION: Glassy, porphyritic andesite or dacite. Weathers to dark brown, almost black. Black glassy groundmass with phenocrysts of plagioclase (10%) rarely to 1cm; hornblende (5.0%) 1-4mm prisms; pyroxene (3.0%) 1-2mm.

ROCK STRUCTURE: Columnar joints plunge 70 degrees S50W.

REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Dark gray porphyritic rock with white phenocrysts of feldspar and black phenocrysts of hornblende.

TEXTURE: Porphyritic with dark aphyric groundmass.

ESSENTIAL MINERALS: Phenocrysts: andesine (28%, <3.5 X 2.0mm, sub to euhedral), hornblende (12%, <2.0 X 1.0mm, euhedral to subhedral), augite (8.0%, <3.0 X 2.0mm, subhedral). Groundmass: 48%, glass-rich dark matrix stippled with microlites of plagioclase.

ACCESSORY MINERALS: Magnetite (3.0%), biotite (1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Plagioclase, hornblende.

CEMENT:
FEATURES:
FULL ROCK NAME: Hornblende andesite.
GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **238**

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4167535
QUADRANGLE NAME: Mellan
UTM EAST: 538526
OCCURRENCE: Boulder and sparse outcrop
ROCK AGE:
ROCK UNIT: Trm rhyolite of Mellan; Ekren=Tob (rhyolite of O'Brien Knob)

ROCK DESCRIPTION: Light gray devitrified or stony rhyolite. Sparsely porphyritic, flow banded, slightly vesicular to massive. Phenocrysts of sanidine (5.0%) 1-4mm; quartz (3.0%) <1mm; biotite (1.0%) 2mm, plagioclase?

ROCK STRUCTURE:

REMARKS: On flank of intrusion or lava dome.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Light-colored welded tuff with crystals of feldspar.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (8.0%, <1.0 X 0.6mm, angular), quartz (5.0%, <0.8 X 0.5mm, subrounded). Matrix: 87%, mixture of spherulitic fibers of cristobalite and granular clear glass with interference crosses.

ACCESSORY MINERALS:
SECONDARY: Calcite (4.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Feldspars, cristobalite, calcite, quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 239

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4168349
QUADRANGLE NAME: Mellan
UTM EAST: 541262
OCCURRENCE: Scattered knobby outcrop
ROCK AGE:
ROCK UNIT: Tf Fraction Tuff

ROCK DESCRIPTION: Densely welded, abundantly porphyritic ash-flow tuff, poor exposure but appears to grade upward from poorly welded base through densely welded interior (sample) to moderately welded, pumice rich upper. Phenocrysts: quartz (10-15%) 1-3mm; sanidine (15%) 1-3mm; plagioclase (10%) 1-2mm; hornblende (<1.0%) to 2mm long; biotite (1.0%) 1-2mm.

ROCK STRUCTURE: Tf is approximately flat lying or very gently E-dipping.

REMARKS: Flank of ridge

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Gray, crystal rich tuff with crystals of feldspars, quartz and biotite, and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (20%, <2.0 X 3.0mm, angular), quartz (8.0%, <1.0 X 1.0mm, subrounded), oligoclase (6.0%, <2.0 X 1.0mm, angular), lithic fragments (30%, irregular). Matrix: 30%, glass-rich, dark, partial devitrified to cristobalite.

ACCESSORY MINERALS: Biotite (3.0%), magnetite (2.0%), hornblende (1.0%).
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, cristobalite, mica, amphibole.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 240

FIELD DATE: 7/11/94
SCALE: 1:24,000
COLLECTOR: C. Henry
UTM NORTH: 4170762
QUADRANGLE NAME: Mellan
UTM EAST: 540415
OCCURRENCE: Blasted road cut (see remarks)
ROCK AGE:
ROCK UNIT: Tm-rhyolite of Mellan

ROCK DESCRIPTION: Strongly flow banded and folded, stony rhyolite lava dome. Finely porphyritic with less than 10% total phenocrysts. Slightly oxidized but biotite preserved. Some Fe-staining along flow bands. Some vitrophyre bands along margin. Intrudes or overlies coarsely porphyritic ash flow tuff (Tzwc according to Ekren et al.). Phenocrysts: quartz (5.0%) ~1mm; sanidine (3.0%) 1mm; biotite (4.0%) 1-2mm.

ROCK STRUCTURE:

REMARKS: Near top of Jack Rabbit Knob. Rhyolite of O'Brien Know of Ekren et al., 1971.

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/22/95

HAND SPECIMEN STUDY: Light colored welded tuff with bandings and crystals of feldspar, quartz and biotite embedded in banded matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (8.0%, <1.5 X 1.0mm, angular), quartz (3.0%, <1.0 X 0.7mm, subrounded), biotite (2.0%, <0.5 X 0.2mm, angular). Matrix: 87%, mixture of spherulitic fibers of cristobalite and rounded, clear globules of glass showing interference crosses.

ACCESSORY MINERALS:
SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, cristobalite, quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 241

FIELD DATE: 9/8/94
SCALE: 1:24,000
COLLECTOR: J. Tingley, H. Bonham
UTM NORTH: 4163237
QUADRANGLE NAME: Quartzite Mt
UTM EAST: 558232
OCCURRENCE: Outcrop
ROCK AGE: 18-19 Ma
ROCK UNIT: Tuff of Cathedral Ridge

ROCK DESCRIPTION: Crystal rich intracaldera tuff, phenocrysts of quartz, sanidine, plagioclase, biotite; contains sphene. Dense welding light brown, highly fractured here. Fresh, no alteration, 40-50% phenocrysts.

ROCK STRUCTURE: Approximately N35W, 25 degrees NE

REMARKS:

REFERENCES: USGS PP 151 **ANALYST:** L. C. Hsu **LAB DATE:** 1/22/95

HAND SPECIMEN STUDY: Light brown crystal-rich tuff with crystals of feldspars, quartz and biotite.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (28%, <2.5 X 1.5mm, subangular), quartz (12%, <2.0 X 1.5mm, subangular), oligoclase (8.0%, <1.5 X 1.2mm subangular), lithic fragments (7.0%, irregular). Matrix: 40%, mainly brownish spherulitic fibers of cristobalite.

ACCESSORY MINERALS: Biotite (4.0%), magnetite (<1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Sanidine, cristobalite, quartz, plagioclase, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 242

FIELD DATE: 7/8/94
SCALE: 1:24,000
COLLECTOR: H. Bonham
UTM NORTH: 4186905
QUADRANGLE NAME: Cactus Peak
UTM EAST: 501637
OCCURRENCE: Outcrop
ROCK AGE: Miocene
ROCK UNIT: Supposed to be Cactus Peak Rhyolite

ROCK DESCRIPTION: Gray, somewhat flow-banded, rhyolite, phenocrysts glassy sanidine. Sparse quartz in gray fine crystalline matrix, no obvious mafics, unaltered. Doesn't look like sample from Cactus Peak.

ROCK STRUCTURE: Flow banded.

REMARKS: Not same rhyolite as collected at Cactus Peak.

REFERENCES: PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 1/22/95

HAND SPECIMEN STUDY: Light colored rhyolite with sparse phenocrysts of feldspar.

TEXTURE: Patchy devitrification

ESSENTIAL MINERALS: Sanidine (7.0%, <3.0 X 1.5mm, angular). Matrix: 88%, mixture of feldspar microlite, cristobalite fibers and magnetite crystallites.

ACCESSORY MINERALS: Magnetite (1.0%).

SECONDARY: Calcite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, sanidine, cristobalite, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite flow.

GENERAL ROCK NAME: Silicic igneous rock.

SAMPLE NUMBER: 243

FIELD DATE: 7/8/94
SCALE: 1:24,000
COLLECTOR: H. Bonham
UTM NORTH: 4176502
QUADRANGLE NAME: White Patch
UTM EAST: 509439
OCCURRENCE: Outcrop
ROCK AGE: Miocene
ROCK UNIT: Granite Porphyry

ROCK DESCRIPTION: Granite porphyry phenocrysts of quartz, pink K-feldspar, and greenish-white plagioclase, rock somewhat altered. Plagioclase probably albitized from microphenocrysts of Fe-Ti oxide mineral K-feldspar phenocrysts to 1cm. Sparse Feox after pyrite, matrix is light greenish-white. K-feldspar appears fresh. May be minor sericitized biotite; quartz is vermicular.

ROCK STRUCTURE:

REMARKS: Several small prospect pits. No real workings, rock is Fe-stained along fractures.

REFERENCES: PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 1/22/95

HAND SPECIMEN STUDY: Light-colored porphyry with coarse crystals of orthoclase, plagioclase, and quartz, and finely crystalline matrix.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Orthoclase (27%, <7.0 X 5.0mm, subhedral), sodic plagioclase (22%, <3.0 X 2.0mm, euhedral), quartz (15%, <2.5 X 2.5mm, subhedral). Matrix: 25%, fine crystal aggregates (<0.2mm) of quartz and alkali feldspar.

ACCESSORY MINERALS: Magnetite (3.0%).

SECONDARY: Sericite (8.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, feldspars, mica.

CEMENT:

FEATURES: Both feldspars are sericitized, but with plagioclase more strongly so.

FULL ROCK NAME: Granite porphyry.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 244

FIELD DATE: 7/8/94
SCALE: 1:24,000
COLLECTOR: H. Bonham
UTM NORTH: 4157667
QUADRANGLE NAME: Civet Cat Canyon
UTM EAST: 512246
OCCURRENCE: Outcrop
ROCK AGE: 7 Ma
ROCK UNIT: Upper member Stonewall Mt Tuff

ROCK DESCRIPTION: Platy, brown ash-flow tuff, K-feldspar, amphiboles.

ROCK STRUCTURE: Foliation near horizontal.

REMARKS:

REFERENCES: PP651, Noble, Weiss **ANALYST:** L. C. Hsu **LAB DATE:** 1/22/95

HAND SPECIMEN STUDY: Brown, compact tuffaceous rock with feldspar crystals.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (10%, <1.5 X 1.0mm, angular). Matrix 87%, iron-stained glassy matter, partial devitrification to cristobalite and feldspar.

ACCESSORY MINERALS: Augite (<1.0%), magnetite (<1.0%).

SECONDARY: Calcite (2.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Feldspar, cristobalite, calcite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 245

FIELD DATE: 7/11/94
SCALE: 1:24,000
UTM NORTH: 4191193
UTM EAST: 554224
ROCK AGE: Miocene

COLLECTOR: H. Bonham, J. Tingley
QUADRANGLE NAME: Kawich Peak SW
OCCURRENCE: Outcrop
ROCK UNIT: Rhyodacite Porphyry Intrusion

ROCK DESCRIPTION: Jointed, banded (flow?) gray weathering porphyry. Prominent phenocrysts of quartz, sanidine, plagioclase, biotite, hornblende and pyroxene. Some bold outcrops but weathers readily to grus.

ROCK STRUCTURE: Jointing, banding

REMARKS:

REFERENCES: PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 1/28/95

HAND SPECIMEN STUDY: Light brown crystal-rich volcanic rock with crystals of feldspar, quartz and biotite.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (18%, <3.0 X 2.0mm, angular to subrounded), oligoclase (14%, <3.5 X 1.5mm, angular to subangular). Matrix 56%, extremely fine aggregates of quartz and alkali feldspar and magnetite.

ACCESSORY MINERALS: Quartz (5.0%), biotite (5.0%), hornblende (1.0%), magnetite (1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 246

FIELD DATE: 7/11/94
SCALE: 1:24,000
UTM NORTH: 4190625
UTM EAST: 551057
ROCK AGE: Miocene

COLLECTOR: H. Bonham, J. Tingley
QUADRANGLE NAME: Kawich Peak SW
OCCURRENCE: Outcrop
ROCK UNIT: Tuff of Kawich Range, intracaldera

ROCK DESCRIPTION: Crystal-rich approximately 50%, brown weathering ash-flow. Phenocrysts of quartz, glassy sanidine, plagioclase and sparse biotite in brown, dense matrix. Dense welding. Some white pumice.

ROCK STRUCTURE: Compaction foliation.

REMARKS: Rock has been called tuff of Pahranagat but here it is clearly intercaldera.

REFERENCES: PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 1/28/95

HAND SPECIMEN STUDY: Brown tuffaceous rock with crystals of quartz, feldspars and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (18%, <2.0 X 2.0mm, subangular to subrounded), sanidine (13%, <3.0 X 1.0mm, angular), oligoclase (8.0%, <1.0 X 1.0mm, angular), lithic fragments (15%, irregular). Matrix: 35%, brownish glass with microlites of quartz and feldspar.

ACCESSORY MINERALS: Magnetite (2.0%).

SECONDARY: Sericite (5.0%), smectite (4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, mica, smectite.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolitic tuff

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **247**

COLLECTOR: H. Bonham, J. Tingley
QUADRANGLE NAME: Reveille Peak
OCCURRENCE: Boulder beneath cap from cap
ROCK UNIT: rhyodacite

FIELD DATE: 7/12/94
SCALE: 1:24,000
UTM NORTH: 4183857
UTM EAST: 566696
ROCK AGE: ?

ROCK DESCRIPTION: Glassy rhyodacite dark gray, phenocrysts, quartz, plagioclase, biotite, hornblende, pyroxene in black perlitic glass.

ROCK STRUCTURE: Strike NW, dip 10 degrees W.

REMARKS: Probable paleo-water table, sample is from cap rock. Apparently identical rock beneath cap is partly to completely opalized and was sampled for minerals.

REFERENCES: Td of Ekren et al. PP 651 **ANALYST:** L. C. Hsu **LAB DATE:** 1/28/95

HAND SPECIMEN STUDY: Dark gray porphyritic rock with coarse phenocrysts of feldspar and biotite.

TEXTURE: Porphyritic.

ESSENTIAL MINERALS: Andesine (25%, <6.0 X 2.0mm, subhedral), biotite (10%, 2.0 X 1.0mm, subhedral), hornblende (8.0%, <3.0 X 1.0mm, subhedral), augite (6.0%, <2.0 X 0.5mm, subhedral). Groundmass: 45%, glass rich matrix with microlites of feldspar.

ACCESSORY MINERALS: Magnetite (5.0%), apatite (1.0%).

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Plagioclase, mica, amphibole.

CEMENT:

FEATURES:

FULL ROCK NAME: Biotite andesite porphyry.

GENERAL ROCK NAME: Intermediate igneous rock

SAMPLE NUMBER: **253**

COLLECTOR: C. Henry
QUADRANGLE NAME: Cedar Pass
OCCURRENCE: Highly fractured rhyolite
ROCK UNIT: Trw: rhyolite of White Ridge

FIELD DATE: 7/12/94
SCALE: 1:24,000
UTM NORTH: 4172960
UTM EAST: 562087
ROCK AGE:

ROCK DESCRIPTION: Hydrated basal vitrophyre of very sparsely porphyritic rhyolite lava dome. Perlitic, light gray. Rest of body is flow banded stony rhyolite. Phenocrysts; quartz (<1.0) 1mm; sanidine (<1.0%) 1mm.

ROCK STRUCTURE:

REMARKS: Lag near 7777

REFERENCES: **ANALYST:** L. C. Hsu **LAB DATE:** 1/28/95

HAND SPECIMEN STUDY: Extremely crystal-poor tuffaceous rock with irregular brown banding in the matrix.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (3.0%, <0.5 X 0.3mm, angular). Matrix: 97%, consisting of spherulitic fibers of cristobalite, clear glass with interference crosses and minute magnetite grains and mica flakes.

ACCESSORY MINERALS:

SECONDARY:

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Cristobalite, sanidine, mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 254

FIELD DATE: 7/12/94
SCALE: 1:24,000
UTM NORTH: 4173509
UTM EAST: 562044
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Cedar Pass
OCCURRENCE: Massive outcrop underlying Trw
ROCK UNIT: Trws: tuff related to rhyolite of White Ridge

ROCK DESCRIPTION: Nonwelded ash-flow tuff; devitrified very sparsely porphyritic, pumice (5.0%) 1cm, plus a few small lithics. Very light pink or tan. Part of layered sequence of nonwelded tuffs that preceded Trw. Phenocrysts; quartz (<<1.0%) all < 1mm; sanidine (<<1.0%); biotite (<<1.0%).

ROCK STRUCTURE: Beds approximately N70E, 25 S.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/28/95
HAND SPECIMEN STUDY: Pinkish brown altered tuffaceous rock with most of original crystals and matrix being altered.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Quartz (<5.0%, <0.5 X 0.4mm, angular), other minerals and lithic fragments being replaced by zeolite. Matrix: replaced by zeolite.

ACCESSORY MINERALS:
SECONDARY: Zeolite most likely is heulandite/clinoptilolite series (97%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Zeolite (heulandite/clinoptilolite), trace quartz.

CEMENT:
FEATURES:
FULL ROCK NAME: Zeolitized tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 255

FIELD DATE: 7/13/94
SCALE: 1:24,000
UTM NORTH: 4178685
UTM EAST: 559103
ROCK AGE:

COLLECTOR: C. Henry
QUADRANGLE NAME: Georges Water
OCCURRENCE: Boulder outcrop on flank ridge
ROCK UNIT: Tep-tuff of Pahranagat

ROCK DESCRIPTION: Densely welded, moderately to abundantly porphyritic, devitrified ash-flow tuff. Pumice to 10cm long and lithics to 2cm (of granitic rock and intermediate volcanic). All outcrop in this area are moderately altered or weathered. Biotite only locally preserved. Feldspars commonly cloudy. Sample is composite of two parts of outcrop: one with preserved biotite, and one with slightly fresher feldspar. Phenocrysts: quartz (12%) bipyramids to 5mm; sanidine (10%) to 5mm; plagioclase (5.0%) to 3mm; biotite (1.0%) to 4mm.

ROCK STRUCTURE:
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/28/95
HAND SPECIMEN STUDY: Brown crystal-rich tuff with crystals of quartz, feldspar, biotite, and lithic fragments.

TEXTURE: Pyroclastic.
ESSENTIAL MINERALS: Quartz (20%, <3.5 X 2.5mm, angular), sanidine (15%, <3.0 X 3.0mm, subangular), lithic fragments (22%, irregular). Matrix: 46%, glass-rich matrix with minute quartz-feldspar intergrowth.

ACCESSORY MINERALS: Biotite (3.0%), magnetite (2.0%).
SECONDARY: Sericite (2.0%).
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, feldspars, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Trachyte tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 256

COLLECTOR: C. Henry
QUADRANGLE NAME: Cedar Pass
OCCURRENCE: Blasted outcrop (see remarks)
ROCK UNIT: Trcp: rhyolite of Cedar Peak

FIELD DATE: 7/13/94
SCALE: 1:24,000
UTM NORTH: 4173213
UTM EAST: 558784
ROCK AGE:

ROCK DESCRIPTION: Moderately porphyritic, slightly flow banded, white, stony lava dome. Phenocrysts: quartz (10%) to 4mm; sanidine (10%) to 4mm, biotite (1.0-2.0%) 1-2mm, hornblende (<1.0%) 1mm.

ROCK STRUCTURE:
REMARKS: Near top of Cedar Peak

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/29/95

HAND SPECIMEN STUDY: Grayish, crystal-rich tuff with quartz, feldspars and biotite.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (18%, <2.5 X 2.0mm, angular), oligoclase (15%, <2.0 X 2.0mm, angular), quartz (8.0%, <1.0 X 1.0mm, subangular). Matrix: 53%, glass-rich glass with spherulitic fibers of cristobalite.

ACCESSORY MINERALS: Biotite (4.0%), magnetite (2.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Cristobalite, feldspars, quartz, mica.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolite.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: 257

COLLECTOR: C. Henry
QUADRANGLE NAME: Cedar Pass
OCCURRENCE: Roadcut Cedar Peak Rd.
ROCK UNIT: Tf Fraction Tuff

FIELD DATE: 7/13/94
SCALE: 1:24,000
UTM NORTH: 4173791
UTM EAST: 559206
ROCK AGE:

ROCK DESCRIPTION: Densely welded, devitrified, moderately porphyritic, pumice-rich, ash-flow tuff. Phenocrysts: quartz (10%) to 3mm; sanidine (10-15%) to 3mm, plagioclase (<10%), biotite (1.0%), hornblende (<1.0%). Pumice is biotite rich.

ROCK STRUCTURE: Very gently east dipping.
REMARKS:

REFERENCES:
ANALYST: L. C. Hsu
LAB DATE: 1/29/95

HAND SPECIMEN STUDY: Gray tuffaceous rock with crystals of quartz, feldspar, biotite, and lithic fragments.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (18%, <3.5 X 2.0mm, irregular, subrounded), sanidine (16%, <2.5 X 1.5mm, subangular), oligoclase (15%, <2.0 X 2.0mm, subangular), lithic fragments (12%, irregular). Matrix: 30%, mostly glass with some spherulitic fibers of cristobalite.

ACCESSORY MINERALS: Biotite (5.0%), hornblende (3.0%), magnetite (1.0%).
SECONDARY:
AUTHIGENIC MINERALS:
DETRITAL MINERALS:
XRAY STUDY: Quartz, feldspars, mica, trace hornblende.

CEMENT:
FEATURES:
FULL ROCK NAME: Rhyolitic tuff.
GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **258**

COLLECTOR: C. Henry
QUADRANGLE NAME: Cactus Peak
OCCURRENCE: Talus (see remarks)
ROCK UNIT: Trcp - Rhyolite Lava of Cactus Peak

FIELD DATE: 7/13/94
SCALE: 1:24,000
UTM NORTH: 4185262
UTM EAST: 510866
ROCK AGE:

ROCK DESCRIPTION: Finely porphyritic, slightly flow banded, slightly vesicular, stony rhyolite. Phenocrysts: quartz (5.0%) <1mm, slightly smoky, sanidine (8.0%), ~1mm; altered mafic (<1.0%) 1mm; plagioclase (1.0-2.0%) 1mm, altered to clay.

ROCK STRUCTURE: Overall lava body appears to dip gently west.

REMARKS: Talus from side of steep isolated peak north end of Cactus Range.

REFERENCES:

ANALYST: L. C. Hsu **LAB DATE:** 1/29/95

HAND SPECIMEN STUDY: Purplish gray tuffaceous rock crystals of quartz and feldspar.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Sanidine (8.0%, <1.5 X 0.5mm, angular), quartz (7.0%, <1.0 X 1.0mm, subangular), oligoclase (3.0%, <0.6 X 0.4mm, angular), magnetite (2.0%, <0.4 X 0.3mm, irregular). Matrix: 78%, mixture of local patches of intergrown quartz and alkali feldspar, radial fibers of chalcedonic quartz, and irregular patches of glass.

ACCESSORY MINERALS:

SECONDARY: Calcite (2.0%), sericite (1.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, sanidine, trace calcite, trace mica.

CEMENT:

FEATURES:

FULL ROCK NAME: Rhyolite.

GENERAL ROCK NAME: Silicic igneous rock

SAMPLE NUMBER: **259**

COLLECTOR: C. Henry
QUADRANGLE NAME: Roller Coaster Knob
OCCURRENCE: Silicified knob on low hill
ROCK UNIT: Tls- Lacustrine sediments

FIELD DATE: 7/8/94
SCALE: 1:24,000
UTM NORTH: 4165257
UTM EAST: 524694
ROCK AGE:

ROCK DESCRIPTION: Silicified, coarsely clastic sedimentary rock, probably debris-flow deposit. Contains clasts to at least 10cm (mostly volcanic rock but one quartzite) in a fine silicified matrix. Clasts are matrix supported. Moderately Fe stained along fractures. Interbedded with very poorly exposed finer clastic rocks.

ROCK STRUCTURE: Sequence dips approximately 25 degrees south

REMARKS:

REFERENCES:

ANALYST: L. C. Hsu **LAB DATE:** 1/29/95

HAND SPECIMEN STUDY: Light brownish altered tuffaceous rock with original crystals and lithic fragments being replaced.

TEXTURE: Pyroclastic.

ESSENTIAL MINERALS: Quartz (<5.0%, <0.5 X 0.3mm, angular), lithic fragments, other crystals, and matrix all replaced by exceedingly fine-grained chalcedonic quartz and light brown alunite with grain size <0.05 X 0.03mm.

ACCESSORY MINERALS:

SECONDARY: Iron oxides (<4.0%).

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: Quartz, alunite.

CEMENT:

FEATURES: Alunitized tuff.

FULL ROCK NAME: Altered tuffaceous sedimentary rock

GENERAL ROCK NAME: Sandstone

SAMPLE NUMBER: **260**

FIELD DATE: 3/30/95

SCALE: 1:24,000

COLLECTOR: J.G. Price

UTM NORTH: 4156994

QUADRANGLE NAME: Quartzite Mountain

UTM EAST: 559705

OCCURRENCE: Dump of adit

ROCK AGE: Tertiary

ROCK UNIT: Dacite

ROCK DESCRIPTION: Dacite, dark gray. Fresh, unweathered and unaltered.

ROCK STRUCTURE:

REMARKS: Field sample tag #5658.

REFERENCES:

ANALYST: L. C. Hsu

LAB DATE: 4/4/96

HAND SPECIMEN STUDY: Greenish gray porphyritic igneous rock with whitish phenocrysts of feldspar and black phenocrysts of hornblende in dark gray groundmass.

TEXTURE: Porphyritic

ESSENTIAL MINERALS: Plagioclase (lab-andesine) (30% <4x3mm, sub- to euhedral), hornblende (10%, <2x1mm, subhedral); groundmass is dark intergrown microlaths of plagioclase with quartz in glassy matrix (36%).

ACCESSORY MINERALS: apatite(2%), magnetite(6%)

SECONDARY: chlorite(8%), magnetite(6%), calcite(5%)

AUTHIGENIC MINERALS:

DETRITAL MINERALS:

XRAY STUDY: quartz, plagioclase, chlorite, amphibole

CEMENT:

FEATURES: Plagioclase altered to mixture of calcite, chlorite; brown hornblende altered to chlorite and magnetite.

FULL ROCK NAME: Hornblend dacite

GENERAL ROCK NAME: Intermediate igneous rock

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Li	Lu	MnO	Mo	Na	Nb
Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	AA	INAA	XRF	ICP	INAA	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm
1	0.009	0.566	0	-10	-5	-0.02	1	34	0.022	3	-5	-10	-3	0.668	-0.2	0.1	0.004	-1	35	1	25	-0.05	0.002	0.138	-500	-2
2	0.012	1.71	0	-10	-5	0.005	1	9	0.007	3	-5	120	-3	6.29	-0.2	0.2	0.047	-1	74	2	-10	-0.05	0.006	0.95	-500	-2
3	0.012	0.862	0	-10	-5	0.008	3	21	0.009	-3	-5	10	-3	1.09	-0.2	-0.1	-0.065	-1	22	1	23	-0.05	0.006	0.154	-500	2
4	0.018	0.583	0	856	-5	0.003	-1	-1	0.02	103	-5	10	5	4.56	1.3	1	0.752	6	17	60	37	0.32	0.057	0.869	27000	12
5	0.042	0.476	0.0002	401	-5	0.027	1	7	0.035	39	33	210	-3	17.9	0.9	6.9	2.59	3	142	19	22	0.26	0.148	0.388	20000	8
6	0.013	0.425	0	1303	-5	-0.048	-1	2	0.026	96	8	70	3	12.5	1	2.2	3.69	5	33	55	27	0.12	0.085	0.655	26000	12
7	0.173	8.78	0.001	167	-5	0.069	2	5	1	36	-5	200	3	48.6	1.4	1	0.884	5	1520	34	30	0.5	0.025	1.76	-500	6
8	0.047	0.424	0	-10	-5	0.014	1	35	0.079	7	-5	-10	-3	1.98	0.3	-0.1	0.005	-1	24	5	-10	-0.05	0.009	0.028	-500	-2
9	0.03	0.291	0	882	-5	0.008	1	2	0.028	85	5	90	5	10	1.2	1.5	3.02	5	301	52	42	0.2	0.053	0.744	23000	14
10	0.024	-0.048	0.0003	27	-5	0.049	2	-1	0.052	80	-5	30	-3	1.01	1.1	0.6	0.401	5	10	45	15	0.34	0.106	0.286	24000	24
12	0.019	0.456	0.001	905	-5	-0.029	1	3	0.049	72	10	80	7	7.75	1.1	2.4	4.25	5	22	41	17	0.3	0.081	0.207	21000	13
13	0.028	2.44	0.0003	120	-5	0.013	1	19	0.477	12	-5	90	-3	5.82	-0.2	0.5	0.286	1	20	7	-10	0.1	0.046	0.642	-500	-2
14	0.009	3.23	0.001	339	-5	0.254	1	1	0.016	72	13	80	12	34	0.6	4.3	6.89	3	20	42	45	0.31	0.045	0.138	1300	17
15	0.016	-0.045	0.001	-10	-5	-0.01	3	19	0.016	-3	-5	-10	-3	3.48	-0.2	-0.1	-0.037	-1	-10	-1	-10	-0.05	0.006	0.016	-500	-2
16	0.003	1.57	0.001	-10	-5	-0.063	2	19	0.018	-3	-5	-10	-3	2.91	-0.2	0.1	-0.032	-1	-10	1	-10	-0.05	0.005	0.602	-500	-2
17	0.026	1.06	0.001	-10	-5	-0.067	4	19	0.017	-3	-5	-10	-3	1.79	-0.2	0.1	-0.05	-1	12	1	-10	-0.05	0.003	0.038	-500	-2
18	0.009	0.606	0.001	-10	-5	-0.042	2	2	0.058	-3	-5	220	-3	3.82	-0.2	0.2	0.016	-1	20	1	-10	-0.05	0.005	1.11	-500	-2
19	0.014	0.825	0.001	-10	-5	-0.01	1	34	0.064	3	-5	10	-3	0.927	0.2	0.1	-0.048	-1	34	2	-10	-0.05	-0.002	0.382	-500	-2
20	0.01	0.539	0.001	-10	-5	-0.017	3	19	0.063	-3	-5	-10	-3	4.45	-0.2	-0.1	-0.04	-1	15	1	-10	-0.05	0.010	0.076	-500	-2
21	0.013	5.33	0.001	-10	-5	-0.013	2	7	0.023	10	-5	160	-3	5.09	0.2	0.2	0.023	-1	18	6	-10	-0.05	0.004	1.03	500	-2
22	0.01	0.9	0.002	-10	-5	-0.02	2	19	0.015	-3	-5	10	-3	2.66	-0.2	-0.1	-0.001	-1	-10	1	-10	-0.05	0.044	0.059	-500	-2
23	0.037	0.597	0	716	-5	0.091	1	1	0.02	63	6	120	6	14.8	0.6	2	3.28	4	41	37	21	0.26	0.068	0.673	17000	10
24	0.017	8.86	0	843	-5	0.398	-1	-1	0.063	110	14	90	7	7.43	1.7	4.7	4.74	6	31	60	44	0.52	0.032	0.219	9200	24
25	0.019	1.4	0.001	-10	-5	0.02	3	20	0.025	-3	-5	10	-3	2.89	-0.2	0.1	-0.017	-1	19	-1	-10	-0.05	0.010	0.149	-500	-2
26	0.015	0.233	0	-10	-5	0.046	1	30	0.01	7	-5	10	-3	1.65	0.2	0.2	0.152	2	33	4	21	-0.05	0.002	0.168	-500	-2
27	0.013	0.171	0	-10	-5	0.016	1	36	0.014	-3	-5	-10	-3	0.697	-0.2	-0.1	-0.023	-1	33	-1	-10	-0.05	0.002	0.032	-500	-2
28	0.015	0.719	0	-10	-5	0.016	2	19	0.024	-3	-5	10	-3	1.74	-0.2	0.1	-0.011	-1	33	1	21	-0.05	0.006	0.088	-500	-2
29	0.014	0.147	0	864	-5	0.045	2	4	0.028	88	16	60	5	16.3	1.5	3.3	4.4	5	52	50	25	0.3	0.064	0.07	19000	11
30	0.013	0.2	0	-10	-5	0.032	2	21	0.015	-3	-5	-10	-3	0.757	-0.2	-0.1	-0.021	-1	-10	1	13	-0.05	0.006	0.032	-500	-2
31	0.015	2.49	0	16	-5	0.031	1	28	0.032	7	-5	10	-3	2.85	0.3	0.3	0.238	1	17	3	-10	0.13	0.005	0.182	-500	2
32	0.013	2.1	0	-10	-5	0.003	1	29	0.037	6	-5	10	-3	1.41	0.3	0.3	0.056	1	17	3	18	0.05	0.006	0.045	-500	-2
33	0.078	2.99	0	244	-5	0.087	1	11	0.032	38	-5	70	-3	3.48	1.1	0.9	0.141	11	76	17	16	0.29	0.041	0.413	8200	4
34	0.034	0.369	0	779	-5	0.175	-1	-1	0.016	104	22	100	4	38	1.7	4.9	6.27	9	24	54	100	0.63	0.051	0.052	10000	20
35	0.016	0.12	0	153	-5	0.024	1	-1	0.005	15	-5	150	-3	2.35	0.3	0.5	0.091	1	19	8	-10	0.09	0.002	0.59	-500	-2
36	0.03	0.222	0	53	-5	0.061	1	-1	0.041	5	-5	230	-3	4.32	0.2	0.5	0.185	3	79	3	-10	0.05	0.006	1.3	-500	-2
37	0.023	0.782	0.0005	513	-5	0.06	1	-1	0.037	28	5	200	-3	14.6	0.5	1.7	0.721	15	205	13	10	0.36	0.108	1.2	18000	11
38	0.01	1.78	0	-10	-5	-0.007	1	31	0.011	-3	-5	-10	-3	1.34	0.2	-0.1	0.313	-1	26	2	-10	-0.05	0.002	0.03	-500	-2
39	0.006	3.1	0	-10	-5	-0.021	1	36	0.012	4	-5	-10	-3	1.56	0.3	0.2	0.299	-1	22	2	-10	-0.05	0.025	0.032	-500	-2
40	0.06	0.958	0.0002	-10	-5	0.782	1	34	0.066	-3	-5	-10	-3	26.3	0.2	-0.1	2.63	-1	17	1	-10	-0.05	0.002	1.35	-500	-2
41	0.022	1.76	0.001	-10	-5	0.016	7	21	0.049	-3	-5	-10	-3	1.83	-0.2	0.1	0.268	-1	89	1	-10	-0.05	0.028	0.063	-500	-2
42	0.014	-0.138	0	-10	-5	-0.006	4	21	0.011	-3	-5	-10	-3	0.944	-0.2	-0.1	0.278	-1	33	-1	-10	-0.05	0.002	0.005	-500	-2
43	0.04	4.19	0.0007	-10	-5	0.185	2	21	0.057	-3	-5	-10	-3	6.1	-0.2	-0.1	8.78	-1	11	1	-10	-0.05	0.009	0.139	-500	-2
44	0.013	0.227	0	-10	-5	0.033	1	-1	0.009	4	-5	180	-3	2.35	-0.2	0.2	0.41	-1	43	3	-10	-0.05	-0.002	0.779	-500	-2
45	0.006	3.6	0	-10	-5	-0.017	2	21	0.041	4	-5	10	-3	1.06	0.2	0.2	0.385	-1	22	3	-10	-0.05	0.010	0.14	-500	-2
46	0.008	2.25	0	-10	-5	-0.029	1	33	0.02	6	-5	-10	-3	1.09	0.2	0.1	0.321	-1	18	4	-10	-0.05	0.016	0.09	-500	-2
47	0.009	2.17	0	913	-5	-0.027	-1	-1	0.017	11	23	130	4	0.973	1.9	6.4	0.278	8	42	55	33	0.63	0.047	0.152	6000	41
48	0.01	1.21	0	-10	-5	0.003	1	-1	0.045	8	-5	250	-3	14.4	0.3	0.6	0.973	2	35	4	-10	0.06	0.006	1.06	-500	2
49	0.015	1.44	0	39	-5	-0.025	2	-1	0.02	9	-5	330	-3	17.9	0.3	0.8	0.864	1	26	4	12	0.1	0.010	1.65	-500	2
50	0.02	3.51	0.0002	20	-5	0.004	1	32	0.895	19	-5	10	-3	3.9	0.7	0.6	0.448	1	16	10	-10	0.12	0.136	0.625	4200	3
51	0.006	2.43	0.002	-10	-5	0.0002	1	33	0.024	9	-5	-10	-3	1.88	0.2	0.3	-0.033	1	25	4	-10	0.09	0.025	0.043	-500	2
52	0.013	0.189	0.002	-10	-5	0.023	1	-1	0.021	-3	-5	190	-3	4.26	-0.2	0.2	0.073	1	11	1	-10	-0.05	-0.002	0.831	-500	-2
53	0.012	1.16	0.002	-10	-5	-0.029	1	29	0.031	6	-5	10	-3	2.45	-0.2	0.1	0.111	-1	19	3	-10	0.05	0.034	0.044	-500	-2
54	0.017	1.64	0.002	-10	-5	0.021	2	19	0.03	-3	-5	40	-3	2.82	-0.2	0.1	-0.012	-1	13	1	-10	-0.05	0.008	0.283	-500	-2
55	0.006	0.424	0.002	-10	-5	-0.028	2	20	0.026	-3	-5	-10	-3	2.53	-0.2	-0.1	-0.035	-1	12	-1	-10	-0.05	0.002	0.228	-500	-2
56	0.008	0.454	0.0009	-10	-5	0.008	1	34	0.273	-3	-5	-10	-3	3.54	-0.2	-0.1	-0.046	-1	14	1	-10	-0.05	0.012	0.024	-500	-2
59	0.014	3.27	0.001	800	-5	0.016	1	2	0.033	68	7	50	4	6.4	0.9	2	2.73	4	19	40	21	0.27	0.065	0.645	20000	15

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Li	Lu	MnO	Mo	Na	Nb
Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	AA	INAA	XRF	ICP	INAA	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm
60	0.012	0.399	0.002	-10	-5	-0.022	1	-1	0.015	6	-5	160	-3	5.59	0.2	0.2	0.097	-1	14	4	-10	-0.05	-0.002	0.696	-500	-2
61	0.043	0.395	0.002	376	-5	0.013	1	5	0.062	46	47	500	-3	74.3	1.8	6.2	5.16	3	12	23	-10	0.27	0.146	0.757	22000	28
62	0.04	0.092	0.002	202	-5	0.001	1	3	0.029	175	-5	50	4	4.18	2.2	1	1.83	8	15	118	-10	0.36	0.096	0.372	31000	20
64	0.013	0.543	0.0008	-10	-5	-0.001	1	33	0.225	-3	-5	-10	-3	1.85	-0.2	-0.1	0.065	-1	13	1	-10	-0.05	-0.002	0.459	-500	-2
65	0.009	5.18	0.002	803	-5	0.019	1	2	0.016	74	6	40	12	3.89	0.9	2.1	2.72	5	23	42	23	0.29	0.032	0.556	20000	14
66	0.029	-0.032	0.001	152	-5	0.019	1	-1	0.018	160	-5	30	3	2.15	1.6	0.9	0.628	7	14	97	-10	0.41	0.091	0.129	25000	19
67	0.016	0.666	0.001	19	-5	0.04	1	-1	0.026	48	-5	70	6	3.59	0.4	0.5	1.21	3	17	24	21	0.44	0.067	0.709	27000	30
69	0.033	16.3	0.001	774	-5	0.053	1	18	0.556	20	7	60	4	7.95	0.3	1.1	1	3	18	11	15	0.1	0.058	4.11	-500	2
70	0.03	19.8	0.0008	178	-5	0.034	1	16	0.377	22	-5	100	5	8.71	0.5	1.2	1.19	4	22	12	11	0.12	0.016	2.38	500	3
71	0.013	1.33	0.0009	-10	-5	-0.014	1	30	0.028	5	-5	10	-3	1.88	0.3	0.1	0.003	3	-10	3	-10	0.05	-0.002	0.051	-500	-2
72	0.027	2.27	0.001	1126	-5	0.251	1	1	0.083	99	7	20	3	5.35	1.5	2.2	4.09	5	12	59	44	0.26	0.071	0.557	22000	12
73	0.03	0.767	0.001	1542	-5	0.028	1	2	0.06	118	6	60	4	6.71	1.5	2.5	3.22	6	18	71	20	0.31	0.087	0.37	22000	12
74	0.02	1.85	0.001	406	-5	0.179	1	-1	0.106	91	-5	30	3	3.28	0.8	0.9	3.07	5	-10	51	12	0.48	0.084	0.243	24000	22
76	0.018	0.296	0.0009	-10	-5	0.017	2	21	0.051	-3	-5	-10	-3	1.28	0.2	-0.1	0.011	-1	-10	2	-10	-0.05	0.009	0.053	-500	-2
77	0.022	2.51	0.0007	88	-5	0.031	2	13	0.1	26	6	30	3	4.28	0.5	1	0.605	1	25	15	10	0.15	0.060	0.51	-500	3
78	0.048	-0.205	0.0003	1441	-5	-0.006	1	4	0.083	128	24	70	-3	18	2.3	5.6	3.49	7	12	71	19	0.35	0.154	0.744	27000	36
79	0.03	1.65	0.0007	96	-5	0.071	-1	-1	0.196	219	5	30	-3	3.9	1.4	2.3	0.701	18	11	140	17	0.72	0.176	1.02	41000	47
80	0.017	0.165	0.0004	700	-5	-0.014	1	15	0.143	95	6	40	3	3.18	1.4	2.7	3.05	6	14	54	-10	0.25	0.067	0.038	20000	10
81	0.016	2.08	0.0004	340	-5	0.006	1	11	0.14	78	-5	50	4	5.79	0.7	1.5	2.29	4	11	47	15	0.29	0.047	0.366	14000	13
82	0.022	1.05	0.0003	-10	-5	0.031	1	36	0.026	-3	-5	-10	-3	0.62	-0.2	-0.1	0.064	-1	-10	1	-10	-0.05	-0.002	-0.022	-500	-2
83	0.02	0.536	0.0003	605	-5	-0.002	2	-1	0.025	94	-5	40	9	2.99	1	1	0.996	5	17	57	-10	0.3	0.037	0.314	19000	17
84	0.015	0.089	0.0007	-10	-5	-0.033	2	23	0.023	-3	-5	-10	-3	0.778	-0.2	-0.1	-0.001	-1	-10	-1	-10	-0.05	0.004	0.018	-500	-2
85	0.018	3.15	0.0008	-10	-5	0.038	1	39	0.02	7	-5	-10	-3	1.1	0.3	0.1	0.043	-1	-10	4	-10	-0.05	0.013	0.055	-500	-2
86	0.017	0.01	0	-10	-5	-0.009	1	40	0.264	-3	-5	-10	-3	2.54	-0.2	-0.1	0.006	-1	-10	1	-10	-0.05	0.013	-0.022	-500	-2
87	0.107	4.66	0.0008	601	-5	0.072	2	8	0.097	43	-5	80	3	13.4	0.7	1.5	0.759	6	45	22	-10	0.33	0.029	1.17	1600	8
88	0.022	3.97	0.0007	236	-5	0.041	1	39	0.148	-3	-5	10	-3	1.46	-0.2	-0.1	0.099	-1	10	1	-10	-0.05	0.021	0.776	-500	-2
89	0.013	2.98	0.0002	59	-5	-0.001	2	31	0.043	3	-5	-10	-3	2.33	-0.2	0.2	0.196	-1	19	2	-10	-0.05	0.022	0.429	-500	-2
90	0.013	1.97	0.0007	-10	-5	0.006	5	40	0.021	-3	-5	-10	-3	1.08	-0.2	-0.1	0.038	-1	-10	-1	-10	-0.05	0.003	-0.005	-500	-2
91	0.005	1.81	0.0005	72	-5	-0.008	1	12	0.023	19	-5	60	-3	2.75	0.3	0.7	0.775	2	10	10	13.2	0.12	0.045	0.413	700	-2
92	0.007	1.24	0	-10	-5	0.02	1	32	0.028	-3	-5	-10	-3	2.44	0.2	0.1	0.067	-1	10	1	-10	-0.05	-0.002	0.602	-500	-2
93	0.026	3.27	0.0005	275	-5	0.133	3	11	0.211	35	5	40	10	7.73	0.8	1.8	2.06	3	19	19	49.2	0.16	0.027	0.493	2300	7
94	0.015	5.18	0.0004	114	-5	0.012	1	-1	0.026	38	-5	220	-3	5.3	0.7	0.6	0.201	3	14	24	14	0.19	0.002	1.81	-500	4
95	0.011	0.209	0.001	-10	-5	-0.018	2	22	0.031	3	-5	10	-3	2.45	-0.2	-0.1	-0.008	-1	12	1	-10	-0.05	0.008	0.02	-500	-2
96	0.009	1.53	0.0006	-10	-5	0.022	1	23	0.046	4	-5	10	-3	3.42	0.2	0.1	0.016	-1	12	2	-10	-0.05	0.003	0.474	-500	-2
97	0.013	1.44	0.0002	-10	-5	0.031	1	22	0.038	-3	-5	-10	-3	2.08	-0.2	0.1	0.135	-1	10	1	27	-0.05	0.007	1.91	600	-2
98	0.01	0.363	0.0003	514	-5	0.004	1	14	0.186	79	-5	40	-3	2.34	1.4	0.8	1.31	2	39	45	26	0.24	0.045	0.233	15000	8
99	0.007	2.43	0.0002	-10	-5	0.027	2	22	0.041	-3	-5	-10	-3	2.8	-0.2	0.1	0.01	-1	-10	1	-10	-0.05	0.005	0.529	-500	-2
100	0.075	7.2	0.001	6657	-5	0.083	1	1	0.053	40	-5	270	-3	32.3	1.2	1.1	0.715	1	74	21	-10	0.28	0.003	3.18	-500	4
101	0.024	2.94	0.0002	847	-5	0.039	1	-1	0.023	118	-5	30	3	4.87	1.3	1	1.54	7	16	67	25	0.38	0.013	1.04	22000	17
108	0.217	5.71	0.0002	188	-5	0.137	2	6	0.085	36	-5	80	-3	15.6	0.7	1.4	0.363	4	99	19	15	0.28	0.027	1.77	4200	7
114	0.014	2.73	0.0005	-10	-5	-0.02	2	40	0.081	-3	-5	-10	-3	2.89	0.2	0.1	-0.006	-1	-10	3	-10	-0.05	0.002	0.038	-500	-2
117	0.018	3.32	0.0007	-10	-5	0.206	1	<1	0.025	78	<5	40	4	0.48	<0.2	0.8	1.13	5	-10	43	30	0.42	0.055	1.53	32000	23
118	0.021	3.02	0.0003	-10	-5	0.216	2	<1	0.053	80	<5	50	3	1.15	0.4	0.8	0.554	10	-10	43	24	0.58	0.104	1.12	37000	31
119	0.02	2.72	0	-10	-5	0.17	1	<1	0.016	12	<5	180	<3	1.66	0.2	0.4	0.031	3	-10	7	7	0.09	0.008	0.605	<500	4
120	0.015	6.49	0.0005	447	-5	0.667	<1	2	0.022	144	18	100	8	28	2.6	5.9	7.4	3	-10	83	172	0.59	0.043	0.295	9300	25
121	0.024	1.3	0	1043	-5	0.172	<1	3	0.028	112	5	<10	72	0.056	1.1	1.2	0.867	8	-10	67	13	0.41	0.030	0.105	17000	20
122	0.036	1.82	0.0002	-10	-5	0.21	1	<1	0.054	76	<5	40	<3	2.72	<0.2	0.8	1.37	9	23	36	46	0.65	0.014	1.57	13000	40
123	0.028	1.65	0.0003	1043	-5	0.159	<1	2	0.039	123	11	30	4	3.75	1.9	3.5	3.13	7	-10	75	37	0.33	0.062	0.434	31000	18
124	0.02	1.03	0	-10	-5	0.136	2	<1	0.154	120	<5	40	4	1.07	0.2	1.6	0.563	19	-10	67	57	1.08	0.071	0.646	38000	56
125	0.013	0.628	0.0007	672	-5	0.292	1	1	0.052	98	<5	10	3	0.857	0.8	1.2	4.91	7	-10	61	36	0.31	0.055	0.046	9100	16
126	0.015	1.07	0	45	6	0.223	2	<1	0.06	86	<5	10	23	0.134	0.5	0.6	1.78	5	10	46	32	0.5	0.089	0.149	19000	30
127	0.016	8.03	0.001	79	6	0.149	1	1	0.023	88	<5	140	5	0.966	0.4	0.4	0.439	7	65	48	168	0.86	0.009	0.509	5700	39
128	0.015	0.341	0.0003	61	-5	0.228	3	<1	0.036	85	<5	30	5	0.495	0.4	0.9	0.784	7	-10	42	36	0.66	0.086	0.275	26000	34
129	0.078	3.02	0.0008	121	23	0.269	3	<1	0.247	668	<5	10	6	2.24	0.9	3.2	0.252	93	-10	329	183	3.6	0.149	0.963	35000	385
130	0.021	0.319	0.0002	598	-5	0.153	3	<1	0.043	130	<5	20	12	0.349	1	1.3	1.41	7	-10	81	20	0.39	0.096	0.209	29000	25
131	0.023	2.45	0.0003	295	-5	0.158	1	2	0.039	88	5	20	3	0.881	0.7	1	1.52	6	-10	53	27	0.45	0.065	0.227	27000	25

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Li	Lu	MnO	Mo	Na	Nb
Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	AA	INAA	XRF	ICP	INAA	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm
151	0.019	3.3	0	23	-5	0.07	1	1	0.032	62	-5	40	4	5.1	0.4	0.7	1.39	5	28	30	34	0.56	0.059	1.22	29000	60
152	0.028	4.72	0	-10	7	0.027	1	-1	0.031	58	-5	50	4	2.75	0.4	0.7	2.06	6	21	27	53	0.66	0.064	2.49	29000	46
153	0.017	0.402	0	-10	-5	0.01	2	-1	0.068	148	-5	30	3	1.78	0.4	1.3	0.839	12	25	79	23	0.79	0.085	0.287	31000	63
154	0.024	-0.241	0.0004	1041	-5	-0.021	2	1	0.065	135	-5	20	3	2.72	2.1	1.7	1.85	11	22	75	30	0.52	0.109	0.331	30000	36
155A	0.062	4.86	0.0003	1149	-5	0.019	1	-1	0.121	180	10	30	-3	7.94	1.9	4	2.79	12	42	104	19	0.63	0.154	2.45	36000	60
155B	0.068	2.54	0.0002	1149	-5	0.034	-1	2	0.057	175	9	30	-3	9.19	2	4.3	2.63	11	49	103	23	0.55	0.140	2.13	36000	55
156	0.047	1.18	0	213	-5	0.01	2	-1	0.033	251	-5	60	3	2.86	1.1	1.7	1.31	16	28	144	29	0.93	0.106	1.78	35000	79
157	0.017	0.043	0	84	-5	-0.001	-1	1	0.041	210	-5	10	-3	1.46	1.5	2.1	0.82	16	22	124	15	0.6	0.188	0.388	37000	46
158	0.025	2.77	0	14	-5	0.002	1	-1	0.116	139	-5	40	3	4.21	0.7	1.3	0.813	12	16	73	33	0.83	0.082	0.948	31000	65
159	0.017	3.49	0	361	-5	-0.009	-1	1	0.18	142	-5	20	-3	3.55	0.8	1.4	1.03	11	20	80	35	0.55	0.099	0.73	32000	38
160	0.053	4.55	0	225	-5	-0.008	-1	-1	0.016	-3	-5	420	-3	6.2	-0.2	0.4	-0.098	-1	645	2	15	-0.05	0.007	2.65	-500	-2
161	0.033	19.9	0	222	-5	0.066	1	-1	0.025	77	-5	110	3	5.33	0.7	0.4	0.457	5	42	45	42	0.25	0.005	1.12	8300	15
162	0.023	1.24	0	1101	26	-0.023	1	1	0.014	85	-5	70	-3	8.35	1	1.5	1.69	5	24	54	82	0.15	0.029	0.399	18000	17
163	0.02	1.99	0	403	-5	0.026	1	-1	0.023	82	-5	60	3	8.36	0.6	0.8	1.06	4	26	48	31	0.25	0.010	0.411	10000	14
164	0.096	3.47	0.0003	496	-5	0.037	3	15	0.338	20	-5	100	-3	11.9	0.4	0.7	0.183	1	28	11	10	0.12	0.032	0.681	600	4
165	0.017	0.435	0	1225	-5	0.003	1	-1	0.016	62	-5	100	-3	7.34	0.7	0.6	0.761	5	28	38	28	0.15	0.017	0.521	10000	15
166	0.02	5.44	0	107	-5	0.11	1	2	0.055	58	-5	10	13	3.87	0.3	0.5	7.07	4	22	33	29	0.33	0.031	0.343	9200	23
167	0.02	5.95	0	30	-5	-0.001	2	-1	0.007	53	-5	50	-3	6.65	0.4	0.2	0.779	3	16	30	67	0.3	-0.002	0.358	4400	24
168	0.011	3.17	0	341	-5	0.038	1	-1	0.009	69	-5	50	7	3.43	0.5	0.6	0.922	3	31	40	38	0.22	0.016	0.548	14000	13
169	0.017	7.87	0	354	-5	-0.013	2	-1	0.059	164	8	10	4	3.55	0.8	1.6	1.38	13	13	95	29	0.59	0.101	1.81	33000	44
170	0.017	-0.116	0	63	-5	0.018	2	-1	0.019	63	5	20	4	2.93	0.6	0.6	0.273	4	18	34	-10	0.34	0.075	0.388	25000	25
171	0.024	1.5	0.0009	54	-5	0.054	1	1	0.049	61	-5	100	-3	4.6	0.5	0.5	0.525	4	18	35	26	0.31	0.029	0.835	24000	26
172	0.017	1.08	0	52	-5	0.057	-1	-1	0.045	61	5	100	-3	3.55	0.6	0.5	0.309	4	19	34	27	0.32	0.034	0.798	23000	27
173	0.026	14.6	0	75	-5	0.061	2	5	0.111	240	10	30	-3	2.6	1.4	2.2	0.623	19	15	137	42	1.04	0.156	1.57	34000	61
174	0.022	3.88	0	40	-5	0.005	-1	-1	0.032	43	-5	120	-3	3.63	0.5	0.4	0.387	3	20	23	72	0.32	0.004	1.17	11000	20
175	0.066	5.19	0	1313	-5	0.019	2	5	0.104	123	33	30	-3	19.3	1.8	8.1	6.7	9	24	63	21	0.48	0.178	0.621	27000	33
176	0.068	14	0	159	30	0.52	2	-1	0.285	699	11	-10	9	3.78	0.8	3.6	0.767	100	21	382	194	5.14	0.195	1.57	37000	468
177	0.012	1.92	0	21	-5	0.038	-1	-1	0.02	89	-5	20	-3	2.93	0.7	0.7	0.593	6	34	52	14	0.42	0.072	1.85	30000	28
178	0.012	0.358	0	-10	-5	-0.016	1	-1	0.027	88	5	10	4	1.26	0.7	0.6	0.916	6	15	51	35	0.4	0.079	0.204	27000	31
179	0.035	-0.066	0.0002	856	-5	-0.034	-1	8	0.095	71	32	60	-3	22	1.7	7.4	6.94	5	30	36	-10	0.36	0.166	0.371	22000	18
180	0.014	0.833	0.0003	172	-5	0.003	-1	-1	0.047	56	-5	110	-3	2.18	1	0.6	0.622	4	775	33	42	0.3	0.043	0.634	15000	24
181	0.013	0.237	0.0003	11	-5	0.021	2	-1	0.008	88	-5	20	-3	2.24	0.6	0.8	0.426	6	28	52	24	0.4	0.081	0.177	26000	34
182	0.013	-0.026	0	227	-5	-0.026	2	-1	0.011	73	-5	40	3	5.04	0.6	0.7	0.353	4	26	44	21	0.33	0.054	0.267	24000	21
183	0.034	12.7	0.003	22	-5	0.029	1	16	0.03	4	-5	110	-3	3.03	-0.2	0.4	0.086	-1	207	4	-10	0.05	0.060	1.8	-500	-2
184	0.019	0.684	0.0003	117	-5	0.033	-1	-1	0.015	74	-5	50	-3	1.81	0.6	0.7	0.731	5	22	42	29	0.33	0.016	0.375	27000	28
185	0.017	19.7	0.0002	114	-5	0.132	-1	-1	0.166	68	-5	80	-3	1.7	0.6	2.3	1.15	4	41	39	60	0.37	0.031	1.51	19000	26
186	0.026	0.816	0	193	8	0.0005	2	2	0.1	189	9	20	-3	4.64	0.8	1.8	0.958	19	22	99	49	1.38	0.100	2.11	36000	104
187	0.023	0.589	0	129	-5	0.02	1	2	0.048	96	-5	40	-3	3.31	0.9	0.7	0.828	4	20	57	11	0.28	0.043	0.391	25000	18
188	0.011	2.41	0	1233	-5	-0.021	1	-1	0.021	105	11	40	3	8.53	2.1	3.2	2.89	9	17	61	-10	0.39	0.078	0.308	26000	22
189	0.039	1.28	0.0002	348	-5	-0.037	-1	-1	0.108	271	7	20	-3	5.55	1.9	2.5	1.56	18	24	161	30	0.87	0.174	1.36	40000	51
190A	0.047	2.4	0.0007	14	-5	-0.003	3	-1	0.107	139	-5	20	3	8.51	1	1.4	1.39	13	27	72	64	1.05	0.084	0.447	25000	64
190B	0.073	3.62	0.001	55	-5	-0.004	1	2	0.114	142	-5	20	4	7.87	0.7	1.2	0.607	13	25	72	22	0.87	0.082	0.951	30000	60
191	0.035	3.32	0	176	30	0.126	-1	5	0.211	670	6	20	11	5.99	4.1	3.6	0.59	97	15	385	170	4.98	0.178	1.48	41000	416
192	0.034	0.57	0	479	11	0.058	3	-1	0.079	383	6	30	7	2.79	1.9	2.4	1.3	28	20	232	31	1.44	0.162	1.04	36000	120
193	0.016	0.296	0.002	136	-5	-0.031	2	-2	0.051	212	5	10	3	3.04	0.8	2.1	0.991	15	32	119	21	0.9	0.180	0.323	32000	51
194	0.06	3	0.0003	61	11	0.009	-1	2	0.126	190	-5	20	4	7.13	0.8	1.6	1.03	20	22	100	51	1.32	0.098	3.83	36000	121
195	0.055	1.13	0.0004	608	-5	0.019	2	2	0.06	151	7	30	4	5.23	1.7	1.7	2.72	8	37	97	26	0.35	0.068	0.382	28000	24
196	0.003	-0.018	0.0005	-10	-5	0.006	2	-1	0.008	68	-5	20	4	3.11	0.7	0.8	0.739	6	24	38	-10	0.28	0.084	0.201	23000	28
197	0.031	0.975	0.0004	-10	-5	0.001	1	1	0.017	49	-5	130	-3	2.6	0.3	0.5	0.551	3	350	27	87	0.21	0.006	1.13	13000	18
198	0.012	0.585	0	17	-5	0.012	3	-1	0.034	247	6	30	4	4.9	0.8	2.4	1.71	22	12	143	25	1.11	0.159	0.312	26000	70
199	0.085	1.23	0	1432	-5	0.051	2	-1	0.014	52	-5	80	-3	8.64	0.4	1	4.07	3	-10	31	20	0.19	0.034	0.642	26000	13
200	0.023	0.459	0.001	842	-5	0.045	1	-1	0.019	67	5	30	7	4.32	0.8	0.6	0.766	4	10	41	-10	0.2	0.042	0.161	21000	16
201	0.029	1.36	0.0008	315	-5	0.109	1	-1	0.043	69	-5	60	4	1.89	1.1	0.7	0.657	4	176	38	21	0.36	0.008	0.391	9200	21
202	0.04	2.22	0.0007	155	-5	0.038	-1	-1	0.154	401	5	20	3	4.23	1.1	2.4	1.34	21	16	265	25	0.85	0.172	1.61	37000	75
203	0.047	0.967	0.0006	61	-5	0.098	1	-1	0.15	285	7	20	-3	3.44	0.9	1.8	1.42	18	25	173	42	1	0.140	2.01	35000	87
204	0.009	0.835	0	305	-5	0.027	1	-1	0.023	96	-5	20	-3	7.23	0.8	0.9	1.22	6	16	56	25	0.43	0.069	0.761	27000	28

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppb	La INAA ppm	Li AA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm	Na INAA ppm	Nb XRF ppm
205	0.01	0.793	0.0005	151	-5	0.181	1	-1	0.047	55	-5	40	-3	3.71	0.3	0.6	1.28	4	164	28	-10	0.36	0.043	0.296	6200	21
206	0.01	0.765	0	270	-5	0.063	1	-1	0.06	89	-5	60	-3	3.99	0.4	0.7	1.04	4	158	54	-10	0.29	0.027	0.667	19000	20
207	0.026	1.61	0	178	5	0.024	2	3	0.122	384	5	20	6	2.89	1.3	2.2	0.985	21	-10	247	39	0.93	0.169	1.28	35000	84
208	0.014	0.394	0.0008	1070	-5	0.015	1	-1	0.023	113	6	40	-3	0.996	0.7	1.1	1.11	8	90	68	-10	0.36	0.065	0.88	25000	25
209	0.022	0.45	0	1160	-5	0.044	2	1	0.003	107	-5	20	3	2.46	0.7	1.1	1.24	6	54	64	-10	0.37	0.085	0.303	26000	26
210	0.011	0.459	0.0004	133	-5	0.058	1	-1	0.024	76	-5	30	-3	1.91	0.3	0.7	1.24	5	104	41	21	0.44	0.052	0.774	21000	33
211	0.014	0.29	0.0009	569	-5	0.131	-1	-1	0.011	69	-5	60	7	3.33	0.4	1	1.51	4	22	39	82	0.27	0.027	0.341	13000	16
212	0.012	15	0.001	713	-5	0.001	1	-1	0.029	74	-5	90	5	3.81	0.6	0.9	0.872	3	16	46	32	0.19	0.009	0.914	8400	11
213	0.022	2.54	0.0009	1574	-5	0.052	-1	-1	0.033	83	-5	40	-3	6.33	1.6	1.7	3.69	7	12	49	16	0.28	0.036	0.536	20000	13
214	0.01	16.3	0.0009	-10	-5	0.009	-1	-1	0.017	50	-5	90	7	4.78	0.5	0.7	2.39	6	10	21	35	1.36	0.085	2.62	29000	95
215	0.035	0.41	0.001	1215	-5	0.038	-1	3	0.073	84	18	30	-3	14.6	1.7	4.4	10.5	6	10	47	49	0.23	0.107	0.252	22000	13
216	0.029	0.388	0.001	1154	-5	0.056	2	2	0.05	78	7	40	-3	3.85	0.7	2.2	2.69	6	11	47	17	0.18	0.082	0.261	25000	8
217	0.061	3.43	0.0009	777	-5	0.32	1	-1	0.021	73	-5	30	3	3.55	0.9	1.2	0.347	4	18	47	-10	0.24	0.036	5.21	500	16
218	0.008	1.21	0.0007	1745	-5	0.008	3	1	0.025	17	-5	110	-3	4.29	0.2	0.2	0.737	7	10	12	11	0.09	-0.002	0.678	2500	17
219	0.036	0.366	0.0006	1077	-5	0.005	-1	2	0.038	105	14	70	-3	11.9	1.3	3.2	5.16	8	10	59	21	0.26	0.070	0.578	22000	15
220	0.052	1.63	0.0005	1304	-5	0.414	-1	-1	0.024	108	-5	60	3	2.48	1.1	1	0.537	5	22	62	18	0.4	0.013	1.92	10000	19
221	0.036	0.405	0.0008	565	-5	-0.017	-1	-1	0.031	90	6	30	4	2.7	1.1	1.9	1.63	9	-10	46	12	0.52	0.083	0.477	14000	21
222	0.031	0.492	0.0006	654	-5	0.101	1	-1	0.04	102	-5	150	4	4.12	0.5	0.8	0.445	5	10	61	13	0.32	0.049	0.889	15000	15
223	0.03	0.521	0.0004	614	-5	0.054	1	-1	0.027	115	-5	60	4	3.19	1	1.3	0.669	5	12	66	21	0.32	0.015	0.456	1200	13
224	0.043	2.63	0.0007	1137	-5	0.116	1	3	0.077	111	14	80	-3	13.6	1.7	3.8	5.24	7	12	58	18	0.26	0.084	0.489	24000	15
225	0.013	13	0.0007	703	-5	0.052	1	-1	0.026	68	-5	80	5	4.96	1.1	0.8	1.03	3	45	43	49	0.17	0.098	1.01	11000	12
226	0.027	1.53	0.001	974	-5	0.053	2	-1	0.1	79	17	40	-3	10.1	1.6	4	10.8	4	-10	44	14	0.21	0.097	0.921	36000	11
227	0.014	3.04	0.0006	1078	-5	0.064	1	-1	0.017	68	-5	50	3	0.801	1.4	0.8	0.769	4	-10	41	11	0.21	0.025	0.572	23000	16
228	0.014	3.55	0.0007	13	-5	0.028	1	-1	0.03	64	-5	30	5	1.7	0.5	0.8	0.939	6	-10	31	45	0.95	0.065	1.46	30000	82
229	0.023	1.48	0.0007	-10	-5	0.014	1	3	0.148	178	6	40	-3	0.85	-0.2	1.6	0.426	20	-10	92	33	0.91	0.122	0.516	37000	54
230	0.012	1.02	0.002	-10	-5	-0.011	1	-1	0.13	175	5	30	3	0.971	-0.2	1.6	0.244	21	-10	93	41	0.96	0.086	0.388	38000	55
231	0.16	1.78	0.001	-10	-5	0.028	2	2	0.173	175	-5	10	3	2.03	-0.2	1.6	1.03	18	10	91	58	0.98	0.102	0.592	31000	55
232	0.033	3.27	0.001	920	-5	0.111	1	-1	0.017	82	-5	30	3	0.605	0.5	0.9	1.68	4	-10	52	26	0.2	0.022	0.565	27000	17
233	0.017	0.037	0.001	1657	-5	0.039	1	5	0.022	110	17	70	-3	10.6	1.9	4.1	3.17	7	-10	66	-10	0.24	0.086	0.178	26000	15
234	0.017	0.705	0.001	1890	-5	0.031	1	3	0.049	134	9	20	-3	8.24	1.5	3.1	3.96	8	-10	79	19	0.24	0.079	0.413	28000	15
235	0.015	0.406	0.001	464	-5	0.03	1	-1	0.056	153	-5	20	3	1.99	1.4	1.5	2.66	8	-10	95	13	0.35	0.064	0.443	26000	25
236	0.017	6.13	0.001	980	-5	0.199	-1	2	0.032	115	-5	10	-3	0.805	1.1	0.8	1.9	6	-10	71	15	0.21	0.028	0.436	20000	18
237	0.017	1.39	0.001	1400	-5	0.063	3	6	0.029	118	20	60	-3	11	1.6	4.1	4.11	6	-10	66	16	0.22	0.093	0.17	26000	16
238	0.014	0.746	0.0009	646	-5	0.051	1	1	0.024	48	-5	40	4	1.33	1	0.5	0.842	2	-10	28	24	0.19	0.047	0.704	24000	18
239	0.014	0.847	0.001	973	-5	0.115	1	1	0.022	78	-5	40	3	1.23	0.5	1	1.51	4	-10	50	21	0.15	0.039	0.336	26000	17
240	0.014	0.157	0.001	557	-5	0.037	2	-1	0.023	51	-5	30	3	0.739	0.8	0.4	0.991	3	31	29	30	0.22	0.048	0.774	26000	19
241	0.012	0.368	0.001	215	-5	0.083	1	2	0.019	36	-5	50	-3	0.682	0.4	0.5	0.848	3	-10	23	26	0.14	0.015	0.282	19000	12
242	0.024	5.14	0.002	-10	6.7	0.025	1	-1	0.085	86	-5	20	5	1.84	0.5	0.8	0.452	8	24	47	24	0.67	0.101	1.11	32000	62
243	0.063	0.309	0.001	1402	-5	0.258	2	-1	0.018	124	-5	40	3	1.34	2.1	0.8	0.5	6	-10	74	-10	0.16	0.004	0.486	19000	7
244	0.017	1.84	0.001	348	-5	0.034	1	-1	0.031	172	-5	20	3	1.28	1.2	1.5	0.977	13	-10	97	30	0.82	0.096	1.75	34000	44
245	0.015	0.117	0.0009	636	-5	0.057	1	3	0.053	67	6	30	6	3.54	1.2	1.6	2.48	4	-10	46	41	0.14	0.036	0.407	20000	13
246	0.021	1.42	0.001	96	-5	0.21	2	-1	0.028	65	-5	40	3	0.514	0.4	0.7	1.02	4	12	36	32	0.43	0.067	0.287	24000	23
247	0.012	-0.151	0.0004	1121	-5	0.032	2	3	0.022	101	11	30	3	6.22	1.3	3.3	3.42	7	-10	59	13	0.28	0.063	0.233	23000	15
253	0.019	0.023	0.001	439	-5	0.041	2	-1	0.024	58	-5	20	4	0.247	0.4	0.5	0.596	3	-10	34	-10	0.2	0.056	0.234	25000	20
254	0.012	1.01	0.002	350	-5	0.147	-1	-1	0.034	50	-5	-10	3	0.291	0.5	0.5	2.5	3	-10	30	-10	0.13	0.005	0.167	7900	17
255	0.025	0.473	0.0005	306	-5	0.092	2	-1	0.045	70	-5	70	3	1.05	0.5	0.8	1.13	4	-10	41	28	0.32	0.095	0.64	21000	16
256	0.02	0.257	0.001	878	-5	0.046	1	2	0.017	68	-5	60	5	1.26	1	0.8	1.31	3	11	42	22	0.18	0.035	0.599	26000	17
257	0.018	0.862	0.0006	1604	-5	0.064	1	-1	0.017	100	-5	70	-3	1.78	1.3	1.3	2.08	4	-10	64	18	0.17	0.042	0.546	26000	13
258	0.014	21.5	0.001	-10	15	0.036	1	1	0.019	36	-5	80	7	1.12	-0.2	0.8	2.22	6	-10	15	114	1.42	0.065	1.36	32000	90
259	0.011	27.5	0.002	1138	-5	1.22	2	-1	0.013	181	-5	130	-3	9.28	2	3	6.26	4	-10	112	-10	0.07	-0.002	3.35	3100	8
260	0.014	3.25	0.001	1100	-5	0.153	1	2	0.024	93	15	110	-3	7.35	1.6	3.8	8.69	6	12	51	10	0.25	0.187	0.813	20000	16

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample Number	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
1	-10	-5	0.68	-30	0.141	0.3	0.012	-0.5	3	343	-1	-0.5	0.072	-0.5	0.02	0.292	0.7	-20	2	-2	-0.2	14.3	34
2	-10	6	1.33	-30	0.148	0.3	-0.281	-0.5	-2	27	-1	-0.5	-0.026	0.5	0.02	0.296	-0.5	-20	-2	2	0.2	5.23	29
3	-10	-5	1.12	-30	0.058	0.2	-0.081	-0.5	-2	65	-1	-0.5	0.028	-0.5	0.02	0.307	-0.5	-20	-2	2	-0.2	1.25	25
4	30	6	3.17	170	0.143	3.3	0.007	5.4	3	224	-1	-0.5	0.041	28	0.28	0.456	5.1	24	3	18	1.9	25	211
5	20	46	4.29	50	0.369	26.2	-0.195	4.1	3	344	1	0.5	0.025	4.2	1.10	0.345	1	212	-2	24	1.7	31.6	130
6	30	11	1.27	90	0.161	4.6	-0.099	5.5	-2	524	-1	0.5	0.087	13	0.52	0.318	2.9	102	-2	17	1.3	49	209
7	30	65	5.16	40	1.25	5.5	1.17	6.1	-2	86	-1	0.8	0.092	5.1	0.37	0.332	6.7	50	3	47	3.1	122	167
8	-10	-5	1.11	-30	0.076	0.4	-0.268	0.5	-2	354	-1	-0.5	0.031	-0.5	0.01	0.362	-0.5	-20	-2	5	0.3	7.92	26
9	30	12	4.51	150	0.125	3.2	-0.101	4.6	3	399	2	0.5	0.039	17	0.35	0.419	4.6	24	5	13	1.4	32.9	186
10	30	5	3.94	90	0.184	1.7	0.251	5.3	-2	30	-1	0.5	0.147	17	0.14	0.299	3.6	-20	-2	25	2.2	11.2	142
12	20	8	3.66	140	0.257	8.2	0.262	4.1	4	483	-1	-0.5	0.108	17	0.51	0.797	3.6	94	-2	17	2	39.2	178
13	-10	12	3.35	-30	0.463	1.4	0.154	1	4	201	-1	-0.5	0.161	0.9	0.05	0.41	1.1	-20	-2	10	-0.5	25.6	48
14	20	49	4.02	120	0.245	12.8	0.301	4.2	4	65	-1	-0.5	0.114	14	0.70	0.427	1.6	152	2	20	2	89.5	147
15	-10	-5	0.286	-30	0.221	-0.1	0.15	-0.5	4	42	-1	-0.5	0.126	-0.5	0.01	0.458	0.8	-20	-2	-2	-0.2	3.67	17
16	-10	5	0.885	-30	0.208	0.1	0.188	-0.5	-2	87	-1	-0.5	0.112	-0.5	0.02	0.177	2.2	-20	2	-2	-0.2	1.85	24
17	-10	5	0.969	-30	0.173	0.2	0.094	-0.5	-2	30	-1	-0.5	0.176	-0.5	0.02	0.1	-0.5	-20	-2	-2	-0.2	4.19	18
18	-10	8	2.75	-30	0.231	0.1	0.075	-0.5	-2	19	-1	-0.5	0.16	-0.5	0.02	0.175	-0.5	-20	-2	2	-0.2	18.8	35
19	-10	9	0.477	-30	0.231	0.2	0.192	-0.5	-2	166	-1	-0.5	0.124	-0.5	0.02	0.113	2	-20	-2	5	-0.2	4.18	27
20	-10	-5	1.83	-30	0.18	0.2	0.24	-0.5	-2	78	-1	-0.5	0.12	-0.5	0.02	0.296	-0.5	-20	-2	3	-0.2	27.1	20
21	-10	9	0.449	-30	0.233	0.5	0.339	0.7	2	34	-1	-0.5	0.118	-0.5	0.04	0.291	0.6	-20	-2	7	0.3	6.04	31
22	-10	-5	0.861	-30	0.227	0.1	0.187	-0.5	5	77	-1	-0.5	0.123	-0.5	0.01	0.05	-0.5	-20	-2	2	-0.2	6.56	21
23	20	8	205	160	9.34	5.9	-0.107	3.8	3	269	-1	-0.5	0.086	21	0.38	0.615	6.7	84	2	12	1.7	36.3	142
24	40	37	19.3	220	0.637	18.6	-0.126	8.4	-2	56	1	1	0.089	16	0.99	0.383	4.1	185	5	30	3.8	71	211
25	-10	-5	1.49	-30	0.277	0.2	0.197	-0.5	2	43	-1	-0.5	0.129	-0.5	0.02	0.277	-0.5	-20	2	-2	-0.2	2.87	19
26	-10	5	4.57	-30	0.218	0.7	-0.238	-0.5	-2	357	-1	-0.5	0.044	0.8	0.04	0.411	0.5	-20	-2	3	-0.2	3.63	69
27	-10	-5	1.22	-30	0.114	0.1	-0.282	-0.5	-2	191	-1	-0.5	0.069	-0.5	0.01	0.428	-0.5	-20	-2	-2	-0.2	1.28	20
28	-10	-5	2.84	-30	0.202	0.4	-0.363	-0.5	3	63	-1	-0.5	0.016	-0.5	0.02	0.556	-0.5	-20	-2	2	-0.2	2.71	19
29	30	18	3.98	130	0.099	10.8	-0.23	5.9	-2	543	-1	0.5	0.023	19	0.53	0.5	3.7	88	3	18	1.8	34	181
30	-10	-5	0.572	-30	0.007	-0.1	-0.148	-0.5	-2	45	-1	-0.5	0.035	-0.5	0.01	0.542	-0.5	-20	-2	-2	-0.2	1.26	22
31	-10	-5	2.31	30	0.191	1.5	0.15	0.7	3	202	-1	-0.5	0.085	1.9	0.08	0.415	1.2	-20	3	5	0.6	5.58	65
32	-10	-5	2.19	-30	0.154	0.6	0.257	0.5	-2	271	-1	-0.5	0.096	0.5	0.05	0.327	-0.5	-20	2	2	0.2	22.4	39
33	20	9	6.45	50	0.174	3.8	-0.107	4	-2	187	-1	0.7	0.091	6.1	0.23	0.555	1.9	26	-2	14	1.8	10.2	312
34	40	39	15	140	0.089	16.5	-0.18	8.5	-2	55	1	1	0.065	15	1.09	0.484	4.6	249	-2	29	4.2	106	214
35	-10	28	2.24	40	0.133	0.5	-0.176	0.8	-2	25	-1	-0.5	0.048	2.8	0.07	0.297	0.8	-20	-2	4	0.6	1.05	53
36	-10	9	2.7	-30	0.245	0.4	-0.244	-0.5	-2	19	-1	-0.5	0.054	1.2	0.05	0.561	0.5	-20	-2	2	0.3	2.89	93
37	10	11	4.76	30	0.405	3.6	0.086	2.5	-2	53	-1	-0.5	0.142	4.8	0.83	0.305	1.3	179	4	19	2.1	6.22	422
38	-10	8	1.01	-30	0.22	0.3	-0.059	-0.5	-2	174	-1	-0.5	0.108	-0.5	0.02	0.316	0.6	-20	-2	-2	-0.2	2.23	24
39	-10	-5	1.25	-30	0.144	0.6	0.304	-0.5	-2	437	-1	-0.5	0.152	0.7	0.02	0.071	0.6	-20	-2	2	0.2	2.44	29
40	-10	-5	2.68	-30	0.481	0.2	0.32	-0.5	3	337	-1	-0.5	0.137	-0.5	0.02	0.265	0.8	-20	-2	-2	-0.2	44.8	24
41	-10	5	3.97	-30	0.337	0.2	0.276	-0.5	-2	33	-1	-0.5	0.13	-0.5	0.01	0.184	-0.5	-20	-2	3	-0.2	3.53	18
42	-10	-5	1.65	-30	0.248	-0.1	0.307	-0.5	3	38	-1	-0.5	0.161	-0.5	0.01	0.167	-0.5	-20	-2	-2	-0.2	1.69	19
43	-10	7	9.06	-30	0.224	0.2	0.035	-0.5	-2	59	-1	-0.5	0.207	-0.5	0.02	0.243	-0.5	-20	-2	2	-0.2	91.2	19
44	-10	8	0.624	-30	0.193	0.1	0.311	-0.5	-2	14	-1	-0.5	0.161	-0.5	0.02	0.41	-0.5	-20	2	-2	-0.2	1.78	32
45	-10	-5	1.86	-30	0.165	0.5	0.254	-0.5	-2	80	-1	-0.5	0.114	-0.5	0.03	0.3	1	-20	-2	4	-0.2	9.45	32
46	-10	-5	1.48	-30	0.147	0.3	0.075	0.5	-2	208	-1	-0.5	0.112	0.5	0.02	0.21	1.3	-20	-2	6	0.2	3.52	24
47	50	72	1.85	150	0.176	17.3	0.205	9	-2	57	2	1.2	0.169	14	1.23	0.172	3.5	282	2	48	4.3	0.897	246
48	-10	7	1.54	-30	0.179	0.5	0.127	0.9	-2	32	-1	-0.5	0.128	1.3	0.05	0.294	2.2	-20	-2	6	0.4	2.56	70
49	-10	11	1.12	-30	0.287	0.7	0.299	1	-2	18	-1	-0.5	0.143	1.4	0.16	0.171	-0.5	-20	-2	7	0.7	6.36	56
50	10	7	92.5	-30	0.465	1.9	0.049	1.8	3	510	-1	-0.5	0.184	1.6	0.07	0.122	1.8	-20	-2	14	0.8	304	51
51	-10	6	1.68	-30	0.169	0.7	0.213	0.8	3	490	-1	-0.5	0.138	1.4	0.04	0.206	0.7	-20	4	6	0.6	4.8	59
52	-10	7	0.471	-30	0.203	-0.1	0.133	-0.5	-2	12	-1	-0.5	0.155	-0.5	0.02	0.359	-0.5	-20	-2	-2	-0.2	3.53	36
53	-10	6	1.4	-30	0.184	0.5	0.204	-0.5	-2	491	-1	-0.5	0.152	0.6	0.04	0.348	0.8	-20	-2	7	0.3	4.9	32
54	-10	-5	1.12	-30	0.238	0.2	0.238	-0.5	4	54	-1	-0.5	0.162	-0.5	0.02	0.453	-0.5	-20	-2	-2	-0.2	7.61	22
55	-10	-5	0.422	-30	0.17	0.1	0.224	-0.5	2	67	-1	-0.5	0.136	-0.5	0.02	0.297	1	-20	3	-2	-0.2	2.26	21
56	-10	-5	0.64	-30	0.154	0.2	0.122	-0.5	2	255	-1	-0.5	0.265	-0.5	0.01	0.342	1.1	-20	-2	4	-0.2	8.28	19
59	20	8	3.71	160	0.443	6	0.2	3.9	5	341	1	0.5	0.183	21	0.42	0.44	4.4	50	3	18	1.8	31.1	176

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample Number	Nd INAA	Ni XRF	Pb ICP	Rb INAA	Sb ICP	Sc INAA	Se ICP	Sm INAA	Sn XRF	Sr XRF	Ta INAA	Tb INAA	Te ICP	Th INAA	TiO2 XRF	Tl ICP	U INAA	V XRF	W XRF	Y XRF	Yb INAA	Zn ICP	Zr XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
60	-10	7	0.523	-30	0.176	0.2	0.236	-0.5	2	14	-1	-0.5	0.126	-0.5	0.02	0.4	-0.5	-20	-2	-2	-0.2	2.56	32
61	20	253	0.762	-30	0.237	24.9	0.204	3.9	5	535	2	0.5	0.107	2.5	1.74	0.243	1	414	-2	20	1.6	58.3	158
62	50	7	3.26	90	0.15	3.9	0.132	7	9	45	2	0.6	0.131	18	0.31	0.274	3.3	38	3	27	2.1	27.2	320
64	-10	-5	0.479	-30	0.187	0.1	0.067	-0.5	3	132	-1	-0.5	0.173	-0.5	0.02	0.475	0.6	-20	3	-2	-0.2	6.5	18
65	20	8	2.84	140	0.403	6.4	0.201	4.2	-2	334	-1	-0.5	0.131	22	0.46	0.232	4.9	93	2	17	2	32.1	171
66	50	6	0.813	110	0.106	3.5	0.159	7.7	3	41	-1	0.6	0.115	19	0.25	0.266	3.5	34	3	25	2.9	16.2	272
67	20	8	2.66	210	0.393	3.1	0.16	3.8	2	37	-1	0.6	0.086	20	0.12	0.342	5.6	-20	2	29	2.9	10.4	89
69	10	30	3.71	-30	0.878	2	0.419	1.4	2	96	-1	-0.5	0.201	1.9	0.10	0.756	2.2	-20	3	9	0.6	46	103
70	10	18	3.34	-30	0.992	2.2	0.459	1.6	3	108	-1	-0.5	0.199	2.4	0.11	0.319	5.1	-20	-2	12	0.8	49.2	132
71	-10	5	1.28	-30	0.187	0.4	0.095	-0.5	-2	294	-1	-0.5	0.154	0.7	0.02	0.064	-0.5	-20	-2	5	0.3	2.1	103
72	30	9	9.47	80	0.445	6.7	0.17	5.4	6	538	-1	0.6	0.214	11	0.43	0.532	2.2	69	3	20	1.8	47.2	222
73	40	11	2.16	110	0.32	6.9	0.06	6.3	4	641	-1	0.5	0.127	13	0.43	0.267	2.9	91	-2	21	2	45.9	254
74	30	6	23.5	150	0.435	1.1	0.118	5.9	8	162	-1	0.7	0.145	19	0.13	1.04	3.5	-20	2	28	3.1	39.9	154
76	-10	-5	0.516	-30	0.235	0.1	0.119	-0.5	3	43	-1	-0.5	0.183	-0.5	0.01	0.271	-0.5	-20	-2	3	-0.2	2.15	19
77	10	13	3.12	30	0.336	4.1	0.181	1.8	-2	269	-1	-0.5	0.175	3.5	0.17	0.488	1.2	23	-2	10	0.9	15.7	75
78	50	40	4.29	50	0.193	13.9	0.242	8.2	6	813	-1	0.9	0.106	4.4	1.54	0.179	0.6	341	-2	33	2.4	86.8	341
79	70	7	6.08	-30	0.283	9.4	0.187	10.1	5	42	-1	1	0.124	14	0.38	0.434	3.1	68	4	47	4.4	66.3	894
80	30	7	1.93	60	0.153	5.9	0.315	5.4	-2	719	-1	0.5	0.156	7.7	0.34	0.393	1	40	2	17	1.7	50.3	232
81	30	11	5.08	80	0.339	3.5	0.284	4.2	7	303	-1	0.5	0.211	11	0.22	0.308	2.3	-20	2	19	1.9	30	157
82	-10	5	0.234	-30	0.145	0.1	0.186	-0.5	3	78	-1	-0.5	0.176	-0.5	0.01	0.292	-0.5	-20	2	2	-0.2	1.74	21
83	30	8	1.86	240	0.269	3	0.195	4.6	3	201	-1	0.5	0.121	24	0.17	0.159	6.6	16	3	20	1.9	11.4	152
84	-10	5	0.322	-30	0.164	-0.1	0.168	-0.5	4	66	-1	-0.5	0.151	-0.5	0.01	0.258	0.5	-20	-2	-2	-0.2	0.975	20
85	-10	5	0.694	-30	0.228	0.3	0.309	-0.5	-2	276	-1	-0.5	0.151	-0.5	0.02	0.221	0.9	-20	-2	2	0.2	2.3	22
86	-10	6	0.397	-30	0.217	0.1	0.143	-0.5	-2	316	-1	-0.5	0.238	-0.5	0.01	0.145	-0.5	-20	3	2	-0.2	8.35	20
87	20	23	5.5	40	0.507	5.5	2.67	3.7	2	120	-1	0.5	0.182	5.9	0.44	0.264	2.6	90	-2	21	2.2	38	219
88	-10	10	0.236	-30	0.31	0.2	0.479	-0.5	-2	296	-1	-0.5	0.146	-0.5	0.02	0.662	5.7	-20	-2	2	-0.2	8.68	23
89	-10	-5	0.766	-30	0.309	0.5	1.09	0.5	-2	270	-1	-0.5	0.198	0.6	0.03	0.37	21.4	-20	-2	2	-0.2	7.66	32
90	-10	-5	0.67	-30	0.183	0.2	0.203	-0.5	-2	333	-1	-0.5	0.18	-0.5	0.01	0.406	-0.5	-20	-2	-2	-0.2	3.06	20
91	10	9	2.21	-30	0.256	2	0.386	1.4	4	203	-1	-0.5	0.125	2.4	0.11	0.306	0.8	-20	2	7	0.8	12.5	82
92	-10	7	1.71	-30	0.271	0.3	0.21	-0.5	4	117	-1	-0.5	0.126	-0.5	0.02	0.316	0.6	-20	-2	-2	-0.2	3.38	21
93	10	20	5.82	70	1.02	6.1	0.237	2.9	3	177	-1	-0.5	0.154	6.6	0.35	0.422	1.9	65	2	13	1.1	38	118
94	10	14	1.99	30	0.497	1.5	0.072	2.7	-2	42	-1	-0.5	0.181	2.5	0.14	0.361	3	-20	-2	17	1.3	26.8	116
95	-10	5	1.52	-30	0.209	0.3	0.149	-0.5	2	47	-1	-0.5	0.177	-0.5	0.02	0.342	0.6	-20	-2	2	-0.2	3.04	21
96	-10	-5	1.93	-30	0.22	0.5	0.191	-0.5	-2	58	-1	-0.5	0.134	0.6	0.03	0.342	1.8	-20	-2	2	-0.2	3.49	35
97	-10	-5	0.465	-30	0.22	0.2	0.151	-0.5	6	642	-1	-0.5	0.127	-0.5	0.02	0.323	8.7	-20	-2	-2	-0.2	3.79	50
98	30	7	4.06	80	0.241	2.1	0.041	4.5	3	487	-1	-0.5	0.155	10	0.13	0.523	3	-20	3	20	1.6	19.4	108
99	-10	6	0.954	-30	0.285	0.2	0.145	-0.5	6	76	-1	-0.5	0.118	-0.5	0.02	0.392	1.3	-20	-2	-2	-0.2	2.78	22
100	20	35	3.15	-30	0.629	3.2	1.2	5.3	-2	112	-1	-0.5	0.154	2.6	0.13	0.418	4.9	-20	-2	24	1.8	20.1	56
101	40	-5	2.92	210	0.306	4.8	0.096	6.5	4	177	-1	0.7	0.177	28	0.14	0.396	4.5	-20	5	27	2.6	32.1	203
108	20	26	5.22	50	0.605	5.4	3.77	3.3	2	134	-1	-0.5	0.178	5	0.36	0.343	2.6	52	-2	22	1.9	26.9	145
114	-10	5	0.633	-30	0.19	0.4	0.584	-0.5	-2	733	-1	-0.5	0.102	-0.5	0.02	0.363	-0.5	-20	-2	5	0.2	16.7	25
117	30	13	3.2	190	0.451	2.7	0.229	6.2	-2	31	<1	0.7	0.125	26	0.09	0.441	5	-20	-2	28	2.9	26.7	106
118	30	14	10.1	190	0.401	1.8	-0.099	7.5	-2	38	<1	0.9	0.1	27	0.14	0.254	4.8	-20	-2	37	3.7	45.7	196
119	<10	11	0.222	<30	0.281	0.6	0.137	0.8	-2	14	<1	<0.5	0.108	2	0.07	0.078	0.9	-20	-2	4	0.5	0.771	77
120	60	58	19.3	180	0.336	21.3	0.244	10.4	-2	190	<1	1.2	0.147	18	0.83	0.145	3.8	113	-2	40	3.8	115	109
121	40	14	2.91	100	0.197	5.1	0.789	6.2	4	346	<1	<0.5	0.135	21	0.20	0.157	4.9	-20	-2	28	2.7	5.05	226
122	30	15	12.1	310	0.85	1.5	0.191	8.4	-2	16	<1	1.2	0.154	33	0.08	0.203	4.2	-20	-2	43	4.6	98.6	167
123	40	19	3.26	110	0.261	6.8	0.636	6.7	-2	930	<1	<0.5	0.091	15	0.56	0.031	3.3	68	-2	20	1.7	63.5	270
124	60	16	29.3	190	0.321	0.7	0.266	12.6	2	14	3	1.6	0.111	20	0.10	0.34	3.8	-20	-2	80	7.3	72.4	483
125	30	12	18.2	110	0.26	2.1	0.202	4.5	-2	523	<1	<0.5	0.106	18	0.22	0.543	1.3	-20	-2	18	1.8	32.1	186
126	30	12	23.2	160	0.322	0.8	0.133	5	-2	463	<1	1	0.094	29	0.11	0.561	1	-20	-2	30	3.4	9.4	132
127	30	17	4.1	300	1.71	0.4	0.106	5.3	9	70	<1	1.5	0.159	17	0.06	0.461	4.5	-20	-2	56	5.8	11.3	136
128	30	14	3.96	210	0.25	1.1	-0.124	7	2	75	1	0.7	0.151	21	0.10	0.364	4.5	-20	-2	41	3.8	13.9	176
129	190	25	65.6	570	0.432	1.4	0.128	33.1	32	75	19	4.1	0.119	110	0.26	0.493	10	20	17	288	25.5	25.8	3634
130	40	13	1.81	100	0.26	1.6	-0.067	6.8	-2	363	<1	0.6	0.143	18	0.22	0.186	3.9	-20	-2	32	2.5	39	231
131	30	12	1.63	130	0.315	1.2	0.14	5.3	-2	178	1	<0.5	0.151	18	0.14	0.201	3.7	-20	-2	29	2.7	47.3	142

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample	Nd	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb	Te	Th	TiO2	Tl	U	V	W	Y	Yb	Zn	Zr
Number	INAA	XRF	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
151	20	18	7.28	230	0.351	0.7	0.144	5.2	3	43	3	0.6	0.121	24	0.08	0.264	5.9	-20	5	39	3.9	49.2	147
152	20	22	6.29	260	0.387	0.6	0.023	5.5	3	19	5	0.7	0.082	30	0.06	1.33	6.3	-20	4	25	4.8	21.6	92
153	60	10	1.65	200	0.207	1.1	0.146	10.3	3	21	3	1	0.138	19	0.12	0.133	4.4	22	7	61	5.3	33.9	427
154	50	7	1.36	130	0.2	6.2	0.049	8.3	3	116	1	0.9	0.134	12	0.38	0.288	2.2	56	2	43	3.5	25.4	560
155A	60	15	12.4	140	0.511	7.7	0.201	10.3	4	475	2	1	0.13	17	0.97	0.334	3.1	153	7	52	3.9	89.4	634
155B	70	12	8.02	100	0.36	8	0.164	10.2	3	501	2	1.1	0.138	15	1.01	0.405	3	246	6	45	3.9	95.9	580
156	90	10	5.73	200	0.278	4	0.194	12.7	3	33	3	1.8	0.166	26	0.32	0.423	5	54	7	66	6.1	40.7	592
157	70	8	1.06	110	0.184	8.5	0.153	10.8	-2	27	-1	1	0.171	13	0.42	0.242	2.2	79	6	47	4.4	26.2	847
158	50	8	15.9	170	0.358	1.2	0.049	10	-2	29	1	1.1	0.163	19	0.13	0.207	4.2	11	4	61	5	89.8	417
159	50	8	5.44	130	0.261	5.8	0.274	8.7	3	81	2	1.1	0.167	14	0.27	0.274	2.7	32	3	40	3.7	47.3	453
160	-10	14	1.17	-30	0.556	0.1	0.251	-0.5	-2	34	-1	-0.5	0.099	-0.5	0.01	0.257	1	-20	2	4	-0.2	3	23
161	20	9	8.03	220	2.09	2.7	0.048	4	-2	115	-1	-0.5	0.068	15	0.11	0.136	4.7	-20	8	15	1.6	6.53	145
162	30	10	6.88	130	0.224	3	0.215	4.1	-2	349	-1	-0.5	0.149	13	0.37	0.302	4.4	46	4	14	0.9	23	193
163	30	8	3.77	210	0.715	2.4	0.124	4.8	-2	100	1	0.5	0.19	17	0.20	0.414	1.6	-20	2	16	1.7	26.7	137
164	10	10	6.78	-30	0.528	2.3	0.247	1.6	3	431	-1	-0.5	0.175	2.2	0.10	0.207	1.5	-20	-2	9	0.7	17.2	73
165	20	6	4.4	180	0.481	3.1	0.112	2.8	-2	325	-1	-0.5	0.171	13	0.43	0.227	3.2	63	5	10	0.8	9.85	189
166	20	7	14.1	170	0.727	0.8	0.266	3.6	-2	416	1	-0.5	0.137	17	0.13	1	2.1	-20	3	23	2.2	26.6	144
167	20	5	4.24	200	0.677	0.6	0.184	3	-2	42	1	-0.5	0.155	16	0.10	0.362	3.2	-20	3	19	2	4.8	101
168	20	8	4.77	230	5.08	2	0.246	3.8	-2	78	-1	-0.5	0.132	17	0.18	0.178	2.4	8	2	14	1.3	21.3	112
169	60	10	5.35	130	0.201	5.8	0.126	9.5	-2	80	4	1.1	0.132	17	0.27	0.227	3.8	53	5	48	3.9	64.4	476
170	20	5	3.56	180	0.124	0.7	0.094	3.7	-2	46	-1	-0.5	0.164	18	0.11	0.152	4	-20	3	23	2	7.32	107
171	20	8	6.27	180	0.254	0.7	0.095	3.8	2	40	-1	0.5	0.188	19	0.11	0.549	3.4	-20	3	20	2.1	27.4	109
172	20	9	6.53	200	0.211	0.6	0.208	3.6	4	39	-1	-0.5	0.18	18	0.11	0.061	2.9	-20	4	21	1.9	24.2	109
173	90	9	10.3	-30	0.724	4	0.165	13.5	-2	71	-1	1.2	0.116	18	0.26	0.422	5.5	-20	4	71	6.8	34.9	724
174	10	9	6.09	110	0.548	0.5	0.17	2.7	-2	47	-1	-0.5	0.175	13	0.09	0.304	4.4	-20	3	21	1.8	11.9	92
175	50	23	2.59	-30	0.153	16.1	0.206	10	-2	945	-1	1.3	0.134	3.3	2.11	0.224	1.1	517	4	38	3.3	111	304
176	210	24	189	780	0.739	2	0.257	46.4	28	75	20	8.4	0.196	140	0.33	0.724	21.3	-20	21	293	34.5	173	4035
177	30	23	8.63	150	0.291	1.3	0.251	4.7	-2	40	-1	-0.5	0.193	20	0.09	0.315	3.9	-20	-2	21	2.5	27.2	153
178	30	5	2.75	180	0.228	1.4	0.194	4.3	-2	44	2	-0.5	0.185	21	0.11	0.39	3.4	-20	3	25	2.4	16.1	168
179	30	24	2.43	-30	0.079	22.8	-0.061	6.3	3	805	1	0.7	0.125	2	1.65	0.257	0.6	360	4	29	2.5	52.1	192
180	20	6	6.19	230	0.422	1.2	0.115	2.3	-2	34	2	-0.5	0.171	16	0.11	0.401	4.2	-20	5	18	1.9	18.3	102
181	30	7	0.575	160	0.208	1.4	0.217	4.5	-2	25	-1	0.5	0.159	21	0.10	0.427	4	-20	-2	27	2.6	5.4	171
182	20	10	0.768	150	0.273	1.5	0.23	3.3	-2	59	3	-0.5	0.132	21	0.13	0.357	3.9	-20	3	18	2	6.98	123
183	-10	8	1.74	-30	3.42	0.8	0.283	-0.5	3	78	-1	-0.5	0.164	-0.5	0.02	0.145	2.5	-20	-2	5	0.4	6.14	24
184	20	6	6.86	170	0.424	0.8	0.184	4.2	-2	47	-1	-0.5	0.156	18	0.13	0.289	3.3	-20	2	23	2.2	41.6	136
185	20	8	33.4	150	50.6	1.4	0.114	4	-2	41	2	-0.5	0.209	18	0.12	0.435	3.5	-20	7	25	2.8	46.4	114
186	80	6	19.5	270	0.23	2.4	0.032	14.9	3	66	6	1.8	0.134	36	0.21	0.139	6.7	-20	6	94	9.1	112	553
187	30	8	0.992	100	0.186	1.7	0.137	4.3	-2	89	-1	-0.5	0.14	26	0.18	0.201	2.8	24	2	18	1.7	25.2	154
188	40	11	1.25	140	0.233	8.1	0.081	6.4	-2	666	-1	0.8	0.146	13	0.80	0.246	3.3	158	3	26	2.3	31.6	377
189	80	9	6.92	190	0.281	8.6	0.23	12.2	-2	107	-3	1.2	0.154	16	0.46	0.492	2.4	72	5	55	5.5	82.7	830
190A	60	7	9.46	200	0.491	1.1	0.176	11.3	3	54	3	1.5	0.166	20	0.14	0.367	4.3	-20	7	68	6.3	26.7	399
190B	60	15	13.5	210	0.492	1.1	0.284	11	-2	55	3	1.4	0.179	19	0.13	0.28	4.2	-20	7	61	5.8	61.1	403
191	200	18	79.5	680	0.391	1.8	0.052	39.7	26	63	19	6	0.122	140	0.30	0.457	25.2	58	21	270	30.9	89.6	3608
192	130	10	6.41	190	0.246	5.4	0.22	17.9	4	128	5	2.6	0.142	40	0.39	0.443	8.2	60	8	92	9.5	35.2	920
193	80	7	0.955	100	0.226	7.5	0.126	13.7	-2	48	3	1.3	0.124	14	0.32	0.369	3.7	48	5	64	5.5	23.4	610
194	80	9	18.4	290	0.309	1.9	0.153	13.7	5	32	4	1.5	0.189	39	0.18	0.518	8.2	24	6	66	8.2	104	573
195	40	9	3.36	140	0.484	3.6	0.12	6.3	-2	270	3	0.6	0.173	18	0.31	0.324	3	59	2	29	2.3	42.8	285
196	20	6	1.8	160	0.151	1	0.045	4.4	-2	31	1	-0.5	0.105	23	0.09	0.297	5	-20	3	21	1.9	5.76	145
197	20	7	4.72	120	0.372	0.9	0.108	3	-2	27	1	-0.5	0.152	14	0.06	0.244	3.9	-20	-2	13	1.3	17.4	100
198	90	7	3.55	160	0.229	2.5	0.243	14	-2	41	4	2	0.145	21	0.23	0.42	4.5	37	7	84	7.4	40.7	856
199	10	5	3.94	100	0.289	2.6	0.085	2.4	3	481	-1	-0.5	0.146	7.9	0.22	0.452	1.2	-20	-2	12	1	26	154
200	20	6	2.13	200	0.202	1.3	0.2	3.1	3	284	2	-0.5	0.201	16	0.15	0.477	2.9	-20	-2	12	1	12.9	112
201	20	7	12.8	230	0.243	2.6	0.172	4.2	5	65	-1	0.5	0.218	25	0.15	0.37	5.9	-20	3	18	2.3	15.3	104
202	120	34	7.18	150	0.314	8.4	0.162	16.2	3	62	-1	1.6	0.126	30	0.34	0.313	5.4	51	4	61	5.9	78	815
203	90	10	17.7	210	0.322	4.9	0.064	13.6	3	42	3	2.4	0.198	30	0.25	0.507	5.9	41	6	75	6.9	106	618
204	30	9	2.53	170	0.174	1.9	0.231	5.4	3	109	1	0.6	0.2	22	0.21	0.328	3.8	21	5	27	2.6	29.2	198

(-) less than indicated value

GEOLOGIC CHARACTERIZATION SAMPLE (GSC) ANALYSES

Sample Number	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
205	20	9	15.6	140	0.323	1.4	0.233	3.9	-2	61	1	-0.5	0.197	16	0.15	0.651	3.1	-20	2	21	2.3	17.9	120
206	30	7	4.21	120	0.264	1.9	0.057	4.1	-2	69	-1	-0.5	0.207	25	0.20	0.296	4.4	-20	3	21	1.6	19.3	172
207	120	10	8.89	210	0.306	7.7	0.219	16.5	3	66	3	2.4	0.233	31	0.32	0.477	5.7	45	5	71	6.5	88.5	820
208	40	6	3.73	160	0.243	1.6	0.161	5.4	3	125	-1	0.5	0.167	19	0.28	0.313	3.9	39	2	24	2.6	28.9	251
209	30	7	1.41	150	0.125	1.6	0.337	5.2	3	292	-1	-0.5	0.091	20	0.32	0.362	4.2	58	3	27	2.4	19.1	275
210	30	10	5.53	180	0.182	1.6	0.271	5.4	-2	56	1	1	0.085	24	0.19	0.104	4.2	-20	3	29	3.2	17.9	168
211	20	7	4.95	270	0.24	3.7	0.061	3.9	4	99	-1	-0.5	0.159	18	0.27	0.344	4.5	39	4	15	1.6	17.1	132
212	20	15	2.14	310	0.872	1.8	0.272	3.4	-2	160	-1	-0.5	0.15	20	0.26	0.371	3.7	33	4	10	1.2	9.6	118
213	30	10	4.62	110	0.21	5.5	0.07	4.3	3	420	-1	0.6	0.143	11	0.55	0.235	3.1	96	3	15	1.7	62.1	246
214	30	12	1.59	530	1.17	1.7	0.236	7.4	7	23	7	1.5	0.117	46	0.07	0.591	10.7	-20	7	77	8.7	32.2	121
215	30	17	4.48	100	0.256	10.9	0.259	5.9	2	1142	-1	0.7	0.156	9	0.67	0.267	1.8	125	3	21	1.7	67.9	272
216	20	11	3.33	50	0.215	5.4	0.22	3.9	2	490	-1	-0.5	0.201	9.3	0.39	0.449	1.9	72	3	13	1	48.1	220
217	20	5	56.6	190	0.211	2.5	0.171	2.8	3	68	-1	-0.5	0.211	19	0.15	0.461	4.4	-20	3	12	1.5	11.6	122
218	-10	-5	4.28	-30	0.236	5.1	0.291	0.5	3	236	-1	-0.5	0.149	4.5	0.02	0.385	0.9	202	-2	4	0.4	1.92	251
219	40	20	7.74	130	0.168	8.4	0.318	6.1	4	845	-1	0.7	0.164	17	0.56	0.245	2.8	100	3	20	1.9	45.2	261
220	40	8	12	210	0.21	4.3	0.21	6	2	149	-1	0.6	0.166	20	0.23	0.141	5	-20	3	24	2.8	31.9	193
221	30	8	4.31	210	0.281	7.9	0.101	5.6	-2	232	-1	0.6	0.175	25	0.42	0.464	5.4	44	-2	29	3.1	38.7	243
222	30	9	7.35	220	0.348	2.3	0.198	4.8	7	135	-1	-0.5	0.161	26	0.15	0.252	4.8	-20	3	18	2.2	7.13	141
223	40	12	3.46	210	0.402	6	0.157	5.8	5	70	-1	0.6	0.145	20	0.16	0.468	3.1	-20	3	17	2.2	5.65	161
224	40	22	9.33	130	0.369	10	0.24	6.3	2	927	-1	0.7	0.214	15	0.60	0.452	2.5	72	3	21	1.9	65.4	256
225	20	12	5.81	340	1.67	1.5	0.054	2.8	5	157	-1	-0.5	0.148	25	0.19	0.943	3.8	-20	3	10	1.1	20.8	99
226	30	13	2.63	80	0.35	10.8	0.226	4.9	5	758	-1	0.5	0.227	10	0.74	0.368	2.3	122	-2	17	1.3	125	196
227	20	8	1.12	170	0.814	1.8	0.207	3.3	3	301	-1	-0.5	0.171	17	0.21	0.345	3.5	22	-2	12	1.4	7.63	131
228	30	9	4.92	290	0.382	0.7	0.15	6.4	8	21	4	1	0.184	34	0.06	0.546	7.5	-20	4	50	5.9	21.6	130
229	70	6	24.7	160	0.336	1.9	0.169	12.1	10	27	3	1.6	0.123	18	0.15	0.314	3.9	-20	2	54	5.9	24.6	648
230	60	8	25	200	0.286	1.9	0.159	12.6	4	17	3	1.8	0.112	19	0.14	0.32	2.7	-20	4	58	6.6	50	640
231	60	9	6.96	160	0.281	2.2	0.194	12.3	8	67	2	1.4	0.164	17	0.15	0.325	4.1	-20	4	70	6.6	38.1	666
232	30	6	5.69	170	0.248	2	0.19	3.6	6	263	-1	0.5	0.146	21	0.25	0.091	3.8	-20	3	11	1.3	25	146
233	40	15	0.697	90	0.104	11.9	0.175	6.8	-2	1036	-1	0.7	0.141	13	0.77	0.362	3.4	171	-2	20	1.6	37	296
234	40	13	2.66	110	0.238	6.8	0.328	6.2	-2	976	-1	0.5	0.118	15	0.72	0.269	2.6	157	-2	18	1.6	73.6	338
235	50	9	1.96	140	0.171	3.3	0.304	6.8	2	233	1	0.7	0.155	19	0.27	0.443	3.3	20	2	26	2.5	30.9	251
236	30	5	13.5	120	0.421	2.8	0.272	5.1	2	312	-1	-0.5	0.205	18	0.21	0.443	3.9	-20	2	15	1.5	30.1	168
237	40	33	0.949	70	0.244	10.4	0.086	6.7	10	1259	-1	0.5	0.173	11	0.83	0.53	2.6	145	4	18	1.5	37.1	338
238	10	7	1.67	160	0.148	1.7	0.112	2.6	-2	177	-1	-0.5	0.156	19	0.11	0.359	4.4	-20	4	14	1.4	15.4	89
239	20	6	1.84	150	0.219	1.8	0.247	3.1	-2	386	-1	-0.5	0.151	22	0.22	0.344	5.8	-20	-2	10	1.3	25.7	148
240	10	7	3.7	180	0.17	1.8	0.279	2.5	5	174	-1	-0.5	0.172	21	0.11	0.286	4.5	-20	-2	11	1.5	21.4	89
241	10	7	3.38	160	0.193	0.9	0.198	1.3	3	158	-1	-0.5	0.164	21	0.10	0.233	3.8	-20	-2	6	0.7	10	80
242	30	9	7.53	240	0.342	0.9	0.171	5.8	8	41	3	1.3	0.135	24	0.08	0.394	7	-20	3	37	4.5	40	195
243	40	7	2.88	200	0.662	3.5	0.033	5.3	2	213	-1	0.7	0.152	10	0.33	0.531	1.7	36	4	15	1	3.55	237
244	60	7	4.46	100	0.212	5.8	0.196	10.5	9	68	2	1.2	0.161	16	0.24	0.482	4.1	-20	3	47	5	56.2	448
245	20	13	2.08	180	0.234	3.8	0.066	3.1	-2	402	2	-0.5	0.125	25	0.42	0.357	5.3	68	2	8	0.9	37.2	154
246	20	7	4.7	220	0.451	2.8	0.095	4.3	6	56	-1	0.5	0.155	28	0.15	0.258	6.4	-20	5	22	2.8	23.4	95
247	30	15	0.918	140	0.162	8.9	0.149	5.6	-2	790	2	0.5	0.145	17	0.65	0.38	4.4	140	2	18	1.8	40.3	226
253	20	8	2.54	140	0.1	1.8	0.039	3	2	181	-1	-0.5	0.169	18	0.12	0.349	3.6	-20	2	13	1.4	10.5	115
254	20	6	12.7	180	0.213	1.7	0.133	2.7	4	188	-1	-0.5	0.149	16	0.11	0.52	3.2	-20	2	9	0.8	12.7	102
255	20	8	8.99	170	0.252	2.6	0.277	3.9	3	96	-1	-0.5	0.184	19	0.17	0.216	4.4	-20	2	17	2.2	25.4	112
256	20	5	1.63	180	0.174	1.3	0.212	2.8	3	313	-1	-0.5	0.11	22	0.17	0.387	3.9	-20	2	11	1.2	24.1	132
257	30	7	1.74	140	0.904	1.8	0.095	3.8	-2	537	-1	-0.5	0.173	19	0.29	0.415	3.6	31	-2	10	1	28.5	190
258	20	11	2.97	470	0.445	1.2	0.058	6.4	9	26	6	1.4	0.128	43	0.05	0.289	9.7	-20	7	73	8.8	19	118
259	50	5	2.2	-30	0.22	21.2	4.45	7	-2	2544	-1	0.5	0.667	18	0.97	0.251	1.2	196	-2	8	0.5	1.87	301
260	40	28	1.94	170	0.244	10.5	-0.007	6.3	-2	648	-1	0.6	0.088	9.6	0.86	0.248	2.4	94	-2	26	1.6	97.2	260

(-) less than indicated value

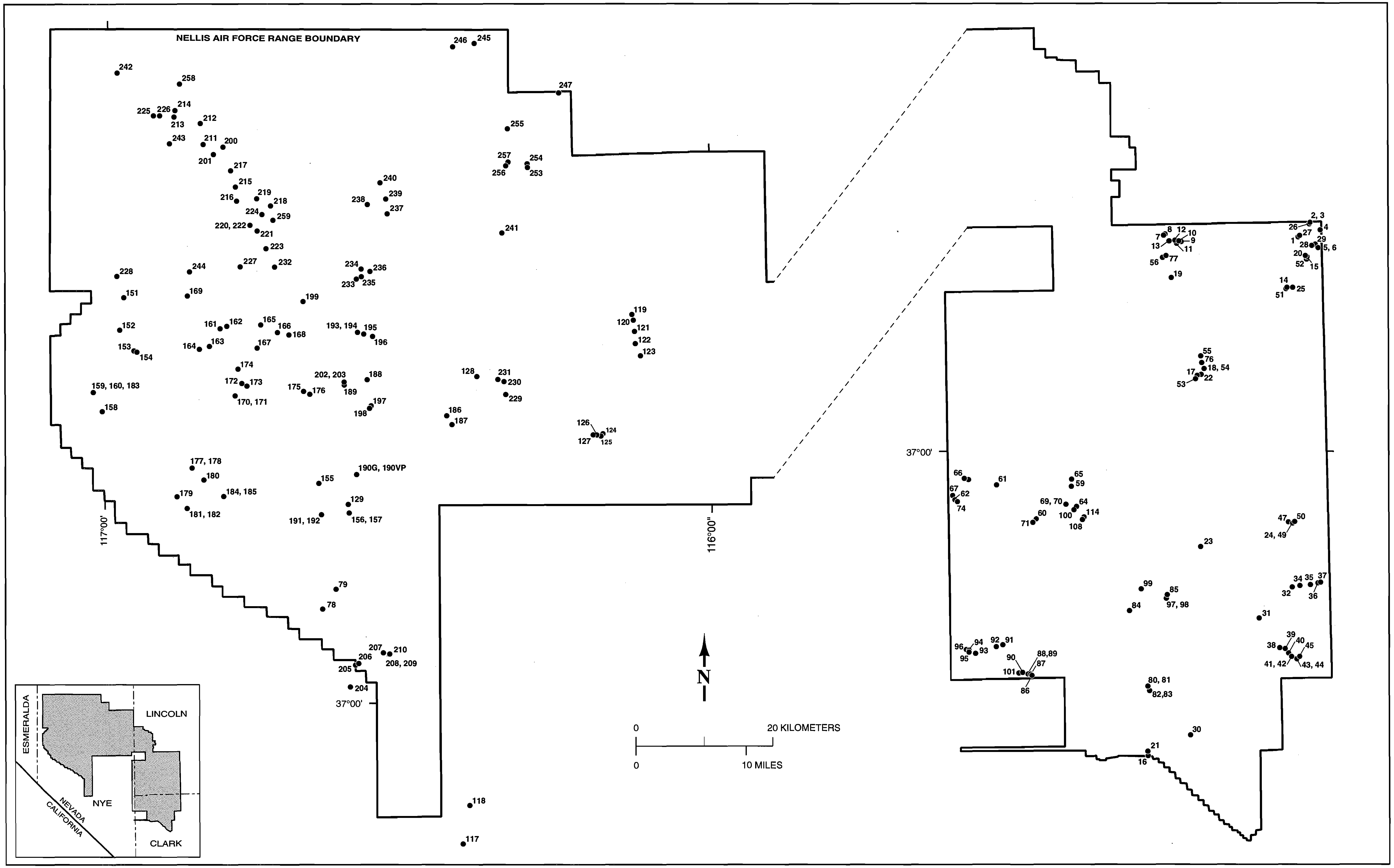

Figure A-1 Location map, geochemical characterization samples, NAFR.

APPENDIX B

STREAM SEDIMENT SAMPLING DATA

FLOAT CHIP ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm
49401	536952	4199455	3	14.30	0.07	216	-5	-0.23	-1	-1	-0.09	16	-5	400	3	15.50	0.3	0.6	-0.5	1	-0.09	9	0.05	0.151	12.50
49403	535351	4197424	3	19.10	0.02	481	-5	-0.24	-1	-1	-0.09	58	-5	260	5	7.39	0.8	0.7	0.7	3	-0.09	36	0.1	0.018	21.90
49405	542099	4194013	8	118.00	0.02	496	-5	-0.24	1	-1	-0.10	40	-5	260	7	6.32	0.3	0.6	0.6	1	0.82	23	0.12	0.011	13.60
49407	544690	4193055	4	54.00	0.06	316	-5	-0.23	-1	-1	-0.09	55	-5	190	9	6.50	0.3	0.7	0.7	3	0.13	32	0.16	0.011	12.10
49409	546066	4193356	1245	341.00	0.93	152	-5	-0.25	1	-1	0.57	14	-5	260	4	252.00	0.4	1.2	-0.5	-1	0.20	8	0.09	0.004	16.90
49411	490565	4139212	1	7.62	0.00	92	-5	0.33	-1	-1	-0.10	39	-5	380	-3	32.90	0.4	1.5	1.1	3	0.90	20	0.6	0.023	3.85
49413	490810	4138692	1	66.80	0.01	481	-5	4.39	-1	-1	0.34	48	20	200	-3	979.00	0.8	11.5	3.1	7	4.97	26	0.29	0.018	9.23
49415	489426	4138427	1	50.50	0.02	346	-5	13.90	-1	1	0.40	50	11	210	-3	314.00	0.7	9.5	2.1	6	59.20	26	0.3	0.022	7.12
49417	489704	4152963	0	23.50	0.00	171	-5	0.30	1	3	0.17	110	-5	130	-3	4.36	0.3	1.8	1.4	9	0.17	61	0.52	0.122	3.07
49419	483446	4181753	0	29.00	0.10	1362	-5	8.48	-1	-1	0.15	60	-5	320	-3	28.30	0.9	6.8	4.8	4	0.28	33	0.12	0.014	11.20
49452	533139	4205768	4	591.00	0.04	450	-5	-0.25	-1	-1	-0.10	56	-5	230	6	5.93	0.5	6	1.3	2	0.63	31	0.2	0.042	9.35
49454	534553	4205560	2	267.00	0.12	788	-5	-0.23	1	-1	0.19	45	-5	210	13	8.13	0.5	4.2	2.9	2	1.03	24	0.2	0.032	18.40
49456	532298	4203597	1	81.80	0.06	1079	-5	-0.24	1	-1	0.15	67	-5	150	10	15.50	0.7	2.4	2.1	5	-0.10	37	0.22	0.036	12.90
49458	535906	4205427	3	6.64	0.02	500	-5	-0.24	-1	-1	0.10	53	-5	220	6	12.60	0.5	1.4	1.1	3	-0.10	29	0.2	0.051	3.48
49460	534390	4207809	0	42.60	0.01	728	-5	-0.23	-1	-1	0.11	76	-5	170	6	9.90	0.6	2	1.7	4	-0.09	43	0.21	0.047	3.92
49462	532155	4210115	0	13.20	0.00	695	-5	0.35	1	-1	0.12	83	-5	120	8	6.05	0.7	2.2	1.7	4	-0.10	46	0.48	0.112	1.49
49464	552168	4201850	1	38.30	0.01	469	-5	-0.24	-1	-1	-0.10	59	-5	140	8	6.36	0.6	0.6	0.6	3	-0.10	34	0.18	0.021	6.22
49466	553836	4201633	8	55.60	0.01	388	-5	-0.25	-1	-1	-0.10	53	-5	210	7	9.65	0.6	0.9	0.8	3	-0.10	31	0.17	0.013	5.59
49468	555775	4202861	1	22.80	0.01	508	-5	-0.24	-1	-1	-0.10	65	-5	190	8	7.32	0.8	0.9	1.0	3	-0.10	37	0.17	0.017	11.30
49470	556866	4204639	1	32.30	0.01	526	-5	-0.25	1	-1	-0.10	62	-5	190	7	6.12	0.8	1	1.2	3	-0.10	37	0.19	0.030	2.36
49472	545170	4214479	0	17.20	0.00	757	-5	0.33	-1	-1	-0.09	67	-5	150	6	7.39	1	1.8	1.3	4	0.11	36	0.18	0.042	4.02
49474	537658	4215170	0	21.30	0.01	594	-5	0.30	-1	-1	-0.10	75	-5	110	8	7.18	0.5	1.6	1.1	4	-0.10	43	0.28	0.058	2.73
49476	537670	4095256	0	2.99	0.00	471	-5	-0.24	1	-1	-0.10	109	-5	110	4	4.70	0.9	1.1	1.7	6	0.37	64	0.33	0.014	1.62
49478	532276	4092198	0	2.49	0.02	472	-5	-0.25	-1	-1	-0.10	86	-5	180	3	5.03	0.5	0.9	1.7	8	1.08	50	0.33	0.018	2.10
49480	530369	4090217	0	3.56	0.00	488	-5	-0.24	-1	-1	-0.10	65	-5	210	-3	4.94	0.5	1.4	1.2	4	0.45	35	0.28	0.005	3.15
49482	519930	4094017	0	9.06	0.01	249	-5	-0.23	-1	-1	-0.09	100	-5	190	5	6.27	0.9	0.9	1.2	6	0.18	54	0.3	0.018	2.43
49484	519739	4097819	0	56.10	0.01	809	-5	-0.23	-1	-1	-0.09	105	-5	190	4	4.97	0.9	1.1	1.1	6	0.66	61	0.35	0.017	4.10
49486	521404	4098525	0	51.70	0.01	953	-5	-0.25	-1	-1	-0.10	110	-5	160	4	10.80	0.8	1	1.7	7	0.14	64	0.34	0.019	3.28
49488	480109	4185649	0	17.90	0.02	1413	-5	0.75	1	1	-0.10	50	-5	150	-3	22.00	0.8	3.7	4.6	4	4.19	28	0.15	0.018	3.89
117502	516123	4150079	0.027	45.5	0.0004	454	-5	0.145	1	1	0.074	71	-5	80	3	5.61	0.6	1.2	0.846	4	0.373	43	0.27	0.018	3.1
117504	514893	4149991	0.027	90.7	0	249	-5	0.237	1	1	0.065	55	-5	100	3	5.01	0.8	1	0.994	4	0.092	31	0.31	0.025	9.14
117506	527344	4147533	0.024	15.7	0.0004	364	-5	0.11	1	-1	0.046	80	-5	50	4	3.12	0.8	1	0.631	3	0.024	45	0.32	0.061	0.864
117508	525269	4145697	0.025	61.3	0	774	-5	0.207	1	3	0.096	60	11	40	3	8.89	0.9	2.3	1.45	3	0.081	34	0.32	0.16	6.48
117510	521714	4143292	0.021	31.9	0	193	-5	0.113	1	1	0.142	64	-5	80	-3	5.44	0.4	0.6	0.49	3	0.038	37	0.32	0.074	2.58
117512	520952	4143327	0.026	39.5	0	160	-5	0.15	-1	-1	0.1	57	-5	50	-3	5.54	0.6	1	0.909	3	0.021	32	0.36	0.073	5.71
117514	525900	4154836	0.041	4.14	0.0002	355	-5	0.032	1	1	0.346	123	-5	30	4	7.48	0.6	1.2	0.71	10	0.037	67	0.75	0.103	0.602
117516	525980	4154586	1.01	25.4	0.012	470	-5	0.032	1	-1	0.047	40	-5	130	-3	6.82	0.7	0.7	0.655	2	0.088	24	0.14	0.013	3.18
117518	526147	4154448	0.179	8.96	0.0006	1051	-5	0.114	-1	1	0.115	76	7	50	-3	12.8	1	2.8	1.46	5	0.189	47	0.21	0.036	3.27
117520	512877	4154657	14.2	76.5	0.475	1927	-5	39.3	1	-1	0.306	89	-5	90	-3	27.1	1.4	3.6	3.77	4	22	55	0.22	0.037	2.58
117522	513855	4129123	-0.001	10	0.0008	603	-5	0.031	-1	-1	0.076	86	-5	80	-3	5.51	0.8	1.3	1.55	5	0.016	50	0.36	0.055	1.74
117524	511180	4126098	0.062	43.2	0.0006	525	-5	0.115	1	-1	0.125	86	-5	70	3	4.95	0.5	1.2	1.9	5	0.159	49	0.35	0.084	2.57
117526	508186	4123464	0.017	3.47	0	114	-5	0.081	1	-1	0.093	44	-5	50	-3	4.04	0.4	1.1	1.48	4	0.266	25	0.4	0.028	2.33
117528	507041	4127159	0.022	3.23	0	484	-5	0.031	1	3	0.197	81	17	50	-3	11.8	1.4	3	3.04	5	-0.037	48	0.38	0.103	0.649
117530	504201	4123595	0.132	88	0.027	229	-5	0.075	1	-1	0.056	56	-5	150	5	3.24	0.5	0.7	1.11	4	0.388	32	0.3	0.013	2.16
117532	503312	4126508	0.024	21.6	0.0004	693	-5	0.129	1	3	0.132	80	11	90	3	12	1.4	2.6	2.35	5	-0.04	45	0.36	0.096	0.872
117534	506524	4121650	0.269	10.7	0.018	448	-5	0.026	1	-1	0.066	82	-5	160	-3	6.51	0.6	0.8	1.36	4	0.569	42	0.39	0.022	0.906
117536	504211	4121435	1.34	32.6	0.016	210	-5	0.104	1	-1	0.079	67	-5	120	5	4.2	0.5	0.8	1.37	4	0.559	37	0.35	0.02	2.11
117538	517611	4128372	0.409	164	0.041	400	-5	0.401	-1	-1	0.058	55	-5	130	-3	4.71	0.3	1.2	1.05	3	0.109	31	0.37	0.02	33.8
117540	530735	4154588	0.283	19.8	0.001	1370	-5	0.177	1	1	0.218	84	-5	50	3	6.95	1.5	1.1	1.86	4	0.019	52	0.22	0.023	3.81
117542	532229	4152345	0.479	13.9	0.001	773	-5	0.126	-1	-1	0.085	48	-5	80	-3	12	0.5	0.9	1.14	2	0.024	31	0.14	0.03	1.62
117544	529899	4155548	25.1	72.4	0.035	1353	-5	0.191	-1	-1	0.149	53	6	80	3	62.9	0.9	2.6	2.66	3	0.068	31	0.12	0.068	12.9
117546	528996	4149978	0.36	373	0.006	735	-5	0.296	-1	1	0.052	43	-5	100	3	12.3	0.7	2.2	0.377	2	0.477	25	0.12	0.029	3.37
117548	515466	4177714	0.051	15.9	0	564	-5	0.194	1	-1	0.188	74	5	60	4	4.1	0.5	3.2	1.94	4	0.06	44	0.36	0.23	4.89
117550	508714	4183016	0.072	33.6	0.004	924	-5	1.08	1	-1	0.096	67	-5	70	-3	15.8	1.1	7	3.55	5	0.421	39	0.28	0.014	10.1
117552	509928	4171415	0.198	46.8	0.0002	664	-5	1.02	1	-1	1.01	65	-5	60	3	22.9	0.6	5.7	2.12	4	0.05	36	0.31	0.033	40.1
117554	514265	4168855	0.482	31.3	0.0005	2481	-5	0.585	1	-1	0.238	56	-5	110	-3	25.1	0.9	5.9	2.98	5	0.069	32	0.16	0.015	6.18
117556	517148	4161731	0.426	29.3	0.001	915	-5	0.244	1	-1	0.126	70	-5	60	4	4.89	0.6	3.4	1.18	6	0.076	40	0.27	0.029	8.05

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm
117558	521669	4157954	0.154	45.6	0.006	855	-5	0.556	-1	-1	0.088	67	-5	120	3	5.84	0.7	4.2	0.621	4	0.057	39	0.38	0.019	11.2
117560	625210	4109364																							
117563	505929	4141286	0.051	57.8	0	330	-5	0.127	1	-1	0.105	87	7	50	3	6.6	1	2.1	1.93	5	-0.014	51	0.44	0.113	5.51
117564	503528	4142336	0.026	29.4	0	264	-5	0.099	-1	1	0.061	92	-5	70	-3	5.16	0.4	1	1.19	7	0.01	53	0.43	0.03	3.27
117566	498925	4128645	0.029	10.4	0.0005	490	-5	0.049	-1	3	0.23	77	11	30	3	12	0.9	2.3	2.69	6	-0.004	42	0.43	0.103	0.76
117568	497951	4130960	0.03	8.79	0.0004	477	-5	0.041	-1	-1	0.058	107	-5	50	3	9.75	0.5	0.8	1.87	6	0.024	64	0.4	0.063	1.12
117570	499055	4133773	0.016	10.8	0.0005	160	-5	0.089	-1	1	0.087	135	-5	60	5	3.83	0.7	1.3	1.14	11	0.021	76	0.71	0.094	0.521
117572	600618	4064537	0.031	47.3	0.0009	26	-5	0.147	1	8	0.083	12	-5	240	-3	9.96	0.4	1.1	0.329	1	0.036	7	0.09	0.011	11.8
117574	602903	4065442	0.039	3.99	0.002	146	-5	0.129	2	5	0.146	16	-5	180	-3	4.21	0.3	0.9	1.16	1	0.058	9	0.08	0.057	1.1
117576	519249	4173024	0.069	4.04	0.001	1204	-5	0.156	1	-1	0.067	77	-5	50	-3	15.7	0.6	10.9	13.2	4	0.138	46	0.16	0.024	5.53
117578	523217	4168880	0.264	13	0.001	999	-5	1.3	1	-1	0.05	69	7	140	-3	6.43	0.8	2.9	1.6	4	0.014	39	0.26	0.048	5.99
117580	515002	4163690	1.35	23.1	0.002	716	-5	1.21	1	-1	0.426	65	5	190	-3	25.8	1.1	3.2	1.82	5	0.07	37	0.29	0.022	8.98
117582	625764	4108657																							
117607	624327	4109051	0	51.2	0.0005	-10	-5	0.25	1	6	0.117	14	-5	160	-3	7.11	0.2	2	0.381	1	0.03	8	0.08	0.018	1.44
117609	621505	4103072	0.018	34.2	0.0008	-10	-5	0.233	1	-1	0.026	16	-5	140	-3	5.37	0.2	1.6	0.347	1	0.026	9	0.05	0.012	2.82
117611	622442	4098889	0.046	118	0.0005	140	-5	0.493	1	3	0.124	20	8	270	6	7.22	0.3	2.4	0.635	2	0.056	13	0.11	0.085	2.5
117613	618887	4109645	0.055	36.9	0.0006	-10	-5	0.309	1	1	0.153	18	-5	250	-3	5.89	0.2	2.4	0.635	2	0.05	10	0.05	0.014	4.09
117659	626740	4097220	0.014	4.89	0	-10	-5	0.202	2	3	0.037	9	-5	140	-3	1.75	0.2	0.4	0.145	1	0.005	6	-0.05	0.017	0.587
117661	625155	4096338	0.025	32.9	0.0004	-10	-5	0.249	1	4	0.43	18	-5	130	-3	4.91	0.4	1.4	0.218	1	0.019	9	0.06	0.009	0.992
117663	624529	4097335	0.02	14.4	0	-10	-5	0.281	1	-1	0.034	18	-5	170	-3	2.71	-0.2	0.6	0.095	2	0.004	9	0.05	0.011	0.687
117665	617674	4096588	0.032	71.6	0.0002	1381	-5	0.27	1	1	0.135	20	-5	180	-3	19.3	0.4	1.3	1.1	2	0.04	11	0.18	0.052	3.52
117667	623680	4094166	0.015	54.8	0.0004	-10	-5	0.325	1	-1	0.037	15	-5	140	-3	4.02	0.5	1.2	0.158	1	-0.016	8	0.06	0.010	1.08
117669	624985	4090407	0.013	22.7	0.0008	-10	-5	0.232	1	1	0.022	10	-5	150	-3	2.39	0.3	0.5	0.059	1	0.002	6	-0.05	0.012	0.774
117671	625289	4087390	0.017	208	0.0004	-10	-5	0.208	2	15	0.041	10	-5	80	-3	5.59	0.4	1.4	0.011	1	0.01	5	0.05	0.009	1.21
117674	563933	4154576	0.077	25.2	0.012	1126	-5	0.351	1	2	0.088	94	10	120	-3	8.44	1.5	4.6	2.69	6	0.438	58	0.21	0.043	4.02
117676	563743	4154122	0.227	12.7	0.0009	377	-5	0.461	1	-1	0.125	77	-5	110	3	5.06	1.1	3.5	3.1	5	0.425	51	0.16	0.019	5.96
117678	572612	4155011	0.045	14.3	0.003	88	-5	0.199	2	4	0.062	32	-5	140	-3	3.1	0.4	1	0.478	2	0.071	17	0.19	0.034	1.17
117680	576352	4158421	0.048	41	0.0006	394	-5	0.321	1	1	0.11	63	-5	90	-3	3.44	0.8	2.2	1.27	4	0.151	37	0.32	0.031	2.87
117682	577118	4146494	0.024	12	0.0003	37	-5	0.234	1	1	0.051	26	-5	100	6	2.11	0.6	0.5	0.642	1	0.141	14	0.18	0.050	4.51
117700	587583	4175195	0.115	196	0.006	4706	-5	0.239	1	5	0.164	59	9	90	11	4.04	1.1	3.6	1.37	2	0.256	35	0.5	0.109	5.18
117702	588042	4172950	0.026	2.57	0.0001	790	-5	0.293	1	3	0.096	64	10	60	-3	3.3	0.4	2.4	2.97	3	-0.036	37	0.28	0.058	0.671
117704	592873	4174698	0.135	168	0.001	576	-5	0.58	1	-1	0.162	70	5	40	3	7.91	1	5.4	1.79	4	0.416	41	0.38	0.033	5.24
117706	593299	4173747	0.027	8.05	0.0005	922	-5	0.331	1	2	0.062	91	7	40	4	2.54	1	2.1	1.98	6	0.034	54	0.36	0.047	1.43
117708	574610	4142661	0.036	335	0.0006	148	-5	0.475	-1	-1	0.055	65	-5	90	4	1.98	0.7	3.1	1.48	4	4.74	36	0.35	0.028	25.1
117710	574358	4141197	0.029	22.5	0.0003	125	-5	0.243	1	-1	0.049	64	-5	120	3	1.59	0.6	0.7	0.813	5	0.501	38	0.4	0.021	0.944
117712	573542	4139572	0.036	5.91	0.0007	-10	-5	0.334	1	-1	0.202	85	-5	110	6	1.91	0.4	1.1	1.48	6	0.226	45	0.65	0.145	1.25
117714	567569	4133444	0.035	4.79	0.0002	534	-5	1.57	1	-1	0.188	160	6	60	-3	2	0.7	2.3	2.51	10	0.089	90	0.72	0.117	0.546
117716	555692	4138935	0.044	1.47	0.0004	-10	-5	0.397	1	-1	0.112	106	-5	140	4	1.78	0.6	1.1	1.05	10	-0.011	59	0.68	0.076	0.968
117718	541230	4133838	0.047	1.65	0.0007	214	-5	0.343	1	-1	0.149	204	-5	90	-3	2.56	1.6	2.1	1.24	14	-0.033	121	0.71	0.135	1.36
117720	541382	4133547	0.06	1.03	0.0005	441	-5	0.404	-1	-1	0.195	261	-5	20	-3	2.93	0.6	2.5	1.58	20	-0.008	151	0.93	0.165	0.888
117722	543221	4115551	0.022	2.24	0	1263	-5	1.45	1	2	0.166	211	-5	40	3	0.857	1.5	1.9	1.95	13	-0.008	129	0.57	0.106	0.545
117724	532202	4123631	0.04	1.55	0	1911	-5	0.272	1	3	0.09	168	8	30	-3	4.68	2.8	3.4	2.25	10	-0.017	99	0.55	0.099	2.21
117726	548484	4084022	0.04	2.08	0.002	674	-5	0.484	1	-1	0.04	118	-5	110	-3	0.644	1.6	0.7	0.81	7	0.055	69	0.41	0.047	0.452
117728	540920	4084015	0.025	2.55	0	146	-5	0.437	1	2	0.049	66	-5	90	3	0.178	0.9	0.7	1.42	5	0.024	37	0.42	0.058	0.461
117730	539910	4087159	0.029	3.02	0.0004	120	-5	0.401	1	1	0.218	50	-5	170	-3	0.988	0.6	0.6	1.4	3	0.023	29	0.28	0.098	0.709
117732	541962	4083211	0.039	0.479	0.0002	410	-5	0.39	1	-1	0.06	95	-5	70	5	0.751	1.2	0.8	1.19	5	0.041	54	0.4	0.076	0.541
117751	644237	4117590	0.015	92.8	0.0006	107	-5	0.09	1	25	0.054	22	-5	30	-3	5.15	0.5	1.2	0.305	1	0.193	11	0.11	0.044	0.883
117754	646686	4123449	0.013	1.72	0.0009	12	-5	0.021	1	-1	0.014	8	-5	180	-3	4.36	-0.2	0.4	0.289	1	0.002	5	-0.05	0.007	0.812
117755	650225	4123264	0.014	2.34	0.0008	37	-5	0.019	2	5	0.034	7	-5	150	-3	5.1	0.2	0.4	0.231	-1	-0.002	4	-0.05	0.014	1.29
117757	649874	4117928	0.018	1.56	0	133	-5	0.077	1	3	0.042	11	-5	210	-3	5.2	0.3	0.7	0.571	1	0.015	6	-0.05	0.02	0.925
117759	649538	4113831	0.019	5.04	0.0002	26	-5	0.039	1	10	0.026	18	-5	90	-3	4.27	-0.2	0.5	0.184	1	-0.016	11	0.05	0.01	0.521
117761	644503	4113262	0.016	1.72	0.0003	-10	-5	0.016	1	18	0.032	14	-5	50	-3	4.3	0.3	0.4	0.333	-1	0.007	8	0.05	0.024	0.425
117763	646547	4096020	0.014	5.03	0	-10	-5	0.042	1	-1	0.022	19	-5	120	-3	4.25	0.3	0.6	0.258	1	-0.007	12	-0.05	0.002	0.766
117765	641526	4103444	0.024	51	0.0009	54	-5	0.104	1	2	0.046	8	-5	190	-3	5.74	0.2	0.6	0.167	-1	0.018	5	-0.05	0.015	3.17
117767	634112	4110375	0.02	7.13	0.0004	-10	-5	0.052	1	17	0.695	3	-5	60	-3	5.27	-0.2	0.1	0.098	-1	0.01	3	-0.05	0.01	0.569
117769	632649	4112828	0.005	8	0	-10	-5	0.023	1	-1	0.021	12	-5	130	-3	3.33	0.2	0.5	0.184	2	0.05	7	-0.05	0.003	0.705
117771	630778	4104908	0.015	5.92	0	23	-5	0.023	1	2	0.056	9	-5	110	-3	4.17	0.2	0.4	0.237	1	0.007	5	-0.05	0.015	0.602

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample	UTM	UTM	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo
Number	East	North	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm
117773	629839	4103448	0.015	8.57	0.0008	-10	-5	0.016	1	-1	0.037	9	-5	160	-3	2.91	-0.2	0.5	0.099	1	-0.014	6	-0.05	0.006	0.971
117775	629296	4102998	0.012	8.34	0.0007	-10	-5	-0.012	3	13	0.037	9	-5	100	-3	2.44	0.2	0.6	0.082	1	0.025	5	-0.05	0.002	0.671
117777	635906	4101101	0.017	5	0.001	-10	-5	0.026	1	3	0.04	11	-5	140	-3	3.04	0.3	0.3	0.06	1	0.019	5	0.06	0.008	0.663
117779	638099	4098536	0.008	40.3	0	-10	-5	-0.019	2	16	1.63	4	-5	20	-3	4.37	0.2	0.3	0.424	-1	-0.002	3	-0.05	0.024	0.433
117781	649486	4089896	0.009	4.82	0	-10	-5	-0.004	1	17	0.019	10	-5	100	-3	4.74	0.2	0.3	0.315	-1	-0.01	6	-0.05	0.018	0.533
117783	641532	4090538	0.032	166	0	391	-5	0.111	1	9	0.069	47	15	70	-3	15.7	1.4	4.2	1.24	6	0.05	22	0.43	0.314	4.46
117785	631284	4089898	0.012	122	0	20	-5	0.035	1	2	0.05	15	-5	130	-3	7.73	-0.2	1.4	0.288	2	0.027	8	-0.05	0.003	1.38
117787	645512	4084762	0.028	6.99	0	193	-5	0.211	1	8	0.032	38	6	80	-3	7.27	0.7	2	0.477	6	0.007	18	0.3	0.172	0.877
117789	643477	4083328	0.009	31.6	0.001	159	-5	0.057	1	4	0.062	13	5	140	-3	8.08	0.3	1.3	0.396	2	0.029	6	0.12	0.178	0.917
117791	633292	4080947	0.034	4.13	0.0003	164	-5	-0.004	1	7	0.261	15	-5	140	-3	7.97	0.6	0.3	0.379	1	-0.004	9	0.07	0.012	0.876
117793	633556	4071884	0.02	38.7	0	21860	-5	0.046	1	2	0.066	14	-5	160	-3	20	0.3	1.7	0.64	-1	0.012	9	0.07	0.028	2.38
117795	643048	4081405	0.02	14.5	0	445	-5	0.153	1	12	0.092	40	8	50	-3	17.7	1.4	3.8	0.838	3	0.04	19	0.36	0.49	0.987
117797	644154	4078290	0.015	22.7	0	355	-5	0.027	1	-1	0.035	16	-5	140	-3	9.99	0.5	1.4	1	2	0.002	8	0.09	0.029	1.19
117799	643900	4075464	0.024	26.5	0	1301	-5	0.074	1	1	0.056	30	8	110	-3	9.37	0.7	3.3	0.421	4	0.009	15	0.17	0.058	2
117801	643554	4069040	0.026	5.57	0	88	-5	0.069	1	2	0.049	27	20	120	-3	27.5	0.4	3.8	1.23	2	0.003	13	0.16	0.022	1.37
117803	541150	4100706	0.019	1.31	0	651	-5	0.215	1	-1	0.065	60	-5	160	-3	3.07	0.5	0.6	0.953	3	0.501	36	0.29	0.068	1
117805	540910	4095137	0.024	3.16	0	375	-5	0.187	1	-1	0.064	80	-5	120	-3	3.73	0.4	1.4	0.927	5	2.44	49	0.31	0.017	1.42
117807	540830	4095738	0.014	1.49	0	573	-5	0.076	1	-1	0.211	69	-5	90	-3	3.79	0.4	1.2	0.914	4	0.157	41	0.22	0.051	0.698
117809	545013	4097664	0.027	1.57	0	446	-5	0.475	-1	-1	0.083	102	-5	60	-3	2.9	0.9	1	0.81	6	0.115	61	0.39	0.022	1.84
117812	641386	4054758	0.016	3.27	0.001	-10	-5	0.055	1	-1	0.019	17	-5	150	-3	2.43	0.2	0.6	0.213	2	0.03	9	-0.05	0.003	0.997
117814	641305	4058588	0.018	5.66	0.0004	32	-5	0.072	1	4	0.02	19	-5	190	-3	2.85	-0.2	0.9	0.374	2	0.004	10	-0.05	0.007	1.91
117816	648967	4064689	0.012	10.3	0.0008	153	-5	0.099	1	20	0.055	39	-5	40	-3	3.49	0.7	1.8	0.514	3	-0.004	19	0.25	0.039	0.536
117818	627632	4067672	0.008	60.2	0	11	-5	0.037	1	29	0.034	19	-5	30	-3	3.24	0.3	1.1	0.918	1	0.003	10	0.07	0.023	0.876
117820	619818	4078239	0.01	84.7	0.0005	-10	-5	0.055	1	17	0.09	8	-5	130	-3	3.17	0.2	2.8	0.126	1	0.002	4	-0.05	0.005	2.85
117822	615941	4066980	0.009	16.2	0.001	11	-5	0.055	1	13	0.057	9	-5	90	-3	4.29	0.4	0.8	0.56	1	0.042	4	-0.05	0.016	1.15
117824	520225	4119696	0.036	5.04	0.001	94	-5	0.125	1	-1	0.087	80	-5	140	-3	2.12	0.4	0.9	1.11	6	0.025	45	0.38	0.044	1.62
117826	520445	4114248	0.026	3.18	0.002	662	-5	0.123	2	3	0.196	163	8	100	3	6.54	1.2	2.7	3.32	11	-0.003	99	0.48	0.115	1.09
117828	525924	4110721	0.032	4.89	0.001	693	-5	0.063	2	-1	0.119	166	-5	70	6	2.69	1.2	1.7	2.74	12	0.16	104	0.67	0.09	0.764
117830	527947	4104653	0.024	2.43	0.0009	798	-5	0.103	2	2	0.098	152	6	120	4	4.03	1.4	1.8	1.78	11	0.025	91	0.48	0.078	1.49
117832	543957	4110418	0.014	0.947	0.0004	151	-5	0.071	1	-1	0.051	62	-5	200	-3	2.21	-0.2	0.7	0.829	3	0	37	0.25	0.054	1.25
117834	604463	4087580	0.019	10.8	0	153	-5	0.089	1	7	0.051	8	-5	170	-3	7.04	-0.2	0.7	0.371	-1	0.019	4	-0.05	0.011	1.21
117836	603870	4081631	0.013	62.8	0.0003	-10	-5	0.07	1	25	0.048	6	-5	70	-3	1.65	0.2	0.6	0.199	-1	0.018	4	-0.05	0.005	0.798
117838	610408	4069654	0.018	2.14	0	-10	-5	0.11	3	7	0.038	6	-5	200	-3	2.81	-0.2	0.2	0.219	1	0.008	2	-0.05	0.003	3.3
117840	610736	4076027	0.012	20.3	0.0006	335	-5	0.105	2	18	0.043	20	-5	50	-3	3.61	0.4	0.8	0.37	-1	0.002	11	0.13	0.264	1.31
117842	607173	4080256	0.023	21.8	0	-10	-5	0.151	1	1	0.053	12	-5	290	-3	5.24	0.2	1.4	0.484	1	0.038	6	0.05	0.01	3.61
117844	603742	4070845	0.015	1.96	0.0008	-10	-5	0.062	2	3	0.033	5	-5	260	-3	2.93	0.2	0.3	0.149	1	0.023	3	-0.05	0.004	2.68
117846	598355	4070422	0.034	10.8	0	-10	-5	0.112	1	2	0.027	6	-5	220	-3	6.53	0.2	0.9	0.27	1	0.028	4	-0.05	0.005	1.43
117848	597623	4067287	0.015	5	0	-10	-5	0.086	1	6	0.036	8	-5	280	-3	4.44	0.2	0.5	0.187	1	0.027	5	0.05	0.005	2.6
117851	639652	4049991	0.012	5.51	0.0005	58	-5	0.111	1	5	0.023	15	-5	100	-3	2.51	0.3	0.6	0.271	2	0.034	8	0.07	0.021	0.956
117853	643855	4064550	0.017	159	0.0008	15	-5	0.16	1	9	0.06	19	-5	100	-3	6.05	0.3	7.6	0.984	1	0.074	11	0.14	0.019	9.51
117855	643745	4066137	0.034	45.3	0.001	1942	-5	0.14	1	4	0.046	22	21	130	-3	9.18	0.4	2.5	0.897	2	0.026	11	0.15	0.161	1.33
117858	646199	4070081	0.021	15.9	0.001	182	-5	0.095	1	19	0.036	19	-5	80	-3	8.58	0.3	1.1	0.447	3	-0.011	9	0.15	0.071	1.08
117859	646445	4072326	0.038	15.4	0.001	300	-5	0.089	1	5	0.137	23	-5	140	-3	7.47	0.6	2.6	0.564	3	0.016	11	0.16	0.167	1.6
117861	649555	4067967	0.02	16.5	0.0008	242	-5	0.093	1	12	0.046	30	-5	110	-3	13.4	0.5	2	0.528	4	0.027	14	0.28	0.183	1.36
117863	632086	4065840	0.016	20.8	0.0008	23	-5	0.051	1	23	0.044	12	-5	80	-3	2.98	0.2	0.7	0.485	1	0.025	6	0.11	0.011	1.05
117865	638319	4096473	0.013	34	0.0008	82	-5	0.074	1	19	0.036	25	-5	50	-3	2.64	0.4	1.3	0.927	4	0.011	12	0.21	0.079	0.692
117867	627353	4059809	0.019	12.3	0.0009	-10	-5	0.033	3	20	0.039	10	-5	60	-3	1.89	0.3	0.4	0.253	1	0.02	5	-0.05	0.004	0.569
117869	619271	4073388	0.024	7.83	0.0009	-10	-5	0.129	1	1	0.024	7	-5	350	-3	3.42	0.2	0.4	0.251	1	0.012	4	-0.05	0.002	3.67
117871	619044	4075187	0.027	10.5	0	43	-5	0.109	1	6	0.037	10	-5	180	-3	2.94	0.3	0.5	0.194	-1	0.041	6	0.06	0.006	0.908
117873	615574	4090288	0.089	55.9	0.0002	543	-5	1.98	1	3	0.161	22	-5	310	5	16.2	0.6	1.9	1.57	2	0.035	12	0.13	0.053	3.86
117875	616116	4070389	0.023	10.9	0.0008	367	-5	0.112	1	11	0.333	11	-5	100	-3	8.18	0.2	0.7	0.494	1	0.054	6	0.06	0.021	1.11
117877	614866	4064523	0.021	382	0.001	-10	-5	0.146	1	17	0.173	10	-5	160	-3	10.4	-0.2	1.7	1.05	-1	0.039	5	-0.05	0.012	2.89
117879	518936	4118870	0.031	1.48	0.001	579	-5	0.117	1	-1	0.136	157	-5	50	-3	2.14	0.4	1.7	1.12	11	0.023	90	0.61	0.133	0.882
117881	519891	4117924	0.03	5.96	0.001	225	-5	0.141	1	-1	0.084	80	-5	130	-3	3.02	0.4	1.3	1.45	5	0.019	44	0.4	0.059	1.82
117883	526114	4113012	0.031	1.63	0.001	256	-5	0.127	3	3	0.191	248	9	40	4	4.4	1.5	3.2	1.78	19	0.015	147	0.87	0.178	0.548
117885	524010	4109961	0.031	2.64	0.0003	1026	-5	0.101	-1	-1	0.06	133	-5	150	3	2.32	0.7	1.3	1.91	8	0.135	79	0.41	0.035	1.81
117887	526940	4104569	0.032	2.41	0.002	1051	-5	0.103	-1	1	0.096	179	-5	60	-3	3.13	1.2	1.5	1.74	16	0.048	100	1.23	0.035	0.662

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm
117889	529061	4105102	0.038	4.9	0.002	620	-5	0.152	1	-1	0.23	234	5	90	4	5.08	1.9	2	2.41	20	0.188	141	0.94	0.126	2.06
117891	531149	4107268	0.033	3.88	0.002	1386	7.8	0.053	1	6	0.17	204	16	60	-3	14.7	1.4	4.9	3.88	20	-0.019	109	0.86	0.151	0.435
117893	542540	4110040	0.048	10.1	0.001	247	6.6	0.153	2	1	0.241	227	-5	110	-3	4.17	0.6	1.8	2.72	14	-0.004	129	0.74	0.135	3.07
117895	540191	4105579	0.028	5.23	0.001	184	-5	0.266	1	1	0.102	93	-5	200	-3	2.95	0.4	0.8	3.29	5	0.008	35	0.37	0.041	2.1
117897	500381	4143082	0.024	33.7	0.002	564	-5	0.108	1	2	0.089	50	5	380	-3	5.13	0.9	1.4	1.61	3	0.033	28	0.25	0.047	5.68
117899	492296	4142440	0.042	1.72	0.002	351	-5	0.151	-1	-1	0.093	104	5	90	3	3.16	1.1	1.4	1.62	10	0.056	61	0.43	0.084	0.617
117901	495294	4145691	0.052	2.18	0	956	-5	0.136	1	-1	0.131	57	-5	350	-3	3.28	1.6	1.2	1.57	7	0.053	31	0.3	0.078	3.56
117904	583290	4174219	0.104	5.25	0.0005	1068	-5	0.432	2	1	0.181	121	8	60	-3	5.43	1.4	2.8	2.98	6	0.055	72	0.31	0.070	0.732
117906	582585	4167858	0.039	2.39	0	1006	-5	0.353	-1	-1	0.05	118	5	30	-3	1.74	1.2	1.9	1.56	7	0.018	65	0.31	0.044	0.574
117908	577368	4167468	0.035	28.8	0	1161	-5	0.424	2	2	0.056	106	10	50	-3	2.82	0.9	3.7	1.8	7	0.027	61	0.29	0.068	1.8
117910	577576	4165978	0.034	133	0.0009	427	-5	0.451	1	1	0.251	55	18	40	8	5.34	0.9	2.7	1.33	3	0.034	33	0.22	0.027	12.5
117912	577292	4161777	0.131	25.3	0.006	-10	-5	0.26	1	8	0.041	6	-5	80	-3	2.92	-0.2	2	0.161	-1	0.249	3	-0.05	0.019	5.78
117914	564292	4147872	0.044	6.35	0.002	538	-5	0.412	1	4	0.085	65	10	80	-3	6.33	1.1	4.2	0.877	4	0.213	35	0.29	0.134	0.943
117916	563961	4149351	0.028	42.6	0.0008	572	-5	0.283	1	-1	0.042	50	-5	140	-3	2.62	0.6	1.4	1.04	3	0.117	29	0.16	0.032	3.32
117918	563601	4149734	0.082	18	0.0006	350	-5	0.358	1	-1	0.056	64	-5	110	3	28.5	1	3.5	0.759	6	0.226	33	0.34	0.021	1.24
117920	563826	4151163	0.055	56	0.0008	456	-5	0.559	1	-1	0.102	85	5	70	-3	32.3	1.1	3.1	0.721	11	0.406	45	0.45	0.010	11.3
117922	550428	4136331	0.045	7.11	0.0004	217	-5	0.37	1	-1	0.177	129	-5	40	3	3.44	0.5	1.7	1.2	9	0.04	75	0.61	0.082	1.13
117924	540522	4123211	0.034	0.806	0	396	-5	0.238	-1	-1	0.172	224	7	30	-3	3.67	1.4	2.1	1.2	21	0.006	146	0.98	0.195	1.05
117926	536910	4124545	0.051	2.52	0.0006	555	13	0.325	2	4	0.285	337	-5	40	4	6.02	1.9	2.9	1.42	43	-0.002	201	1.88	0.148	2.94
117935	585021	4156831	0.039	144	0.0008	576	6	0.24	<1	<1	0.147	102	<5	140	3	3.56	2	3.4	1.36	7	0.122	64	0.38	0.034	4.59
117937	586763	4154543	0.076	119	0.001	636	-5	0.294	1	<1	0.09	80	6	140	8	3.47	1.1	4.1	1.44	6	1.35	48	0.4	0.044	3.02
117939	569947	4136226	0.068	12.8	0.0004	157	-5	0.362	1	-1	0.185	91	-5	70	3	2.95	0.3	0.9	1.56	7	0.029	60	0.65	0.031	0.706
117941	568453	4134885	0.05	1.42	0	45	-5	0.652	1	-1	0.134	173	-5	130	-3	18.7	0.4	1.8	1.48	11	0.01	104	0.56	0.085	2.96
117943	562835	4142352	0.047	1.03	0	-10	-5	0.417	1	-1	0.177	174	-5	50	-3	1.74	0.2	1.6	0.592	17	0.017	97	0.89	0.124	0.742
117945	562153	4143618	0.049	1.58	0	19	-5	0.439	1	-1	0.17	215	-5	50	-3	1.62	0.3	1.9	1.37	17	-0.026	123	0.86	0.126	0.682
117947	562356	4144505	0.079	6.19	0.0003	3659	-5	0.748	1	1	0.063	68	-5	120	-3	15.5	0.7	1.3	0.625	7	0.249	36	0.26	0.026	0.668
117949	547670	4133857	0.051	1.77	0	938	-5	0.479	-1	2	0.238	154	14	70	14	9.02	2.2	3.8	4.06	14	-0.026	106	0.76	0.121	1.3
117951	575826	4151883	0.036	129	0.0006	649	-5	0.242	1	<1	0.087	61	11	130	3	5.73	1.5	5.7	0.786	7	0.101	32	0.41	0.052	1.81
117953	576652	4173844	0.01	24	0.001	724	-5	0.17	1	3	0.081	110	8	50	<3	3.88	0.3	2.5	1.68	8	0.016	72	0.3	0.081	1.08
118252	523235	4127241	1.1	3.18	0.171	622	-5	0.08	-1	1	0.056	87	-5	90	-3	3.94	1	1.2	1.13	6	0.018	52	0.25	0.056	0.715
118254	524371	4127368	0.871	6.38	0.468	389	9	0.059	-1	-1	0.033	76	-5	130	4	6.83	0.4	1	1.09	5	0.104	44	0.3	0.031	1.03
118256	524487	4127238	0.114	30.9	0.016	1040	-5	0.095	-1	-1	0.047	116	5	70	3	8.93	1	2	2.69	7	0.072	70	0.33	0.044	0.937
118258	521101	4131137	0.037	53.5	0.0003	524	-5	0.122	-1	-1	0.074	99	-5	60	-3	3.45	0.8	1	0.849	7	0.028	58	0.47	0.045	3.8
118260	499617	4126352	0.096	8.28	0.001	343	-5	0.195	1	2	0.201	110	6	200	5	6.65	1.1	1.7	2.12	7	0.057	64	0.56	0.123	3.09
118262	546351	4190018	0.709	113	0.029	644	-5	0.231	1	-1	0.067	53	-5	180	12	3.08	0.4	1.5	1.05	2	0.437	32	0.21	0.017	3.15
118264	548434	4191524	1.96	176	0.02	648	-5	0.135	-1	-1	0.075	74	-5	130	8	4.96	0.5	1.9	1.96	3	0.054	46	0.11	0.017	1.94
118266	548583	4191561	14.8	637	0.078	983	-5	0.087	-1	-1	0.244	88	-5	100	5	10.7	1.4	3.6	1.86	5	0.422	53	0.18	0.01	3.59
118268	549122	4191765	3.9	93.5	0.029	616	-5	0.028	1	-1	0.097	61	-5	140	10	3.71	1	1.5	0.768	2	0.268	38	0.13	0.023	1.45
118270	550259	4190922	0.012	8.04	0.001	538	-5	0.128	1	-1	0.075	84	-5	120	4	17.8	0.5	1.2	1.77	3	0.01	49	0.28	0.048	1.6
118272	550710	4190380	0.013	3.15	0.002	458	-5	0.102	1	1	0.045	75	-5	60	3	1.97	0.7	1.1	1.29	4	-0.004	44	0.26	0.052	0.645
118274	541982	4190578	0.727	403	0.015	1338	-5	0.205	1	-1	0.075	43	-5	260	12	5.18	0.8	1.3	0.675	2	0.307	27	0.13	0.01	5.44
118276	562935	4158626	0.043	24.9	0.001	645	-5	0.146	1	-1	0.05	59	-5	130	-3	5.62	1	2.5	2.04	3	2.34	32	0.12	0.015	5.11
118278	561774	4156141	0.054	4.26	0.001	610	-5	0.214	1	1	0.07	43	-5	320	-3	6.43	0.5	3	2.16	4	0.354	25	0.12	0.021	3.55
118280	562822	4167324	0.03	15.9	0.001	832	-5	0.201	1	2	0.058	76	-5	50	-3	3.45	0.7	2.2	2.72	4	0.187	47	0.16	0.019	1.38
118282	567364	4171243	0.045	109	0.002	644	-5	0.303	1	-1	0.111	71	-5	100	-3	2.32	1.5	1.3	1.48	4	0.433	43	0.27	0.016	18.6
118284	563485	4175269	0.65	12	0.005	786	-5	0.099	1	1	0.07	63	7	180	5	4.28	0.6	3.3	2.25	4	1.44	37	0.29	0.089	3.44
118286	507199	4180334	0.059	15.5	0.001	687	-5	0.344	1	-1	0.081	76	-5	60	-3	6.55	0.8	1.6	1.01	4	0.106	45	0.22	0.013	3.02
118288	503593	4175273	0.029	3.96	0.0007	676	-5	0.164	1	-1	0.049	65	-5	110	4	2.29	1.1	1	1.42	4	0.044	40	0.2	0.041	1.65
118290	505177	4173587	0.023	6.65	0.0009	902	-5	0.17	1	-1	0.063	93	7	50	4	7.67	1.4	1.9	2.14	5	0.002	54	0.2	0.069	0.761
118292	503031	4176167	0.047	19.3	0.0006	885	-5	0.134	1	-1	0.044	85	-5	90	3	17	0.5	0.9	1.22	4	0.044	55	0.21	0.019	2.71
118294	507201	4173500	0.171	165	0.008	543	-5	0.494	1	-1	0.118	78	10	170	-3	38.9	0.6	5.1	11.5	4	0.169	45	0.2	0.079	47.7
118296	511501	4170532	0.097	10.1	0.003	1120	-5	0.504	-1	-1	0.25	97	-5	50	-3	32.2	0.7	6.5	2.12	5	0.033	58	0.24	0.008	10.7
118298	515284	4164210	0.086	7.68	0.002	1120	-5	0.221	-1	-1	0.097	76	-5	140	3	3.74	0.7	1.7	1.16	4	0.037	45	0.21	0.025	2.23
118300	513192	4155626	0.037	38.5	0.002	813	-5	0.128	1	-1	0.151	99	-5	50	3	6.41	1	2.2	1.18	6	0.098	58	0.27	0.026	1.48
118302	513141	4156069	0.06	57.7	0.001	778	-5	0.227	1	-1	0.088	96	-5	120	6	6.35	1.2	1.9	2.41	5	0.037	58	0.27	0.041	4.12
118304	513035	4156380	0.2	44.2	0.008	1520	-5	0.116	1	1	0.082	79	-5	220	4	4.49	0.7	1.5	0.833	4	0.061	44	0.52	0.034	3.71
118306	507230	4158590	1.43	154	0.075	803	-5	1.11	1	-1	0.121	79	-5	100	-3	63.2	1	3.7	6.2	5	0.708	48	0.24	0.02	2.65

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm
118308	500755	4159286	0.053	26.5	0	554	-5	0.246	2	-1	0.104	99	-5	140	3	12.5	0.6	2.6	2.66	7	0.078	58	0.51	0.033	2.77
118310	555762	4142479	0.041	2.17	0.0006	113	-5	0.126	-1	-1	0.234	211	-5	50	3	2.88	0.8	1.8	1	20	0.011	120	1.09	0.132	0.987
118312	555881	4142721	0.055	2.03	0.003	72	6.9	0.117	1	-1	0.208	192	-5	90	3	3.2	0.7	1.9	0.986	18	0.013	100	1.02	0.136	1.75
118314	556614	4146600	0.027	4.59	0.002	230	-5	0.144	1	-1	0.159	204	-5	100	4	2.66	1.8	3.1	2.21	13	0.023	113	0.92	0.178	1.52
118316	557854	4149372	0.22	6.07	0.003	360	-5	0.113	1	-1	0.047	36	-5	180	-3	4.52	0.7	1.2	0.39	4	0.549	17	0.15	0.004	0.858
118318	563131	4180347	0.048	184	0.001	643	-5	0.346	1	-1	0.147	72	-5	130	3	7.29	1.7	3.2	4.05	4	0.079	40	0.22	0.027	8.43
118320	562724	4181839	0.032	21.3	0.001	414	-5	0.223	-1	-1	0.075	71	-5	60	3	3.54	1.1	1	0.93	4	0.043	40	0.25	0.014	2.15
118322	562249	4185730	0.088	6.19	0.002	324	-5	0.42	1	-1	0.059	55	-5	300	-3	3.46	0.6	0.8	0.807	3	0.072	33	0.22	0.044	5.15
118324	559105	4188173	0.029	3.53	0.001	425	-5	0.142	1	-1	0.063	76	-5	60	4	1.52	1	1.3	1.14	3	0.019	45	0.3	0.036	0.637
118326	556911	4190231	1.13	10.3	0.002	609	-5	1.07	2	1	0.132	59	-5	140	-3	32.4	1	1.8	2.06	3	0.032	35	0.34	0.058	4.21
118328	558619	4192350	0.03	7.38	0.001	639	-5	0.094	1	-1	0.053	107	-5	280	3	4.2	1.4	1	1.42	4	0.016	62	0.2	0.057	1.77
118330	557011	4193148	0.025	5.14	0.001	439	-5	0.239	-1	1	0.036	73	-5	120	3	2.05	0.9	1.1	1.62	3	0.004	44	0.23	0.033	1.58
118332	556940	4193276	0.011	2.34	0.002	281	-5	0.057	1	-1	0.048	77	-5	40	3	1.05	0.8	1	1.32	3	0.026	44	0.3	0.044	0.421
118334	567061	4184248	0.03	18.2	0.002	1026	-5	0.042	1	-1	0.201	116	-5	60	-3	4.26	0.9	1.4	2.46	5	0.051	67	0.1	0.007	1.61
118336	556346	4180867	0.083	45.6	0.002	549	-5	0.163	1	-1	0.06	76	-5	90	5	1.67	0.5	0.9	0.566	3	0.041	46	0.29	0.045	6.9
118338	555215	4181749	0.143	16.2	0.002	628	-5	0.553	1	-1	0.053	86	-5	240	5	3.34	0.9	0.9	0.872	3	0.007	54	0.24	0.022	11.6
118340	554557	4182938	0.381	18.6	0.002	555	-5	0.413	1	-1	0.049	59	-5	140	3	1.92	0.6	0.6	0.293	2	0.031	36	0.22	0.016	16.5
118342	554744	4183559	0.103	8.16	0.002	657	-5	0.126	-1	-1	0.053	82	-5	170	4	2.08	0.5	0.8	1.01	3	0.026	51	0.25	0.019	5.98
118344	554732	4183735	0.54	64.2	0.002	547	-5	0.231	1	-1	0.076	55	-5	240	-3	9.14	0.8	1.9	0.856	3	0.065	32	0.23	0.017	10.4
118346	552088	4185658	0.104	8.86	0.002	509	-5	0.091	1	-1	0.06	77	-5	50	3	1.56	1	1.3	0.762	3	0.049	46	0.27	0.072	2.82
118348	554685	4182062	0.165	20.8	0.002	678	-5	0.064	1	-1	0.033	63	-5	150	6	2.01	0.7	0.6	0.501	3	0.041	37	0.16	0.015	2.45
118351	542469	4166952	0.026	4.55	0.003	1277	-5	0.113	1	1	0.066	83	-5	60	3	3.7	1.5	1.4	2.07	5	0.024	50	0.17	0.046	0.849
118353	556644	4161116	0.049	20.4	0.003	526	-5	0.169	-1	1	0.083	68	8	130	3	24.2	1.2	4	3.21	4	0.112	37	0.31	0.066	7.34
118355	556700	4159432	0.061	18.8	0.001	942	-5	0.161	2	-1	0.071	80	18	110	-3	17.6	1	4.5	4.99	6	0.207	46	0.27	0.076	1.67
118357	556880	4156994	0.109	109	0.006	748	-5	0.857	1	1	0.801	69	9	140	4	15.8	0.8	4.8	2.67	5	0.937	39	0.33	0.071	10.1
118359	554709	4172071	0.016	3.4	0.002	1169	-5	0.076	1	2	0.041	88	-5	60	4	1.76	0.9	1.5	2.61	4	0.03	57	0.21	0.05	0.549
118361	554915	4175742	0.169	31.3	0.003	760	-5	0.307	1	-1	0.08	79	-5	110	3	4.95	1.4	2	1.57	4	0.058	47	0.21	0.066	4.84
118363	514839	4182238	0.025	9.84	0.002	480	-5	0.12	-1	-1	0.073	79	8	60	4	6.67	0.9	2.1	2.05	4	0.049	43	0.44	0.098	1.46
118365	514403	4183521	0.037	4.15	0.002	421	-5	0.178	2	-1	0.044	69	-5	110	4	2.65	1	1.1	2.04	4	0.036	39	0.37	0.039	1.69
118367	510353	4185351	0.037	13.7	0.001	509	-5	0.08	1	-1	0.051	75	-5	90	3	3.04	0.5	1.1	1.73	6	0.057	43	0.48	0.067	1.98
118369	539910	4087159	0.063	34.9	0.002	512	-5	0.172	1	1	0.087	75	-5	170	-3	5.94	-0.2	2.3	2.45	7	0.139	40	0.67	0.033	2.5
RC1094-01	607731	4113097	0.013	277	0.003	368	-5	0.712	1	-1	2.61	47	10	190	10	152	1.1	5.7	1.79	13	0.065	22	0.47	0.052	3.81
RC1094-02	601148	4118446	0.093	609	0.018	511	-5	5.89	2	-1	1.09	48	5	170	-3	30.8	0.7	19.9	6.57	5	0.129	25	0.24	0.019	26.7
RC1094-03	599806	4119027	0.243	461	0.133	515	-5	39.6	-1	-1	2.65	60	55	120	4	38.6	1	22.6	5.99	6	2.67	30	0.29	0.094	2.57
RC0595-04	588306	4141279	0.027	54.1	0.0002	540	-5	0.274	-1	-1	0.113	70	-5	90	5	1.78	0.7	2.5	1.09	4	0.186	41	0.35	0.075	2.4
RC0695-05	598398	4115661	0.048	111	0.002	461	-5	3.8	-1	-1	0.613	25	6	150	-3	37	-0.2	3.2	1.7	3	0.148	14	0.1	0.047	3.41
RC0695-06	597600	4116493	0.044	81	0.003	272	-5	0.615	-1	-1	0.287	44	14	140	4	35.3	0.5	6	1.16	6	0.986	24	0.31	0.064	2.33
RC0795-07	597679	4110213	0.055	14.1	0.002	172	-5	0.212	1	-1	0.113	38	7	190	-3	11.9	0.8	1.4	0.326	7	0.084	22	0.24	0.019	0.627
RC0995-09	603840	4110834	2.21	85.3	0.016	200	-5	0.231	1	<1	0.18	45	9	190	5	19.5	1.1	5	0.92	6	0.153	24	0.27	0.042	1.57
RC1095-10	600453	4116935	0.091	250	0.004	870	-5	1.29	1	<1	0.573	83	53	130	6	48.4	1.6	17.7	1.89	8	0.114	46	0.5	0.276	2.65
RC1095-11	599906	4115071	0.421	257	0.004	520	5	0.286	1	<1	1.01	48	23	210	3	59.6	1	14.5	3.48	5	0.106	26	0.28	0.112	5.12
RC1095-12	585693	4147747	0.072	118	0	638	-5	0.266	1	2	0.134	74	8	140	5	4.32	1.2	5.3	2.14	5	0.153	43	0.35	0.093	6
RC1095-13	585184	4147602	0.051	45.3	0.001	193	-5	0.345	1	1	0.111	69	<5	290	3	3.85	0.8	2	1.28	4	0.409	47	0.34	0.034	6.3

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	Na INAA ppm	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
49401	1400	2	-10	10	10.20	80	2.93	0.9	-0.93	0.9	-2	50	-1	-0.5	0.6	2.8	0.05	-0.46	1.2	-20	-2	4	0.3	12.30	48
49403	5100	6	20	11	10.60	180	2.18	1.7	-0.94	3	-2	97	-1	-0.5	0.6	9	0.10	-0.47	2.5	-20	2	9	0.9	12.90	103
49405	2100	12	20	10	6.16	230	11.00	1.1	-0.95	2.5	-2	111	-1	-0.5	-0.5	15	0.09	0.59	6.6	-20	4	9	0.9	7.88	68
49407	1400	8	20	10	10.50	230	4.65	2.1	-0.93	3.3	-2	68	-1	-0.5	-0.5	13	0.17	0.50	4.1	-20	-2	11	1	6.16	87
49409	2600	4	-10	9	152.00	180	495.00	0.6	3.56	0.8	3	48	-1	-0.5	35.6	4.1	0.03	0.87	1.7	-20	-2	6	0.6	121.00	33
49411	1400	4	20	8	5.26	40	3.64	2.7	-0.95	3.5	-2	33	-1	-0.5	-0.5	5.1	0.14	-0.47	3.5	-20	3	31	3.9	8.22	99
49413	1900	7	20	26	15.50	110	1.91	6.2	2.20	4.7	-2	105	-1	0.5	1.5	7.9	0.36	-0.49	8	45	17	21	1.9	37.30	189
49415	1500	7	20	33	12.90	90	4.70	5.4	1.29	4.2	4	67	-1	0.6	1.2	6.7	0.31	-0.46	4.4	29	8	21	1.9	97.30	181
49417	23000	30	40	9	10.90	140	0.71	3.8	-0.92	7.5	-2	78	-1	0.9	-0.5	17	0.19	0.50	3.8	-20	-2	33	3.6	82.20	252
49419	2400	9	20	9	5.80	-30	0.78	5.9	-0.97	4.3	-2	808	-1	-0.5	1.0	8.2	0.69	0.61	2.9	177	-2	10	0.8	34.70	166
49452	3200	9	20	10	9.68	160	11.90	4.1	-0.99	3.8	-2	123	-1	-0.5	-0.5	11	0.16	-0.49	4.3	-20	6	16	1.2	111.00	89
49454	3400	8	20	11	12.80	150	9.61	3.5	-0.94	3.3	3	134	-1	-0.5	-0.5	9.8	0.19	0.58	4.5	21	4	15	1.3	36.40	95
49456	3500	10	30	11	10.40	160	2.16	5.7	-0.97	4.9	-2	129	-1	0.5	-0.5	12	0.36	-0.48	5.8	34	3	16	1.3	53.30	163
49458	4300	9	20	9	7.43	130	1.01	2.6	-0.95	3.6	-2	75	-1	-0.5	-0.5	14	0.20	-0.48	3.6	-20	-2	12	1.2	39.00	92
49460	5700	13	30	8	13.50	170	1.53	3.5	-0.92	4.8	-2	118	-1	0.6	-0.5	19	0.23	-0.46	6.2	37	-2	18	1.6	37.80	135
49462	14000	13	30	10	9.82	150	1.21	4.8	-0.99	5.9	-2	314	-1	0.6	-0.5	17	0.28	-0.49	6.4	50	-2	27	3	35.50	150
49464	1000	12	20	9	7.65	240	5.33	2.4	-0.97	3.9	-2	71	-1	-0.5	-0.5	16	0.17	0.58	5.6	-20	-2	14	1.5	11.60	108
49466	3200	9	20	11	7.23	160	2.80	1.9	-0.98	3.6	2	63	-1	-0.5	-0.5	14	0.14	-0.49	4	-20	-2	12	1.1	12.40	87
49468	5700	11	20	9	14.90	150	2.26	2.2	-0.96	3.7	-2	84	-1	-0.5	-0.5	17	0.17	-0.48	4.9	25	-2	14	1.1	15.80	111
49470	10000	12	20	7	5.06	180	1.14	2.6	-1.00	3.8	2	132	-1	-0.5	-0.5	16	0.18	-0.50	4.5	-20	-2	11	1.5	17.90	110
49472	10000	11	20	8	17.20	120	1.50	3.4	-0.94	4	-2	192	-1	-0.5	-0.5	17	0.23	0.63	5.1	-20	2	15	1.4	31.00	123
49474	9900	13	30	9	9.71	150	1.70	3.6	-0.98	5	3	155	-1	0.6	-0.5	17	0.26	0.59	5.6	48	-2	19	1.9	23.80	128
49476	4800	19	40	8	4.65	110	0.48	2.5	-0.98	6.4	-2	133	-1	0.7	-0.5	21	0.26	-0.49	5	22	-2	25	2.4	9.12	202
49478	8500	19	30	10	5.76	140	0.53	1.9	-0.99	5.1	4	156	-1	0.5	-0.5	20	0.22	-0.50	4.2	-20	-2	23	2.4	11.50	312
49480	2800	18	30	7	6.79	100	0.28	1.6	-0.97	5	3	76	-1	0.6	-0.5	16	0.16	-0.48	5.9	-20	-2	19	1.9	15.20	125
49482	4000	23	40	11	3.68	230	2.02	2.1	-0.91	7	2	252	-1	0.7	-0.5	24	0.21	-0.46	5.9	-20	3	26	2.4	14.30	184
49484	4100	21	40	11	9.50	270	8.30	2.1	-0.92	6.6	-2	87	-1	0.6	-0.5	18	0.21	0.58	6.4	-20	4	26	2.4	21.30	203
49486	3500	20	40	9	9.77	260	3.21	2.6	-0.99	7	3	85	-1	0.8	-0.5	16	0.28	0.58	5.2	22	2	31	2.6	19.00	241
49488	7100	10	20	10	4.86	40	0.65	8.6	2.15	3.8	4	773	-1	-0.5	1.6	5.4	0.86	0.58	3	191	-2	12	1	22.70	188
117502	8300	16	20	9	9.49	190	4.73	2.9	0.102	3.9	-2	153	-1	-0.5	0.181	14	0.2	0.524	8.4	-20	11	17	1.7	28.1	144
117504	3800	20	20	12	9.65	130	3.76	2.2	0.15	3.3	3	86	-1	-0.5	0.164	12	0.16	0.439	6.1	23	5	22	2	21.4	131
117506	14000	16	30	8	10.6	210	2.61	2.1	0.116	4.8	3	160	-1	-0.5	0.141	18	0.18	0.411	6.3	28	5	19	1.9	15.7	105
117508	8200	12	20	10	9.21	90	1.98	5.6	0.153	3.9	-2	356	-1	-0.5	0.179	8.3	0.29	0.429	5	31	6	22	1.9	52.9	148
117510	3300	22	20	11	40.1	110	1.51	0.9	0.265	3.7	-2	121	1	0.8	0.12	9.6	0.13	0.717	5.9	20	5	26	2.3	30.9	140
117512	9100	22	20	9	9.36	120	1.6	1	0.219	3.5	3	96	-1	0.7	0.125	12	0.12	0.783	6.2	-20	4	25	2.5	25	112
117514	23000	49	50	13	12.7	210	0.511	1.5	0.196	9.3	3	114	3	1.1	0.166	16	0.13	0.225	3.8	-20	5	57	5	71.3	351
117516	3500	8	10	8	90.1	90	1.32	1.5	0.78	2.2	-2	109	-1	-0.5	3.46	7.2	0.16	0.203	2.2	-20	2	10	0.8	22.7	85
117518	15000	15	30	13	15.2	130	1.64	5	0.154	4.6	-2	399	-1	-0.5	0.113	9.1	0.6	0.146	3.3	109	4	19	1.2	37.3	230
117520	3900	13	30	10	221	100	11.3	4.5	1.39	4.2	-2	644	1	-0.5	8.92	11	0.39	0.53	4.6	91	4	15	1.5	84.2	183
117522	20000	25	30	12	5.67	180	0.761	2.1	0.176	4.7	3	148	2	-0.5	0.164	20	0.3	0.265	4	49	3	26	2.4	28.2	183
117524	14000	23	30	10	10.1	210	1.29	1.6	0.229	4.7	3	119	-1	0.6	0.156	16	0.22	0.916	3.1	32	3	25	2.5	23	174
117526	10000	28	20	9	5.96	120	0.478	2.3	0.316	3	-2	94	2	-0.5	0.183	18	0.17	0.374	3	-20	3	20	2.5	10.3	125
117528	24000	23	30	19	6.2	80	0.28	10.1	0.15	5.1	-2	340	-1	0.6	0.094	13	0.67	0.08	2.3	108	2	28	2.5	49.1	185
117530	5300	22	20	10	5.25	200	3.94	1.5	0.288	3.5	-2	70	-1	-0.5	0.175	17	0.16	0.328	4.5	-20	6	20	2	8.98	116
117532	22000	17	30	21	5.3	110	1.53	8.3	0.257	4.8	-2	360	-1	0.6	0.178	11	0.55	0.213	2.2	80	4	24	2	40.4	216
117534	4500	25	30	10	6.95	120	0.581	2.4	0.417	5.8	-2	151	-1	0.7	0.166	19	0.17	0.302	4	-20	4	29	2.9	14.3	130
117536	7100	26	20	9	8.9	260	3.21	1.9	0.447	4.3	-2	73	-1	-0.5	0.094	20	0.18	0.428	6.6	28	5	23	2.4	12	135
117538	4000	17	20	11	7.08	210	2.58	1.9	0.276	3.5	-2	105	1	0.5	0.178	13	0.2	0.433	3.2	28	3	26	2.7	28.7	139
117540	16000	13	30	10	15.8	190	0.661	2.3	0.163	3.8	-2	258	-1	-0.5	0.32	14	0.24	0.428	3	25	-2	13	1.2	44.5	161
117542	10000	9	10	8	34.2	130	0.714	2.2	0.055	2.5	3	154	-1	-0.5	2.18	10	0.16	0.523	2.3	-20	4	8	1	38.6	108
117544	2900	8	20	12	82.2	230	1.56	3.9	0.097	2.9	-2	326	-1	-0.5	4.81	6	0.35	0.537	1.6	-20	4	9	0.9	90.1	185
117546	5400	7	10	9	8.94	120	14.3	1.9	0.226	2	-2	104	-1	-0.5	0.123	9	0.15	0.36	1.6	-20	4	7	0.9	7.61	86
117548	11000	15	30	11	17.9	180	0.89	3.3	0.201	4.8	8	115	-1	0.5	0.116	21	0.23	0.48	5.7	28	2	20	2.2	88.2	126
117550	1900	15	20	7	7.54	70	1.76	6.9	4.08	4.2	8	1002	-1	0.5	2.21	12	0.71	0.429	4.8	150	4	17	1.7	74.9	199
117552	3200	11	20	5	41	150	1.65	7.9	0.57	4.2	5	127	-1	-0.5	0.814	18	0.37	0.537	6.8	75	2	22	2	106	136
117554	5200	10	20	5	26.3	50	5.34	6.1	0.92	3.2	8	578	-1	-0.5	0.504	25	0.56	0.498	3.4	131	-2	10	1.1	68.3	187
117556	5200	12	20	9	17.7	130	0.736	6	0.319	3.9	6	350	-1	-0.5	0.403	13	0.43	0.479	4.1	58	-2	17	1.7	48	221

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample	Na	Nb	Nd	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb	Te	Th	TiO2	Ti	U	V	W	Y	Yb	Zn	Zr
Number	INAA	XRF	INAA	XRF	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
117558	600	13	20	8	23.7	110	2.4	5.5	0.416	4.1	10	108	-1	-0.5	0.283	12	0.23	0.325	5.6	24	7	21	2.6	44.3	176
117560																									
117563	13000	27	30	11	12.9	140	1.27	3.7	0.307	5.8	-2	166	-1	0.7	0.156	14	0.4	0.5	3.4	85	4	34	3	35.1	216
117564	8700	27	30	7	5.65	130	1.48	2.6	0.179	5.5	-2	153	-1	0.7	0.172	11	0.27	0.202	3.4	34	6	30	2.9	16.2	303
117566	19000	32	30	15	5.34	110	1.14	6.9	0.174	4.9	-2	401	2	0.6	0.136	14	0.49	0.248	2.4	95	4	29	2.8	47.4	228
117568	25000	30	30	6	7.07	170	1.28	1	0.161	5.5	-2	109	-1	0.5	0.161	17	0.18	0.628	3	20	5	28	2.8	46.1	217
117570	22000	37	50	12	7.71	130	0.813	2.6	0.125	8.5	-2	103	-1	0.9	0.176	15	0.19	0.482	3.2	-20	3	41	4.6	23.3	358
117572	-500	2	-10	15	4.57	-30	0.992	0.8	0.816	0.8	5	69	-1	-0.5	0.145	1.4	0.07	0.294	1.7	-20	-2	7	0.5	20.5	66
117574	-500	2	-10	12	4.3	-30	0.452	1.7	0.068	1.2	4	107	-1	-0.5	0.134	1.9	0.09	0.422	0.6	-20	-2	8	0.6	19.2	62
117576	2100	12	20	7	12.7	70	0.694	6.6	0.289	3.8	2	277	-1	-0.5	0.175	22	0.48	0.332	3.7	89	-2	9	1	104	140
117578	1500	11	20	14	8.28	110	0.93	5.5	0.353	4.1	5	103	-1	-0.5	0.604	12	0.37	0.465	2.7	46	-2	17	1.5	40.4	142
117580	6000	11	20	13	82.5	140	0.692	4.6	0.874	3.7	5	155	-1	-0.5	0.518	13	0.29	0.41	3.5	28	-2	15	1.8	85.1	149
117582																									
117607	-500	4	-10	22	11.7	-30	2.76	1.1	0.242	0.9	-2	28	-1	-0.5	0.3	1.3	0.07	0.349	2.8	37	-2	5	0.4	38.3	45
117609	-500	4	-10	18	6.23	-30	1.83	1.2	0.305	0.9	-2	28	-1	-0.5	0.23	1.9	0.10	0.375	0.6	41	-2	3	0.3	5.39	53
117611	900	5	10	27	10.6	-30	5.14	1.5	0.117	1.3	-2	48	-1	-0.5	0.093	1.7	0.10	1.05	1.4	56	-2	8	0.7	25.1	65
117613	-500	4	-10	19	7.11	-30	2.7	1.2	0.335	1	-2	30	-1	-0.5	0.18	2.1	0.09	0.595	0.9	41	-2	4	0.3	53.6	54
117659	-500	3	-10	14	1.95	-30	0.261	0.7	0.332	0.5	-2	22	-1	-0.5	0.078	0.9	0.05	0.236	0.7	-20	-2	2	0.2	4.35	29
117661	-500	4	-10	15	6.3	-30	1.6	1.2	0	1.2	-2	32	-1	-0.5	0.105	2.1	0.08	0.267	0.7	26	-2	3	0.4	18.6	45
117663	-500	4	-10	15	3.16	-30	0.528	1.2	0.073	1.2	-2	19	-1	-0.5	0.175	2.1	0.12	0.341	0.6	26	-2	3	0.3	6.4	60
117665	1000	5	10	21	4.57	-30	2.7	2.1	0.187	1.5	-2	61	-1	-0.5	0.218	2.3	0.15	0.857	2.5	133	-2	9	0.9	34.1	58
117667	-500	4	-10	17	3.56	-30	2.05	1.2	0.028	0.9	-2	23	-1	-0.5	0.175	2.2	0.12	0.161	0.5	31	4	4	0.4	12.9	56
117669	-500	3	-10	15	2.77	-30	1.8	0.7	0.369	0.6	-2	19	-1	-0.5	0.151	1.2	0.06	0.144	-0.5	21	-2	2	0.2	7.02	37
117671	-500	2	-10	17	8.27	-30	8.98	0.7	0.097	0.7	-2	76	-1	-0.5	0.136	1.3	0.04	0.129	1	25	4	4	0.3	33.9	50
117674	6000	17	30	19	8.06	30	2.42	6.6	0.384	5.1	-2	787	-1	-0.5	0.462	14	0.74	0.338	4.5	95	-2	15	1.4	27.7	229
117676	800	13	20	18	22.8	30	0.846	3.7	-0.088	3.4	3	390	-1	-0.5	0.163	16	0.58	0.422	2.6	62	-2	11	1.2	19.1	172
117678	2700	8	10	16	5.28	50	3.47	1.8	-0.112	1.9	-2	65	-1	-0.5	0.077	6.8	0.13	0.244	2.6	31	-2	11	1.1	14	60
117680	2300	14	20	16	15.3	150	3.94	3.4	0.194	3.9	-2	74	-1	-0.5	0.125	14	0.19	0.329	4.4	27	-2	22	2.1	36.2	154
117682	6300	10	10	15	1.85	90	6.98	0.9	0.282	2.1	3	60	2	-0.5	0.098	8	0.07	0.729	2.5	-20	-2	12	1.1	14.5	48
117700	1400	8	20	18	29.4	60	6.25	5.3	0.129	3.6	3	186	-1	0.7	0.128	9.1	0.23	0.723	9.4	29	-2	31	3.3	61.4	71
117702	19000	15	20	16	4.06	100	0.261	7	0.296	3.8	5	363	-1	-0.5	0.157	17	0.62	0.348	3.9	74	-2	17	1.6	49.5	156
117704	1500	13	20	14	27.6	60	7.8	8.2	0.322	4.1	4	142	-1	-0.5	0.195	18	0.58	0.359	7.7	96	-2	19	2.4	184	128
117706	16000	16	30	15	8.36	190	0.637	6.1	-0.011	5.3	-2	309	-1	-0.5	0.1	19	0.49	0.328	5.7	56	-2	25	2.5	37.2	184
117708	9600	24	30	15	7.97	170	232	1.7	0.087	4.8	7	144	1	0.5	0.085	16	0.18	6.12	3.3	-20	-2	24	2.5	23.6	140
117710	5500	26	30	20	6.91	330	2.25	1.5	0.176	4.7	-2	48	1	0.6	0.084	19	0.16	0.489	4.7	-20	-2	31	2.7	12	137
117712	11000	33	40	17	17.2	300	5.39	1.4	-0.483	7.7	-2	46	2	1	0.161	24	0.10	0.528	5.5	-20	-2	50	4.2	65.9	173
117714	24000	40	60	17	99.8	120	0.772	6	0.094	10.5	10	190	2	1.1	0.3	11	0.58	0.899	3.9	23	-2	57	4.8	39.7	517
117716	20000	38	40	15	12.4	140	0.381	1.5	-0.205	7.5	2	44	-1	0.6	0.104	14	0.11	0.64	4.1	-20	-2	45	4.2	26.5	394
117718	27000	46	70	14	7.59	80	0.254	5.1	-0.163	11.1	7	44	3	1.1	0.09	16	0.27	0.864	19.7	-20	-2	46	4.9	47.4	620
117720	38000	67	90	17	10.1	110	0.287	7.1	-0.432	14.3	7	73	2	1.7	0.197	22	0.42	0.771	3.9	21	-2	65	6.4	54.1	877
117722	25000	33	70	14	7.15	130	0.753	5.2	-0.049	10.1	-2	341	-1	1	0.202	19	0.44	0.836	3.2	-20	-2	38	3.9	37.2	569
117724	33000	37	60	14	8.28	90	0.392	9.7	-0.242	10.9	-2	447	2	1.2	0.195	13	0.89	0.464	2.7	42	-2	43	3.8	62.6	530
117726	19000	18	40	16	5.11	150	0.352	2.8	0.243	7	-2	119	-1	0.6	0.09	16	0.20	0.701	3.5	-20	-2	26	2.5	14.1	231
117728	17000	21	20	14	10.3	110	0.241	1.4	-0.026	4.7	2	289	-1	0.8	0.182	19	0.11	0.936	8.3	-20	-2	23	2.6	20.2	124
117730	10000	16	20	14	8.06	60	0.268	0.9	0.09	3.5	-2	288	1	-0.5	0.123	13	0.10	1.03	14.7	-20	-2	17	1.8	14.1	92
117732	24000	25	40	15	6.77	130	0.429	2.2	-0.311	6.1	4	151	-1	0.5	0.136	21	0.19	1.23	5.1	-20	-2	31	2.9	24.2	193
117751	-500	-2	10	11	5.35	-30	0.614	3.9	0.103	1.6	-2	139	-1	-0.5	0.178	1.7	0.07	1.04	1.7	-20	-2	11	0.9	15.9	40
117754	500	-2	-10	14	1.9	-30	0.224	0.9	0.24	0.5	-2	32	-1	-0.5	0.117	0.6	0.09	0.25	0.6	-20	-2	3	0.2	6.04	51
117755	800	-2	-10	8	2.14	-30	0.303	0.6	0.182	0.6	-2	64	-1	-0.5	0.093	0.9	0.04	0.345	16.7	-20	-2	3	0.2	5.24	33
117757	1600	3	-10	16	1.98	-30	0.237	1.7	0.14	0.8	-2	92	-1	-0.5	0.125	1.4	0.16	0.473	7	-20	2	4	0.3	10.2	89
117759	-500	-2	-10	8	2.89	-30	0.349	1.3	0.12	1.3	-2	137	-1	-0.5	0.178	1.6	0.06	0.387	4.5	-20	-2	8	0.5	5.63	64
117761	-500	-2	-10	8	2.39	-30	0.173	0.9	-0.119	1	-2	185	-1	-0.5	0.137	1.5	0.03	0.083	1.3	-20	-2	7	0.4	10.6	38
117763	-500	2	-10	8	5.12	-30	0.303	1	-0.031	1	-2	23	-1	-0.5	0.095	1.9	0.13	0.23	0.5	-20	2	4	0.4	4.2	72
117765	-500	-2	-10	10	5.51	-30	0.724	0.3	0.16	0.5	-2	31	-1	-0.5	0.114	0.6	0.03	0.485	0.6	-20	-2	4	0.2	18.4	29
117767	-500	-2	-10	7	5.36	-30	0.463	0.5	-0.066	-0.5	-2	28	-1	-0.5	0.072	-0.5	0.03	0.66	0.8	-20	2	3	0.2	34.3	35
117769	-500	-2	-10	10	2.4	-30	0.328	0.8	0.319	0.6	-2	20	-1	-0.5	0.167	1.4	0.1	0.185	-0.5	-20	-2	4	0.3	6.42	65
117771	-500	-2	-10	8	2.39	-30	0.341	0.6	0.127	0.7	-2	23	-1	-0.5	0.123	0.9	0.06	0.111	-0.5	-20	-2	4	0.2	7.16	44

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	Na INAA ppm	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
117773	-500	-2	-10	6	4.66	-30	0.427	0.6	0.08	0.5	3	19	-1	-0.5	0.155	1	0.06	0.145	-0.5	-20	-2	3	0.2	8.15	58
117775	-500	-2	-10	9	3.82	-30	0.375	0.8	0.06	0.5	4	125	-1	-0.5	0.168	1.1	0.04	0.301	0.7	-20	-2	3	0.2	5.32	53
117777	-500	-2	-10	8	4.89	-30	0.349	0.7	0.138	1.1	-2	27	-1	-0.5	0.155	1.1	0.06	0.273	0.5	-20	-2	6	0.3	3.52	43
117779	-500	-2	-10	5	8.61	-30	0.833	0.6	0.132	-0.5	-2	44	-1	-0.5	0.074	-0.5	0.03	0.177	0.6	-20	-2	2	-0.2	148	23
117781	-500	-2	-10	9	1.05	-30	0.32	0.6	0.217	0.6	-2	155	-1	-0.5	0.149	-0.5	0.02	0.193	-0.5	-20	-2	5	0.2	18	27
117783	2100	7	20	25	10.7	40	1.47	3.9	4.46	5	-2	109	-1	0.8	0.17	5	0.22	0.193	1.9	-20	5	36	3	35.7	215
117785	-500	3	-10	15	7.68	-30	1.96	1.2	0.314	1	-2	35	-1	-0.5	0.176	1.9	0.13	0.158	1.1	-20	2	4	0.3	11.4	86
117787	3700	6	10	18	246	40	0.43	4.2	0.223	3.2	3	101	-1	0.5	0.163	5.3	0.24	0.071	2.1	25	-2	22	1.9	32.6	203
117789	-500	2	-10	18	5.24	-30	0.566	1	0.237	1.2	-2	144	-1	-0.5	0.18	2.2	0.11	0.281	1.1	-20	-2	8	0.8	23.3	99
117791	-500	-2	-10	14	2.32	-30	0.508	0.9	0.531	1.1	-2	103	-1	-0.5	0.097	1	0.06	0.08	1.6	-20	-2	9	0.4	15	52
117793	-500	-2	-10	25	4.25	-30	10.4	1.6	0.527	0.7	-2	124	-1	-0.5	0.178	1	0.1	0.311	0.7	-20	3	5	0.4	48	48
117795	4000	9	20	22	10.4	40	0.477	6.2	0.414	4.4	-2	193	-1	0.7	0.169	4.6	0.3	0.172	2.2	53	2	32	2.3	37.9	138
117797	1200	3	10	13	3.82	30	0.481	3	0.555	1.3	-2	40	-1	-0.5	0.234	2.5	0.25	0.234	1.1	35	-2	6	0.6	11.8	85
117799	700	7	10	24	9.16	40	0.509	3.6	0.536	2.4	-2	127	-1	-0.5	0.177	4.1	0.33	-0.019	3.1	-20	4	11	1.1	49.5	152
117801	2400	6	10	29	13.2	-30	0.409	4	0.55	2	-2	127	-1	-0.5	0.186	3.7	0.21	0.277	1.6	-20	2	10	1	87.4	86
117803	8100	13	20	8	36.7	50	0.371	0.9	0.277	2.9	3	241	-1	-0.5	0.09	9.5	0.17	1.16	5.7	-20	-2	20	1.6	11.7	143
117805	7000	19	20	10	6	90	0.585	1.7	0.23	3.9	3	119	-1	-0.5	0.196	15	0.23	0.226	4.4	25	4	20	2	8.45	161
117807	5100	15	20	10	5.15	80	0.468	1.2	0.363	3.7	-2	89	1	-0.5	0.167	12	0.19	0.162	3.3	-20	2	17	1.3	19	148
117809	9000	22	30	7	4.83	90	0.422	2.3	0.085	5	-2	95	-1	0.5	0.246	18	0.28	0.117	3.2	36	3	24	2.6	11	219
117812	-500	-2	-10	8	2.58	-30	0.205	1	0.36	0.9	2	23	-1	-0.5	0.169	1.5	0.09	0.427	-0.5	-20	-2	3	0.2	3.58	77
117814	-500	2	-10	8	1.98	-30	0.251	1.1	0.266	1.1	3	62	-1	-0.5	0.167	2.1	0.09	0.247	0.7	-20	-2	5	0.4	3.76	78
117816	1400	5	20	10	7.4	70	0.26	4.9	0.084	3.3	-2	221	-1	-0.5	0.173	4.9	0.18	0.37	1.9	26	-2	19	1.6	23.4	112
117818	-500	-2	10	10	3.47	-30	0.603	1.6	0.098	1.3	12	173	-1	-0.5	0.143	1.8	0.05	0.371	1.4	-20	-2	8	0.5	11.9	47
117820	-500	-2	-10	13	2.96	-30	2.85	0.7	0.124	0.5	4	66	-1	-0.5	0.138	0.8	0.04	0.215	2.2	-20	2	4	0.4	21.5	53
117822	-500	-2	-10	11	4.63	-30	1.25	0.8	0.227	1	3	58	-1	-0.5	0.22	1.1	0.05	0.646	0.9	-20	-2	5	0.3	14.6	52
117824	24000	30	30	7	9.32	150	0.859	1.1	0.027	4.9	5	65	-1	0.5	0.217	17	0.15	0.63	2.5	-20	3	26	2.6	33.8	204
117826	23000	38	50	13	11.9	140	0.444	6.8	0.314	8.1	5	388	-1	0.9	0.214	16	0.55	0.457	2.7	107	3	38	3.1	49.6	398
117828	25000	40	50	8	11.5	190	0.591	2.7	0.047	8	4	143	-1	0.8	0.155	18	0.25	0.593	3	26	-2	41	4	51.6	441
117830	25000	37	50	13	9.58	100	0.496	3.8	0.156	7.2	7	276	-1	0.8	0.172	14	0.41	0.357	3.5	82	-2	38	3.4	47.5	387
117832	14000	19	20	10	4.65	70	0.177	1.4	0.105	3.4	3	55	-1	-0.5	0.098	12	0.15	0.415	12.3	-20	-2	19	1.7	20.6	129
117834	-500	-2	-10	14	2.26	-30	0.808	1	0.245	0.6	6	69	-1	-0.5	0.164	0.9	0.06	0.462	0.5	-20	-2	3	0.3	16.9	42
117836	-500	-2	-10	5	2.44	-30	1	0.8	0.101	-0.5	4	140	-1	-0.5	0.2	0.6	0.03	0.603	-0.5	-20	-2	4	0.2	7.53	28
117838	-500	-2	-10	10	0.919	-30	0.343	0.3	0.102	-0.5	-2	69	-1	-0.5	0.209	0.6	0.03	0.636	1.1	-20	-2	2	-0.2	3.86	36
117840	800	2	10	8	11.2	-30	0.579	1.1	-0.014	1.3	2	204	-1	-0.5	0.146	1.3	0.06	0.275	0.5	-20	3	12	0.8	9.03	43
117842	-500	-2	-10	14	3.27	-30	0.363	0.7	0.188	0.9	-2	41	-1	-0.5	0.114	0.8	0.04	0.479	1.5	-20	-2	5	0.3	53	46
117844	-500	-2	-10	10	1.25	-30	0.323	0.3	0.106	-0.5	-2	31	-1	-0.5	0.158	0.8	0.05	0.405	0.6	-20	-2	4	0.3	3.49	52
117846	-500	2	-10	12	2.31	-30	0.602	0.6	0.059	-0.5	5	29	-1	-0.5	0.157	0.9	0.06	0.563	0.5	-20	-2	4	0.2	6.5	50
117848	-500	-2	-10	14	2.09	-30	0.389	0.6	0.158	0.6	4	37	-1	-0.5	0.152	0.8	0.05	0.21	0.6	-20	-2	6	0.4	7.87	55
117851	500	2	-10	6	3.44	-30	0.286	1.1	0.337	1	-2	71	-1	-0.5	0.124	1.8	0.09	0.304	0.7	-20	-2	5	0.5	10.3	93
117853	-500	2	-10	20	6.65	-30	0.778	1.7	0.396	1.2	3	101	-1	-0.5	0.172	1.9	0.08	0.448	2.3	-20	3	7	0.6	34.7	59
117855	800	5	10	35	8.61	40	0.298	3.5	0.353	1.7	8	100	-1	-0.5	0.181	3.6	0.25	0.55	2	-20	-2	9	0.8	54.4	91
117858	2100	5	10	13	3.52	-30	0.472	2.4	0.18	1.7	2	166	-1	-0.5	0.147	2.4	0.23	0.195	1.3	19	-2	9	1	12.2	128
117859	3300	5	10	18	13.6	40	0.48	3.9	0.384	2.1	4	116	-1	-0.5	0.196	3	0.24	0.368	2.1	-20	-2	12	1	32.3	108
117861	2000	5	10	15	16.7	40	0.523	3.3	0.098	3	-2	169	-1	-0.5	0.145	4	0.17	0.514	1.9	-20	3	22	1.8	20.9	158
117863	-500	2	-10	8	2.83	-30	0.604	1.5	0.239	1	-2	199	-1	-0.5	0.187	1.6	0.08	0.544	1.1	-20	-2	8	0.6	8.94	58
117865	700	5	10	8	4.38	40	0.607	2.7	0.126	2.2	4	221	-1	-0.5	0.15	4.4	0.17	0.405	2.1	-20	-2	16	1.5	9.22	150
117867	500	-2	-10	7	2.86	-30	0.382	0.8	0.109	0.6	8	154	-1	-0.5	0.139	1.5	0.04	0.501	1.9	-20	-2	3	0.3	6.87	59
117869	-500	-2	-10	14	2.11	-30	0.907	0.5	0.16	0.5	4	24	-1	-0.5	0.194	0.7	0.05	0.593	-0.5	-20	2	4	-0.2	3.56	41
117871	-500	2	-10	12	2.08	-30	0.757	0.6	0.153	-0.5	6	45	-1	-0.5	0.199	0.9	0.06	0.438	0.8	-20	-2	5	0.4	8.3	38
117873	2800	4	10	22	6.16	40	3.56	2.2	0.402	1.6	5	96	-1	-0.5	0.175	3.9	0.15	0.579	1.6	-20	2	11	0.8	61.3	81
117875	-500	-2	-10	14	3.78	-30	1.15	1.7	0.198	0.9	-2	117	-1	-0.5	0.211	0.9	0.06	0.415	1.8	-20	-2	8	0.5	29.2	54
117877	-500	-2	-10	15	46.2	-30	7.45	0.8	0.063	0.6	-2	57	-1	-0.5	0.218	0.9	0.04	0.473	0.6	-20	3	6	0.3	39.2	38
117879	28000	46	60	10	13.9	130	0.292	2.1	0.112	9.7	6	167	2	1.1	0.173	16	0.24	0.294	2.9	41	-2	48	4	30.2	482
117881	22000	29	30	8	9.61	130	0.898	2.2	0.13	5.1	5	127	1	0.6	0.135	16	0.25	0.503	3.1	35	-2	29	2.6	38.9	205
117883	34000	55	90	12	19.7	170	0.344	6	0.224	13.6	12	166	1	1.7	0.162	18	0.47	0.536	1.9	76	3	71	6	47.4	696
117885	25000	29	40	12	8.67	170	1.13	1.7	0.073	6.7	7	186	2	0.7	0.156	14	0.27	0.512	2.6	23	4	28	2.7	74	314
117887	23000	30	70	8	11.2	190	0.602	2.3	0.14	11.2	3	185	3	1.3	0.142	30	0.27	0.648	6	-20	4	29	7.9	43.5	311

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample Number	Na INAA ppm	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
117889	28000	76	80	13	20	200	0.556	4.3	0.253	11.3	13	192	1	1.6	0.131	24	0.35	0.619	4.6	56	6	69	6.1	75.1	760
117891	25000	94	80	38	12.1	110	0.34	10.6	0.049	13	10	900	3	1.6	0.193	25	1.26	0.491	4.1	277	2	64	6.3	78.3	857
117893	27000	73	80	13	18.2	180	0.509	4	0.19	12.4	10	113	1	1.3	0.137	26	0.27	0.716	5.4	-20	4	58	5.4	91	617
117895	10000	26	30	9	7.57	60	0.502	1.1	0.107	4.7	3	69	1	0.6	0.216	25	0.14	0.697	7.6	-20	-2	30	2.7	21.6	164
117897	8600	15	20	12	4.03	40	1.53	3	0.104	3.6	6	222	-1	-0.5	0.144	6.7	0.26	0.582	8.7	26	-2	21	1.6	20.7	158
117899	19000	22	40	7	2.96	70	0.482	5.9	0.196	6	6	101	-1	0.6	0.217	12	0.3	0.331	3.4	35	-2	27	2.7	14.2	396
117901	17000	22	20	9	3.71	90	0.511	3.5	0.161	4	3	122	1	0.5	0.161	9.2	0.27	0.374	2.9	43	4	20	2.1	24.4	253
117904	21000	19	40	18	6.51	100	9.66	6.4	-0.021	7.1	-2	546	-1	0.8	0.139	15	0.53	1.01	3.7	48	-2	30	2.2	36.6	222
117906	24000	23	40	14	3.02	160	0.295	4.2	-0.116	7	3	410	1	0.8	0.124	15	0.55	0.758	3.6	33	-2	25	2.2	31.2	276
117908	22000	22	40	22	2.72	90	0.823	7.5	-0.01	7	3	586	-1	0.6	0.152	12	0.66	0.723	3	82	-2	25	1.9	22.3	305
117910	9500	12	20	15	4.56	120	1.11	3.6	0.07	3.4	3	417	-1	-0.5	0.174	14	0.24	0.735	5.8	52	-2	14	1.5	46	101
117912	-500	3	-10	13	6.73	-30	7.05	0.4	-0.16	-0.5	-2	45	-1	-0.5	0.097	0.8	0.05	0.582	1.3	-20	-2	-2	0.2	7.68	21
117914	6200	10	20	29	4.2	70	0.431	5.7	0.272	4.9	-2	218	-1	-0.5	0.129	8.7	0.36	0.725	1.9	54	-2	25	1.9	52.8	161
117916	4700	8	20	16	3.84	80	0.98	2.6	0.096	3.2	-2	177	-1	-0.5	0.145	6.8	0.29	0.297	4.6	67	-2	11	1.1	24	94
117918	1400	9	20	24	5.26	100	1.4	6.5	0.037	4.7	2	71	-1	0.5	0.129	9.9	0.35	0.72	2.4	73	-2	20	2.2	30.2	188
117920	2000	13	30	23	13.9	100	2.39	8	0.307	6.9	-2	130	1	0.9	0.16	18	0.38	0.64	4.1	59	-2	32	3.1	42	307
117922	28000	52	50	19	8.78	180	0.32	3	0.057	7.4	5	95	2	0.8	0.087	32	0.25	0.852	4.9	24	-2	39	3.8	41	306
117924	34000	74	80	16	11.9	140	0.288	5.8	-0.403	12.2	10	66	2	1.5	0.092	22	0.41	0.788	3.8	-20	-2	75	6	47.4	882
117926	36000	199	120	20	21.1	190	0.48	2.6	0.043	18.7	8	164	7	3.1	0.162	57	0.36	0.519	10.6	-20	-2	146	12.7	81.4	1820
117935	8100	16	40	19	16.2	310	4.23	3.8	0.46	5.6	-2	90	<1	0.7	0.148	20	0.18	0.514	7.5	34	-2	25	2.7	78.2	143
117937	7800	14	30	19	10.5	280	4.3	6.5	0.037	4.5	4	127	2	<0.5	0.175	17	0.35	0.442	6	72	-2	22	2.6	47.7	124
117939	8300	42	40	15	14.5	290	3.85	1.4	0.145	7.1	-2	43	2	0.8	0.125	19	0.11	0.422	4.7	-20	-2	50	4.4	58.9	210
117941	17000	34	60	15	13.4	100	0.413	5.5	-0.034	9.9	5	68	2	1	0.102	13	0.23	0.727	1.9	-20	-2	40	3.7	40	502
117943	34000	57	70	16	14	160	0.29	2.8	-0.127	13.1	6	23	3	1.4	0.164	21	0.16	0.961	4.1	-20	-2	69	5.8	37	699
117945	32000	55	80	17	17.5	140	0.375	5.6	-0.049	12.8	-2	38	1	1.3	0.113	19	0.24	0.979	3.1	-20	-2	63	5.4	51.3	755
117947	1000	8	20	21	5.39	40	1.09	4.3	-0.196	4.7	4	76	-1	0.6	0.141	10	0.35	1.05	2.1	24	-2	15	1.7	9.6	209
117949	29000	57	70	30	28.2	120	0.499	9.9	-0.138	10	10	342	2	1.3	0.152	15	0.91	1.56	2.2	63	-2	72	5.2	79.5	551
117951	4000	16	20	27	7.1	70	5.35	9.5	0.174	4.9	-2	62	<1	0.6	0.192	9.5	1.14	0.518	3.9	126	-2	23	2.8	52	217
117953	22000	16	40	14	2.33	80	1.96	3.4	0.826	6.4	-2	346	<1	<0.5	0.186	17	0.34	0.187	5.7	55	-2	19	1.7	32.5	175
118252	11000	16	30	8	9.88	150	0.755	2.3	-0.044	4.7	-2	162	-1	0.5	0.639	10	0.28	0.171	1.9	23	4	19	1.6	26.3	219
118254	7300	19	30	11	8.59	140	3.82	1.3	0.146	4.2	-2	71	1	-0.5	0.155	10	0.18	0.262	2	-20	2	18	1.9	24.8	183
118256	13000	22	40	13	8.13	160	1.56	4.5	0.056	6.3	3	199	1	0.5	0.153	14	0.52	0.336	2.7	88	3	27	2.1	46	268
118258	12000	26	30	7	11.6	230	1.62	2.5	0.198	5.5	-2	101	-1	0.6	0.232	19	0.25	0.289	4.2	20	2	33	3.1	27.8	224
118260	18000	29	40	13	29.9	110	1.51	3.6	0.3	6.9	7	173	2	0.8	0.168	13	0.24	0.493	2.8	28	4	39	3.6	38.3	279
118262	4300	12	20	11	7.86	220	32.2	1	0.011	2.8	-2	135	-1	-0.5	0.122	15	0.13	0.515	5.6	-20	13	10	1.6	19.6	85
118264	7400	10	20	12	8.77	270	9.26	4.6	0.233	3.4	3	221	-1	-0.5	0.173	17	0.41	0.694	4.8	87	7	10	1.2	25	134
118266	1900	12	30	11	10.6	190	30.2	4.1	0.468	4.7	-2	345	1	-0.5	0.171	19	0.39	1.42	5.8	52	9	13	1.5	21.3	155
118268	1200	9	20	11	10.9	140	5.98	2	0.208	2.8	-2	143	-1	-0.5	0.143	13	0.25	0.512	3.3	35	-2	9	0.9	29.9	90
118270	20000	15	30	10	7.9	180	1.71	2.9	0.171	4.6	-2	178	1	0.5	0.146	19	0.19	0.563	4.2	-20	3	24	1.9	36.2	145
118272	23000	16	20	8	5.3	160	0.505	2.8	0.164	4	5	160	-1	-0.5	0.11	20	0.2	0.407	4.6	-20	-2	16	1.7	23.5	131
118274	2100	6	10	11	4.39	130	22.3	0.7	0.402	2.3	-2	328	1	-0.5	0.174	7.6	0.1	0.409	4.1	-20	9	11	1	20.3	82
118276	8100	9	20	13	4.28	40	3.12	4.5	1.75	3.3	-2	615	-1	-0.5	1.24	6.6	0.49	0.492	2.7	96	-2	11	1	24.5	166
118278	2600	12	10	13	6.05	-30	0.647	5.5	0.25	2.3	3	404	-1	-0.5	0.332	9.8	0.62	0.397	3	131	-2	8	0.8	24	189
118280	17000	18	20	10	7.29	130	0.633	4.3	0.131	4	4	290	-1	-0.5	0.231	17	0.31	0.395	3.8	-20	-2	16	1.4	24.7	153
118282	13000	18	20	8	22.9	130	14.1	2.5	0.299	4.2	4	207	-1	-0.5	0.164	16	0.21	0.335	4.1	-20	-2	18	1.7	34.5	143
118284	15000	13	20	14	7.94	130	0.506	4.9	0.076	3.8	3	233	-1	-0.5	0.6	13	0.34	0.464	3.9	41	2	16	1.9	62.9	130
118286	7800	13	20	6	8.17	60	0.987	4.8	0.282	4	9	777	-1	-0.5	0.322	15	0.42	0.252	4.2	72	-2	13	1.6	40.2	210
118288	15000	14	20	6	8.36	150	0.766	2.7	0.145	3	4	277	-1	-0.5	0.146	16	0.23	0.538	5.5	-20	8	13	1.4	14	134
118290	17000	15	30	12	8.14	140	0.453	5	0.076	5.3	2	611	-1	-0.5	0.156	16	0.45	0.317	4.8	73	-2	17	1.5	34.1	173
118292	12000	16	20	8	8.25	150	0.839	2.1	0.423	2.8	3	250	-1	-0.5	0.242	20	0.16	0.252	8.3	-20	-2	14	1.3	8.83	131
118294	2100	14	20	12	22	80	8.33	3.7	0.929	3.7	5	838	-1	-0.5	0.313	19	0.23	0.872	9.4	-20	2	13	1.5	66	155
118296	3600	12	30	-5	24.4	90	0.473	6.3	0.758	4.3	9	262	-1	-0.5	0.275	15	0.39	0.431	2.9	62	2	12	1.4	71.8	178
118298	12000	15	20	10	16.2	140	0.525	3.9	0.32	3.7	-2	240	-1	-0.5	0.257	16	0.31	0.196	4.1	34	-2	16	1.4	29	152
118300	12000	15	40	10	8.88	130	1.59	6.6	0.3	6.2	8	277	-1	0.6	0.198	14	0.48	0.319	4.4	73	4	17	1.9	45.4	213
118302	11000	16	30	12	11.5	170	2.86	4.1	0.284	5.1	6	325	-1	-0.5	0.357	14	0.37	0.535	3.7	72	3	18	1.7	55.9	211
118304	4800	15	30	8	15.1	160	4.4	4.4	0.233	4.5	5	158	-1	-0.5	0.163	15	0.16	0.262	4.6	-20	3	30	3.2	20	142
118306	4500	14	30	9	97.9	80	6.08	5	0.879	4.4	8	634	-1	-0.5	0.782	10	0.56	0.257	5.4	127	-2	14	1.6	34.8	223

(-) less than indicated value

FLOAT CHIP ANALYSES

Sample	Na	Nb	Nd	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb	Te	Th	TiO2	Tl	U	V	W	Y	Yb	Zn	Zr
Number	INAA	XRF	INAA	XRF	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
118308	14000	27	30	11	9.93	120	3.85	5.3	0.234	5.6	6	389	1	0.5	0.386	14	0.44	0.896	3.5	75	2	27	3.1	41.8	256
118310	35000	55	80	9	12.5	100	0.497	3.6	0.175	13.8	4	46	-1	1.5	0.157	19	0.18	0.389	5.4	25	2	77	7.3	42.6	690
118312	35000	56	70	10	17.2	200	0.384	3.1	0.285	13	13	49	-1	1.6	0.164	17	0.19	0.361	4	28	3	65	6.5	47.5	706
118314	36000	44	80	9	10.8	90	0.567	7.2	0.246	12.7	8	55	-1	1.3	0.19	12	0.37	0.52	4.8	54	4	55	5.6	69.2	543
118316	-500	4	20	8	2.89	-30	2.74	2.5	0.124	3.5	-2	47	-1	-0.5	0.143	5.5	0.18	0.248	1.3	-20	-2	9	1.1	1.36	147
118318	8400	13	30	9	24.2	60	1.74	6.6	0.114	4.9	7	282	-1	-0.5	0.201	12	0.41	1.43	4.1	65	5	17	1.6	36.4	159
118320	11000	13	20	9	9.88	150	0.747	4.7	0.104	4.3	6	338	1	0.5	0.257	20	0.3	0.339	5.7	39	-2	14	1.7	11.9	142
118322	10000	14	20	10	10.7	150	0.677	1.5	0.026	2.9	4	74	-1	-0.5	0.184	17	0.14	0.259	5.1	-20	3	11	1.5	10.5	94
118324	15000	14	30	6	7.19	200	0.435	2.4	0.145	4.1	5	118	1	-0.5	0.103	23	0.19	0.221	5.8	-20	-2	16	1.8	16	119
118326	13000	14	20	13	15.7	140	9.44	3	0.541	3.4	4	167	1	-0.5	0.148	18	0.21	0.335	5.4	31	4	16	2	39.5	126
118328	2500	12	40	13	45.3	-30	0.934	3.4	0.192	6.5	-2	90	-1	0.7	0.168	15	0.53	0.21	5.5	85	-2	21	1.6	11.2	162
118330	19000	15	20	9	5.15	180	0.449	2.5	0.266	3.6	11	158	-1	-0.5	0.21	23	0.19	0.282	5.2	-20	4	13	1.6	15.5	127
118332	22000	19	30	8	4.46	230	0.428	2.7	0.174	4.5	8	121	1	0.5	0.116	24	0.19	0.22	4.8	-20	-2	16	2	24.5	117
118334	1300	13	30	6	38.2	-30	1.49	5.9	0.255	5.3	3	971	-1	0.5	0.136	22	0.52	0.236	2.9	86	-2	8	0.7	11.3	230
118336	8800	17	20	9	12.2	170	1.06	2.1	0.265	4	5	76	1	-0.5	0.142	23	0.14	0.282	6.4	-20	2	16	1.8	15.3	103
118338	3200	13	20	10	16.9	160	0.813	1.8	0.201	3.3	5	75	-1	-0.5	0.199	23	0.14	0.48	6.1	-20	2	12	1.4	11.1	95
118340	2500	13	20	9	26.1	170	1.48	1.3	0.123	2.9	4	48	1	-0.5	0.156	19	0.1	0.249	5.7	-20	-2	11	1.5	10.6	72
118342	4300	14	30	10	14.3	190	0.626	1.8	0.262	4	-2	66	-1	-0.5	0.145	23	0.12	0.284	4.7	-20	-2	14	1.5	7.18	103
118344	3000	8	20	9	17.8	110	1.08	3.1	0.288	3	3	64	-1	-0.5	0.278	11	0.22	0.288	5.2	28	2	14	1.4	32.1	119
118346	15000	18	20	9	9.4	200	0.574	2.3	0.106	4.1	5	112	-1	-0.5	0.185	23	0.17	0.139	5.6	-20	-2	15	1.8	20.4	118
118348	1000	12	20	7	11.5	210	0.547	1.7	0.19	2.8	3	61	1	-0.5	0.176	22	0.13	0.248	4.5	-20	-2	9	1.3	7.87	95
118351	22000	15	30	10	3.46	150	0.518	3.4	0.191	4.3	4	502	1	-0.5	0.153	16	0.35	0.243	4.1	58	-2	14	1.3	26.3	180
118353	9600	11	30	27	23	50	0.869	8.5	0.333	4.9	2	634	-1	0.5	0.268	9.5	0.65	0.448	2.8	137	-2	22	2	93.6	195
118355	15000	16	30	30	24.6	70	0.954	9.4	0.273	5.1	6	464	-1	0.6	0.17	10	0.75	0.219	3.3	135	-2	18	1.9	62.9	246
118357	3100	13	20	21	146	80	6.76	8.7	1.04	4.1	3	286	-1	-0.5	0.617	13	0.5	0.451	2.9	79	2	22	2.2	79	178
118359	25000	15	30	8	1.53	150	1.02	1.9	0.176	3.6	6	439	1	-0.5	0.122	22	0.25	0.281	4.9	41	-2	10	1.2	33.8	169
118361	14000	13	30	8	9.48	160	0.942	3.5	0.301	4.3	5	718	-1	-0.5	0.223	17	0.28	0.426	4	42	-2	15	1.4	28.4	176
118363	25000	29	30	11	6.47	220	0.711	5.5	0.102	5.5	9	191	-1	0.6	0.151	21	0.58	0.367	6.3	123	-2	27	3	48.8	152
118365	22000	27	20	9	6.22	230	0.613	2.7	0.208	4.3	2	136	-1	0.5	0.163	23	0.2	0.262	4.7	25	3	22	2.4	33.3	128
118367	25000	54	20	10	6.44	220	0.727	3	0.174	3.6	7	297	1	0.5	0.186	15	0.26	0.238	4.8	25	3	31	3.6	41	206
118369	15000	48	30	15	8.59	340	1.39	5.8	0.073	5.6	6	270	1	0.7	0.166	21	0.45	0.397	7.2	86	3	36	4.2	43.1	191
RC1094-01	3000	9	20	24	173	60	12.4	5.6	0.388	4.5	-2	52	-1	0.7	0.375	6.6	0.64	0.406	2.6	145	13	30	3.1	182	375
RC1094-02	-500	10	10	17	20.1	60	22.6	5.3	0.424	3.2	-2	84	-1	-0.5	0.394	8.6	0.50	1.36	2.2	87	78	12	1.6	183	162
RC1094-03	500	11	20	111	17.3	60	40.4	8.1	0.351	5.5	-2	131	1	0.6	0.912	8.3	0.51	0.522	3.5	111	36	15	2.3	238	182
RC0595-04	7300	15	20	15	10.6	180	3.78	3	0.172	4.4	-2	98	-1	0.5	0.135	14	0.22	0.494	4.5	29	-2	25	2.2	38.8	137
RC0695-05	-500	4	10	19	11.1	-30	24.7	1.4	0.174	1.6	3	43	-1	-0.5	0.383	3.4	0.12	0.617	1.9	22	2	9	0.7	101	87
RC0695-06	500	9	20	38	12.9	50	6.68	5.3	0.19	3.5	-2	55	-1	-0.5	0.136	6.6	0.38	0.565	3.8	61	4	18	2	95.5	187
RC0795-07	700	7	10	19	24.5	60	11.8	3	-0.021	2.5	-2	29	-1	0.5	0.121	6	0.24	0.481	1.6	42	-2	17	1.5	12	181
RC0995-09	700	8	10	31	81.9	40	19.6	4.2	0.14	3.1	2	186	<1	<0.5	0.207	6.9	0.24	0.722	3.5	50	-2	14	1.6	62.8	160
RC1095-10	1400	15	30	95	35.3	80	13.5	16.5	0.357	6	5	103	<1	0.6	0.288	10	0.58	0.527	4.5	97	13	28	3.2	395	213
RC1095-11	<500	9	20	72	57.1	50	13	6.4	1.23	3.9	8	137	<1	<0.5	0.191	8.1	0.28	0.511	3.4	96	10	17	1.8	436	142
RC1095-12	6000	10	20	20	13.9	160	5.3	5.7	0.142	4.2	-2	125	<1	<0.5	0.141	14	0.26	0.39	4.9	50	-2	23	2.3	78.6	116
RC1095-13	8500	15	30	20	8.95	220	5.15	2.3	0.333	5.2	-2	104	<1	0.5	0.177	16	0.15	0.549	4.1	52	-2	20	2.2	31.4	109

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm	Na INAA ppm
401	618105	4133503	0.028	7.77	0	442	-5	0.346	3	6	0.112	96	8	30	4	7.55	1.3	2.1	2.24	9	0.075	54	0.33	0.067	0.467	15000
402	615197	4140141	0.058	25.4	0.0005	269	-5	0.413	5	9	0.201	64	9	40	8	11.5	0.9	2.1	2.22	7	0.289	35	0.31	0.081	2.45	8600
424	609674	4131284	0.028	3.19	0.0003	393	-5	0.363	2	11	0.062	74	10	30	5	8.1	1.5	2.2	2.02	8	0.006	38	0.41	0.055	0.288	8400
428	609180	4132170	0.266	31.7	0.006	802	-5	0.473	2	3	0.413	128	16	50	11	16.3	1.7	4.1	2.43	19	0.385	70	0.65	0.094	0.611	11000
441	605022	4132873	0.034	8.07	0.001	632	-5	0.318	1	1	0.085	133	12	50	9	10.6	1.5	3.6	1.61	31	0.076	70	0.71	0.084	0.383	11000
444	605840	4137417	0.036	6.2	0.0006	461	-5	0.393	3	6	0.08	81	11	40	6	9.71	0.9	2.9	1.64	15	0.041	41	0.51	0.065	0.386	9900
445	606099	4137950	0.044	6.84	0.002	662	-5	0.406	2	1	0.205	106	9	50	8	9.5	1.1	2.5	2.31	15	0.045	56	0.48	0.076	0.53	13000
447	605363	4139073	0.057	6.9	0.002	612	-5	0.397	2	2	0.199	104	12	40	6	10.2	1.3	2.8	2.38	14	0.047	54	0.51	0.088	0.506	14000
448	605126	4139661	0.047	5.62	0.0008	558	-5	0.43	2	3	0.228	107	12	50	6	11	1.5	2.8	2.27	14	0.076	60	0.52	0.085	0.621	14000
449	605550	4140539	0.043	4.94	0.0004	588	-5	0.378	1	1	0.127	109	10	40	4	7.87	1.2	2.7	2.21	15	0.054	60	0.51	0.080	0.512	16000
460	606751	4145139	0.025	3.64	0.0005	647	-5	0.378	1	1	0.099	132	12	50	4	9.12	1.6	3.6	2.03	32	0.025	72	0.67	0.084	0.737	16000
462	608203	4140531	0.062	4.56	0.0009	942	-5	0.349	-1	3	0.091	155	25	100	4	8.83	1.8	6.5	4.69	22	0.002	77	0.56	0.108	0.323	17000
465	617737	4141753	0.034	5.67	0.001	998	-5	0.306	3	2	0.151	135	22	50	-3	15.2	2.1	5	3.21	17	0.176	73	0.4	0.066	0.992	14000
482	603752	4147808	0.037	8.88	0.0007	557	-5	0.38	2	1	0.096	119	12	50	6	12.9	1.1	3.7	2.05	29	0.144	64	0.7	0.079	0.861	11000
483	603946	4147589	0.042	6.62	0.0003	607	-5	0.418	1	2	0.165	139	10	50	4	11.4	1.3	3.5	2.38	29	0.099	78	0.68	0.089	0.868	16000
490	605589	4152195	0.042	6.56	0.0007	668	-5	0.465	2	2	0.102	158	12	60	6	8.34	1.9	4.7	3.71	43	0.039	86	0.8	0.092	0.94	13000
495	616842	4150623	0.032	3.31	0.0002	1771	-5	0.334	2	-1	0.092	140	31	80	3	6.89	1.9	13.4	8.66	25	-0.003	82	0.43	0.153	0.668	19000
496	613862	4148334	0.037	2.97	0.0007	674	-5	0.329	2	-1	0.134	107	10	20	4	6.5	1.7	2.6	2.32	13	0.019	60	0.41	0.112	0.591	22000
499	614518	4153685	0.047	5.66	0.001	744	-5	0.468	2	2	0.147	115	8	30	8	8.2	1.7	2.4	2.83	14	0.526	65	0.46	0.076	0.821	14000
503	613089	4155420	0.044	7.15	0.0008	603	-5	0.445	2	2	0.113	110	11	20	5	7.2	1.1	2.9	2.51	17	0.137	59	0.53	0.077	0.598	13000
504	613203	4155501	0.051	4.84	0	685	-5	0.435	2	3	0.11	109	9	20	6	5.5	1.5	2.6	2.76	11	0.094	61	0.44	0.074	0.536	16000
508	608755	4156974	0.098	9.82	0.0003	634	-5	0.439	2	-1	0.302	93	12	50	7	17.1	1.8	2.9	2.06	14	0.054	49	0.51	0.116	0.683	10000
514	606308	4154338	0.046	6.44	0.0005	709	-5	0.382	2	2	0.123	87	12	20	7	10	1.2	2.6	2.77	11	0.067	47	0.41	0.113	0.784	11000
520	617958	4131270	0.038	3.14	0	637	-5	0.291	2	7	0.081	249	12	30	3	4.79	1.3	5.1	5.68	17	-0.004	151	0.45	0.097	0.446	16000
522	602228	4141146	0.047	5.56	0.0005	571	-5	0.424	3	2	0.15	104	9	30	6	8.01	1.4	2.5	2.25	12	0.064	56	0.49	0.082	0.588	14000
527	605411	4140864	0.035	8.06	0.002	527	-5	0.331	2	-1	0.105	99	9	30	5	6.8	1.3	2.1	1.8	18	0.079	52	0.56	0.067	0.544	10000
531	608326	4132833	0.023	9.19	0.002	587	-5	0.375	2	2	0.063	91	13	40	15	12.8	1.5	3	1.81	12	0.026	45	0.7	0.085	0.456	9200
49402	536952	4199455	0.047	3.42	0.0010	926	-5	0.13	1	1	0.14	100	7	30	6	7.73	1.3	2.8	2.8	8	0.02	60	0.32	0.105	0.71	20000
49404	535351	4197424	0.050	3.69	0.0012	961	-5	0.14	2	1	0.14	96	7	20	6	8.22	0.9	2.4	2.5	7	-0.02	55	0.3	0.101	0.68	20000
49406	542099	4194013	0.026	3.25	0.0002	992	-5	0.10	2	1	0.07	129	13	30	5	5.15	0.9	5.3	2.9	12	-0.02	74	0.28	0.115	0.50	19000
49408	544691	4193054	0.138	3.95	0.0005	901	-5	0.08	5	1	0.09	120	6	20	5	3.83	0.6	2.6	1.7	14	-0.02	68	0.33	0.091	0.57	22000
49410	546066	4193356	2.332	32.40	0.0136	864	-5	0.16	2	1	0.13	95	6	20	7	7.33	0.9	1.9	1.2	10	0.04	51	0.3	0.074	2.26	15000
49412	490565	4139212	0.064	4.95	0.0014	883	-5	0.15	1	1	0.11	96	8	30	6	7.93	1.4	2.5	2.1	8	0.03	53	0.33	0.094	0.68	20000
49414	490809	4138692	0.042	7.19	0.0011	855	-5	0.34	1	-1	0.13	103	10	30	4	27.00	1.2	3.2	2.5	9	0.68	57	0.33	0.087	0.77	16000
49416	489427	4138427	0.055	7.85	0.0021	850	-5	0.31	1	2	0.15	101	9	40	6	24.20	1.5	3.1	2.7	9	0.22	55	0.32	0.094	0.94	17000
49418	489704	4152963	0.219	15.10	0.0014	585	-5	0.24	2	5	0.18	100	9	30	5	9.42	1	2.8	2.6	9	0.03	53	0.3	0.137	1.58	15000
49420	483446	4181754	0.084	8.16	0.0113	1225	-5	0.21	2	2	0.15	87	13	30	5	12.40	1.3	3.7	3.1	7	0.03	46	0.31	0.121	1.60	16000
49451	533139	4205768	0.148	6.85	0.0093	949	-5	0.15	-1	1	0.13	85	7	20	8	7.44	0.8	2.2	1.9	7	0.03	47	0.27	0.079	1.07	20000
49453	534554	4205560	0.068	8.49	0.0059	1003	-5	0.15	1	1	0.13	89	5	10	9	6.37	1.2	1.9	1.8	7	0.03	52	0.29	0.079	1.07	20000
49455	532298	4203597	0.088	6.17	0.0031	1065	-5	0.15	1	-1	0.11	90	7	10	8	6.69	0.9	2	1.8	7	-0.02	51	0.28	0.072	1.74	21000
49457	535906	4205427	0.302	3.37	0.0010	940	-5	0.13	1	1	0.12	87	6	20	6	8.37	0.9	2	1.9	7	0.03	49	0.27	0.087	0.59	21000
49459	534390	4207809	0.058	3.48	0.0021	938	-5	0.14	1	2	0.15	124	9	30	5	9.14	1.6	3.5	2.7	9	0.02	71	0.3	0.101	0.66	21000
49461	532155	4210115	0.035	3.15	0.0011	1008	-5	0.14	3	1	0.07	128	8	30	5	5.03	0.9	3.2	3.3	13	-0.02	74	0.35	0.081	0.57	22000
49463	552168	4201849	0.055	6.17	0.0051	786	-5	0.20	5	1	0.15	180	6	10	6	10.80	1.1	3	3.6	12	0.04	106	0.4	0.151	0.85	19000
49465	553837	4201633	0.093	6.47	0.0037	957	-5	0.15	1	1	0.21	91	7	20	9	9.96	1.3	1.9	2.0	8	0.03	50	0.29	0.128	0.88	19000
49467	555775	4202861	0.258	5.35	0.2260	946	-5	0.14	1	1	0.13	94	7	10	7	7.69	1.2	1.7	1.4	8	-0.02	54	0.29	0.101	0.67	21000
49469	556866	4204639	0.075	3.75	0.0014	760	-5	0.09	6	-1	0.08	159	6	20	7	5.44	0.6	2.4	2.1	16	0.04	94	0.36	0.110	0.55	21000
49471	545170	4214479	0.053	4.05	0.0010	952	-5	0.15	-1	1	0.09	148	7	20	9	6.74	1.2	2.8	2.4	15	0.02	88	0.35	0.101	0.78	19000
49473	537658	4215170	0.071	5.42	0.0016	885	-5	0.18	3	1	0.14	94	5	20	9	6.35	1.2	1.9	1.7	7	0.03	53	0.3	0.095	0.94	18000
49475	537670	4095256	0.022	3.75	0.0019	693	-5	0.12	1	-1	0.11	142	9	30	8	10.30	1.2	2.9	1.9	11	0.04	78	0.41	0.099	0.71	19000
49477	532276	4092198	0.021	2.86	0.0013	886	-5	0.12	1	1	0.10	191	8	30	4	7.64	1.1	3.3	1.9	14	0.04	108	0.5	0.121	0.56	21000
49479	530369	4090217	0.015	2.87	-0.0002	890	-5	0.15	-1	2	0.09	288	10	40	4	5.73	1.6	6.4	2.7	25	0.05	166	0.59	0.175	0.62	20000
49481	519929	4094017	0.023	5.16	0.0137	1178	-5	0.13	1	1	0.09	174	13	40	6	6.63	1.8	5	2.4	16	0.06	98	0.51	0.119	0.81	21000
49483	519739	4097819	0.034	11.60	0.0045	1014	-5	0.13	1	2	0.11	126	10	30	6	10.40	1.5	3.2	1.9	12	0.04	69	0.41	0.116	1.23	18000
49485	521404	4098525	0.023	11.20	0.0029	994	-5	0.12	-1	1	0.09	156	9	30	6	8.08	1.4	3.9	2.0	15	0.05	86	0.51	0.124	1.12	19000
49487	480110	4185649	0.127	8.47	0.244	1003	-5	0.57	2	1	0.15	122	20	60	5	14.60	1	8.5	4.5	11	0.96	68	0.36	0.185	1.38	15000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample	UTM	UTM	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na
Number	East	North	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
117501	516123	4150079	0.075	6.64	0.0008	916	-5	0.197	1	4	0.154	95	9	50	5	13	0.9	2.9	3.75	10	0.151	54	0.34	0.105	1.14	18000
117503	514892	4149992	0.097	10.8	0.0004	677	-5	0.27	2	1	0.186	128	10	40	7	13.1	1.2	3.9	4.68	15	0.092	77	0.45	0.118	1.58	16000
117505	527345	4147533	0.074	6.29	0.001	490	-5	0.248	2	1	0.185	102	7	40	8	14.5	0.5	2.4	4.49	6	0.243	59	0.36	0.1	0.978	12000
117507	525270	4145697	0.087	7.09	0	823	-5	0.295	1	1	0.155	103	10	30	6	13.5	0.9	3.3	4.51	14	0.159	58	0.37	0.11	1.12	17000
117509	521714	4143291	0.083	8.92	0.0004	677	-5	0.278	2	2	0.179	98	8	40	7	13.5	0.8	2.2	3.74	12	0.181	57	0.36	0.099	1.27	18000
117511	520950	4143327	0.076	6.7	0	669	-5	0.282	1	2	0.202	80	7	30	8	14.4	1.1	2.2	3.36	8	0.148	44	0.34	0.102	1.04	17000
117513	525900	4154838	0.069	5.35	0	751	-5	0.225	1	2	0.201	84	7	30	5	13.9	1.2	2.2	3.78	8	0.18	48	0.33	0.104	1	18000
117515	525980	4154587	0.08	5.87	0.0002	847	-5	0.273	1	2	0.2	81	8	30	6	14.6	0.8	2.3	3.84	7	0.169	46	0.3	0.106	1.02	16000
117517	526153	4154450	0.06	5.22	0	871	-5	0.24	1	1	0.16	90	7	30	4	12.5	0.7	2.5	3.3	8	0.172	52	0.32	0.108	0.934	18000
117519	512874	4154657	0.084	6.83	0.0006	780	-5	0.294	2	2	0.178	88	8	20	4	18.4	0.8	2.4	3.34	8	0.178	49	0.33	0.099	1.16	18000
117521	513852	4129123	0.086	5.31	0.0008	718	-5	0.197	1	2	0.2	87	8	30	4	16	0.9	2.7	4.24	10	0.136	51	0.37	0.103	1.02	18000
117523	511179	4126099	0.086	7.49	0	689	-5	0.204	1	2	0.174	89	7	30	12	14.9	1	2.3	4.73	8	0.149	49	0.34	0.103	1.05	15000
117525	508184	4123464	0.072	4.83	0.0006	747	-5	0.219	2	-1	0.139	112	8	50	5	12.3	0.8	2.9	4.25	9	0.105	67	0.38	0.095	0.995	17000
117527	507043	4127158	0.053	5.43	0.0007	716	-5	0.132	1	1	0.103	103	9	40	3	12.1	0.8	2.8	3.25	7	-0.006	61	0.33	0.102	0.644	20000
117529	504201	4123594	0.043	6.44	0.0006	757	-5	0.213	1	2	0.157	88	7	30	5	10.1	1.1	1.9	2.38	7	0.106	51	0.34	0.108	0.787	20000
117531	503313	4126508	0.028	6.54	0.0005	685	-5	0.173	1	3	0.091	103	10	40	7	8.83	1.1	2.7	2.83	9	0.053	61	0.33	0.096	0.766	21000
117533	506524	4121653	0.059	6.87	0.002	703	-5	0.245	1	2	0.126	88	8	20	4	13.7	0.7	2.3	2.92	8	0.222	51	0.32	0.104	1.75	18000
117535	504214	4121434	0.051	6.26	0.0006	794	-5	0.217	1	1	0.156	87	6	40	5	11.1	1	2	2.8	8	0.097	50	0.31	0.104	0.883	20000
117537	517611	4128373	0.048	22.3	0.001	707	-5	0.201	2	1	0.135	124	8	30	4	11.4	1	2.7	3.63	11	0.079	69	0.42	0.114	1.43	18000
117539	530735	4154579	0.056	7.57	0.0002	1357	-5	0.19	2	2	0.145	147	12	30	3	11.4	1.7	3.7	4.04	12	0.075	89	0.31	0.094	1.21	13000
117541	532228	4152343	0.087	12.8	0.001	931	-5	0.188	1	1	0.132	173	12	50	6	16.5	1.1	3.7	5.39	12	0.084	103	0.4	0.117	1.24	17000
117543	529902	4155547	0.194	13.3	0.003	1039	-5	0.258	1	1	0.168	115	9	40	5	17.1	1.2	2.7	4.1	12	0.112	67	0.33	0.127	2.14	18000
117545	528995	4149978	0.077	54.4	0.001	1030	-5	0.282	1	1	0.133	117	10	30	7	15.4	1.1	2.6	3.72	7	0.083	67	0.33	0.125	1.36	15000
117547	515476	4177702	0.061	6.01	0	883	-5	0.256	2	2	0.157	87	6	30	6	8.1	0.7	2.3	2.52	10	0.033	49	0.31	0.108	1.64	22000
117549	508695	4183000	0.061	6.39	0	961	-5	0.247	1	-1	0.129	79	12	30	6	8.32	1.6	2.5	3.49	9	0.032	46	0.32	0.111	1.5	18000
117551	509947	4171403	0.18	8.81	0.001	920	-5	0.571	2	3	0.683	80	8	20	5	12.7	1.2	2.4	3.13	7	0.026	46	0.32	0.11	3.74	16000
117553	514263	4168869	0.141	13.8	0.001	1534	-5	0.791	2	-1	0.166	125	12	50	6	12	1.3	4.3	3.57	27	0.036	76	0.5	0.11	3.85	15000
117555	517149	4161732	0.148	11.3	0.0007	1133	-5	0.299	1	3	0.2	82	12	30	5	11.7	1.4	3.3	4.48	6	0.065	45	0.29	0.127	1.84	12000
117557	521671	4157956	0.118	8.83	0.003	977	-5	0.42	3	2	0.208	87	8	30	9	13.2	1.7	3.2	3.86	10	0.041	47	0.33	0.128	1.61	15000
117559	625214	4109364	0.029	5.13	0.002	230	-5	0.101	2	11	0.161	49	-5	30	-3	6.08	0.6	1.2	1.67	5	-0.005	28	0.18	0.049	0.737	6500
117561	505928	4141286	0.051	4.82	0	708	-5	0.178	1	2	0.129	194	11	40	4	11.1	1	6	6	18	-0.036	118	0.46	0.133	0.61	19000
117562	503529	4142336	0.101	6.37	0.002	701	-5	0.224	2	2	0.198	136	10	30	6	14.9	0.8	4.3	4.9	14	0.009	78	0.45	0.119	0.878	18000
117565	498905	4128625	0.037	7.1	0	772	-5	0.17	1	5	0.115	107	12	60	5	13	0.9	3.3	3.48	8	0.037	60	0.35	0.108	0.83	20000
117567	497993	4130976	0.03	4.58	0.0008	643	-5	0.176	-1	1	0.106	98	7	30	7	10.7	0.8	2	2.5	9	0.077	57	0.33	0.103	0.683	19000
117569	499063	4133759	0.031	6.68	0.0008	808	-5	0.239	2	1	0.127	559	21	120	7	14.4	1.6	6.7	7.19	38	0.015	373	0.93	0.23	0.755	21000
117571	600619	4064535	0.043	10	0	350	-5	0.255	2	11	0.295	50	6	30	3	7.3	0.6	1.7	3.28	4	0.027	28	0.22	0.042	2.23	6100
117573	602905	4065444	0.072	4.76	0.001	448	-5	0.404	2	7	0.168	59	7	40	3	11.4	0.7	1.9	3.31	6	0.028	35	0.25	0.061	0.922	11000
117575	519243	4173028	0.092	6.19	0.0008	1297	-5	0.443	2	2	0.11	79	8	40	4	9.15	0.7	3	3.22	9	0.048	48	0.28	0.063	2.48	15000
117577	523232	4168856	0.171	10.3	0.0005	1041	-5	0.678	2	2	0.18	90	17	30	7	9.88	1.1	3.6	4.18	9	0.042	50	0.3	0.182	4.98	11000
117579	515000	4163693	0.165	9.09	0.001	966	-5	0.363	1	-1	0.261	89	14	40	6	19.1	1.1	2.9	4.93	7	0.069	52	0.4	0.107	1.54	18000
117581	625762	4108655	0.09	9.69	0.002	198	-5	0.063	2	12	0.736	36	-5	20	-3	19.3	0.4	0.9	1.31	3	0.068	20	0.14	0.056	0.674	5200
117606	624327	4109050	-0.024	8.46	0.0008	201	-5	0.273	2	13	0.178	44	6	40	-3	7.01	0.7	1.4	2.09	5	0.0003	26	0.21	0.050	1.27	7300
117608	621505	4103072	0.017	5.79	0.0002	162	-5	0.254	2	9	0.098	68	-5	70	-3	8	0.8	1.5	2	6	0.013	43	0.22	0.050	0.835	7300
117610	622442	4098889	0.031	4.11	0.0004	54	-5	0.277	2	13	0.094	30	-5	40	-3	5.01	0.2	0.7	0.911	3	0.029	19	0.11	0.032	0.565	3600
117612	618887	4109646	0.05	4.99	0.002	306	-5	0.348	2	7	0.131	74	7	220	3	14	0.9	2.1	2.79	6	0.025	44	0.24	0.058	1.77	10000
117660	626737	4097220	0.031	5.68	0.0002	190	-5	0.293	3	10	0.091	46	5	50	-3	4.74	0.6	1.1	1.6	5	0.009	27	0.22	0.041	0.611	6200
117662	625155	4096338	0.032	16.3	0.0005	250	-5	0.334	3	8	0.127	47	6	40	4	8.07	0.6	1.4	1.98	5	0.005	24	0.22	0.048	0.576	6000
117664	624529	4097339	0.038	4.69	0.0003	217	-5	0.286	3	13	0.147	58	6	30	3	6.11	0.3	1.3	2.49	5	0.004	32	0.23	0.048	0.588	6200
117666	617674	4096588	0.032	6.89	0.0003	572	5	0.276	2	7	0.227	72	9	40	8	7.03	0.9	2.3	3.07	6	-0.023	41	0.28	0.074	0.612	12000
117668	623680	4094166	0.022	13.6	0	178	-5	0.285	2	7	0.1	41	7	50	3	5.42	-0.2	1.1	1.3	6	-0.011	23	0.19	0.040	0.49	5100
117670	624985	4090407	0.022	10.9	0	206	-5	0.277	2	10	0.116	63	7	50	3	5.35	0.3	1.7	2.02	7	0.001	36	0.24	0.044	0.692	6600
117672	625288	4087390	0.021	14.9	0	140	-5	0.333	2	15	0.105	34	-5	30	-3	4.14	0.3	1.1	0.899	4	-0.02	19	0.21	0.033	0.468	4500
117673	563933	4154576	0.047	8.86	0.001	817	-5	0.357	2	3	0.123	143	14	40	5	14.8	1.8	3.5	3.8	11	0.008	87	0.39	0.095	1.12	17000
117675	563743	4154122	0.032	8.21	0.0005	846	-5	0.44	2	-1	0.094	100	11	30	5	16.7	1.7	2.5	3.05	8	0.011	60	0.32	0.082	0.735	18000
117677	572612	4155011	0.064	5.7	0	464	-5	0.318	2	5	0.165	80	7	30	4	8.94	1.7	1.7	2.69	6	0.027	46	0.33	0.075	0.725	17000
117679	576351	4158421	0.06	9.41	0.0008	589	-5	0.482	3	6	0.152	81	9	20	7	14.4	1.2	2.3	3.18	10	0.008	47	0.33	0.079	1.38	13000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample	UTM	UTM	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na
Number	East	North	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
117681	577118	4146494	0.048	3.67	0.0007	577	-5	0.4	3	-1	0.181	110	10	30	7	11.1	1.7	2.9	2.9	10	0.014	62	0.46	0.107	0.894	19000
117699	587580	4175197	0.071	17.5	0.0008	870	-5	0.353	1	2	0.175	74	10	30	10	22	0.9	2.8	3.45	8	0.026	43	0.33	0.093	1.1	15000
117701	588040	4172950	0.05	3.76	0.001	823	-5	0.316	2	-1	0.138	110	13	40	5	26.9	1.3	3.4	4.47	13	-0.012	66	0.35	0.097	0.688	22000
117703	592872	4174698	0.054	23.3	0.0009	839	-5	0.376	2	2	0.161	82	10	30	8	15	1.2	3.2	3.34	10	-0.028	46	0.43	0.105	1.21	17000
117705	593299	4173747	0.032	1.4	0.0006	534	-5	0.31	2	-1	0.097	87	6	20	6	22.1	2	1.9	2.07	7	-0.001	50	0.32	0.089	0.343	18000
117707	574610	4142662	0.062	6.76	0.0007	536	-5	0.471	3	-1	0.238	120	11	50	7	36.3	1.5	2.5	3.9	11	0.086	69	0.42	0.105	1.48	19000
117709	574358	4141197	0.069	8.98	0.0009	531	-5	0.418	2	3	0.188	165	8	50	6	54.2	1.4	3.3	3.88	19	0.163	98	0.55	0.109	1.85	20000
117711	573542	4139572	0.036	3.09	0.0005	266	-5	0.417	3	-1	0.18	126	5	20	13	12.3	1.5	1.8	3.37	11	0.109	72	0.66	0.095	0.718	16000
117713	567569	4133444	0.054	1.87	0.0005	559	-5	0.492	3	-1	0.129	341	7	30	4	30.3	1.5	5.1	4.3	19	-0.023	211	0.76	0.165	0.691	20000
117715	555693	4138935	0.063	3.18	0.0004	414	-5	0.452	2	3	0.206	118	5	40	6	10.4	1.2	2	2.81	9	0.02	66	0.45	0.098	0.651	22000
117717	541230	4133837	0.072	2.45	0.0008	525	-5	0.495	1	3	0.155	168	6	40	3	20.4	1.5	2.4	2.1	12	0.016	99	0.57	0.114	0.827	27000
117719	541382	4133547	0.072	2.85	0.0003	524	-5	0.452	2	-1	0.176	160	7	30	5	11	0.8	3.1	2.99	14	-0.019	92	0.56	0.115	0.752	26000
117721	543221	4115551	0.036	6.27	0	406	-5	0.487	2	-1	0.206	333	6	30	4	10.8	1.6	3.1	1.93	22	0.013	199	0.85	0.127	1.31	26000
117723	532202	4123631	0.048	3.07	0	2360	-5	0.354	-1	4	0.112	227	19	50	-3	19	2.5	14.1	7.77	37	0.007	130	0.95	0.259	3.23	26000
117725	548484	4084022	0.042	2.8	0.0005	730	-5	0.406	1	3	0.087	161	6	30	5	10.4	1.5	2.3	2.05	13	0.031	95	0.44	0.084	0.48	26000
117727	540920	4084015	0.073	1.59	0.0007	394	-5	0.509	1	-1	0.077	208	5	50	4	33.8	1.3	3.2	2.49	15	0.093	118	0.74	0.105	0.607	26000
117729	539910	4087158	0.035	1.87	0.0002	221	-5	0.488	1	-1	0.072	130	6	30	7	10.3	1.2	1.7	1.67	9	0.025	74	0.62	0.087	0.348	25000
117731	541962	4083212	0.045	2.42	0	539	-5	0.512	2	1	0.102	212	5	30	5	14.9	1	2.5	2.29	16	0.026	115	0.63	0.097	0.509	23000
117752	644200	4117581	0.037	6.54	0.0006	359	-5	0.131	3	12	0.168	50	6	30	3	10.1	0.5	1.7	2.5	6	0.091	28	0.24	0.068	0.547	8200
117753	646662	4123455	0.031	3	0.0002	312	-5	0.115	2	7	0.096	68	6	60	-3	8.47	0.4	2.3	3.26	7	0.091	41	0.18	0.055	0.755	7000
117756	650225	4123247	0.034	3.23	0	524	-5	0.154	2	8	0.122	119	7	40	3	11.7	0.9	2.8	3.85	13	0.032	69	0.33	0.074	0.787	13000
117758	649867	4117917	0.041	3.68	0	520	-5	0.127	3	6	0.174	75	11	70	3	13.3	0.6	2.9	3.94	8	0.041	42	0.3	0.089	0.727	12000
117760	649531	4113818	0.027	3.44	0	405	-5	0.138	2	10	0.11	81	9	40	-3	10.2	0.9	3	3.33	9	0.026	44	0.25	0.062	0.522	9900
117762	644491	4113258	0.029	4.41	0	343	-5	0.167	2	12	0.14	50	6	30	3	9.7	0.6	1.5	2.24	6	0.027	27	0.2	0.053	0.54	8300
117764	646565	4096021	0.035	4.41	0	269	-5	0.121	2	11	0.129	41	-5	30	3	10.2	0.5	1.3	2.06	4	-0.003	23	0.18	0.047	0.605	5700
117766	641511	4103430	0.035	4.22	0	327	-5	0.14	3	10	0.135	80	6	40	3	11.2	0.9	2.2	3.07	7	0.032	46	0.24	0.065	0.81	8100
117768	634103	4110387	0.023	3.63	0	203	-5	0.103	3	14	0.125	30	-5	20	-3	8.4	0.4	1	1.52	4	0.034	16	0.15	0.038	0.699	4900
117770	632628	4112819	0.033	3.93	0	277	-5	0.09	2	10	0.158	37	5	30	-3	9.79	0.5	1.2	1.86	5	0.038	21	0.17	0.057	0.594	5700
117772	630766	4104911	0.028	6.75	0	238	-5	0.105	2	11	0.129	38	-5	20	-3	8.07	0.6	1.1	1.51	5	0.047	20	0.17	0.043	0.621	5200
117774	629840	4103468	0.031	5.76	0.001	247	-5	0.08	2	11	0.153	52	-5	20	-3	6.56	0.8	1.3	1.99	5	0.031	30	0.19	0.045	0.759	6200
117776	629301	4103015	0.025	6.02	0.0007	269	-5	0.124	3	10	0.127	42	5	20	-3	6.53	0.3	1.2	1.61	5	0.002	23	0.19	0.046	0.603	6600
117778	635924	4101088	0.048	6.19	0	306	-5	0.125	2	11	0.185	47	6	30	-3	9.48	0.9	1.4	1.98	6	0.022	26	0.23	0.055	0.618	7400
117780	638109	4098520	0.036	4.82	0	332	-5	0.149	2	12	0.165	41	5	20	-3	9.33	0.6	1.4	2.1	5	0.039	23	0.24	0.056	0.557	7400
117782	649475	4089902	0.02	5.67	0.0002	233	-5	0.092	3	15	0.093	40	5	20	-3	7.12	0.5	1.2	1.54	6	0.021	22	0.2	0.045	0.508	5900
117784	641525	4090542	0.034	4.78	0	413	-5	0.161	2	8	0.129	64	8	60	4	14.2	1.1	2.1	2.53	8	0.028	33	0.34	0.066	0.579	7600
117786	631277	4089907	0.02	16.3	0	239	-5	0.1	2	12	0.097	37	5	30	3	8.31	0.5	1.1	1.46	5	0.041	21	0.18	0.04	0.622	5100
117788	645500	4084770	0.036	5.29	0	358	-5	0.163	2	10	0.123	48	6	20	3	10.1	0.7	1.4	2.24	6	0.057	25	0.24	0.059	0.462	7200
117790	643472	4083333	0.04	4.55	0	497	-5	0.141	2	6	0.125	58	8	110	3	17.4	1.2	1.9	2.64	9	0.062	31	0.32	0.065	0.723	7500
117792	633303	4080936	0.029	4.71	0	340	-5	0.087	2	11	0.139	56	6	40	-3	9.97	0.8	1.8	2.64	7	0.025	33	0.22	0.048	0.645	6500
117794	633565	4071876	0.022	8.3	0	425	-5	0.074	2	10	0.179	44	5	30	3	10.9	0.4	1.3	1.89	7	0.002	24	0.2	0.048	0.74	6000
117796	643055	4081395	0.041	5.73	0	434	-5	0.177	3	8	0.163	53	9	40	3	14.7	0.7	1.8	2.8	7	0.035	28	0.32	0.062	0.629	7900
117798	644160	4078283	0.033	5.99	0	511	-5	0.156	2	5	0.135	54	8	40	3	12.1	0.7	1.9	1.94	10	0.077	29	0.35	0.068	0.462	6800
117800	643907	4075459	0.039	5.7	0.0002	534	-5	0.195	1	3	0.152	65	9	60	3	14.9	0.5	2	2.12	12	0.046	34	0.41	0.07	0.568	6900
117802	643563	4069030	0.04	9.54	0	457	-5	0.205	1	3	0.112	76	12	70	3	22.6	1.2	3	3.27	9	0.003	39	0.47	0.079	1.32	6900
117804	541150	4100704	0.036	3.64	0.0002	976	-5	0.247	1	2	0.167	112	8	40	4	11.6	1.5	2.1	3.66	10	0.058	66	0.37	0.11	0.791	20000
117806	540911	4095136	0.04	2.66	0	880	-5	0.257	1	-1	0.131	121	5	50	3	12.9	1.1	2.4	2.81	12	0.036	71	0.39	0.099	0.825	22000
117808	540828	4095735	0.036	2.75	0	914	-5	0.258	1	3	0.129	118	6	30	3	10.1	1.5	2	2.48	12	0.053	68	0.4	0.089	0.656	21000
117810	544995	4097667	0.047	3.31	0	901	-5	0.22	1	-1	0.199	101	7	20	4	10.7	1.4	2	2.34	10	0.049	57	0.38	0.109	0.695	22000
117811	641384	4054758	0.03	3.98	0.0007	103	-5	0.153	2	11	0.1	23	-5	30	-3	4.35	0.5	0.7	0.951	3	0.02	12	0.11	0.027	0.573	2100
117813	641304	4058589	0.038	3.86	0.002	165	-5	0.267	2	15	0.136	29	-5	50	-3	6.02	0.5	0.9	1.53	4	0.009	16	0.14	0.034	0.675	4000
117815	648967	4064690	0.04	5.52	0.0008	249	-5	0.299	2	15	0.123	44	7	40	3	8.93	0.7	1.4	1.98	5	0.044	25	0.26	0.045	0.673	5200
117817	627632	4067672	0.052	8.92	0.0003	300	-5	0.277	1	15	0.193	38	6	20	3	10	0.5	1.3	2.37	4	0.05	21	0.17	0.046	0.751	6100
117819	619798	4078226	0.035	8.29	0.002	143	-5	0.122	2	16	0.119	27	-5	20	-3	5.48	0.6	0.8	1.24	3	0.024	16	0.14	0.025	0.666	4000
117821	615941	4066980	0.03	5.79	0.0003	221	-5	0.174	2	13	0.131	32	-5	30	-3	6.22	0.6	1	1.5	4	-0.004	18	0.15	0.03	0.669	4700
117823	520222	4119695	0.073	3.95	0	816	-5	0.267	3	-1	0.147	155	9	30	6	8.52	1.1	2.7	3.78	11	0.047	93	0.5	0.11	0.93	23000
117825	520448	4114251	0.051	4.4	0.0004	812	-5	0.204	2	-1	0.145	127	12	30	6	11.7	1.4	3.2	3.94	11	0.016	75	0.43	0.112	0.659	20000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample	UTM	UTM	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Lu	MnO	Mo	Na
Number	East	North	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
117827	525923	4110721	0.047	2.73	0.001	946	-5	0.32	2	-1	0.161	387	13	80	5	7.84	1.3	7.4	6.93	24	-0.009	250	0.73	0.209	0.722	22000
117829	527959	4104666	0.044	3.52	0.0007	799	-5	0.194	-1	-1	0.16	336	14	50	5	8.99	1.3	6	5.92	23	0.015	225	0.69	0.159	0.806	21000
117831	543960	4110419	0.044	1.81	0.0008	637	-5	0.339	1	-1	0.172	488	10	40	5	5.79	1.5	4.4	4.3	30	-0.001	305	0.94	0.191	2.19	23000
117833	604489	4087564	0.033	6.04	0.0002	392	-5	0.172	2	11	0.133	50	5	40	-3	7.03	0.6	1.3	1.98	4	0.017	27	0.27	0.05	0.701	9300
117835	603832	4081658	0.017	8.99	0.0007	355	-5	0.137	1	10	0.072	53	5	40	-3	4.88	0.8	1.2	1.77	4	-0.001	31	0.18	0.044	0.745	11000
117837	610413	4069648	0.038	4.15	0.001	344	-5	0.177	2	11	0.151	51	5	50	3	8.61	0.9	1.5	2.38	6	0.036	30	0.25	0.046	1.05	9400
117839	610721	4076030	0.026	3.81	0.001	241	-5	0.137	2	12	0.097	49	6	40	-3	8.7	0.7	1.6	2.75	5	0.001	27	0.25	0.061	0.543	5500
117841	607158	4080216	0.026	4.32	0.0005	449	-5	0.136	3	8	0.088	53	5	40	-3	6.6	0.9	1.4	2.19	5	0.03	31	0.23	0.045	0.638	12000
117843	603741	4070848	0.037	3.6	0.0005	372	-5	0.131	5	9	0.131	50	6	30	3	8.52	1.1	1.4	2.68	7	0.023	27	0.24	0.049	0.749	9500
117845	598353	4070415	0.031	4.06	0.0005	303	-5	0.173	2	13	0.076	48	-5	50	-3	7.65	0.6	1.4	2.47	6	0.017	27	0.22	0.042	0.763	9000
117847	597621	4067286	0.035	3.89	0	354	-5	0.183	2	12	0.094	56	6	40	3	8.63	1.3	1.8	2.66	7	0.022	31	0.23	0.05	0.645	10000
117852	639687	4050117	0.039	3.9	0.0007	247	-5	0.172	2	12	0.192	44	6	40	-3	8.73	0.7	1.4	2.26	6	0.024	24	0.22	0.045	0.697	6500
117854	643858	4064549	0.021	9.4	0.0007	154	-5	0.106	3	15	0.111	35	5	40	-3	6.51	0.4	1.2	1.84	5	0	19	0.16	0.041	0.634	4300
117856	643747	4066137	0.04	5.93	0.0007	488	-5	0.18	2	5	0.139	70	9	80	3	12.4	1	2.1	2.28	11	0.026	36	0.34	0.066	0.724	6700
117857	646193	4070091	0.038	5.25	0	491	-5	0.208	2	6	0.156	65	10	70	4	13.3	1.1	2.2	3.26	10	0.042	34	0.38	0.078	0.76	8600
117860	646454	4072320	0.038	6.51	0.0009	484	-5	0.255	2	6	0.15	64	9	50	4	13.5	0.8	2.3	2.85	12	0.038	35	0.37	0.077	0.724	8100
117862	649554	4067967	0.028	5.29	0.0008	273	-5	0.154	2	15	0.123	48	7	40	-3	8.84	0.7	1.5	2.33	7	0.034	27	0.25	0.052	0.609	5300
117864	632087	4065840	0.024	5.44	0.0009	224	-5	0.132	3	16	0.124	41	5	20	-3	6.74	0.9	1.3	1.79	6	0.015	23	0.2	0.037	0.571	6300
117866	638335	4096470	0.029	5.14	0.0007	226	-5	0.156	3	14	0.124	39	5	30	3	7.39	0.3	1.2	2.02	5	-0.002	22	0.2	0.049	0.52	6200
117868	627354	4059810	0.017	5.82	0.001	235	-5	0.075	2	15	0.102	58	6	50	-3	5.88	0.7	2	2.36	6	-0.023	33	0.21	0.044	0.78	6000
117870	619277	4073379	0.032	4.06	0.0008	217	-5	0.128	2	14	0.15	40	-5	30	-3	6.88	0.6	1.1	1.83	5	-0.004	23	0.19	0.038	0.558	5800
117872	619057	4075195	0.032	8.38	0.0007	189	-5	0.105	2	18	0.139	38	5	50	-3	6.22	0.7	1.1	1.52	5	-0.01	22	0.19	0.029	0.8	5300
117874	615566	4090298	0.029	8.31	0	482	-5	0.153	3	9	0.191	84	8	40	6	8.94	1.3	3.2	4	9	-0.01	49	0.29	0.064	0.829	11000
117876	616112	4070390	0.014	6.32	0.0006	148	-5	0.111	2	19	0.128	38	-5	50	-3	4.99	0.5	1.1	1.11	5	-0.033	22	0.14	0.028	0.788	4800
117878	614866	4064522	0.026	6.13	0.0007	206	-5	0.084	2	17	0.15	39	5	30	-3	7.27	0.8	1.2	1.73	5	-0.005	22	0.15	0.035	0.719	5800
117880	518937	4118871	0.086	4.7	0.001	715	-5	0.371	1	3	0.153	140	8	40	5	10.1	0.9	3.2	3.85	13	0.022	81	0.51	0.1	1.06	24000
117882	519893	4117926	0.058	3.91	0.0008	765	-5	0.256	2	2	0.147	135	9	40	6	9.17	1.5	2.7	3.38	12	0.009	76	0.52	0.101	0.87	25000
117884	526114	4113014	0.039	3.93	0.001	782	-5	0.161	3	-1	0.126	229	13	70	5	7.56	1.6	3.9	4	18	-0.004	138	0.67	0.124	0.657	24000
117886	524012	4109956	0.062	5.53	0.0007	818	-5	0.271	1	3	0.19	125	10	30	5	12	1.7	2.9	3.84	12	0.057	71	0.51	0.135	0.887	22000
117888	526933	4104556	0.031	5.59	0.0008	779	-5	0.137	1	2	0.126	131	12	40	6	10	1.2	3.3	4.08	11	0.038	76	0.46	0.105	0.701	21000
117890	529074	4105098	0.039	3.96	0.0009	683	-5	0.168	2	-1	0.134	231	15	30	4	6.87	2.3	3.5	3.28	21	-0.027	141	0.66	0.11	0.93	27000
117892	531152	4107268	0.066	5.59	0.001	873	-5	0.159	1	4	0.163	140	11	50	4	13.8	1.3	3.7	4.04	12	0	81	0.51	0.107	0.817	23000
117894	542544	4110039	0.049	3.8	0.0008	689	-5	0.212	4	-1	0.193	292	10	50	5	8.99	1.6	3.3	3.44	18	0.015	188	0.81	0.134	1.23	26000
117896	540190	4105580	0.027	3.45	0.0009	785	-5	0.209	3	-1	0.127	238	10	40	5	7.12	1.6	3	3.04	16	-0.002	148	0.51	0.103	0.789	26000
117898	500381	4143081	0.085	5.31	0.0009	933	-5	0.247	3	1	0.19	122	11	40	6	11.2	1.6	3.2	3.55	11	0.018	65	0.51	0.118	0.933	24000
117900	492280	4142438	0.052	5.01	0.0008	723	-5	0.279	2	-1	0.158	138	11	30	5	8.28	1	3.2	2.71	17	0.012	82	0.53	0.105	0.962	26000
117902	495283	4145703	0.044	4.15	0.0004	1154	-5	0.197	2	-1	0.172	105	9	30	5	7.28	2.1	3.1	3.25	18	0.069	67	0.5	0.122	1.16	26000
117905	583291	4174218	0.063	2.67	0.0002	1002	-5	0.421	2	3	0.119	127	15	50	3	14.1	1.1	5.8	5.38	14	0.004	75	0.32	0.106	0.343	21000
117907	582585	4167859	0.059	2.52	0.001	735	-5	0.442	2	3	0.109	115	10	40	4	11.2	1.1	3.1	2.9	10	0.013	65	0.32	0.087	0.369	19000
117909	577369	4167468	0.061	3.4	0.0008	802	-5	0.434	2	1	0.098	125	12	50	5	14.5	0.8	4	3.86	9	0.023	76	0.31	0.093	0.324	18000
117911	577571	4165972	0.032	83.5	0.0004	614	-5	0.508	1	2	0.313	124	9	20	8	14.2	1.2	2.5	2.33	16	0.02	73	0.39	0.103	3.6	15000
117913	577292	4161777	0.053	4.41	0.0009	372	-5	0.441	3	9	0.104	71	5	30	3	10.5	0.9	1.5	1.96	7	0.032	42	0.22	0.062	0.712	13000
117915	564292	4147872	0.091	7.67	0.001	936	-5	0.997	2	4	0.154	134	20	110	3	71.7	1	5.4	4.02	10	0.14	76	0.42	0.137	0.798	15000
117917	563961	4149351	0.067	8.64	0.0002	917	-5	0.611	2	2	0.137	142	13	130	4	23.6	1.1	3.4	2.79	13	0.055	85	0.45	0.107	0.89	17000
117919	563601	4149734	0.09	5.14	0.0006	673	-5	0.526	2	2	0.198	108	9	40	5	15.2	1.3	2.7	2.96	13	0.071	61	0.43	0.093	0.81	17000
117921	563826	4151163	0.066	7.85	0.001	863	-5	0.433	2	1	0.126	107	15	70	4	20.7	1.2	3.5	2.49	11	0.203	60	0.37	0.097	1.35	17000
117923	550428	4136331	0.079	3.93	0.0009	564	-5	0.726	3	1	0.201	191	8	30	4	12.5	1	2.8	3.01	13	0.037	110	0.56	0.103	0.97	21000
117925	540522	4123211	0.106	2.79	0.001	566	-5	0.67	2	1	0.179	174	8	50	4	99.3	1.3	3.3	3.13	12	-0.009	103	0.51	0.118	0.983	22000
117927	536910	4124545	0.074	2.95	0.002	1360	-5	0.413	2	-1	0.191	338	10	60	4	113	2.3	6.1	4.11	26	0.023	241	0.69	0.166	1.18	25000
117934	585021	4156831	0.045	10.9	0.0009	530	-5	0.339	2	-1	0.229	108	8	40	6	9.45	1.9	2.1	2.23	12	0.05	64	0.42	0.095	0.848	20000
117936	586763	4154543	0.05	19.8	0.0008	661	-5	0.339	1	-1	0.151	96	11	30	9	9.15	1.2	2.8	2.33	16	0.057	58	0.46	0.101	0.88	19000
117938	569947	4136226	0.072	3.69	0.0002	497	-5	0.571	1	-1	0.228	118	7	30	5	11.1	0.9	2.3	3.05	11	0.053	66	0.48	0.102	0.675	20000
117940	568453	4134885	0.071	1.94	0.003	409	-5	0.542	3	-1	0.216	175	7	50	4	26.6	0.7	2.4	3.44	10	0.035	103	0.53	0.115	0.729	19000
117942	562835	4142352	0.089	4.15	0.0003	555	-5	0.614	2	-1	0.315	128	7	30	6	15.3	1	2.5	2.85	12	0.036	72	0.55	0.129	0.807	22000
117944	562152	4143618	0.083	3.32	0.0009	498	-5	0.495	2	-1	0.222	133	6	50	5	13.6	0.6	2.6	3.37	12	0.018	74	0.55	0.117	0.851	19000
117946	562356	4144505	0.08	4.82	0	569	-5	0.553	2	3	0.218	106	9	40	5	13.9	1.1	2.5	2.8	10	0.097	61	0.42	0.103	0.796	18000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm	Na INAA ppm
117948	547670	4133857	0.063	1.87	0	407	-5	0.399	2	-1	0.152	371	9	50	4	8.45	0.8	3.5	2.64	30	-0.016	254	0.8	0.143	1.79	22000
117950	575826	4151883	0.058	10.1	0.0008	565	-5	0.343	3	4	0.148	95	11	50	6	10.9	1.8	3	2.88	9	0.051	57	0.39	0.089	0.914	16000
117952	576653	4173844	0.054	3.52	0.001	684	-5	0.29	2	3	0.132	112	7	30	4	7.99	1.7	3.2	2.62	10	0.035	72	0.38	0.084	0.624	23000
118251	523236	4127242	0.063	6.78	0.003	846	-5	0.234	2	1	0.246	133	9	40	5	11	1.3	2.9	3.24	15	0.048	71	0.44	0.147	1.1	19000
118253	524370	4127367	0.052	3.78	0.002	756	-5	0.172	2	-1	0.231	180	8	40	5	9.79	1.1	3.1	3.68	12	0.028	100	0.49	0.127	0.909	22000
118255	524486	4127244	0.064	5.38	0.001	780	-5	0.227	1	1	0.215	200	9	50	5	9.33	2.1	3.6	4.02	22	0.029	114	0.5	0.138	1.59	21000
118257	521101	4131141	0.077	8.2	0.0006	737	-5	0.253	3	1	0.199	104	10	40	9	13.5	1	2.7	4.05	7	0.041	56	0.45	0.113	0.976	17000
118259	499634	4126363	0.036	4.53	0	630	-5	0.228	1	2	0.13	94	6	20	5	8.86	0	2.1	2.27	9	0.001	56	0.38	0.089	0.756	20000
118261	546369	4190038	0.047	15.9	0.0005	626	-5	0.291	2	2	0.109	75	-5	50	14	4.2	0.7	1.3	1.6	5	0.02	48	0.21	0.072	1.09	14000
118263	548432	4191524	0.083	19.9	0.002	851	-5	0.133	2	-1	0.103	90	9	30	8	6.39	1.2	2.5	1.85	8	0.003	57	0.22	0.084	1.4	15000
118265	548579	4191560	0.126	24.3	0.009	789	-5	0.181	2	-1	0.147	89	8	30	4	6.85	2.2	1.6	1.78	9	0.006	56	0.3	0.084	1.01	20000
118267	549126	4191766	0.07	14.9	0.0003	829	-5	0.166	2	-1	0.181	91	8	20	6	7.04	2.5	1.9	1.78	9	0.038	54	0.29	0.101	1.06	21000
118269	550245	4190877	0.042	3.6	0.001	826	-5	0.177	2	-1	0.203	94	11	20	5	7.84	1.6	1.6	2.48	7	0.035	55	0.29	0.118	0.747	23000
118271	550716	4190392	0.027	2.63	0.0004	818	-5	0.096	1	1	0.1	80	7	20	5	4.67	1.1	1.3	1.58	6	0.005	46	0.26	0.078	0.534	25000
118273	542002	4190546	0.034	9.53	0.0007	884	-5	0.136	2	-1	0.108	91	9	20	4	5.58	0.9	1.7	1.99	6	0.013	56	0.27	0.079	0.706	23000
118275	562935	4158631	0.026	4.61	0.0002	1059	-5	0.168	-1	-2	0.108	168	11	30	8	5.86	1.5	3	3.76	13	0.026	109	0.35	0.097	0.815	19000
118277	561771	4156144	0.036	4.26	0	915	-5	0.186	2	2	0.121	151	10	50	4	8.06	1.7	3.3	3.48	13	0.046	96	0.32	0.105	1.26	18000
118279	562827	4167330	0.037	3.16	0.0003	793	-5	0.211	3	2	0.136	148	10	30	4	7.31	1.5	3.4	4.26	11	0.024	94	0.32	0.101	0.802	20000
118281	567351	4171242	0.036	4.37	0.0003	724	-5	0.169	3	1	0.125	81	7	30	4	6.24	1.4	1.4	2.04	7	0.03	51	0.33	0.088	1.04	19000
118283	563486	4175271	0.047	5.85	0.0004	927	-5	0.207	3	2	0.115	127	15	30	5	8.02	1.6	4.1	4.04	11	0.049	74	0.32	0.114	1.14	17000
118285	507204	4180336	0.066	5.33	0.0005	898	-5	0.211	2	2	0.14	83	10	30	5	8.58	1.2	2.4	2.96	8	0.054	50	0.27	0.096	1.19	20000
118287	503604	4175329	0.05	4.03	0.0006	774	-5	0.205	2	2	0.134	94	10	30	5	7.42	1.2	2.5	3.21	9	0.054	61	0.32	0.089	0.815	20000
118289	505195	4173592	0.04	4.06	0.051	840	-5	0.148	3	2	0.117	83	10	10	6	7.7	1.7	2.3	3.06	7	0.019	51	0.26	0.093	0.778	20000
118291	503040	4176163	0.057	3.42	0.0008	797	-5	0.241	2	2	0.122	111	13	30	5	8.3	1.6	3.7	3.74	10	0.034	69	0.33	0.098	0.799	19000
118293	507218	4173486	0.076	9.53	0.002	851	-5	0.227	2	2	0.146	79	7	20	7	8.1	1.6	2	2.22	8	0.04	51	0.29	0.104	2.69	18000
118295	511479	4170514	0.08	8.79	0.002	1050	-5	0.5	2	-1	0.28	89	8	20	4	16.3	1.3	2.4	2.35	9	0.018	54	0.25	0.088	6.48	17000
118297	515277	4164199	0.079	7.16	0.0006	866	-5	0.263	3	-1	0.152	82	8	20	6	9.54	1.4	2.1	2.7	9	0.039	51	0.36	0.101	1.41	17000
118299	513193	4155627	0.105	11.7	0.003	863	-5	0.232	2	3	0.191	93	11	30	6	11	0.8	2.6	3.83	7	0.039	58	0.35	0.099	1.19	16000
118301	513142	4156068	0.058	5.6	0.0003	754	-5	0.173	3	-1	0.173	97	7	30	6	8.96	1.8	2.1	2.4	9	0.019	55	0.32	0.093	1.03	20000
118303	513032	4156383	0.063	5.71	0.0007	420	-5	0.194	2	2	0.16	99	8	40	5	8.91	1.4	2.2	2.67	9	0.037	57	0.35	0.067	1.16	20000
118305	507231	4158586	0.097	5.37	0.001	774	-5	0.236	2	-1	0.203	148	8	50	4	9.5	1.8	3	3.54	14	0.015	94	0.4	0.11	1.34	21000
118307	500758	4159280	0.058	4.9	0.0008	612	-5	0.241	2	-1	0.128	142	7	30	5	6.68	0.8	2.7	3.02	14	0.006	89	0.53	0.102	1.49	23000
118309	555763	4142479	0.058	3.13	0.0008	579	-5	0.257	2	2	0.212	168	7	50	4	8.01	1	2.6	3.15	16	-0.007	103	0.7	0.138	1.04	23000
118311	555881	4142719	0.078	4.15	0.0005	573	-5	0.326	3	-1	0.233	125	8	50	7	10.6	1.8	2.2	3.43	12	0.026	74	0.53	0.116	0.997	21000
118313	556612	4146601	0.065	3.02	0.0002	670	-5	0.222	4	-1	0.204	160	9	60	6	8.17	1.7	3	3.58	13	-0.001	98	0.6	0.139	0.998	27000
118315	557852	4149372	0.084	6.42	0.0006	695	-5	0.227	3	-1	0.22	158	8	50	5	13.5	1.3	2.7	2.98	12	0.108	95	0.6	0.088	0.873	27000
118317	563130	4180311	0.039	4.94	0.0003	759	-5	0.171	1	1	0.106	100	10	30	5	6.15	0.7	3.2	3.54	10	0.017	58	0.32	0.099	0.835	19000
118319	562733	4181852	0.041	2.65	0.0002	864	-5	0.159	4	2	0.15	95	7	40	5	6.22	1.8	2.2	2.65	9	0.042	63	0.35	0.102	0.699	26000
118321	562240	4185750	0.055	3	0.0005	890	-5	0.236	3	-1	0.154	125	11	50	6	7.09	1.7	2.8	3.55	13	0.017	78	0.34	0.094	0.898	26000
118323	559127	4188162	0.047	3.06	0.0007	718	-5	0.196	7	2	0.145	87	6	40	4	6.62	0.8	1.7	2.46	8	0.033	50	0.33	0.11	0.711	21000
118325	556918	4190247	0.038	2.4	0.0004	808	-5	0.112	13	2	0.126	94	7	40	6	5.52	1.1	1.9	2.45	9	0.023	61	0.26	0.088	0.579	26000
118327	558619	4192350	0.041	2.03	0.0007	925	-5	0.166	3	-1	0.119	168	15	70	6	6.2	1.9	5	4.97	15	-0.003	107	0.43	0.109	0.691	27000
118329	557009	4193150	0.053	3.23	0.0005	822	-5	0.206	4	1	0.165	96	8	40	5	6.44	1.2	2.4	3.17	9	0.053	58	0.34	0.121	0.727	24000
118331	556938	4193276	0.037	2.72	0.0005	813	-5	0.191	4	-1	0.117	94	8	30	6	4.39	1.3	1.9	2.57	10	0.013	63	0.32	0.094	0.613	27000
118333	567060	4184247	0.051	2.8	0.0005	916	-5	0.191	2	4	0.187	110	11	40	4	8.07	1	3.4	4.06	9	0.038	63	0.37	0.094	0.756	21000
118335	556349	4180863	0.031	3.01	0.0007	764	-5	0.188	3	-1	0.096	114	6	30	6	3.75	1.4	1.5	1.52	9	0.036	68	0.29	0.084	0.685	25000
118337	555232	4181773	0.07	4.5	0.0006	798	-5	0.289	2	1	0.256	91	6	30	5	7.9	0.9	1.6	2.19	6	0.058	53	0.33	0.129	1.15	20000
118339	554558	4182941	0.05	4.78	0.0005	729	-5	0.262	1	-1	0.16	128	5	30	5	5.98	0.8	2	2.25	11	0.02	77	0.42	0.103	1.16	21000
118341	554755	4183569	0.074	3.96	0.0004	829	-5	0.207	1	1	0.27	103	6	70	5	8.26	0.7	1.7	2.37	8	0.066	61	0.38	0.123	1.23	19000
118343	554723	4183747	0.065	3.74	0.0002	819	-5	0.222	2	2	0.189	102	5	30	5	7.16	1.3	1.7	2.19	8	0.048	58	0.36	0.113	1.16	21000
118345	552075	4185640	0.062	3.53	0.0006	829	-5	0.22	2	-1	0.168	104	7	40	5	7.34	0.8	1.9	2.71	7	0.029	61	0.36	0.103	0.843	24000
118347	554690	4182052	0.083	5.63	0.0004	772	-5	0.327			0.213					7.31			2.31		0.026			0.1	1.09	
118350	542486	4166936	0.063	4.19	0	880	-5	0.259	2	2	0.14	180	11	40	6	9.09	1.5	3.2	4	11	0.039	112	0.43	0.1	0.814	21000
118352	556646	4161120	0.042	3.03	0.0004	849	-5	0.174	2	1	0.096	128	10	50	6	6.83	1.2	2.8	3.37	8	0.036	76	0.38	0.102	0.678	23000
118354	556708	4159431	0.05	3.18	0.0003	866	-5	0.2	2	1	0.102	135	12	70	4	8.2	1.9	3.5	4.36	12	0.011	78	0.39	0.101	0.871	22000
118356	556896	4156988	0.059	8.74	0.001	860	-5	0.248	2	2	0.122	130	10	40	4	9.4	1.2	3.1	3.47	11	0.058	75	0.42	0.098	1.55	20000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm	Na INAA ppm
118358	554709	4172064	0.039	2.17	0.0009	1170	-5	0.16	2	2	0.125	198	7	30	4	6	1.8	2.6	3.66	10	0.019	127	0.36	0.092	0.62	24000
118360	554905	4175717	0.049	3.27	0.001	963	-5	0.207	2	1	0.089	133	7	50	4	5.41	1	3	3.41	10	0.025	78	0.36	0.089	0.769	24000
118362	514838	4182228	0.069	5.79	0.0002	795	-5	0.311	5	3	0.205	89	10	40	5	9.78	0.9	2.7	3.44	9	0.056	51	0.41	0.092	0.979	23000
118364	514388	4183500	0.083	5.01	0.0005	803	-5	0.236	2	2	0.181	84	9	40	7	10.2	0.6	2.6	3.65	9	0.039	48	0.36	0.112	0.97	21000
118366	513467	4183960	0.049	4.33	0	941	-5	0.226	2	2	0.108	105	8	50	6	6.78	1.6	2.8	2.86	10	0.027	62	0.43	0.1	1.01	25000
118368	510345	4185354	0.084	5.33	0.0003	758	-5	0.244	2	2	0.167	66	8	30	8	10.4	0.7	2	3.17	5	0.038	37	0.31	0.095	1.04	18000
1192-001	626972	4109414	0.03	9.37	0.00	150	-5	0.10	2	10	0.08	31	-5	20	-3	10.70	0.4	0.7	0.84	3	0.04	17	0.11	0.037	0.55	3100
1292-002	627129	4110234	0.02	3.52	0.00	124	-5	0.08	2	10	0.10	26	-5	20	-3	8.50	0.3	0.7	0.95	3	0.01	15	0.1	0.031	0.71	3400
0193-003	612943	4106751	0.04	20.80	0.00	423	-5	0.14	2	5	0.31	60	8	120	5	38.30	0.7	1.6	1.60	6	0.06	31	0.25	0.077	1.88	8800
0193-004	613081	4106055	0.03	12.10	0.00	489	-5	0.09	2	5	0.20	56	5	50	5	24.50	0.7	1.5	1.43	6	0.06	31	0.23	0.061	1.12	9900
0193-005	612735	4104268	0.07	14.60	0.00	1512	-5	0.19	1	2	0.22	84	9	130	5	33.80	1.2	2.1	2.25	9	0.07	47	0.4	0.075	2.36	11000
0393-006	612711	4105106	0.05	10.20	0.00	666	-5	0.18	2	3	0.18	77	7	50	7	19.00	1.1	2	2.39	8	0.05	39	0.34	0.072	1.07	12000
0393-007	611950	4103783	0.05	12.50	0.00	615	-5	0.15	2	4	0.23	80	7	70	6	18.70	0.9	2.1	2.23	9	0.03	44	0.36	0.073	1.58	12000
0393-008	612627	4101767	0.04	6.81	0.00	617	-5	0.15	2	4	0.18	74	7	70	5	33.60	0.9	2	2.38	9	0.05	41	0.36	0.073	1.19	12000
0393-009	611648	4102549	0.04	5.79	0.00	574	-5	0.15	2	4	0.20	82	8	80	3	17.70	0.9	2.1	2.06	10	0.05	45	0.34	0.077	1.43	13000
0493-011	609117	4114876	0.03	4.69	0.00	582	-5	0.15	1	2	0.12	103	7	30	4	9.91	0.9	2.2	2.49	10	0.02	59	0.33	0.077	0.59	15000
0493-012	608890	4113388	0.04	7.63	0.00	618	-5	0.19	1	1	0.15	101	8	30	6	13.70	1	2.5	2.34	10	0.09	54	0.42	0.091	0.61	13000
0493-013	609955	4111855	0.03	6.57	0.00	629	-5	0.13	1	3	0.12	162	8	50	4	13.70	0.9	3.6	3.82	19	0.04	91	0.45	0.103	0.82	15000
0493-014	610433	4111506	0.03	5.78	0.00	581	-5	0.17	2	2	0.12	109	7	40	4	12.70	1.1	2.2	2.68	12	0.06	61	0.41	0.087	0.81	15000
0493-015	611185	4111252	0.03	5.99	0.00	593	-5	0.19	2	3	0.14	106	6	40	4	12.60	1	2.2	2.56	9	0.05	60	0.35	0.081	0.86	15000
0493-016	612412	4110582	0.04	4.58	0.00	616	-5	0.16	2	3	0.15	110	8	60	5	14.80	1.4	2.7	2.85	10	0.05	61	0.37	0.089	0.91	14000
0493-017	613535	4110279	0.04	4.93	0.00	575	-5	0.17	3	3	0.17	89	8	40	5	14.50	0.7	2.1	2.96	9	0.07	51	0.38	0.075	0.72	13000
0493-018	616036	4110251	0.05	4.99	0.00	542	-5	0.20	2	4	0.18	112	8	50	6	13.00	0.8	2.6	3.51	12	0.07	62	0.4	0.081	0.83	12000
0593-010	606684	4101056	0.03	4.69	0.00	569	-5	0.13	2	4	0.10	78	6	50	4	13.10	0.7	1.9	2.56	9	0.04	43	0.33	0.065	0.77	14000
0593-019	606234	4101766	0.04	6.62	0.00	569	-5	0.18	2	3	0.18	78	7	30	5	12.70	0.8	2.2	2.84	7	0.05	42	0.32	0.073	0.70	11000
0593-020	609752	4114066	0.05	4.77	0.00	621	-5	0.20	1	2	0.15	79	6	30	6	10.90	1.3	2	2.54	8	0.07	44	0.34	0.081	0.60	14000
0593-021	608140	4112374	0.05	9.11	0.00	844	-5	0.30	1	1	0.15	123	12	80	8	25.50	1.1	3.4	2.38	20	0.09	58	0.58	0.119	0.85	12000
0593-022	604632	4116132	0.07	31.00	0.00	722	-5	1.06	-1	-1	0.19	120	8	70	5	16.80	1.1	2.7	2.80	19	0.11	66	0.49	0.097	1.72	12000
0593-023	605623	4107065	0.05	5.86	0.00	760	-5	0.23	1	1	0.15	129	8	130	5	24.60	1.1	2.9	3.73	13	0.06	73	0.4	0.100	1.37	13000
0593-024	607169	4108769	0.04	20.60	0.00	795	-5	0.20	1	1	0.14	136	9	70	10	28.20	1.3	3.3	2.83	16	0.08	73	0.51	0.089	0.91	12000
0593-025	607462	4109621	0.04	5.08	0.00	585	-5	0.25	1	1	0.13	115	6	50	5	19.40	0.5	2.4	2.68	12	0.05	62	0.48	0.088	0.77	14000
0593-026	607549	4109950	0.05	13.60	0.00	895	-5	0.26	1	1	0.16	105	10	60	8	23.20	0.8	2.7	2.87	12	0.10	56	0.44	0.105	0.88	13000
0593-027	607400	4111072	0.06	5.90	0.00	743	-5	0.28	1	1	0.18	107	9	60	5	19.00	1.2	2.4	3.03	12	0.08	57	0.41	0.098	0.89	14000
0593-028	607210	4111291	0.04	9.81	0.00	776	-5	0.24	1	1	0.15	150	13	80	5	28.70	1.6	3.5	3.21	22	0.17	80	0.52	0.151	1.00	12000
0693-029			0.03	4.80	0.00	567	-5	0.16	2	4	0.10	82	6	60	4	17.60	0.8	2	2.63	9	0.06	44	0.31	0.065	0.88	14000
0693-030			0.05	4.57	0.00	503	-5	0.19	2	4	0.17	115	9	30	5	16.40	0.5	2.5	3.20	11	0.05	63	0.38	0.075	0.69	12000
0693-031			0.04	5.50	0.00	568	-5	0.24	1	3	0.16	106	8	40	5	25.10	1	2.5	3.33	11	0.08	59	0.36	0.081	0.90	14000
0993-032	617605	4106586	0.04	3.73	0.00	438	-5	0.09	1	2	0.09	215	8	90	3	12.70	1.1	3.9	4.90	20	-0.03	127	0.45	0.109	1.15	12000
0993-033	626412	4108151	0.04	8.82	0.00	297	-5	0.10	3	6	0.20	94	5	40	-3	18.60	0.4	2.3	3.03	8	0.05	56	0.26	0.091	0.79	6600
0993-034	626193	4108345	2.05	107.00	0.01	156	-5	0.25	2	8	4.62	39	-5	20	-3	247.00	0.5	1	1.46	3	3.79	23	0.11	0.062	35.20	3600
0993-035	625115	4106779	0.04	4.33	0.00	259	-5	0.12	2	8	0.10	66	-5	40	-3	19.10	0.8	1.6	2.11	6	0.02	39	0.23	0.059	0.94	6000
0993-036	582973	4146445	0.04	2.41	0.00	331	-5	0.22	1	1	0.11	105	-5	60	9	19.30	0.5	1.6	3.26	9	0.06	61	0.32	0.104	0.99	12000
0993-037	584443	4147910	0.04	3.99	0.00	715	-5	0.22	1	1	0.16	88	7	50	7	15.60	0.9	1.8	2.68	11	0.04	49	0.38	0.106	0.90	16000
0993-038	619370	4118341	0.03	3.29	0.00	685	-5	0.11	2	5	0.07	62	6	40	3	14.60	0.8	1.3	2.15	6	0.02	35	0.24	0.109	0.74	9500
0993-039	618992	4117607	0.02	3.01	0.00	337	-5	0.04	3	10	0.02	38	-5	30	-3	16.90	0.4	0.7	0.80	3	0.01	21	0.11	0.063	0.43	3500
0993-040			0.04	2.09	0.00	135	-5	0.20	2	-1	0.10	108	-5	40	9	18.80	0.4	1.7	2.90	10	0.03	61	0.38	0.036	0.75	13000
0993-041	618394	4104891	0.02	3.34	0.02	352	-5	0.18	1	1	0.05	107	6	60	26	16.80	0.8	2.1	2.50	9	0.03	61	0.37	0.104	0.66	12000
0993-042	618520	4103276	0.03	7.65	0.00	590	-5	0.16	2	4	0.14	76	5	20	6	12.40	0.7	1.9	2.05	9	0.04	42	0.33	0.078	0.66	10000
1093-s043	618587	4103664	0.03	13.10	0.00	472	-5	0.29	2	1	0.10	74	9	60	9	18.60	1	3	3.59	8	0.04	40	0.36	0.053	0.92	4700
1193-044	616129	4105846	0.03	3.25	0.00	620	-5	0.13	1	2	0.05	155	7	20	4	8.71	0.8	3.3	4.09	23	0.00	88	0.52	0.104	0.40	16000
1193-045	615686	4105132	0.02	5.06	0.00	533	-5	0.10	1	4	0.11	147	7	40	3	15.30	0.9	2.9	3.12	14	0.01	88	0.38	0.082	0.76	12000
1193-046	616700	4106346	0.03	3.63	0.00	638	-5	0.10	1	-1	0.03	218	7	80	3	19.60	1.1	2.8	3.63	18	0.00	133	0.4	0.093	0.85	16000
1193-047	616612	4107533	0.03	3.87	0.00	508	-5	0.13	1	3	0.06	95	-5	30	4	11.80	0.5	1.8	2.18	8	0.02	54	0.34	0.062	0.61	12000
1193-048	617147	4106470	0.03	4.11	0.00	586	-5	0.12	2	2	0.05	112	7	30	3	12.20	0.9	2	2.14	11	0.03	64	0.39	0.079	0.61	14000
1193-049	619560	4103963	0.03	3.19	0.00	497	-5	0.12	1	2	0.04	159	6	60	3	13.80	1.1	2.5	2.89	16	0.00	94	0.44	0.098	0.84	14000
1193-050	619627	4104192	0.03	3.12	0.00	533	-5	0.12	1	4	0.04	190	5	60	5	12.10	1	2.7	2.88	15	0.01	112	0.43	0.096	0.72	13000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	UTM East	UTM North	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	Br INAA ppm	Ca INAA %	Cd ICP ppm	Ce INAA ppm	Co INAA ppm	Cr INAA ppm	Cs INAA ppm	Cu ICP ppm	Eu INAA ppm	Fe INAA %	Ga ICP ppm	Hf INAA ppm	Hg CVAA ppm	La INAA ppm	Lu INAA ppm	MnO XRF %	Mo ICP ppm	Na INAA ppm
1193-051	614919	4108020	0.03	2.54	0.00	682	-5	0.13	-1	2	0.03	393	11	40	3	17.50	1.6	6.6	6.55	22	-0.02	222	0.6	0.165	0.36	17000
1193-052	613545	4117865	0.04	3.84	0.00	537	-5	0.13	1	3	0.06	123	7	60	3	14.40	1.1	2.9	3.79	10	0.00	74	0.35	0.097	0.91	13000
1193-053	615292	4117204	0.04	3.27	0.00	479	-5	0.15	2	3	0.04	128	8	40	4	13.00	1.4	2.8	3.24	12	0.02	75	0.4	0.089	0.65	14000
1193-054	619630	4115335	0.03	4.25	0.00	401	-5	0.08	2	5	0.12	87	6	40	5	10.30	0.8	1.9	2.61	8	0.01	50	0.32	0.076	0.76	10000
1193-055			0.03	3.73	0.00	509	-5	0.12	1	3	0.13	128	7	50	4	10.30	1.1	3.1	3.65	11	-0.02	74	0.31	0.083	0.72	13000
0394-056	597629	4112190	0.04	6.44	0.00	701	-5	0.18	1	1	0.16	100	7	50	5	13.00	0.6	2.3	2.95	13	0.04	57	0.39	0.099	1.13	14000
0394-057	597341	4112563	0.04	14.80	0.00	852	-5	0.38	-1	1	0.19	134	9	80	8	18.10	1.2	3.4	3.10	17	0.03	77	0.43	0.123	1.17	13000
0394-058	597562	4112699	0.03	11.20	0.00	753	-5	0.25	1	-1	0.17	110	8	40	9	13.60	0.8	2.6	2.46	14	0.03	61	0.42	0.110	0.80	13000
0394-059	579586	4128180	0.04	2.00	0.00	462	-5	0.18	1	-1	0.10	191	-5	60	3	12.90	0.9	2.8	3.85	14	0.03	111	0.48	0.129	1.29	19000
0394-060	581105	4128992	0.02	1.71	0.00	460	-5	0.14	1	-1	0.11	126	-5	30	3	9.91	0.8	1.7	2.38	11	0.01	70	0.43	0.107	0.85	19000
0394-061	582430	4129843	0.04	2.41	0.00	512	-5	0.19	1	1	0.14	132	-5	40	4	16.00	0.8	1.7	2.59	10	0.03	72	0.46	0.123	0.89	18000
0394-062	583995	4130042	0.02	2.41	0.00	535	-5	0.18	1	-1	0.12	145	5	40	5	8.88	0.4	2	2.39	14	0.02	80	0.48	0.114	0.82	19000
0394-063	584915	4130048	0.02	2.28	0.00	496	-5	0.15	1	-1	0.11	168	-5	40	4	8.74	1	2.5	3.28	16	0.00	98	0.51	0.121	0.90	19000
0394-064			0.03	2.21	0.00	532	-5	0.15	1	-1	0.12	132	-5	60	4	13.20	0.7	2	2.62	14	0.01	76	0.48	0.114	1.03	19000
0594-065	590151	4150232	0.039	13.1	0.001	836	-5	0.308	1	1	0.121	85	9	20	11	9.68	1	2.7	2.98	10	0.051	49	0.36	0.103	0.848	16000
0594-066	588548	4150703	0.037	16	0.002	882	-5	0.241	1	1	0.115	86	9	20	13	8.26	1.1	3	2.88	13	0.04	50	0.39	0.125	0.89	14000
0594-067	587633	4150441	0.049	18	0.002	807	-5	0.281	1	2	0.134	85	11	20	14	9.39	1	3.2	3.58	12	0.053	49	0.35	0.136	0.965	12000
0794-068	584045	4128723	0.049	4.24	0	557	-5	0.312	1	7	0.191	238	9	30	-3	9.69	1	4.8	5.11	24	0.033	137	0.57	0.123	0.64	13000
1094-069	607732	4113092	0.044	7.64	0.001	772	-5	0.354	2	1	0.345	99	13	40	6	17.2	1.4	3.5	2.65	19	0.037	52	0.58	0.110	0.712	12000
1094-070	608306	4113168	0.087	8.14	0.001	693	-5	0.566	2	3	0.183	105	9	70	5	14.4	1.1	2.6	3.1	13	0.053	58	0.4	0.092	0.889	14000
1094-071	587849	4130139	0.03	3.03	0.0008	557	-5	0.297	2	2	0.119	146	5	30	4	6.5	0.7	2.4	2.58	13	-0.011	85	0.47	0.098	0.783	19000
1094-072	587690	4129741	0.046	5.21	0.0009	571	-5	0.354	2	3	0.174	79	6	20	4	9.88	0.9	2.1	2.53	9	0.013	45	0.33	0.083	0.759	14000
1094-073	586431	4130478	0.044	4.14	0.001	631	-5	0.35	2	1	0.222	90	9	30	5	10.3	1.1	2.3	2.84	11	0.05	48	0.38	0.110	0.785	17000
1094-074	589207	4125999	0.044	4.32	0	730	-5	0.421	1	1	0.229	126	7	30	4	11	1.2	2.5	3.24	12	0.043	73	0.44	0.107	0.93	18000
1094-075	586291	4123906	0.063	4.87	0.0005	506	-5	0.345	2	4	0.213	147	7	40	4	10.4	1.2	2.3	3.33	12	0.04	82	0.42	0.099	0.906	14000
1094-076	599904	4119033	0.089	25.3	0.002	778	-5	1.09	2	1	0.274	88	9	40	5	20	1	2.6	3.01	10	0.055	48	0.36	0.096	0.924	14000
1094-077	601082	4118344	0.102	23.2	0.01	708	-5	1.85	3	2	0.273	82	11	50	6	22.3	1.1	2.6	3.75	7	0.192	43	0.36	0.074	1.03	12000
1194-078	593912	4116291	0.035	4.29	0.002	491	-5	0.467	1	5	0.305	91	9	40	4	11.1	1.1	2.6	1.7	12	0.112	51	0.43	0.079	0.597	12000
1194-079	595826	4113240	0.027	2.48	0.0009	410	-5	0.29	1	8	0.355	62	9	40	4	8.62	0.8	2	0.892	10	0.044	33	0.34	0.074	0.41	6900
0595-080	589031	4139021	0.054	4.77	0.001	580	-5	0.37	1	2	0.195	121	8	190	3	10.5	1.2	2.3	3.14	13	0.032	72	0.45	0.094	1.75	20000
0595-081	588306	4141280	0.072	6.61	0.002	521	-5	0.409	2	1	0.207	100	9	120	9	13.8	0.9	2.5	4.15	10	0.063	58	0.41	0.098	1.3	15000
0595-082	586545	4142645	0.06	3.81	0.003	475	-5	0.375	1	2	0.165	128	6	160	4	10.1	0.9	2.1	4.62	13	0.114	75	0.49	0.076	1.61	14000
0595-083	586794	4142975	0.059	5.51	0.0008	418	-5	0.386	2	2	0.152	83	6	100	10	8.91	0.8	1.9	3.56	9	0.068	48	0.44	0.082	1.15	14000
0695-084	586213	4144034	0.039	4.2	0.0007	414	5	0.364	2	1	0.135	172	8	110	6	7.01	1.1	4	5.85	22	0.241	98	0.49	0.134	0.77	11000
0695-085	586103	4145677	0.04	3.07	0.001	313	-5	0.362	1	1	0.12	108	6	70	9	5.41	0.4	1.7	2.82	12	0.056	63	0.5	0.076	0.807	16000
0695-086	586274	4146069	0.053	8.41	0.003	595	-5	0.374	2	3	0.165	85	7	70	9	9.94	1.3	2.2	3.37	10	0.026	51	0.39	0.089	1.14	15000
0695-087	584634	4148298	0.066	7.02	0.001	547	-5	0.431	2	2	0.258	79	8	120	7	12.5	1.2	2.2	3.73	9	0.044	47	0.36	0.100	1.6	15000
0695-088	598398	4115661	0.066	6.71	0.002	595	-5	0.475	2	2	0.191	103	11	120	6	13.9	1.5	2.8	3.99	14	0.05	57	0.48	0.087	1.32	14000
0695-089	597600	4116493	0.067	7.57	0.0009	722	-5	0.342	1	1	0.141	139	11	240	4	15.7	1.6	3.7	4.52	19	0.138	77	0.5	0.107	1.54	14000
0795-090	597679	4110213	0.06	5.67	0.0009	593	-5	0.375	2	1	0.189	106	8	140	6	12.7	1.4	2.2	3.15	14	0.069	61	0.4	0.084	1.51	14000
0795-091	583356	4133188	0.056	3.85	0.002	580	-5	0.375	2	1	0.166	135	9	160	5	9.23	0.8	2.4	3.4	13	0.015	81	0.43	0.112	1.5	19000
0795-092	583650	4135106	0.054	3.93	0.001	475	-5	0.418	1	-1	0.168	140	5	100	4	8.75	0.6	2.4	3.65	15	0.037	82	0.61	0.108	1.11	19000
0795-093	583783	4135418	0.054	4.54	0.0004	376	-5	0.345	2	-1	0.177	129	5	160	5	8.49	0.6	2.1	4.1	12	0.046	77	0.5	0.093	1.72	18000
0795-094	585390	4134224	0.048	3.44	0.0009	424	-5	0.376	2	-1	0.159	115	6	130	4	6.79	0.6	2	3	16	0.048	66	0.53	0.097	1.5	20000
0995-095	603840	4110834	0.12	7.59	0.003	589	-5	0.317	2	2	0.205	105	11	110	7	15.5	1.8	2.8	3.26	13	0.044	61	0.52	0.086	1.23	16000
0995-096	586237	4140204	0.045	4.9	0.0008	341	-5	0.4	2	1	0.177	185	6	120	9	10.2	1.2	2.7	3.06	16	0.024	109	0.6	0.091	1.43	20000
1095-097	600453	4116935	0.066	11	0.002	645	-5	0.52	2	-1	0.183	108	14	70	6	16.1	1.9	3.2	2.95	16	0.045	62	0.51	0.094	0.827	16000
1095-098	599906	4115071	0.062	8.79	0.0008	575	-5	0.342	2	3	0.18	117	11	70	6	12.6	1.4	3	2.93	17	0.073	66	0.54	0.087	0.863	17000
1095-099	585693	4147747	0.043	12.9	0.0009	253	-5	0.294	2	8	0.131	89	9	30	8	10.2	1.4	2.5	2.67	11	0.055	53	0.38	0.072	0.799	16000
1095-100	585185	4147601	0.046	5.69	0.001	477	-5	0.352	2	-1	0.21	94	10	40	9	9	1.6	2.1	2.52	11	0.073	57	0.43	0.090	0.859	18000

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
401	17	40	26	11	110	2.35	6.9	0.105	6	-2	271	1	0.8	0.051	13	0.42	0.625	2.6	46	-2	22	2.3	34.5	299
402	15	20	35	18.7	100	10.1	6.6	0.199	4.6	-2	170	-1	0.6	0.194	11	0.42	0.693	2.5	49	-2	18	2	51.3	214
424	16	30	30	12.4	130	0.582	8.1	-0.368	5.8	-2	220	1	0.8	0.173	10	0.42	0.52	2.8	43	-2	29	2.8	38	250
428	24	50	30	291	130	8.9	11.1	-0.048	8.2	-2	215	1	1.1	0.149	16	0.81	0.793	3.5	76	-2	41	4.5	190	604
441	21	50	28	11.7	120	1.53	10.2	-0.148	9.1	4	184	-1	1.1	0.172	18	0.94	0.597	4.1	86	-2	40	4.8	31.4	784
444	17	30	25	9.93	120	1.27	8.8	0.047	6.1	-2	164	-1	0.6	0.108	11	0.71	0.647	3.5	60	-2	33	3.5	32	389
445	18	40	27	14.1	130	1.29	8.3	-0.428	7	-2	227	-1	0.9	0.084	15	0.58	0.725	3.2	54	-2	32	3.2	44.4	442
447	19	40	28	14.4	130	1.23	8.9	-0.374	6.9	-2	229	1	0.8	0.107	14	0.68	0.929	3.5	66	-2	30	3	39.8	413
448	18	40	26	17.2	110	1.57	8.7	-0.144	7.1	-2	243	1	0.9	0.121	16	0.60	0.839	3.7	61	-2	30	3.5	42.1	409
449	18	40	23	14.3	110	1.01	7.9	-0.163	7.1	2	290	1	0.8	0.13	15	0.60	0.769	3.1	60	-2	30	3.1	36.5	430
460	26	50	23	12.1	130	1.32	8.8	0.02	8.5	-2	248	1	1	0.151	19	1.02	0.456	4.9	87	-2	36	4.5	38.5	810
462	23	60	31	11	100	0.887	14.9	-0.509	9.7	-2	453	2	0.9	0.145	15	1.37	0.48	3.8	180	-2	32	3.7	83.1	506
465	21	50	30	12.2	100	0.523	12.1	0.402	8.9	-2	649	1	0.8	0.475	14	1.01	0.635	3.8	127	-2	27	2.8	40.8	454
482	22	50	24	12.5	110	3.93	10.2	-0.271	8.5	4	194	1	1	0.108	17	1.03	0.792	4.7	92	-2	40	4.8	42.4	754
483	22	50	24	13.2	130	2.89	9.7	-0.026	8.9	-2	256	1	1	0.209	19	0.85	0.433	4.8	84	-2	35	4.4	41.8	671
490	24	60	26	14.1	110	1.74	9.4	-0.435	8.8	-2	254	1	1.1	0.143	23	1.05	0.957	6.3	123	-2	40	5.2	50.7	1025
495	37	50	31	13.2	-30	0.707	12	-0.048	8	-2	710	-1	0.8	0.099	11	2.64	0.561	2.6	403	-2	26	2.6	122	897
496	22	40	21	13	110	0.638	6.7	0.286	6.2	-2	419	-1	0.7	0.105	15	0.63	0.588	4	67	-2	26	2.6	38.1	427
499	21	40	19	16.8	130	3.97	7.1	-0.245	6.9	-2	256	-1	0.7	0.168	18	0.55	0.621	4.5	63	-2	28	3	41	403
503	22	40	20	15.5	110	1.08	7.6	-0.619	7.1	-2	284	-1	0.8	0.116	16	0.70	0.591	4	76	-2	34	3.4	47.6	510
504	20	40	20	12.4	150	0.781	7.5	-0.216	6.7	4	419	-1	0.8	0.08	17	0.57	0.931	4	59	-2	26	2.6	38.3	347
508	23	30	29	26.3	130	1.64	9.5	0.031	6.6	5	184	-1	0.8	0.097	15	0.96	0.737	3.8	87	-2	35	3.4	56.1	454
514	20	30	22	13.1	100	1.17	8.1	0.01	5.5	7	249	1	0.6	0.129	16	0.77	0.584	4	89	-2	26	2.8	42.7	397
520	22	70	20	11.6	140	0.621	7.3	-0.176	10	-2	340	-1	0.9	0.119	23	0.81	0.591	3	115	-2	25	3.1	104	583
522	19	40	23	14.2	130	1.23	7.1	-0.009	6.5	-2	259	-1	0.7	0.102	15	0.53	0.469	3.1	57	-2	28	3.3	36.5	370
527	18	40	27	9.86	90	1.37	7.2	-0.015	7	-2	214	-1	1	0.103	14	0.57	0.398	3.6	55	-2	34	3.9	27.3	535
531	22	30	30	12.9	120	1.38	10.8	0.212	6.8	-2	173	-1	0.9	0.101	13	0.85	0.264	3.6	80	-2	42	4.4	39.6	478
49402	17	40	17	11.80	130	0.49	6.4	-0.25	6.4	-2	447	-1	0.7	-0.05	18	0.52	-0.5	4.8	86	-2	19	2.1	42.10	276
49404	14	40	20	11.60	110	0.39	6.1	-0.25	6.2	-2	404	-1	0.6	-0.05	16	0.52	-0.5	5	92	-2	18	1.8	38.00	266
49406	18	40	16	7.91	110	0.41	6.7	-0.25	6.9	5	625	-1	0.7	-0.05	16	0.82	-0.5	4.1	163	-2	20	1.7	42.40	402
49408	16	40	16	7.20	130	0.33	6.1	-0.25	6.8	5	472	-1	0.7	-0.05	19	0.49	-0.5	5.2	108	-2	19	2.4	28.20	421
49410	20	30	13	15.20	160	2.53	5.2	-0.25	5.9	6	329	-1	0.5	0.11	18	0.51	-0.5	5.8	87	-2	20	2.1	29.20	388
49412	20	40	18	11.40	110	0.46	7	-0.24	6.5	4	466	-1	0.6	0.05	15	0.54	-0.5	4.6	103	-2	26	2.3	35.50	328
49414	17	40	17	14.50	100	0.93	7.8	-0.24	7.2	3	473	-1	0.7	0.07	16	0.57	-0.5	3.9	117	-2	24	2.4	42.50	303
49416	20	40	16	13.60	130	0.86	8	-0.24	6.9	-2	427	-1	0.8	0.09	16	0.57	-0.5	4	118	-2	24	2.3	44.30	292
49418	19	40	17	18.20	100	0.77	6.7	-0.25	6.7	10	297	-1	0.7	0.09	14	0.49	-0.5	4.4	83	-2	24	2.2	46.10	330
49420	21	30	24	11.00	90	0.62	9	-0.25	6	3	774	-1	0.7	0.15	12	0.77	-0.5	3.7	169	-2	29	1.8	48.50	343
49451	14	30	18	12.20	150	0.75	6.2	-0.24	5.4	-2	399	-1	0.6	-0.05	14	0.43	-0.5	4.6	54	-2	20	1.6	30.80	233
49453	16	30	17	12.30	130	0.82	5.8	-0.25	5.6	7	425	-1	0.6	-0.05	15	0.43	-0.5	4.8	61	-2	20	1.9	30.50	277
49455	13	30	17	11.20	140	0.60	6.4	-0.24	5.8	5	435	-1	0.7	0.07	15	0.43	-0.5	4.5	78	-2	18	1.9	31.10	235
49457	15	30	11	10.70	120	0.50	5.8	-0.24	5.6	-2	457	-1	0.5	-0.05	15	0.44	-0.5	5	66	-2	20	1.7	30.60	227
49459	17	40	14	11.40	110	0.52	7.1	-0.24	6.9	-2	464	-1	0.6	-0.05	18	0.63	-0.5	4.4	149	-2	23	2	43.10	333
49461	14	50	19	7.79	100	0.47	6.3	-0.25	7.1	-2	532	-1	0.7	-0.05	19	0.48	-0.5	4.8	103	-2	18	2	44.90	316
49463	20	60	14	13.10	110	0.65	6.5	-0.25	8.6	4	368	-1	0.6	0.05	22	0.62	-0.5	7.2	92	-2	24	2.6	60.70	444
49465	17	30	20	15.20	130	0.78	5.8	-0.24	5.9	-2	345	-1	0.5	-0.05	15	0.51	-0.5	4.7	113	-2	22	1.9	34.90	305
49467	15	30	14	13.10	120	0.75	4.8	-0.24	5.9	-2	356	-1	0.5	-0.05	16	0.39	-0.5	4.4	40	-2	21	1.8	26.20	271
49469	19	60	16	8.36	140	0.57	6.6	-0.24	8.1	4	356	-1	0.8	-0.05	22	0.51	-0.5	5.6	109	-2	22	2.6	38.20	480
49471	20	50	16	12.00	120	0.50	6.5	-0.24	7.5	3	405	-1	0.7	-0.05	22	0.63	-0.5	6	136	-2	23	2.4	41.60	552
49473	16	40	26	12.00	140	0.56	5.6	-0.24	6	-2	355	1	0.7	-0.05	17	0.44	-0.5	5.4	84	-2	22	1.7	31.00	279
49475	26	50	18	12.30	150	0.28	6.9	-0.25	8.7	5	383	-1	0.9	-0.05	20	0.58	-0.5	4.3	98	-2	30	2.7	35.40	359
49477	30	70	20	11.40	110	0.25	6.9	-0.25	10.7	-2	333	1	1	-0.05	21	0.84	-0.5	4.3	169	-2	33	3	37.80	537
49479	40	100	14	12.20	110	0.28	8.4	-0.25	15	-2	339	1	1.2	0.06	28	1.41	-0.5	4.6	322	-2	42	4.3	57.40	920
49481	29	60	15	12.90	120	0.62	10.2	-0.25	10.3	4	480	1	1.1	-0.05	25	1.00	-0.5	5	224	-2	28	3.1	45.50	420
49483	22	50	23	15.10	120	1.22	8.4	-0.24	8.8	-2	347	-1	0.9	-0.05	19	0.75	-0.5	4.6	167	-2	28	2.9	36.30	374
49485	27	60	21	14.70	120	1.30	8.3	-0.25	9.6	5	342	-1	0.8	-0.05	22	0.95	-0.5	4.9	190	-2	27	3	42.20	441
49487	18	40	29	11.80	90	1.20	10.6	-0.25	7.3	7	449	-1	0.8	0.36	14	1.54	-0.5	4.3	354	2	20	2.3	78.30	403

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
117501	23	30	20	16.9	100	1.1	6.7	0.381	5.6	-2	446	1	-0.5	0.161	14	0.59	0.491	4	116	3	26	2.2	58.9	378
117503	27	40	21	20.2	120	1.33	7.4	0.334	6.7	-2	393	1	0.6	0.159	16	0.64	0.57	3.8	128	5	26	2.8	83.9	482
117505	26	30	19	19.1	160	0.956	5.3	0.328	5.6	-2	266	1	0.6	0.186	19	0.48	0.479	3.1	101	4	25	2.3	54.8	246
117507	24	30	22	20.5	140	1.29	6.9	0.342	5.6	-2	492	1	0.5	0.211	14	0.63	0.321	3.4	115	3	26	2.5	71.9	483
117509	22	30	17	19.1	110	1.21	6	0.281	5.4	3	414	2	0.6	0.244	16	0.52	0.46	3.7	111	4	23	2.2	54.8	382
117511	21	30	19	16.6	150	1.06	6.7	0.245	4.9	-2	391	1	-0.5	0.165	14	0.55	0.44	3.6	73	-2	25	2.2	48.3	278
117513	22	30	20	15.4	120	0.976	6.3	0.242	5.3	-2	350	1	-0.5	0.209	13	0.52	0.323	3.5	68	5	24	2.1	57.7	304
117515	20	30	19	16	140	1.11	6.3	0.305	4.9	-2	345	1	0.5	0.199	14	0.54	0.538	3.1	110	3	22	2	53.2	266
117517	20	30	18	15.4	100	1.01	6.1	0.182	5.4	3	387	1	0.6	0.261	13	0.57	0.352	3	104	4	24	2	52.5	301
117519	22	30	16	18.2	110	1.13	6.5	0.244	5.3	-2	420	-1	0.5	0.219	13	0.52	0.514	3.4	72	3	23	2.2	57.9	320
117521	23	30	21	14.3	120	1.05	6.4	0.199	5.4	3	335	-1	0.6	0.149	14	0.54	0.447	3.7	103	4	24	2.5	55.3	261
117523	22	30	18	19.5	130	1.53	6	0.294	5.1	-2	398	1	0.5	0.193	14	0.54	0.602	3.1	112	2	20	2.2	59.9	315
117525	25	40	17	13.2	110	0.843	7.2	0.176	6.2	-2	329	1	0.6	0.23	16	0.64	0.315	3.4	119	3	22	2.6	57.9	331
117527	23	30	19	10.3	100	0.64	6.9	0.165	5.1	-2	345	1	0.5	0.146	15	0.64	0.338	2.6	110	2	23	2.2	46.3	287
117529	21	30	13	13.1	130	1.22	5.5	0.15	5.2	-2	355	1	0.5	0.133	15	0.47	0.338	2.9	104	2	21	2.2	38.4	262
117531	25	30	19	8.85	100	0.708	6.3	0.164	5.9	-2	437	-1	0.5	0.119	14	0.56	0.314	2.7	97	3	25	2.2	39.5	311
117533	22	30	18	12.7	120	0.76	6.2	0.033	5	-2	388	-1	-0.5	0.121	15	0.52	0.329	3.2	95	-2	24	2.1	43.6	295
117535	21	30	17	12.8	110	1.16	5.3	0.204	5	-2	357	1	-0.5	0.187	15	0.49	0.301	2.9	69	2	22	2.2	42.5	270
117537	26	40	14	15.9	110	1.09	6	0.194	6.6	-2	338	-1	0.6	0.196	18	0.57	0.319	3.1	152	4	27	2.7	58.7	406
117539	20	50	13	18.3	120	0.804	6.2	0.178	6.5	-2	745	-1	0.6	0.219	16	0.72	0.342	3.3	120	2	23	2.2	60.3	423
117541	27	50	21	17.9	140	0.988	7.9	0.284	7.9	-2	411	1	0.7	0.175	21	0.74	0.504	3.4	119	6	27	2.6	72.4	432
117543	23	40	18	24.1	130	1.14	6.9	0.354	6.3	-2	378	1	0.5	0.436	15	0.69	0.34	3.5	99	7	23	2.3	69.6	406
117545	21	40	24	15.9	130	3.35	7.7	0.208	6.4	-2	345	-1	0.6	0.178	20	0.64	0.584	3	120	6	23	2.3	56.2	289
117547	19	30	14	15.6	120	0.898	5.9	0.068	4.8	7	389	1	0.5	0.162	16	0.47	0.497	4.1	91	-2	19	2.1	42	305
117549	18	30	14	12.6	100	0.85	6.6	0.122	4.6	8	483	-1	0.5	0.192	15	0.56	0.543	3.7	94	-2	20	2.1	52.4	316
117551	20	30	12	37.3	140	1.05	6.5	0.352	5.1	10	350	-1	0.5	0.223	17	0.54	0.585	3.8	113	-2	20	2.1	71.6	269
117553	24	40	15	29.4	90	3.5	7.7	0.324	6	6	452	-1	0.6	0.36	17	0.77	0.444	4.3	161	3	25	2.6	67.5	907
117555	16	30	18	18.6	110	0.91	8.4	0.333	5.6	5	467	-1	0.6	0.226	12	0.7	0.383	2.7	123	2	21	2	78.4	244
117557	21	30	18	22.6	140	1.26	7.7	0.131	5.3	6	320	-1	0.5	0.14	15	0.64	0.697	4	133	2	21	2.2	59.5	318
117559	8	20	12	10.8	-30	0.697	3.3	0.172	2.8	-2	159	-1	-0.5	0.147	6.1	0.24	0.386	1.4	-20	-2	11	1.2	34.2	151
117561	35	60	18	11.9	110	0.749	10.2	0.284	8.7	-2	384	2	0.8	0.214	19	0.9	0.458	3.5	212	5	31	3.1	128	621
117562	28	50	23	15.9	130	1.11	9.3	0.251	7.1	4	342	1	0.6	0.209	17	0.66	0.463	3.7	160	5	28	3	90.4	467
117565	23	40	22	12	90	0.877	8.5	0.197	5.8	-2	549	1	0.7	0.195	15	0.69	0.636	2.9	149	4	24	2.4	56.3	349
117567	24	30	14	11.8	100	0.79	5.6	-0.018	5.4	3	406	-1	-0.5	0.164	15	0.48	0.561	2.9	88	3	23	2.1	40.7	319
117569	59	150	27	22.9	-30	0.861	14.1	0.151	19.3	3	523	4	1.6	0.16	36	1.49	0.589	3.4	321	7	58	6.2	150	1332
117571	9	20	20	11.3	60	0.653	5.4	0.142	3.4	5	306	-1	-0.5	0.153	7.2	0.37	0.446	2.3	39	-2	16	1.3	44.7	183
117573	13	20	17	13.1	40	0.741	5.8	0.141	3.8	7	303	-1	-0.5	0.092	8.4	0.4	0.374	2	51	-2	18	1.7	46.6	233
117575	15	30	12	14.9	90	0.869	7	0.231	4.5	2	759	-1	-0.5	0.24	12	0.65	0.478	3.3	131	-2	16	1.8	45.7	313
117577	18	30	20	25.3	90	0.837	7.3	0.371	5.6	4	402	-1	0.6	0.341	14	0.65	0.456	3.2	138	-2	20	1.9	68.4	327
117579	19	30	20	29.6	120	0.961	8.5	0.196	5.6	4	475	-1	0.5	0.287	14	0.69	0.422	3.8	113	-2	22	2.1	77.9	267
117581	6	10	11	67.1	-30	4.83	2.8	0.192	2.3	-2	148	-1	-0.5	0.176	4.8	0.21	0.309	1.2	-20	-2	9	0.9	87.6	120
117606	9	10	16	12.9	40	5.14	4.3	0.254	2.7	-2	169	-1	-0.5	0.184	6.9	0.25	0.355	1.6	33	-2	13	1.2	39	166
117608	13	20	17	8.34	40	1.34	3.1	0.03	3.6	2	144	-1	-0.5	0.159	8	0.25	0.414	1.4	32	-2	16	1.4	38.3	239
117610	6	10	13	4.95	30	1.01	2.1	0.078	1.7	-2	113	-1	-0.5	0.088	3.5	0.14	0.57	1.3	26	-2	8	0.8	18.3	106
117612	13	20	24	7.87	50	0.99	5.2	0.009	3.9	-2	218	-1	-0.5	0.08	8.8	0.36	0.746	2.2	49	-2	17	1.7	42	253
117660	8	10	17	6.74	30	0.595	3.5	0.122	2.5	-2	169	-1	-0.5	0.114	5.8	0.22	0.389	1.2	44	-2	12	1.2	23.1	150
117662	10	10	20	11.3	60	0.863	4.4	0.287	2.9	-2	166	-1	-0.5	0.179	6.8	0.32	0.341	1.8	45	-2	13	1.3	32.2	177
117664	11	20	17	11	70	0.601	3.7	0.012	3.4	-2	171	-1	-0.5	0.117	7.2	0.27	0.326	1.8	38	-2	14	1.3	35.1	173
117666	14	20	21	10.3	60	0.671	6.9	0.084	4.4	-2	313	-1	-0.5	0.078	12	0.43	0.38	2.8	50	-2	20	1.9	43.6	220
117668	9	10	16	6.65	-30	0.911	3.9	0.367	2.7	-2	138	-1	-0.5	0.139	6.4	0.30	0.261	1.9	45	-2	10	1.1	22.9	165
117670	10	20	17	7.2	-30	0.976	4.1	0.389	3.5	-2	184	-1	-0.5	0.148	7.5	0.28	0.243	1.7	44	-2	14	1.5	39.4	217
117672	7	10	16	5.75	50	0.822	2.9	0.249	2.2	-2	163	-1	-0.5	0.204	4.8	0.19	0.265	1.5	30	-2	9	1.1	20	145
117673	23	40	25	15.3	90	1.01	7	0.089	6.7	5	499	-1	-0.5	0.157	18	0.69	0.432	3.3	84	-2	24	2.2	65.3	391
117675	20	30	22	12.4	80	1.15	6.2	0.205	5.4	-2	497	-1	-0.5	0.097	14	0.57	0.339	3.2	70	-2	22	2.1	47.3	344
117677	18	30	22	12.6	140	1	4.9	0.077	4.8	-2	312	-1	0.5	0.076	14	0.36	0.488	2.5	39	-2	21	2	38.6	250
117679	18	30	20	15.5	100	1.53	6.9	0.123	4.7	4	328	-1	-0.5	0.192	14	0.50	0.364	3.3	64	-2	22	2.2	51.8	315

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF	Nd INAA	Ni XRF	Pb ICP	Rb INAA	Sb ICP	Sc INAA	Se ICP	Sm INAA	Sn XRF	Sr XRF	Ta INAA	Tb INAA	Te ICP	Th INAA	TiO2 XRF	Tl ICP	U INAA	V XRF	W XRF	Y XRF	Yb INAA	Zn ICP	Zr XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
117681	26	40	20	12.6	150	0.911	6	0.203	6.5	-2	357	-1	0.7	0.115	17	0.61	0.694	3.2	74	-2	31	3.2	47.2	382
117699	20	30	22	18.3	100	1.42	6.7	-0.193	4.5	-2	306	2	-0.5	0.107	15	0.70	0.435	5	66	-2	24	2.1	65	285
117701	19	30	20	12.7	110	0.609	8	-0.168	5	-2	461	-1	0.6	0.172	19	0.74	0.512	4.2	100	-2	22	2.1	82.8	373
117703	20	30	18	16.7	140	1.57	8.5	0.652	4.9	-2	335	-1	0.5	0.143	16	0.76	0.382	4.8	75	-2	23	2.4	65.6	378
117705	19	30	16	10.2	140	0.418	4.7	0.15	4.6	2	396	-1	-0.5	0.112	19	0.40	0.413	4.4	42	-2	19	2.1	28.6	221
117707	29	40	22	18.6	150	2.06	6.2	-0.039	6.7	5	291	-1	0.6	0.116	18	0.56	0.564	3.6	62	-2	29	3.2	68	409
117709	40	50	22	23.8	110	2.56	4.7	0.278	7.2	7	293	2	0.8	0.127	22	0.69	0.431	4.5	55	-2	36	3.7	83.9	691
117711	36	50	18	20.9	190	1.39	3.6	0.024	7.8	-2	221	2	0.9	0.121	21	0.35	0.634	3.2	31	-2	36	4.2	47.7	395
117713	46	100	21	10.9	130	0.612	8.1	-0.154	14.5	10	214	-1	1	0.151	38	0.92	0.705	3.3	72	-2	46	4.7	101	842
117715	30	40	20	15.4	130	0.761	5.8	0.02	6.8	-2	243	-1	0.7	0.109	19	0.45	0.81	4	47	-2	33	2.9	47.6	322
117717	36	60	19	12.4	100	0.749	7	-0.219	8.7	6	247	2	0.7	0.121	18	0.47	0.915	3.7	41	-2	33	3.8	51	449
117719	36	50	21	15.5	130	0.636	8.2	-0.254	8.5	-2	262	-1	0.8	0.155	17	0.59	0.709	3.9	54	-2	30	3.8	60.4	484
117721	57	110	21	11.9	160	5.24	8.7	0.274	15.2	4	204	-1	1.7	0.192	27	0.52	0.666	3.7	47	-2	46	5.5	73.7	759
117723	162	80	22	4.49	60	0.457	17.3	0.208	12.9	8	210	7	1.5	0.199	16	4.16	0.38	3.8	222	-2	53	6.5	264	1509
117725	23	50	18	10.7	100	0.592	5.8	0.114	8.7	-2	306	-1	1	0.093	17	0.50	0.876	3.4	38	-2	32	3.2	41.1	448
117727	40	70	19	10.4	180	0.592	5.5	-0.293	12.1	-2	189	-1	1.1	0.096	28	0.52	0.717	5.2	44	-2	48	4.7	63.7	448
117729	30	40	16	7.77	210	0.455	5	0.018	7.3	-2	165	2	0.8	0.169	25	0.31	0.631	6.2	24	-2	32	3.9	30	246
117731	32	80	19	9.88	140	0.66	5.8	-0.176	13.2	-2	254	2	1.3	0.168	23	0.49	0.764	3.5	45	-2	45	4.4	52	477
117752	8	20	15	11.4	60	0.56	5.3	0.109	3.4	-2	242	-1	-0.5	0.096	8.1	0.35	0.43	1.9	66	-2	16	1.5	36.1	200
117753	8	20	14	9.13	40	0.507	4.5	0.039	3.6	-2	197	-1	-0.5	0.127	8	0.35	0.358	1.2	50	-2	12	1.2	50.8	230
117756	13	40	14	10.7	70	0.614	6.7	0.208	6.5	-2	285	-1	0.7	0.19	16	0.48	0.422	2.8	70	2	20	2.3	56.2	422
117758	14	30	25	11	80	0.619	8	0.1	4.9	-2	352	1	0.5	0.165	11	0.54	0.302	2.2	108	-2	18	1.8	51.4	286
117760	10	30	16	8.77	60	0.521	6.8	0.152	4.6	-2	296	1	-0.5	0.2	10	0.4	0.337	2	112	-2	20	1.4	40.7	294
117762	9	20	14	10.7	70	0.587	5	0.263	3.3	3	287	-1	-0.5	0.157	7.9	0.33	0.309	2.1	34	-2	16	1.4	31.7	220
117764	7	10	14	10.3	50	0.504	4.3	0.311	2.6	-2	224	-1	-0.5	0.143	6.1	0.26	0.373	1.8	43	2	13	1	29.6	153
117766	10	30	12	10.8	60	0.552	4.9	0.158	4.2	-2	215	-1	-0.5	0.151	8.9	0.36	0.309	1.5	41	-2	16	1.6	48.4	221
117768	6	10	11	7.42	40	0.475	3.1	0.182	2	-2	147	-1	-0.5	0.167	4.5	0.22	0.327	1.6	21	3	11	1	24.1	132
117770	7	10	12	9.43	40	0.572	3.9	0.221	2.5	-2	159	-1	-0.5	0.129	5.2	0.29	0.36	1.7	39	2	12	1.1	30.7	171
117772	6	10	12	8.95	40	0.597	3.6	0.317	2.3	3	159	-1	-0.5	0.171	4.9	0.26	0.38	1.5	32	3	12	0.9	25.9	173
117774	8	20	13	10.7	40	0.612	3.7	0.133	3.2	8	167	-1	-0.5	0.128	6.2	0.26	0.373	1.2	-20	-2	14	1.1	35.6	163
117776	7	10	14	8.54	-30	0.66	4	0.198	2.8	5	200	1	-0.5	0.144	5.8	0.28	0.352	1.5	31	-2	13	1.2	27.3	168
117778	8	20	12	15.9	40	0.646	4.7	0.215	3.2	4	224	-1	-0.5	0.139	6.6	0.33	0.297	1.6	53	-2	14	1.3	34.2	193
117780	8	10	15	11.1	70	0.556	4.6	0.07	2.8	-2	255	1	-0.5	0.109	6.7	0.32	0.352	1.7	52	3	15	1.4	32	200
117782	7	10	15	7.07	50	0.429	3.9	0.24	2.6	-2	243	-1	-0.5	0.156	5.8	0.26	0.367	1.7	43	2	12	1.3	23.2	186
117784	12	20	18	12.6	80	0.53	6.7	0.212	4.4	3	204	1	-0.5	0.202	8.7	0.45	0.345	2.6	90	2	20	2.2	38.5	249
117786	7	10	13	6.52	40	0.766	3.6	0.204	2.4	-2	202	-1	-0.5	0.125	5.4	0.25	0.429	1.7	-20	2	13	1	24.7	173
117788	10	20	18	9.8	50	0.491	5.1	0.189	3.2	-2	247	-1	-0.5	0.138	6.9	0.37	0.452	2.2	65	2	19	1.6	32.4	192
117790	13	20	22	12.2	90	0.541	5.9	0.162	4	-2	209	1	-0.5	0.167	8.6	0.49	0.229	2.2	99	-2	23	2.1	36.9	315
117792	7	20	12	8.97	30	0.576	4.1	0.224	3.2	-2	219	-1	-0.5	0.151	7	0.31	0.256	1.5	-20	-2	13	1.3	38.9	188
117794	8	20	17	8.49	30	0.679	4.2	0.431	3	-2	216	-1	-0.5	0.202	6.1	0.34	0.293	1.8	48	-2	15	1.5	30.6	250
117796	12	20	19	13.2	60	0.611	5.8	0.392	3.7	-2	234	-1	-0.5	0.215	7.4	0.44	0.326	2.1	54	3	20	2	40.8	242
117798	12	20	18	13	90	0.528	5.8	0.322	3.9	-2	178	1	-0.5	0.159	8.2	0.52	0.362	2.3	92	-2	21	2.3	30.5	325
117800	13	20	22	14.9	60	0.515	6.5	0.229	4.6	-2	162	1	0.5	0.142	9.3	0.58	0.351	2.7	83	6	24	2.6	33.9	364
117802	20	30	28	16	60	0.469	9.2	0.363	5.9	-2	199	-1	0.8	0.227	9.5	0.65	0.17	3.4	118	2	33	3.1	60.7	305
117804	26	40	15	11.8	90	0.704	5.9	0.235	5.9	3	373	2	0.5	0.173	14	0.61	0.643	2.3	117	3	29	2.3	47.4	460
117806	26	40	16	12.9	80	0.614	5.4	0.022	6.8	-2	301	-1	0.7	0.1	16	0.62	0.562	3.2	102	3	28	2.6	47.8	493
117808	23	40	11	12	110	0.62	5	0.153	6.3	3	304	-1	0.6	0.141	15	0.51	0.515	2.9	75	3	26	2.7	38.5	414
117810	23	30	16	12.9	140	0.642	5.9	0.002	5.7	-2	320	1	0.7	0.136	13	0.56	0.578	3	119	2	27	2.5	40.4	352
117811	3	10	8	5.52	-30	0.328	2.1	0.201	1.5	2	112	-1	-0.5	0.159	3	0.15	0.304	0.9	-20	-2	8	0.8	16.4	125
117813	6	10	11	6.45	-30	0.399	3	0.136	2	11	183	-1	-0.5	0.134	4	0.19	0.255	1.4	-20	-2	10	1.1	21.7	147
117815	7	20	12	10.7	40	0.44	4.6	0.202	3.1	2	210	-1	-0.5	0.142	6.4	0.26	0.189	2.1	20	-2	15	1.8	33.3	180
117817	9	10	15	14.7	50	0.679	4.4	0.142	2.7	2	242	-1	-0.5	0.164	6	0.31	0.314	1.9	41	-2	13	1.4	40.7	169
117819	5	10	9	6.54	-30	0.678	2.6	0.165	1.8	-2	163	-1	-0.5	0.126	3.5	0.18	0.448	1.4	-20	-2	9	0.8	22.3	127
117821	6	10	11	6.46	-30	0.526	3	0.171	2	5	183	-1	-0.5	0.14	4.4	0.22	0.275	1.5	33	-2	12	1	24.6	180
117823	28	50	16	12.8	100	0.854	5.6	0.229	7.4	-2	370	-1	0.7	0.159	15	0.54	0.53	4.4	101	-2	30	3.2	59.5	410
117825	25	40	19	13.3	90	0.748	8.8	0.109	6.8	5	417	-1	0.6	0.103	15	0.79	0.564	3.1	137	-2	25	2.7	60.7	378

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
117827	63	110	23	17.3	80	0.787	10.5	0.071	14.7	6	361	-1	1.1	0.151	27	1.56	0.238	3.1	356	-2	41	4.6	187	917
117829	57	100	21	16.2	130	0.789	10.5	0.188	13.1	5	393	-1	1.2	0.182	25	1.18	0.404	3.7	269	2	40	3.8	145	848
117831	78	150	14	16.5	130	0.605	11.4	0.199	20.5	10	246	-1	2	0.107	30	0.97	0.577	4.8	191	-2	67	6.4	143	1198
117833	9	20	11	7.93	50	0.73	4.3	0.19	3.1	6	274	-1	-0.5	0.178	7.2	0.28	0.403	1.7	-20	-2	14	1.3	29.4	199
117835	9	20	9	6.33	30	0.453	4	0.101	3.2	2	312	-1	-0.5	0.163	6.6	0.21	0.541	1.5	-20	-2	14	1.2	23.5	168
117837	10	20	13	27.6	60	0.912	4.8	0.188	3.3	3	254	-1	-0.5	0.192	7.3	0.33	0.406	1.8	54	-2	16	1.7	33.7	254
117839	10	20	15	9.21	50	0.489	5	0.211	3.3	4	214	-1	0.5	0.139	7.3	0.3	0.176	1.8	43	-2	16	1.7	33.4	172
117841	11	10	12	7.03	70	0.506	4.6	0.309	3.4	6	310	-1	0.6	0.137	8.1	0.29	0.301	1.6	43	-2	15	1.5	27.2	203
117843	10	20	14	8.73	80	0.569	4.7	0.24	3.1	-2	253	-1	-0.5	0.145	7.1	0.32	0.244	1.4	63	-2	14	1.5	32	187
117845	9	20	12	8.35	50	0.588	4.5	0.223	3.1	5	216	-1	-0.5	0.137	7.1	0.28	0.337	2.1	24	-2	14	1.5	29.5	190
117847	9	20	14	9.38	60	0.573	5.4	0.14	3.7	6	239	-1	-0.5	0.193	7.9	0.35	0.409	2.1	24	-2	19	1.6	34.7	210
117852	8	10	13	11.4	40	0.473	4.8	0.111	2.9	6	196	-1	-0.5	0.165	6.5	0.31	0.424	1.8	31	-2	14	1.5	35.5	189
117854	6	10	11	7.09	40	0.475	3.6	0.261	2.3	7	174	-1	-0.5	0.15	4.7	0.22	0.508	1.3	27	-2	10	1	26.9	151
117856	11	30	19	13.5	90	0.577	6.9	0.111	4.9	3	170	-1	0.6	0.192	9.9	0.49	0.351	2.5	94	-2	21	2.4	33.9	326
117857	13	20	17	14.8	90	0.653	7.2	0.237	4.5	4	204	-1	0.5	0.195	9.4	0.54	0.354	2.6	116	-2	21	2.6	42.1	309
117860	14	20	21	15.5	80	0.669	7.1	0.231	4.6	3	195	-1	-0.5	0.215	9.8	0.55	0.61	2.6	99	-2	23	2.6	42.7	385
117862	9	20	19	12.3	70	0.536	4.9	0.329	3.2	4	206	-1	-0.5	0.16	7.5	0.28	0.409	1.8	44	-2	16	1.6	33	187
117864	6	10	11	8.14	50	0.571	4	0.222	2.7	7	208	-1	-0.5	0.137	6	0.24	0.556	1.7	41	-2	12	1.3	25.9	180
117866	7	10	15	9.33	50	0.535	4.1	0.241	2.5	5	221	-1	-0.5	0.128	5.9	0.26	0.581	1.6	25	-2	12	1.2	29.8	159
117868	8	20	13	7.66	50	0.467	4.4	0.112	3.1	-2	244	-1	0.5	0.118	7	0.28	0.453	1.5	27	-2	13	1.3	37.3	213
117870	6	10	11	10.1	30	0.56	3.4	0.011	2.4	8	220	-1	-0.5	0.174	5.3	0.22	0.35	1.6	27	-2	13	1.1	27.5	158
117872	6	10	13	6.47	30	0.775	3.4	0.266	2.3	2	206	-1	-0.5	0.173	5.1	0.2	0.374	1.6	-20	-2	12	1.2	27.4	192
117874	13	30	18	11	60	0.823	6.2	0.211	4.5	6	287	-1	-0.5	0.194	10	0.46	0.307	1.9	67	-2	20	1.9	61.9	294
117876	5	10	13	5.19	30	0.661	3	0.138	2.4	5	163	-1	-0.5	0.174	4.9	0.17	0.323	1.4	-20	-2	11	1.2	21.5	161
117878	7	10	13	9.39	40	0.636	3.9	0.036	2.5	-2	191	-1	-0.5	0.169	5.1	0.24	0.41	1.7	32	-2	11	1.2	28.5	162
117880	27	50	19	14.6	120	0.936	7.2	0.195	7.2	2	367	-1	0.7	0.172	17	0.54	0.427	3.5	96	-2	28	3.2	64.5	423
117882	28	50	18	12.1	130	0.754	7.2	0.159	7.3	7	345	-1	0.8	0.197	17	0.53	0.402	4.2	84	2	29	3.5	49.7	364
117884	34	80	17	13.3	60	0.782	8.4	0.08	11.2	3	369	-1	1	0.179	22	0.75	0.363	3.7	141	-2	36	3.9	84.1	529
117886	25	40	20	16.5	150	1.25	7.6	0.229	7.1	6	356	-1	0.8	0.125	15	0.63	0.436	3.3	107	-2	27	3.3	62.6	369
117888	29	40	26	12.6	50	0.686	8.3	0.111	6.9	7	500	-1	0.7	0.163	16	0.74	0.591	3	143	-2	28	2.8	57.9	413
117890	40	70	15	13.3	130	0.662	8.7	0.23	10	4	382	-1	0.9	0.178	21	0.61	0.75	4.2	91	-2	36	4	66	559
117892	31	50	27	15.8	120	0.876	8.7	0.243	7.5	5	459	-1	0.6	0.219	16	0.77	0.546	3.4	164	-2	30	3.1	69.6	404
117894	40	90	16	14.8	160	0.735	9.5	0.152	12.2	8	255	-1	1.1	0.148	23	0.7	0.696	4.1	151	2	36	4.7	75.6	577
117896	27	80	16	10.5	110	0.633	8.7	0.233	10.4	4	335	-1	1	0.172	23	0.6	0.447	3.7	77	-2	30	3.4	52.6	502
117898	28	40	10	13.1	130	0.951	9.6	0.149	7.2	9	364	-1	0.7	0.194	16	0.65	0.7	3.1	118	2	30	3.1	59.5	433
117900	27	50	15	11.1	80	0.815	9.3	0.135	7.5	5	362	-1	0.8	0.179	15	0.55	0.418	3.8	95	-2	28	3.2	50.3	541
117902	31	40	14	10.3	90	0.742	8.4	0.022	5.6	10	319	-1	0.5	0.156	13	0.74	0.436	2.9	178	-2	29	3	81.4	613
117905	25	40	23	9.97	110	0.517	8.4	0.142	6.9	-2	533	1	0.7	0.175	16	0.86	0.885	2.9	110	-2	25	2.3	77.5	447
117907	23	40	20	8.71	120	0.659	7.2	-0.28	6.5	5	477	2	0.5	0.147	16	0.63	0.915	3.6	61	-2	24	2.3	44.1	324
117909	23	40	23	9.07	120	0.492	6.6	-0.102	6.1	4	447	1	0.6	0.176	18	0.80	0.795	3.5	104	-2	22	2	59.4	311
117911	20	40	20	15.8	80	1.42	5.7	-0.231	6	3	476	-1	-0.5	0.147	18	0.63	1.17	3.8	83	-2	21	2.5	64.6	397
117913	14	20	20	9.18	70	1.07	4.2	0.164	3.9	-2	282	1	-0.5	0.054	10	0.32	0.729	2.2	36	-2	16	1.5	30.1	204
117915	22	50	32	20.3	90	0.924	9.8	0.101	7.9	-2	465	1	-0.5	0.133	15	0.90	0.593	3.1	127	-2	30	2.9	78.1	397
117917	22	50	22	13.4	110	1.32	7.4	-0.111	7.2	-2	467	2	0.7	0.159	16	0.67	0.815	2.9	80	-2	26	3	47.7	396
117919	22	40	23	17.9	130	1.2	8.2	0.233	6.8	-2	309	1	0.8	0.121	17	0.64	0.829	3.2	73	-2	29	3	45.5	381
117921	19	40	24	12.1	100	1.28	9.8	-0.114	6.5	4	511	-1	0.5	0.155	13	0.75	0.552	3.4	95	-2	26	2.4	38.1	356
117923	35	70	22	15.4	130	0.719	7.1	0.302	9.7	-2	244	1	1	0.075	24	0.60	0.678	3.5	64	-2	38	3.5	57.1	453
117925	42	60	24	15.1	120	0.715	8.5	-0.421	9	7	250	1	0.9	0.145	18	0.77	0.789	4.2	61	-2	32	3.4	95.6	531
117927	105	110	19	16.6	110	0.598	8.4	0.3	12.3	7	294	5	1.5	0.119	22	2.00	0.54	3.2	117	-2	50	4.5	141	1095
117934	21	40	18	15	110	1.02	6.6	0.554	6	3	309	-1	0.5	0.178	19	0.48	0.401	3.5	44	-2	25	2.4	38.1	314
117936	20	30	19	13.5	160	1.62	8	0.396	5.8	-2	324	-1	0.5	0.171	19	0.59	0.618	4.1	70	-2	24	2.7	40.8	412
117938	29	40	22	15.6	140	0.809	6.3	0.111	7.4	3	289	2	0.8	0.089	18	0.50	0.774	3.5	51	-2	32	3.3	46.3	347
117940	33	60	19	14.5	150	1.29	5.9	-0.602	9.2	10	232	1	0.9	0.153	24	0.47	0.985	4	44	-2	37	3.5	55.1	328
117942	30	50	24	16.3	140	0.879	7.4	0.216	7.8	-2	288	1	0.8	0.136	16	0.52	0.995	4.1	52	-2	37	3.7	55	421
117944	35	50	26	15	110	0.916	7	-0.318	7.5	-2	278	1	0.9	0.143	16	0.56	0.832	3.4	50	-2	36	3.4	59.5	445
117946	24	40	23	14.4	130	1.03	7.5	-0.219	6.7	-2	297	1	0.8	0.165	15	0.51	0.974	2.9	57	-2	31	2.8	46.8	329

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
117948	61	120	19	15.1	130	0.487	8.8	-0.106	14	5	187	3	2.1	0.13	29	0.66	0.819	4.2	51	-2	51	5	91	1024
117950	18	30	22	13.1	120	1.21	9.7	0.173	5.8	-2	305	-1	0.6	0.133	17	0.58	0.496	3.2	75	-2	21	2.4	47	272
117952	20	40	19	9.89	90	0.702	7.3	0.274	6.3	-2	435	-1	-0.5	0.174	18	0.52	0.361	2.9	65	-2	22	2.2	37.5	272
118251	25	40	16	18.3	140	1.06	7.3	0.155	7.3	5	336	1	0.8	0.178	17	0.63	0.535	4	99	-2	25	2.9	58.9	442
118253	28	60	18	12.4	110	0.738	6.7	0.144	9.3	10	350	1	1	0.165	19	0.58	0.599	3.8	85	3	31	3.3	60.3	410
118255	34	60	16	17.9	130	0.849	7.8	0.259	9.5	11	319	1	1	0.229	20	0.74	0.425	4.1	131	-2	33	3.6	66.9	650
118257	22	40	20	14.9	120	1.03	8.2	0.069	6.4	-2	313	1	0.6	0.196	18	0.57	0.706	4.1	140	2	23	2.9	51.4	244
118259	24	30	16	12.2	100	0.686	5.5	0.19	5	-2	433	-1	0.7	0.221	17	0.48	0.514	3.4	101	4	25	2.6	37.7	333
118261	14	20	9	12.7	120	2.08	3.4	0.185	3.3	8	282	-1	-0.5	0.159	16	0.27	0.49	3.8	34	-2	14	1.4	22.7	200
118263	17	30	13	13.5	120	2.22	6.4	0.175	4.3	4	345	-1	-0.5	0.193	14	0.63	0.334	3.7	140	-2	17	1.6	37.7	312
118265	18	30	12	12.3	100	2.31	4.9	0.313	4.2	3	380	-1	-0.5	0.205	14	0.45	0.458	3.6	78	-2	19	2	32.5	301
118267	18	30	12	12.2	130	1.75	5.6	0.19	4.4	7	364	-1	-0.5	0.186	15	0.47	0.544	4	56	-2	20	1.9	34.5	287
118269	17	30	13	11.8	100	0.911	5.5	0.195	4.1	8	404	-1	-0.5	0.239	14	0.47	0.437	3.8	96	2	18	1.8	40.4	241
118271	15	20	11	7.26	90	0.596	4.3	0.116	3.6	2	450	-1	-0.5	0.217	11	0.38	0.425	3.3	64	-2	16	1.7	26.6	236
118273	14	30	14	9.05	150	1.23	5	0.158	4.2	4	457	-1	-0.5	0.175	15	0.4	0.312	3.6	54	-2	19	1.7	30	240
118275	19	50	10	12.5	40	1.1	6.2	0.193	5.9	4	683	-1	0.5	0.197	19	0.62	0.429	3.5	122	-2	20	2.1	52.2	486
118277	23	40	21	15.5	60	0.777	7.2	0.064	6	7	546	-1	0.5	0.168	16	0.71	0.485	3.2	120	3	23	2.1	58.4	419
118279	22	40	16	10.5	140	0.68	6.2	0.16	5.3	5	463	-1	-0.5	0.129	17	0.58	0.492	3.3	100	-2	22	2	60.2	374
118281	18	30	13	14.4	120	0.74	4.9	0.319	4	9	339	-1	-0.5	0.147	14	0.37	0.561	2.7	61	-2	19	1.6	32.2	224
118283	19	40	19	13.8	-30	0.807	8.2	0.231	5.7	9	516	-1	-0.5	0.191	15	0.77	0.377	3.1	145	-2	21	2	67.4	347
118285	17	30	13	13.2	100	0.807	6.5	0.251	4.2	6	457	-1	-0.5	0.17	13	0.52	0.582	3.8	76	-2	20	1.6	47	257
118287	18	30	13	12.6	80	0.699	7.2	0.229	4.7	6	561	-1	-0.5	0.186	15	0.52	0.582	3.7	74	-2	22	2.1	46	278
118289	17	30	14	11.5	140	0.694	7.2	0.24	4.2	7	602	-1	-0.5	0.174	13	0.55	0.26	3.4	83	-2	17	1.7	42.9	275
118291	18	30	15	13.5	80	0.694	7.7	0.043	5.2	5	660	-1	0.5	0.211	14	0.6	0.471	3.5	99	-2	23	2	44.8	374
118293	19	30	12	18.8	90	1.05	6.1	0.291	4.1	6	395	-1	-0.5	0.214	13	0.47	0.457	4.1	68	-2	19	1.9	44.1	303
118295	19	30	13	28.5	100	1.06	6.7	0.45	4.3	3	436	-1	-0.5	0.244	14	0.53	0.382	4.1	102	2	22	1.7	50.7	347
118297	20	30	15	21.8	120	0.944	6.6	0.253	4.2	9	355	-1	-0.5	0.262	15	0.5	0.387	3.3	79	-2	21	2	45.4	310
118299	19	30	15	17.2	80	1.48	6.9	0.131	4.5	5	469	-1	-0.5	0.247	13	0.54	0.455	3	93	-2	20	1.9	55.9	278
118301	20	30	17	13.4	100	0.864	6.5	0.18	4.6	-2	426	-1	0.5	0.168	13	0.49	0.528	3.1	73	-2	23	2	43	319
118303	19	30	9	14.1	100	0.873	6.7	0.246	4.7	7	337	-1	-0.5	0.177	14	0.29	0.388	4.3	45	-2	21	2.2	47.3	289
118305	34	50	16	14.2	120	0.975	8.1	0.19	6.6	8	431	-1	0.7	0.215	14	0.65	0.562	3.9	110	3	31	2.6	68.4	602
118307	37	50	14	11.8	120	0.819	6.9	0.272	6.7	8	360	-1	0.8	0.201	18	0.48	0.434	4.3	77	-2	32	3.4	57	475
118309	43	50	16	17.7	90	0.738	7.1	0.357	7.7	9	273	-1	0.8	0.143	15	0.57	0.591	3.3	99	2	38	3.7	69	612
118311	33	40	18	18	130	0.905	6.5	0.151	6.3	8	301	-1	0.7	0.136	14	0.47	0.469	3.1	83	-2	35	3.2	59.2	477
118313	33	50	17	16.8	110	0.733	8.2	0.164	7.9	7	286	-1	0.8	0.121	17	0.53	0.432	3.2	89	-2	34	3.6	70.2	446
118315	21	50	18	16.2	130	1.51	8	0.231	7.8	4	308	-1	0.9	0.242	15	0.55	0.416	4.2	64	2	29	3.8	47.9	332
118317	17	30	13	11.7	100	0.549	7	0.232	5.3	-2	337	-1	-0.5	0.219	14	0.69	0.307	2.9	114	-2	20	2.1	58.4	322
118319	17	30	11	11	160	0.598	6.4	0.152	5	6	429	-1	-0.5	0.186	15	0.45	0.41	3.2	65	-2	19	2.3	35.7	281
118321	19	40	12	12.1	80	0.66	6.8	0.06	5.5	9	465	-1	0.5	0.147	15	0.57	0.345	3.3	113	-2	20	2	50.2	356
118323	18	30	12	12.4	120	0.642	4.9	0.219	4.6	7	357	-1	-0.5	0.124	16	0.44	0.577	5.9	66	-2	19	2.2	41.3	294
118325	14	30	11	8.55	150	0.601	5.2	0.221	4.3	4	380	-1	-0.5	0.184	15	0.41	0.555	7.8	73	-2	18	1.7	40.9	273
118327	21	50	15	10.3	90	0.577	8.2	-0.025	7.4	-2	553	-1	0.8	0.115	20	0.7	0.491	2.8	138	-2	24	2.7	66.7	433
118329	15	30	11	13.4	90	0.649	5.4	0.004	5	7	425	-1	-0.5	0.17	16	0.49	0.219	5.6	83	-2	16	1.9	55.7	279
118331	15	30	9	9.43	150	0.578	5.2	0.12	4.3	5	448	-1	-0.5	0.174	15	0.43	0.439	3.6	59	-2	15	1.8	40.1	322
118333	18	40	16	12.2	110	0.665	8.9	0.113	6.1	5	588	-1	0.7	0.124	15	0.67	0.608	3.5	134	-2	22	2.5	46.2	338
118335	18	30	9	9.3	80	0.485	4.9	0.057	4.8	6	373	-1	-0.5	0.172	17	0.37	0.391	4.8	82	2	20	1.9	24.8	298
118337	18	30	14	19.9	140	0.79	4.9	0.111	5.1	5	311	-1	0.5	0.17	17	0.4	0.444	4.1	47	-2	19	2.2	36	224
118339	21	40	12	16.1	130	0.738	5.5	0.01	6.5	8	356	-1	0.6	0.111	21	0.46	0.404	4.5	75	-2	21	2.7	34.9	374
118341	19	40	13	20.2	140	0.752	5.2	0.15	5.6	5	318	-1	0.8	0.146	19	0.41	0.451	3.9	47	-2	19	2.6	35.8	267
118343	18	30	12	15.2	140	0.619	5.3	-0.011	5.4	8	342	-1	-0.5	0.136	18	0.45	0.516	4.5	59	-2	21	2.3	35.7	275
118345	17	30	13	12.9	150	0.684	5.7	0.191	5.7	-2	358	-1	-0.5	0.172	18	0.42	0.584	4	61	2	18	2.4	37.1	256
118347	19		14	19.3		0.952		0.129		6	329			0.131		0.41	0.367		64	-2	20		35.7	264
118350	20	60	17	12.9	120	0.857	8.2	0.074	8.1	3	488	-1	0.8	0.142	22	0.55	0.335	3.7	78	2	26	3.1	56.8	378
118352	20	40	16	10.8	140	0.606	6.8	0.24	6.4	7	531	-1	0.5	0.118	17	0.54	0.346	3.7	85	-2	22	2.4	46.7	324
118354	22	50	15	12.3	130	0.593	8.1	0.018	6.8	6	538	-1	0.7	0.163	16	0.68	0.501	3.7	150	2	24	2.6	59.4	401
118356	20	50	19	15.3	110	0.965	8.4	0.274	6.9	5	429	-1	0.7	0.28	16	0.62	0.503	3.5	107	-2	23	2.8	53.5	369

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF	Nd INAA	Ni XRF	Pb ICP	Rb INAA	Sb ICP	Sc INAA	Se ICP	Sm INAA	Sn XRF	Sr XRF	Ta INAA	Tb INAA	Te ICP	Th INAA	TiO2 XRF	Tl ICP	U INAA	V XRF	W XRF	Y XRF	Yb INAA	Zn ICP	Zr XRF
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
118358	19	60	11	7.49	100	0.59	4.6	0.208	6.8	7	584	-1	0.6	0.186	24	0.49	0.481	3	100	-2	20	2.4	56.1	341
118360	18	40	12	8.92	140	0.583	6.2	0.33	6.3	6	528	-1	0.5	0.203	18	0.54	0.41	4.4	94	-2	18	2.5	45.6	315
118362	18	30	13	12.2	140	0.951	7.4	0.268	5.3	9	451	-1	0.5	0.17	16	0.47	0.647	4.3	69	-2	19	2.7	45.5	296
118364	18	30	16	16.2	140	0.962	7	0.152	5	6	394	-1	-0.5	0.216	16	0.51	0.548	4.3	74	-2	21	2.4	51.1	258
118366	19	30	13	11.3	120	0.731	6.1	0.071	5.7	7	562	-1	0.5	0.171	16	0.5	0.498	4.2	82	-2	21	2.7	41.2	316
118368	21	30	18	14.3	150	0.996	6.3	0.235	4.5	7	411	-1	0.5	0.143	14	0.45	0.468	3.7	72	2	23	2	42.5	212
1192-001	3	10	9	8.23	-30	0.49	2.3	0.31	1.8	4	114	-1	-0.5	0.16	3.8	0.17	0.16	1.6	-20	-2	9	0.8	21.80	120
1292-002	3	10	8	6.47	30	0.32	2.3	0.09	1.7	-2	113	-1	-0.5	0.16	4	0.14	0.21	1.5	-20	-2	8	0.7	20.00	95
0193-003	10	20	23	12.00	60	1.85	4.9	0.37	3.6	-2	255	-1	-0.5	0.20	8.1	0.32	0.13	2.2	-20	-2	18	1.7	66.40	221
0193-004	10	20	21	12.10	60	1.08	4.8	0.21	3.5	2	309	-1	-0.5	0.18	7.6	0.31	0.34	1.9	51	-2	16	1.4	49.90	209
0193-005	13	30	44	13.60	60	0.95	6.5	1.49	6	4	319	1	0.7	0.26	10	0.45	0.48	3.3	83	-2	34	2.8	106.00	289
0393-006	14	30	26	13.00	90	0.77	6.5	0.50	4.9	4	327	2	0.6	0.18	11	0.44	0.23	2.6	66	-2	25	2.1	60.30	256
0393-007	13	30	27	12.30	60	1.03	6.5	0.91	5.2	3	293	-1	0.5	0.20	11	0.43	0.26	3	78	-2	26	2.4	71.80	283
0393-008	14	30	25	9.73	90	0.60	6.9	0.47	4.9	3	301	1	0.5	0.23	11	0.47	0.12	3	69	-2	24	2.4	65.70	310
0393-009	13	30	21	11.50	110	0.91	6.4	0.35	5	-2	332	1	-0.5	0.18	12	0.42	0.27	3.1	57	-2	22	2.2	50.60	308
0493-011	17	40	16	10.80	70	0.53	6.5	0.28	6.3	-2	335	2	0.7	0.15	14	0.46	0.34	3.2	49	-2	27	2.3	43.50	313
0493-012	16	30	20	17.40	90	1.55	7.3	0.25	5.9	4	292	-1	0.7	0.15	13	0.55	0.30	2.2	90	-2	25	2.6	47.40	313
0493-013	20	50	18	11.80	60	0.66	7.5	0.41	8.1	6	341	2	0.7	0.22	18	0.64	0.25	2.9	118	-2	29	2.8	73.90	612
0493-014	16	40	16	10.60	100	0.58	6.5	0.39	6.2	-2	339	2	0.7	0.21	14	0.44	0.37	2.8	92	-2	21	2.6	46.90	359
0493-015	15	40	18	10.80	50	0.54	6.6	0.37	6	-2	320	1	0.6	0.20	13	0.45	0.17	3.3	81	-2	23	2.5	47.70	301
0493-016	16	40	18	11.60	80	0.53	7.2	0.32	6.1	3	324	-1	0.8	0.20	14	0.51	0.34	3.1	90	-2	23	2.4	51.10	327
0493-017	16	30	17	10.90	90	0.52	6.1	0.33	5.6	4	290	1	0.6	0.18	13	0.41	0.32	2.7	72	-2	22	2.3	47.30	244
0493-018	16	30	19	20.50	110	0.60	6.6	0.33	6.4	2	296	1	0.7	0.18	14	0.46	0.49	3	79	-2	24	2.7	60.60	333
0593-010	14	30	15	9.63	70	0.38	6.1	0.22	5	2	340	1	0.6	0.22	11	0.43	0.27	2.6	72	-2	22	2.2	39.10	326
0593-019	14	30	20	10.60	70	0.51	6.5	0.23	4.7	-2	293	1	0.5	0.23	11	0.47	0.39	2.5	78	-2	21	2.1	47.70	230
0593-020	16	30	16	11.60	80	0.61	6.3	0.28	4.9	3	315	1	0.6	0.21	12	0.46	0.34	2.8	76	-2	21	2.1	40.10	257
0593-021	22	40	20	35.70	110	9.32	9.4	0.32	7.4	-2	236	1	0.7	0.15	15	1.04	0.37	3.2	207	4	36	4	52.70	633
0593-022	21	40	16	14.50	90	3.41	7.4	0.22	7.5	4	274	1	0.8	0.21	15	0.7	0.16	2.9	127	5	37	3.7	53.20	586
0593-023	19	50	22	15.60	80	0.78	7.4	0.30	7.3	-2	299	2	0.6	0.18	15	0.67	0.41	3.6	159	-2	29	2.9	69.90	429
0593-024	22	50	21	14.00	110	1.10	9.2	0.32	7.9	3	278	2	0.8	0.24	15	0.92	0.47	3	203	-2	34	3.6	57.00	482
0593-025	23	40	14	14.20	120	0.62	6.8	0.23	7.1	-2	285	1	0.8	0.19	16	0.53	0.36	3.5	101	-2	33	3.4	48.50	381
0593-026	19	40	21	16.10	100	1.60	8.8	0.32	6.7	6	284	1	0.6	0.17	14	0.75	0.25	3.6	159	-2	29	3	53.40	363
0593-027	17	40	21	18.40	90	0.82	7.4	0.32	6.6	3	296	2	0.7	0.19	15	0.56	0.27	3.3	102	-2	27	2.8	52.30	385
0593-028	22	50	21	20.70	100	1.69	9.3	0.17	8.3	4	258	1	0.9	0.21	18	0.94	0.41	3.5	207	-2	33	3.5	72.90	610
0693-029	15	30	18	9.94	80	0.44	6.2	0.37	5	4	335	1	0.6	0.15	11	0.42	0.26	2.8	65	-2	24	2	41.90	325
0693-030	17	40	18	19.90	80	0.57	6.4	0.15	6.2	4	303	1	0.7	0.16	14	0.45	0.26	3.1	48	-2	26	2.5	58.90	332
0693-031	17	30	17	13.40	90	0.63	6.9	0.49	5.9	2	327	1	0.5	0.22	14	0.49	0.42	2.4	86	-2	25	2.5	62.50	312
0993-032	25	70	16	18.40	50	0.30	5.4	0.35	10.1	-2	233	3	1	0.20	17	0.65	0.27	2.6	113	-2	34	3.5	106.00	619
0993-033	11	30	15	41.90	40	1.22	4.2	0.30	4.7	5	184	-1	0.5	0.21	9.2	0.39	0.44	1.5	75	-2	16	1.7	86.70	263
0993-034	5	10	11	2401.00	-30	41.50	2.4	0.15	2.1	-2	119	-1	-0.5	0.19	4.4	0.19	0.20	1.5	-20	-2	10	0.9	2092.00	136
0993-035	9	20	12	13.80	50	0.67	3.8	0.42	3.7	-2	144	-1	-0.5	0.20	7.7	0.32	0.30	1.8	40	-2	14	1.5	47.70	218
0993-036	23	40	17	18.50	150	0.52	3.6	0.36	5.8	2	178	1	0.5	0.22	21	0.37	0.48	4.3	53	-2	26	2.2	46.30	275
0993-037	22	30	15	14.90	130	0.62	5.5	0.24	5.6	3	303	1	0.6	0.20	16	0.5	0.34	3.6	62	-2	25	2.6	48.50	357
0993-038	22	20	14	10.30	50	0.24	4	0.25	3.9	6	316	1	-0.5	0.17	10	0.51	0.28	2.2	77	-2	30	1.6	35.50	373
0993-039	11	10	14	6.94	30	0.14	2.2	0.26	2.1	4	224	-1	-0.5	0.11	4.1	0.28	0.16	0.7	23	-2	17	0.9	26.20	185
0993-040	4	40	9	18.00	150	0.47	3.6	0.27	6	2	124	-1	0.5	0.19	20	0.17	0.42	4.3	20	-2	7	2.6	45.00	126
0993-041	25	40	12	15.20	80	2.70	6	0.27	5.9	-2	185	2	0.5	0.17	16	0.35	0.60	2.5	38	-2	25	2.6	35.90	278
0993-042	15	30	19	12.10	50	0.52	5.9	0.26	4.8	6	245	1	0.5	0.21	11	0.45	0.44	2.2	59	-2	22	2.2	41.90	282
1093-s043	14	30	27	17.70	80	1.02	9.1	0.28	5.1	-2	160	1	0.6	0.19	13	0.63	0.41	2.2	125	-2	24	2.5	51.50	247
1193-044	28	50	17	11.00	90	0.27	6	0.18	8.6	-2	274	1	0.7	0.10	18	0.72	0.33	3.6	141	-2	36	3.4	73.90	809
1193-045	18	50	17	10.10	40	0.34	5.7	0.12	7.3	-2	275	-1	0.7	0.18	14	0.52	0.33	2.5	81	-2	27	2.8	68.20	454
1193-046	26	70	13	9.74	50	0.28	6	0.36	10.1	4	323	2	0.9	0.22	18	0.67	0.21	2.2	117	-2	39	3	79.20	671
1193-047	15	30	16	9.88	40	0.29	4.8	0.27	5.4	-2	244	1	0.6	0.20	12	0.36	0.16	1.8	32	-2	22	2.3	41.00	246
1193-048	16	40	19	9.46	50	0.25	5.2	0.22	6.2	2	260	1	0.5	0.13	13	0.45	0.38	2.6	58	-2	23	2.5	45.00	349
1193-049	25	50	15	10.50	110	0.23	4.9	0.24	8.1	2	227	2	0.7	0.15	17	0.57	0.35	3	120	-2	33	3	56.80	526
1193-050	23	60	14	14.30	80	0.38	5.8	0.28	9.6	6	291	-1	0.9	0.15	17	0.58	0.28	2.2	103	-2	36	3.3	59.70	521

(-) less than indicated value

SILT SAMPLE ANALYSES

Sample Number	Nb XRF ppm	Nd INAA ppm	Ni XRF ppm	Pb ICP ppm	Rb INAA ppm	Sb ICP ppm	Sc INAA ppm	Se ICP ppm	Sm INAA ppm	Sn XRF ppm	Sr XRF ppm	Ta INAA ppm	Tb INAA ppm	Te ICP ppm	Th INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	Yb INAA ppm	Zn ICP ppm	Zr XRF ppm
1193-051	29	130	20	14.00	90	0.20	8.6	0.28	17.1	2	363	-1	1.5	0.20	24	0.96	0.20	2.6	209	-2	42	4.2	178.00	603
1193-052	17	40	19	11.80	70	0.32	5.9	0.28	6.2	4	302	-1	0.6	0.17	14	0.53	0.47	2.8	71	-2	24	2.5	72.30	370
1193-053	20	40	17	9.61	90	0.24	6.1	0.24	6.9	5	282	-1	0.7	0.11	16	0.46	0.37	3	62	-2	24	2.7	61.20	358
1193-054	13	30	13	9.69	80	0.36	5	0.12	5	3	279	-1	0.5	0.15	12	0.36	0.43	3.1	47	-2	18	2	38.80	247
1193-055	17	40	17	10.60	60	0.37	5.8	0.28	6.5	2	307	-1	0.7	0.15	15	0.45	0.27	2.3	87	-2	22	2.3	71.70	359
0394-056	20	40	19	13.50	90	0.74	6.3	0.30	6	5	311	-1	0.5	0.22	14	0.59	0.31	3	140	-2	27	2.7	54.30	410
0394-057	18	50	22	13.30	100	0.74	7.8	0.22	7.2	4	317	1	0.7	0.25	18	0.75	0.24	2.8	124	-2	30	2.9	61.10	532
0394-058	19	40	18	14.40	90	0.88	7.1	0.21	6.4	6	295	1	0.7	0.15	16	0.67	0.29	2.9	124	-2	27	2.8	49.80	462
0394-059	35	60	15	9.65	130	0.26	6.1	0.23	9.2	-2	205	3	0.9	0.19	32	0.59	0.23	3.8	92	-2	36	3.3	63.00	475
0394-060	29	40	13	8.79	120	0.22	4.7	0.21	6.6	3	206	2	0.5	0.18	22	0.4	0.31	3.7	77	-2	32	2.9	38.30	385
0394-061	29	50	13	12.20	100	0.36	5.3	0.29	7.4	4	248	2	0.8	0.25	19	0.43	0.40	3.5	71	-2	34	3.1	43.80	353
0394-062	32	50	13	9.38	140	0.27	5.7	0.34	7.8	3	243	1	0.7	0.19	22	0.51	0.40	4	113	-2	35	3.4	40.40	474
0394-063	34	60	11	9.78	130	0.19	5.9	0.18	8.6	6	237	2	1	0.17	26	0.54	0.34	4.1	103	-2	36	3.6	57.20	533
0394-064	30	50	13	9.91	150	0.30	5.5	0.26	7.4	-2	230	2	0.8	0.10	23	0.49	0.20	3.9	88	-2	32	3.3	44.60	442
0594-065	18	30	11	13.8	160	1.26	6.9	0.11	5.1	-2	352	-1	0.5	0.139	17	0.68	0.508	4.1	149	-2	22	2.2	49.7	326
0594-066	16	30	11	13.7	160	1.43	7.4	0.117	5	-2	329	-1	0.5	0.114	17	0.72	0.52	5	128	-2	22	2.4	52.1	388
0594-067	17	30	11	16.2	170	1.54	8.4	0.125	5.1	-2	295	-1	0.6	0.124	18	0.75	0.367	4.7	148	-2	22	2.2	59.9	350
0794-068	34	80	12	24.7	90	1.06	4.9	0.213	11.6	-2	263	2	1.1	0.141	18	0.76	0.294	3.5	168	-2	34	3.8	126	749
1094-069	22	40	24	38.4	120	2.55	9.9	0.289	7.3	-2	242	-1	0.9	0.137	14	0.94	0.351	3.1	202	-2	34	3.7	58.4	533
1094-070	18	40	19	60.3	110	2.79	7.2	0.167	6.8	-2	320	-1	0.9	0.202	14	0.59	0.3	2.8	109	-2	28	2.6	51.2	448
1094-071	30	50	14	12.8	120	0.624	5.6	0.148	8.3	-2	271	-1	1	0.138	21	0.47	0.401	3.7	67	-2	31	3.2	43.6	468
1094-072	17	30	18	13.4	100	0.904	5.9	0.028	5.3	-2	263	-1	0.5	0.158	13	0.43	0.507	3.1	98	-2	24	2.3	39.2	290
1094-073	25	30	18	13.2	130	0.739	6.6	0.244	6.3	-2	287	-1	0.8	0.197	15	0.50	0.377	3.2	97	-2	28	2.6	40.2	328
1094-074	24	50	16	16.6	130	0.771	6.4	0.218	7.6	-2	338	-1	0.7	0.175	15	0.57	0.515	2.9	110	-2	29	2.8	49.6	448
1094-075	25	50	18	23	80	1.06	5.7	0.225	8.1	-2	253	1	0.7	0.153	14	0.49	0.491	3	93	-2	29	3	58.4	428
1094-076	20	30	18	19.5	110	1.88	7.9	0.102	6.1	-2	297	1	0.8	0.212	14	0.63	0.479	3.7	136	-2	27	2.8	46	370
1094-077	18	30	23	14.3	100	3.19	9.1	0.125	5.9	-2	280	-1	0.6	0.221	14	0.65	0,604	3.4	136	-2	26	2.5	53.7	253
1194-078	18	30	19	17.5	100	0.911	7	0.219	6.2	-2	205	1	0.8	0.134	12	0.54	0.391	3.4	98	-2	27	2.8	40.8	381
1194-079	12	20	24	15.8	70	0.509	7.1	0.297	5	-2	142	1	0.7	0.134	9.9	0.47	0.092	2.3	62	-2	24	2.3	33.5	295
0595-080	25	40	23	12.6	110	1.14	6.1	0.042	6.8	-2	295	-1	0.7	0.164	14	0.52	0.483	3.5	60	-2	29	2.9	45.2	475
0595-081	24	40	24	16.1	130	1.73	6.6	0.062	6	-2	278	1	0.6	0.122	17	0.56	0.921	3.1	59	2	26	2.6	54.6	361
0595-082	27	40	19	15.9	110	1.46	4.7	-0.084	7.4	3	254	1	0.8	0.098	17	0.49	0.924	2.8	42	2	34	2.9	48.4	437
0595-083	23	30	20	14.2	160	1.48	5.2	-0.124	5.3	-2	274	1	0.6	0.077	17	0.43	0.88	3.6	57	3	26	2.8	39.1	276
0695-084	37	50	19	20.4	160	1.36	4.8	0.118	7.2	5	243	2	0.7	0.122	22	0.80	0.523	4.4	91	-2	34	3.1	97	792
0695-085	29	40	17	12.5	210	0.895	4	0.013	6.4	3	264	2	0.7	0.103	20	0.38	0.675	4	40	2	30	3.1	30	368
0695-086	20	30	22	12.9	150	1.5	6.3	0.168	5.1	-2	291	1	-0.5	0.13	16	0.51	0.632	3.7	54	-2	25	2.6	46.1	345
0695-087	21	30	24	16.2	110	1.99	6.3	-0.01	4.8	-2	263	1	0.5	0.12	15	0.52	0.736	3.2	59	-2	24	2.4	53.7	294
0695-088	22	30	27	17.4	110	1.62	7.9	0.044	6.1	-2	267	-1	0.7	0.164	14	0.62	0.885	3.2	65	-2	32	3.1	60.1	485
0695-089	25	50	31	15.5	110	1.56	7.4	0.144	7.2	-2	265	1	0.7	0.113	16	0.79	0.43	3.6	82	-2	36	3.1	77.7	694
0795-090	21	40	23	16.7	110	1.46	6.1	0.075	6.4	-2	271	1	1.1	0.104	13	0.51	0.63	2.5	57	-2	32	2.7	48.6	475
0795-091	31	50	24	12.1	100	1.05	5.8	0.082	6.9	-2	276	2	0.8	0.105	18	0.55	0.737	3.5	55	-2	33	2.9	52.1	492
0795-092	38	50	21	14.7	140	0.922	5.2	0.084	8	3	268	-1	0.9	0.075	18	0.49	0.601	3.8	47	-2	41	4	62.5	588
0795-093	31	40	23	12.5	140	1.28	4.5	0.025	7.4	-2	253	1	0.9	0.1	15	0.42	0.652	3.1	40	-2	39	3.1	55.4	477
0795-094	36	40	24	15.2	100	0.742	4.8	-0.047	6.9	5	263	2	1	0.134	16	0.42	0.722	3.9	40	3	40	3.6	48.2	535
0995-095	20	40	25	22.4	110	1.59	9.1	0.17	6.6	-2	298	2	0.6	0.191	15	0.58	0.553	3.3	67	-2	29	3.2	49.3	374
0995-096	33	70	20	12.6	140	0.902	5.6	0.09	10.2	-2	230	-1	1	0.147	24	0.49	0.563	4.2	54	-2	39	3.9	50.8	490
1095-097	21	40	31	13.1	100	1.6	10.9	0.488	7.2	-2	258	-1	0.8	0.152	16	0.68	0.559	3.6	73	-2	30	3.2	52.7	385
1095-098	21	40	26	16.5	110	1.58	9.2	0.233	7	-2	273	-1	0.9	0.198	16	0.59	0.464	2.7	63	-2	31	3.3	43.9	394
1095-099	9	30	13	11.2	130	1.28	7.8	0.344	5.1	-2	168	-1	-0.5	0.133	15	0.39	0.42	3.4	53	-2	10	2.4	40.8	162
1095-100	22	30	19	14.5	170	1.01	6.5	0.657	6.2	-2	273	-1	0.7	0.109	17	0.47	0.672	3.1	50	-2	25	2.5	40.7	317

(-) less than indicated value

SILT SAMPLE ANALYSES
(U.S. Geological Survey Laboratory Analyses)

Sample	UTM	UTM	Ag	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	W	Y	Zn	Zr
Number	East	North	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	Inst	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
400	617338	4131811	N0.5	10	N10	30	500	-1	N10	5	N20	-5	30	10	2.0	0.02	50	2.00	500	N5	10	30	-2	5	N10	200	0.3	50	N50	15	50	200
401	618105	4133503	N0.5	10	N10	50	500	1	N10	5	N20	-5	20	10	2.0	0.08	30	2.00	300	N5	10	20	-2	5	N10	200	0.3	50	N50	15	30	200
402	615197	4140141	N0.5	20	N10	70	300	1	N10	5	N20	-5	30	10	1.5	0.24	30	2.00	300	N5	15	30	8	5	N10	100	0.2	30	N50	15	40	100
403	615918	4140188	N0.5	-10	N10	30	500	1	N10	1.5	N20	N5	30	7	1.5	0.02	50	0.50	500	N5	10	20	-2	5	N10	150	0.3	30	N50	15	35	150
404	617098	4140390	N0.5	10	N10	50	500	-1	N10	5	N20	5	30	10	2.0	0.06	100	2.00	500	N5	15	20	4	7	N10	300	0.5	50	N50	20	40	200
405	618690	4140341	N0.5	10	N10	30	500	-1	N10	5	N20	5	30	10	2.0	0.06	50	2.00	500	N5	15	20	4	7	N10	200	0.5	50	N50	15	40	150
406	617999	4139927	N0.5	-10	N10	30	500	-1	N10	1.5	N20	-5	20	7	1.5	0.02	50	0.70	300	N5	7	15	2	5	N10	200	0.3	30	N50	15	30	100
407	618093	4139430	N0.5	-10	N10	20	300	-1	N10	2	N20	5	100	10	5.0	-0.02	70	0.70	500	N5	10	50	2	7	N10	200	0.7	100	N50	20	190	500
408	618767	4138294	N0.5	N10	N10	20	500	-1	N10	2	N20	10	150	15	5.0	0.12	70	1.00	700	N5	20	15	-2	10	N10	300	0.7	150	N50	20	65	300
409	618799	4137469	N0.5	10	N10	30	500	-1	N10	5	N20	-5	30	10	2.0	0.02	30	1.50	500	N5	10	15	-2	5	N10	200	0.3	50	N50	15	40	300
410	618660	4135891	N0.5	-10	N10	30	700	-1	N10	3	N20	5	100	7	5.0	N0.02	100	1.00	1000	N5	10	30	-2	7	N10	200	0.7	100	N50	30	100	500
411	618437	4135355	N0.5	-10	N10	30	700	-1	N10	5	N20	5	100	7	3.0	N0.02	30	2.00	500	N5	15	20	-2	7	N10	300	0.3	50	N50	15	25	200
412	618417	4135077	N0.5	N10	N10	20	500	-1	N10	2	N20	5	20	5	5.0	N0.02	100	0.70	700	N5	5	20	-2	7	N10	300	0.7	100	N50	50	180	300
413	610293	4129392	N0.5	-10	N10	30	500	1	N10	7	N20	-5	20	10	2.0	N0.02	30	5.00	300	N5	7	20	2	5	N10	200	0.2	20	N50	15	30	200
414	611466	4129505	N0.5	-10	N10	50	300	-1	N10	10	N20	-5	20	7	2.0	N0.02	20	7.00	200	N5	7	15	-2	-5	N10	150	0.2	20	N50	10	20	100
415	611779	4129557	N0.5	10	N10	50	300	1	N10	7	N20	-5	20	7	1.5	0.04	100	3.00	300	N5	7	20	2	5	N10	200	0.2	20	N50	15	30	100
416	612009	4129565	N0.5	10	N10	30	300	-1	N10	10	N20	-5	20	10	2.0	0.04	30	5.00	300	N5	7	15	-2	5	N10	200	0.3	20	N50	15	30	100
417	612732	4129670	N0.5	10	N10	30	500	1	N10	7	N20	-5	30	10	1.5	0.02	30	3.00	300	N5	7	20	2	5	N10	200	0.2	20	N50	15	30	300
418	613208	4129700	N0.5	10	N10	30	300	1	N10	7	N20	-5	15	10	1.0	0.04	30	2.00	300	N5	7	15	2	5	N10	200	0.2	20	N50	15	35	100
419	613994	4129881	N0.5	-10	N10	50	500	1	N10	5	N20	5	30	10	2.0	0.02	30	2.00	300	N5	10	20	2	5	N10	200	0.3	30	N50	15	30	100
420	614533	4130049	N0.5	-10	N10	50	500	-1	N10	5	N20	-5	20	10	2.0	0.04	50	3.00	300	N5	10	30	-2	5	N10	200	0.3	30	N50	15	35	150
421	615018	4130298	N0.5	-10	N10	30	300	-1	N10	5	N20	N5	20	7	1.5	0.02	50	1.50	300	N5	5	20	-2	5	N10	200	0.2	20	N50	15	35	70
422	615875	4131276	N0.5	-10	N10	30	500	1	N10	7	N20	N5	20	7	1.5	-0.02	30	2.00	300	N5	5	15	2	5	N10	200	0.2	20	N50	15	35	200
423	615989	4131385	N0.5	-10	N10	20	300	1	N10	5	N20	-5	15	7	1.5	0.02	50	1.50	300	N5	5	20	-2	5	N10	200	0.2	20	N50	15	30	150
424	609674	4131284	N0.5	N10	N10	50	500	-1	N10	10	N20	5	50	10	2.0	-0.02	30	2.00	300	N5	10	10	-2	7	N10	150	0.2	20	N50	15	35	50
425	608325	4131762	N0.5	10	N10	70	500	1	N10	1	N20	5	30	15	3.0	0.02	30	0.50	500	N5	10	10	2	7	N10	100	0.7	50	N50	20	40	300
426	608085	4131781	N0.5	10	N10	70	700	1	N10	1.5	N20	5	50	15	3.0	0.02	30	0.70	500	N5	15	10	2	7	N10	150	0.7	50	N50	20	40	300
427	608498	4131681	3	70	N10	70	500	1	N10	5	N20	10	20	50	2.0	0.88	50	0.70	500	5	15	7000	50	7	N10	150	0.5	30	N50	20	200	300
428	609180	4132170	-0.5	50	N10	70	700	1	N10	3	N20	5	30	15	3.0	0.32	70	1.00	500	N5	15	200	10	7	N10	150	0.5	50	N50	20	210	300
429	608883	4137457	N0.5	10	N10	50	300	-1	N10	10	N20	5	50	10	2.0	0.02	20	5.00	300	N5	15	15	2	5	N10	100	0.3	30	N50	15	25	200
430	608171	4136903	N0.5	10	N10	50	500	1	N10	2	N20	5	30	10	2.0	0.02	50	0.50	300	N5	15	20	2	7	N10	150	0.5	50	N50	20	45	300
431	608735	4136425	N0.5	10	N10	50	500	1	N10	5	N20	7	30	10	2.0	0.02	30	0.50	500	N5	15	20	-2	7	N10	150	0.3	30	N50	20	70	100
432	608534	4135406	N0.5	N10	N10	50	500	1	N10	3	N20	5	50	15	2.0	0.02	50	0.50	500	N5	15	20	2	7	N10	150	0.3	30	N50	20	60	150
433	608745	4134932	N0.5	10	N10	70	300	1	N10	5	N20	5	30	10	2.0	0.02	50	0.50	500	N5	15	30	-2	7	N10	150	0.3	30	N50	20	70	70
434	608830	4134653	N0.5	-10	N10	70	500	1	N10	5	N20	7	50	15	2.0	0.02	50	0.70	500	N5	20	50	2	7	N10	150	0.3	30	N50	20	75	200
435	609307	4133977	N0.5	10	N10	100	500	-1	N10	5	N20	10	70	15	2.0	-0.02	50	0.70	500	N5	20	30	2	7	N10	150	0.3	30	N50	20	65	200
436	608786	4133242	N0.5	20	N10	100	1000	1	N10	5	N20	15	150	20	3.0	0.04	30	1.00	500	N5	30	100	2	10	N10	200	0.3	30	N50	20	60	150
437	608452	4133005	10	40	N10	100	700	1	N10	7	N20	15	100	100	3.0	3.00	50	1.50	700	N5	20	15000	80	10	N10	200	0.5	50	N50	20	220	200
438	604917	4131071	N0.5	10	N10	50	500	1	N10	1	N20	-5	20	10	1.5	0.02	50	1.00	300	N5	10	30	2	5	N10	200	0.3	30	N50	15	35	150
439	604919	4130836	N0.5	10	N10	70	500	1	N10	1	N20	-5	50	10	2.0	0.08	70	0.70	500	N5	7	20	2	5	N10	150	0.5	30	N50	15	35	150
440	605071	4132376	N0.5	20	N10	100	500	1	N10	0.7	N20	-5	20	10	2.0	0.06	50	0.50	500	N5	7	20	2	5	N10	150	0.3	50	N50	20	45	300
441	605022	4132873	N0.5	10	N10	70	700	1	N10	1	N20	-5	30	15	2.0	0.02	50	0.50	500	N5	10	20	2	7	N10	150	0.5	50	N50	20	30	300
442	605125	4135030	N0.5	10	N10	100	500	-1	N10	0.5	N20	-5	20	10	1.5	0.02	50	0.50	300	N5	7	20	2	5	N10	100	0.3	30	N50	15	30	50
443	605336	4137262	N0.5	10	N10	50	1000	1	N10	0.7	N20	-5	30	10	1.5	0.02	30	0.70	300	N5	7	30	-2	5	N10	200	0.2	20	N50	10	30	50
444	605840	4137417	N0.5	10	N10	50	500	-1	N10	7	N20	5	50	15	3.0	-0.02	30	3.00	500	N5	15	20	-2	7	N10	150	0.3	50	N50	20	35	300
445	606099	4137950	N0.5	10	N10	70	500	1	N10	0.7	N20	-5	30	10	1.5	0.04	50	0.50	500	N5	10	30	2	5	N10	200	0.3	30	N50	15	45	200
446	606306	4137505	N0.5	10	N10	50	500	1	N10	5	N20	5	50	15	2.0	N0.02	50	2.00	500	N5	15	30	-2	7	N10	150	0.5	50	N50	20	35	200
447	605363	4139073	N0.5	10	N10	50	700	1	N10	1	N20	10	50	15	2.0	0.02	50	1.00	500	N5	15	30	2	7	N10	150	0.3	30	N50	15	40	200
448	605126	4139661	N0.5	-10	N10	30	700	1	N10	2	N20	7	30	15	2.0	0.04	70	0.70	500	N5	15	30	-2	7	N10	200	0.3	30	N50	15	40	200
449	605550	4140539	N0.5	10	N10	30	700	1	N10	1.5	N20	7	50	15	3.0	0.02	50	1.00	500	N5	15	30	-2	7	N10	300	0.5	50	N50	20	40	200
450	606113	4140640	N0.5	-10	N10	30	500	1	N10	1.5	N20	N5	20	7	1.0	0.04	50	1.00	300	N5	7	20	N2	5	N10	200	0.3	20	N50	15	35	200

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

SILT SAMPLE ANALYSES
(U.S. Geological Survey Laboratory Analyses)

Sample Number	UTM East	UTM North	Ag E.S.	As AA	Au E.S.	B E.S.	Ba E.S.	Be E.S.	Bi E.S.	Ca E.S.	Cd E.S.	Co E.S.	Cr E.S.	Cu E.S.	Fe E.S.	Hg Inst	La E.S.	Mg E.S.	Mn E.S.	Mo E.S.	Ni E.S.	Pb E.S.	Sb AA	Sc E.S.	Sn E.S.	Sr E.S.	Ti E.S.	V E.S.	W E.S.	Y E.S.	Zn AA	Zr E.S.
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
451	607315	4140697	N0.5	10	N10	30	500	-1	N10	2	N20	5	50	7	2.0	0.04	30	2.00	300	N5	10	20	-2	7	N10	200	0.5	50	N50	20	50	150
452	607012	4140549	N0.5	N10	N10	70	500	1	N10	0.5	N20	-5	20	15	1.5	0.04	50	0.50	500	N5	7	15	-2	5	N10	100	0.3	30	N50	15	40	200
453	607320	4140946	N0.5	N10	N10	30	500	1	N10	1	N20	N5	20	5	1.5	0.02	70	0.70	500	N5	7	15	-2	5	N10	200	0.3	30	N50	15	60	300
454	607254	4141075	N0.5	N10	N10	50	300	1	N10	0.7	N20	N5	20	10	1.0	0.02	100	0.50	500	N5	5	15	-2	5	N10	100	0.3	30	N50	20	75	200
455	610727	4146661	N0.5	-10	N10	30	500	1	N10	0.7	N20	5	30	10	2.0	0.02	50	0.50	500	N5	10	30	-2	7	N10	150	0.5	50	N50	20	40	200
456	609423	4145200	N0.5	N10	N10	30	500	1	N10	0.7	N20	-5	20	7	1.0	0.02	70	0.50	500	N5	5	20	-2	5	N10	150	0.3	30	N50	20	40	150
457	608357	4144578	N0.5	N10	N10	20	700	1	N10	1	N20	-5	20	5	1.5	0.02	70	0.50	500	N5	7	15	-2	5	N10	200	0.3	30	N50	15	45	300
458	607525	4144882	N0.5	N10	N10	50	1000	1	N10	1	N20	5	50	15	2.0	0.04	50	0.70	500	N5	15	20	2	7	N10	150	0.3	30	N50	20	35	300
459	607420	4144521	N0.5	N10	N10	30	1000	1	N10	1.5	N20	7	30	10	2.0	0.02	70	0.70	500	N5	10	20	-2	7	N10	200	0.5	50	N50	20	60	500
460	606751	4145139	N0.5	-10	N10	30	700	1	N10	1	N20	5	50	10	3.0	0.08	50	0.50	500	N5	10	20	2	10	N10	200	0.5	50	N50	50	35	300
461	608398	4140340	N0.5	10	N10	30	300	-1	N10	3	N20	7	100	10	3.0	0.04	30	2.00	700	N5	15	15	2	10	N10	150	0.5	100	N50	15	170	200
462	608203	4140531	N0.5	-10	N10	30	500	-1	N10	1.5	N20	5	100	10	3.0	0.02	50	1.00	500	N5	15	15	2	10	N10	200	0.5	70	N50	20	90	150
463	617912	4141113	N0.5	-10	N10	30	500	1	N10	2	N20	5	100	10	3.0	0.10	50	1.00	700	N5	10	20	2	7	N10	200	0.5	70	N50	20	75	200
464	617946	4141456	N0.5	-10	N10	30	700	1	N10	1.5	N20	-5	30	7	1.5	0.04	70	0.50	500	N5	7	30	2	5	N10	200	0.3	20	N50	15	40	100
465	617737	4141753	N0.5	10	N10	70	1000	1	N10	1	N20	7	30	15	2.0	0.20	70	0.70	300	N5	10	20	N2	7	N10	300	0.5	50	N50	20	40	100
466	617689	4142783	N0.5	10	N10	50	1000	1	N10	1	N20	5	30	15	2.0	0.06	70	0.70	500	N5	10	30	N2	7	N10	200	0.5	30	N50	15	45	200
467	618418	4142825	N0.5	10	N10	50	700	1	N10	1	N20	10	50	15	2.0	0.08	50	0.70	300	N5	10	20	N2	7	N10	300	0.5	50	N50	15	45	150
468	617476	4144543	N0.5	10	N10	30	700	1	N10	1	N20	5	20	10	2.0	0.04	50	0.50	500	N5	10	50	-2	5	N10	200	0.3	30	N50	15	65	150
469	615706	4144638	N0.5	10	N10	20	700	1	N10	1	N20	5	30	15	2.0	0.04	50	0.70	500	N5	15	100	2	7	N10	200	0.5	50	N50	20	100	200
470	618403	4144686	N0.5	20	N10	30	500	1	N10	0.7	N20	5	15	10	1.0	0.06	50	0.50	300	N5	7	15	2	5	N10	200	0.3	30	N50	10	45	200
471	618242	4145233	N0.5	10	N10	30	700	1	N10	1.5	N20	10	70	15	3.0	0.10	50	1.00	500	N5	20	15	-2	10	N10	500	0.5	50	N50	20	45	100
472	618888	4146021	N0.5	-10	N10	30	1000	1	N10	1.5	N20	7	30	15	2.0	0.06	50	0.70	300	N5	20	20	N2	7	N10	300	0.5	50	N50	15	35	300
473	618249	4146299	N0.5	10	N10	30	1000	1	N10	1.5	N20	7	30	10	2.0	0.12	50	0.70	500	N5	15	20	N2	7	N10	300	0.5	50	N50	20	40	200
474	618379	4146685	N0.5	N10	N10	30	1000	1	N10	1.5	N20	7	50	15	3.0	0.04	70	1.00	500	N5	15	30	N2	7	N10	300	0.5	50	N50	20	45	200
475	618781	4147537	N0.5	-10	N10	30	700	1	N10	1.5	N20	7	30	15	2.0	0.04	50	1.00	500	N5	15	30	N2	7	N10	200	0.5	50	N50	20	60	200
476	618538	4148190	N0.5	N10	N10	-10	500	N1	N10	2	N20	30	200	20	10.0	0.10	30	1.50	1000	N5	30	15	N2	10	N10	200	0.7	150	N50	15	190	150
477	618613	4148590	N0.5	-10	N10	30	500	1	N10	1.5	N20	7	50	15	3.0	0.04	50	1.00	500	N5	15	30	N2	7	N10	200	0.5	70	N50	20	55	200
478	618003	4149204	N0.5	N10	N10	50	700	1	N10	1.5	N20	10	50	15	2.0	0.02	50	1.00	500	N5	15	30	N2	7	N10	200	0.3	50	N50	20	35	200
479	617664	4149500	N0.5	N10	N10	30	700	1	N10	1.5	N20	7	30	10	3.0	0.02	50	0.70	500	N5	10	30	N2	7	N10	200	0.3	50	N50	15	45	150
480	603151	4146349	N0.5	N10	N10	50	500	1	N10	1	N20	5	30	10	2.0	0.02	100	0.70	500	N5	10	20	N2	7	N10	200	0.5	30	N50	30	35	300
481	603237	4146471	N0.5	10	N10	30	500	-1	N10	1	N20	-5	20	10	1.5	0.04	70	0.50	300	N5	10	15	N2	5	N10	200	0.3	30	N50	20	45	100
482	603752	4147808	N0.5	10	N10	50	500	1	N10	1.5	N20	5	30	15	2.0	0.04	30	0.70	500	N5	10	20	2	5	N10	100	0.5	50	N50	20	35	200
483	603946	4147589	N0.5	10	N10	50	500	1	N10	0.7	N20	-5	20	10	1.5	0.14	50	0.50	500	N5	7	20	2	5	N10	150	0.5	30	N50	15	40	300
484	604087	4148730	N0.5	N10	N10	30	500	1	N10	0.7	N20	5	30	10	2.0	0.04	30	0.50	300	N5	15	20	N2	7	N10	150	0.3	20	N50	20	40	300
485	605801	4150047	N0.5	10	N10	30	700	1	N10	1	N20	7	30	10	2.0	0.04	70	0.70	500	N5	10	30	-2	7	N10	200	0.3	30	N50	20	45	200
486	608001	4149641	N0.5	N10	N10	50	500	3	N10	1.5	N20	7	30	15	2.0	0.04	30	1.00	500	N5	20	50	N2	7	N10	200	0.5	30	N50	20	60	150
487	605183	4150307	N0.5	10	N10	30	700	1	N10	1.5	N20	7	30	10	2.0	0.02	50	1.00	500	N5	15	30	-2	7	N10	200	0.3	30	N50	20	40	100
488	605297	4150563	N0.5	-10	N10	30	700	1	N10	1.5	N20	7	30	10	2.0	0.02	50	0.70	500	N5	10	30	N2	7	N10	200	0.3	30	N50	15	40	70
489	605380	4151386	N0.5	-10	N10	50	700	1	N10	1	N20	7	30	15	2.0	0.04	50	0.70	500	N5	15	20	N2	7	N10	150	0.3	20	N50	20	35	150
490	605589	4152195	N0.5	10	N10	30	500	1.5	N10	1	N20	7	30	10	3.0	0.04	50	0.50	500	N5	15	20	2	7	N10	150	0.5	50	N50	20	45	500
491	605328	4129327	N0.5	10	N10	50	700	1.5	N10	2	N20	10	50	15	3.0	0.02	50	1.50	500	N5	20	50	-2	7	N10	200	0.5	30	N50	20	40	500
492	609347	4131858	N0.5	10	N10	50	700	1	N10	1.5	N20	10	70	10	3.0	0.02	70	1.00	500	N5	20	30	N2	10	N10	150	0.3	30	N50	30	50	150
493	617379	4149761	N0.5	10	N10	30	500	1	N10	1	N20	7	50	10	3.0	-0.02	50	0.70	700	N5	15	20	N2	7	N10	200	0.5	70	N50	20	70	200
494	617234	4150101	N0.5	10	N10	10	1000	-1	N10	1.5	N20	7	30	10	2.0	0.02	50	0.70	500	N5	10	15	N2	7	N10	300	0.5	50	N50	15	30	150
495	616842	4150623	N0.5	10	N10	15	700	-1	N10	1.5	N20	15	100	15	7.0	N0.02	50	0.70	700	N5	20	15	N2	10	N10	300	1.0	200	N50	15	180	200
496	613862	4148334	N0.5	-10	N10	15	700	1	N10	1.5	N20	7	30	10	2.0	0.02	70	0.70	500	N5	10	20	N2	5	N10	200	0.3	30	N50	15	40	100
497	617997	4150871	N0.5	10	N10	20	1500	1	N10	2	N20	5	15	7	2.0	-0.02	100	1.00	700	N5	5	30	N2	5	N10	500	0.3	30	N50	20	30	200
498	616393	4152580	N0.5	-10	N10	30	500	1	N10	3	N20	-5	20	7	2.0	-0.02	50	1.00	500	N5	7	20	-2	-5	N10	200	0.2	20	N50	15	30	50
499	614518	4153685	N0.5	10	N10	50	1000	1	N10	1	N20	5	30	10	2.0	0.08	50	0.70	300	N5	10	20	4	5	N10	200	0.5	30	N50	20	40	200
500	613708	4154298	N0.5	N10	N10	30	500	1	N10	0.7	N20	-5	20	10	1.5	0.04	50	0.50	300	N5	10	20	N2	5	N10	200	0.3	30	N50	20	40	200
501	613130	4154598	N0.5	N10	N10	50	500	1	N10	0.5	N20	-5	20	10	1.5	0.04	30	0.30	300	N5	10	30	N2	5	N10	200	0.3	30	N50	15	45	200

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

SILT SAMPLE ANALYSES
(U.S. Geological Survey Laboratory Analyses)

Sample	UTM	UTM	Ag	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	W	Y	Zn	Zr
Number	East	North	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	Inst	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
502	612793	4154727	N0.5	N10	N10	30	700	-1	N10	2	N20	5	50	10	2.0	0.02	70	0.50	300	N5	10	20	N2	7	N10	200	0.3	50	N50	20	35	300
503	613089	4155420	N0.5	N10	N10	50	700	1	N10	1.5	N20	5	30	10	3.0	0.06	50	0.50	500	N5	15	30	N2	7	N10	200	0.5	50	N50	20	45	300
504	613203	4155501	N0.5	N10	N10	20	700	1	N10	1.5	N20	-5	20	7	1.5	0.04	50	0.70	300	N5	7	20	N2	7	N10	300	0.3	30	N50	15	40	200
505	610944	4156126	N0.5	-10	N10	50	500	1.5	N10	3	N20	7	30	15	2.0	0.02	50	0.50	500	N5	15	50	N2	7	N10	200	0.5	50	N50	30	65	200
506	610591	4156675	N0.5	N10	N10	30	500	1	N10	2	N20	-5	20	10	2.0	0.06	50	1.50	500	N5	10	30	N2	5	N10	150	0.3	50	N50	20	50	300
507	609283	4157585	N0.5	10	N10	30	700	1	N10	5	N20	7	30	10	2.0	0.04	70	0.70	500	N5	10	30	N2	7	N10	200	0.3	50	N50	20	60	200
508	608755	4156974	N0.5	N10	N10	50	500	1	N10	0.5	N20	10	50	20	2.0	0.04	50	0.50	500	N5	20	50	N2	7	N10	150	0.5	50	N50	20	50	200
509	608949	4159127	N0.5	N10	N10	30	500	1	N10	5	N20	7	30	10	2.0	0.02	50	0.70	500	N5	15	20	N2	5	N10	200	0.3	30	N50	20	45	150
510	608599	4158775	N0.5	10	N10	50	700	1	N10	0.5	N20	5	50	15	3.0	0.02	50	0.50	500	N5	15	50	-2	7	N10	150	0.5	50	N50	30	70	300
511	605125	4158063	N0.5	N10	N10	15	500	1	N10	1	N20	5	30	7	2.0	0.04	150	0.30	500	N5	7	30	N2	5	N10	200	0.5	50	N50	30	50	200
512	605555	4157055	N0.5	-10	N10	30	700	1	N10	1.5	N20	5	30	10	2.0	0.04	50	0.50	500	N5	10	20	N2	5	N10	150	0.3	30	N50	20	35	200
513	605952	4155945	N0.5	10	N10	20	700	1.5	N10	2	N20	5	30	10	2.0	0.06	50	0.50	300	N5	15	30	N2	7	N10	150	0.3	50	N50	20	30	300
514	606308	4154338	N0.5	N10	N10	30	500	1	N10	1	N20	5	20	10	2.0	0.04	50	0.30	500	N5	10	20	N2	5	N10	150	0.3	50	N50	20	40	200
515	605782	4153064	N0.5	N10	N10	30	1000	-1	N10	1	N20	20	150	20	7.0	0.12	100	0.70	700	N5	30	20	-2	20	N10	200	1.0	150	N50	50	110	500
516	618637	4137906	N0.5	-10	N10	15	300	-1	N10	5	N20	N5	20	5	1.0	0.02	20	2.00	300	N5	5	15	N2	5	N10	200	0.2	20	N50	10	20	70
517	615191	4141829	N0.5	10	N10	30	300	1	N10	5	N20	N5	20	7	1.0	0.08	30	2.00	300	N5	5	20	2	5	N10	150	0.1	15	N50	10	30	70
518	617210	4130835	N0.5	N10	N10	20	500	1	N10	1.5	N20	5	20	5	3.0	0.02	50	0.70	700	N5	5	15	N2	7	N10	200	0.5	50	N50	20	95	300
519	619980	4131664	N0.5	N10	N10	30	500	1	N10	2	N20	-5	20	7	2.0	-0.02	70	1.00	500	N5	7	20	N2	7	N10	300	0.2	20	N50	20	30	100
520	617958	4131270	N0.5	N10	N10	30	500	-1	N10	3	N20	-5	30	7	3.0	0.02	70	1.00	500	N5	5	20	N2	5	N10	200	0.2	30	N50	15	90	70
521	601730	4142517	N0.5	N10	N10	30	500	1	N10	0.7	N20	5	30	10	3.0	0.02	50	0.70	500	N5	10	15	N2	5	N10	150	0.5	50	N50	20	45	200
522	602228	4141146	N0.5	N10	N10	50	300	1	N10	0.5	N20	-5	20	10	1.0	0.04	50	0.50	500	N5	7	15	N2	5	N10	100	0.3	20	N50	15	30	150
523	602364	4140650	N0.5	N10	N10	50	500	1	N10	1	N20	-5	20	10	1.0	0.02	50	0.70	300	N5	5	20	N2	5	N10	150	0.3	30	N50	15	35	100
524	614287	4128184	N0.5	N10	N10	50	500	1	N10	3	N20	7	30	10	5.0	0.02	30	1.50	2000	N5	10	20	N2	5	N10	200	0.5	100	N50	15	210	100
525	613475	4126651	N0.5	-10	N10	50	300	1	N10	5	N20	N5	20	5	1.0	0.02	50	1.50	300	N5	5	15	N2	-5	N10	150	0.2	20	N50	10	40	30
526	613677	4126318	N0.5	-10	N10	30	500	1	N10	5	N20	5	30	10	3.0	0.02	150	1.50	700	N5	5	15	N2	7	N10	200	0.5	50	N50	20	65	150
527	605411	4140864	N0.5	10	N10	50	500	1	N10	0.5	N20	-5	30	7	1.5	0.04	30	0.70	300	N5	7	15	N2	5	N10	150	0.3	20	N50	20	20	150
528	607016	4141293	N0.5	N10	N10	50	500	1	N10	0.3	N20	5	30	7	0.7	-	70	0.50	300	N5	10	15	-2	7	N10	150	0.3	30	N50	20	40	200
529	608254	4134057	N0.5	N10	N10	70	500	-1	N10	0.2	N20	10	50	15	2.0	-	30	0.50	500	N5	15	20	-2	10	N10	-100	0.5	50	N50	20	40	200
530	608329	4134086	N0.5	-10	N10	70	300	1	N10	2	N20	5	30	10	1.5	-	50	0.50	300	N5	15	15	-2	7	N10	150	0.3	30	N50	30	40	200
531	608326	4132833	N0.5	-10	N10	70	500	1	N10	1	N20	5	30	15	1.5	-	50	0.50	300	N5	15	20	-2	7	N10	100	0.5	50	N50	20	40	300
532	608102	4132622	N0.5	10	N10	100	500	1	N10	0.3	N20	7	50	15	1.5	-	30	0.30	500	N5	20	20	2	10	N10	100	0.5	50	N50	50	40	300
533	615759	4140007	N0.5	10	N10	30	300	-1	N10	5	N20	7	70	10	2.0	-	30	2.00	300	N5	15	20	6	7	N10	300	0.5	70	N50	15	75	100
534	615731	4140242	N0.5	10	N10	50	500	1	N10	5	N20	5	100	10	1.5	-	30	1.50	300	N5	20	20	2	7	N10	200	0.3	50	N50	20	45	100
535	616401	4140182	N0.5	10	N10	30	500	1	N10	5	N20	7	50	10	2.0	-	30	1.50	300	N5	20	15	4	7	N10	300	0.3	50	N50	20	40	150

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

SILT SAMPLE ANALYSES
(NURE samples)

Map Point	Sample Id.	UTM East	UTM North	Ag NAA ppm	Al NAA %	As NAA ppm	B NAA ppm	Ba NAA ppm	Be NAA ppm	Br NAA ppm	Ca NAA %	Ce NAA ppm	Cl NAA ppm	Co NAA ppm	Cr NAA ppm	Cs NAA ppm	Cu NAA ppm	Dy NAA ppm	Eu NAA ppm	Fe NAA %	Hf NAA ppm	K NAA %	La NAA ppm	Li NAA ppm	Lu NAA ppm	Mg NAA %	Mn NAA ppm	Mo NAA ppm	Na NAA %
1	7074377	606713	4128364	2.00	7.8		62	614	3		4	58		9	39		23			2.9	15	2.55	28	71		1.3	538	4	1.09
2	8034162	606713	4128364		0.0						0									0.0		0.00				0.0			0.00
3	8075358	629202	4089096		0.9	43.9		162		3	32	22		2	21			1.97		0.4		0.95	11			1.3	269		0.04
4	8075359	630703	4089997		0.8	10.0				4	32	11			17			2.13	0.3	0.4		0.80	10		0.14	2.5	199		0.04
5	8075360	630598	4085800	4.81	1.8	20.4		209		3	29	27			23			1.81		0.9	2	1.62	14			1.2	389		0.08
6	8075361	630301	4095305		0.8	10.5				3	30	14						1.66		0.4		0.71	9			3.3	203		0.03
7	8075362	631204	4093300		1.3	9.6				4	26	20			20			1.59		0.7		1.21	12		0.24	4.2	253		0.05
8	8075363	625896	4091599		0.6	4.1				4	33	14			22					0.4		0.46	9		0.18	4.1	111		0.05
9	8075364	640995	4094500		0.9	6.9		125		4	33	15			19			1.85		0.7		0.79	10			2.7	242		0.06
10	8075399	624304	4050399		0.8	10.6		193		4	23	18	174	2	13			2.26		0.5		0.00	13			8.5	229		0.09
11	8075400	624498	4050601		0.8	5.6		272		4	28	18	157		20			2.47	0.3	0.5		0.58	15		0.12	9.2	262		0.11
12	8075401	623204	4051604		0.6	9.4		209		4	24	20			26			2.23	0.5	0.4		0.60	13			9.2	232		0.06
13	8075402	625196	4051799		2.0	6.3		475		3	22	36						3.03	0.4	0.5	2	1.61	19			4.8	227		0.51
14	8075403	627604	4054697		0.6	6.9				2	23	17	116		21			1.42		0.4		0.53	9		0.18	6.7	111		0.04
15	8075404	630200	4058696		1.4	7.2		181		3	32	27		10	26			2.49	0.3	1.4	2	1.17	14		0.32	1.9	306		0.09
16	8075405	631302	4055596		0.3						26	11	242		24				0.2	0.3		0.00	6			9.8	115		0.04
17	8075406	631804	4063104		2.0	4.2		161			30	29		4				2.39		1.2	3	1.88	18		0.34	1.2	355		0.12
18	8075407	631703	4065000		0.9	7.2				3	34	14		1	16			1.44	0.3	0.6	1	0.86	9			2.3	240		0.04
19	8075408	632401	4066698		0.7	7.0				3	35	16	124					1.37		0.3		0.00	8			4.7	237		0.04
20	8075409	641402	4093098		0.6	4.2		116		4	36	12			18			2.01		0.4		0.47	8		0.13	3.7	102		0.04
21	8075410	642097	4091998		0.8	4.6		134		4	37	11						1.54		0.4		0.72	8			4.0	121		0.06
22	8075411	643902	4091097		0.7	3.6				2	23							1.56		0.4		0.81	6			1.6	273		0.03
23	8075412	641800	4088998		4.2	3.3		548			4	65		13	44			7.34	1.1	3.5	13	3.57	32		0.72	1.4	564		0.59
24	8075413	643299	4088302		5.4	6.2		614			18	82		12	53	6		8.54	0.9	3.7	8	4.35	40		1.11	1.7	542		0.39
25	8075414	642902	4086498		3.6	3.2		412		2	0	59		10				6.54	0.9	2.7	10	3.10	28			0.9	366		0.47
26	8075415	643800	4084005		3.2			398		2	0	36						5.03	0.6	0.9		2.55	18			0.6	155		0.25
27	8075416	644496	4082896		4.0			487		3	11	65		8	39	2		6.05	0.7	2.5	5	3.13	35		0.71	1.3	389		0.34
28	8075417	643701	4081395		3.9	4.8		410			12	60		7	38	4		6.22	0.7	2.2	4	3.02	28		0.74	1.3	424		0.33
29	8075418	612602	4064607		0.4	5.6		140		4	34	14	176	3	14			1.18		0.3		0.00	7		0.19	4.9	167		0.04
30	8075419	614399	4065804		0.5	6.3				5	27	11	193							0.3	6	0.00	9			8.8	145		0.05
31	8075420	615698	4066799		0.4	3.9		110		5	28	10	245		19					0.3		0.00	7			9.7	127		0.06
32	8075421	616800	4069200		0.6	4.8				4	29	16	135					1.44		0.3		0.00	7			5.8	110		0.04
33	8075422	618603	4069901		0.3	3.5				3	27	10	205							0.2		0.00	7			10.8	119		0.04
34	8075423	618697	4070802		0.5	3.6				3	25	10	215					1.15		0.2		0.00	7			10.1	105		0.04
35	8075424	645896	4066695		3.7			477			4	69		5				5.30		1.9		3.47	26			0.7	210		0.37
36	8075431	605202	4078702		0.0	5.5					28	33		4	25				0.4	1.1	3	0.00	17		0.27	0.0			0.13
37	8075432	603703	4080205		1.1	26.0		170		3	34	24		2	23	2		2.62	0.3	0.7		0.68	12		0.18	0.7	321		0.12
38	8075433	604203	4081597		1.8	12.4				3	33	18						1.58	0.3	0.7	2	0.93	12		0.23	1.4	235		0.08
39	8075434	604198	4083505		1.0	33.2				2	33	16				3				0.6		0.70	10			0.4	385		0.03
40	8075435	604000	4084401		0.8	14.2				3	37	19			19			1.42		0.5		0.62	8			0.6	250		0.03
41	8075436	604895	4086897	5.68	1.2	10.2		410		3	15	25		4	22	3		2.87	0.4	1.2	2	0.96	17		0.17	4.4	633		0.06
42	8075437	605002	4087698		1.8			508			13	14	216							0.0		1.27	7			8.2	224		0.44
43	8075438	608998	4083799		0.8	6.2				5	29	20						1.83		0.5		0.60	12		0.27	2.4	192		0.05
44	8075439	608500	4081595		1.1	3.7				3	33	18	143					2.05		0.4		0.62	11		0.22	2.1	130		0.03
45	8075440	608896	4078505	4.83	0.9	7.0		482		4	16	16		4	15	4			0.3	0.5		0.52	11		0.16	3.3	279		0.07
46	8075441	611100	4075003		3.2			318			15	42		10	38			2.94	0.4	1.9	2	2.02	23			5.8	940		0.07
47	8075442	637600	4055495		1.0	7.9		316		3	23	17		5	27	2		2.25		0.7	2	0.00	12		0.29	1.2	233		0.09
48	8075443	622801	4050399		0.6	8.1		229		3	27	23	155		14			1.90	0.3	0.4		0.46	13		0.21	8.6	242		0.07
49	8075444	612396	4051000		0.8	4.9				5	25	21	228	2	16			2.17		0.6		0.00	11		0.20	9.7	282		0.09
50	8075462	602897	4050105		1.1			250			33	25						3.16		0.6		0.61	16			3.8	299		0.12
51	8075464	601104	4050405		0.7			326		6	25	20	164		25			2.05	1.1	0.3		0.00	15		0.21	6.3	162		0.10
52	8075465	606199	4050100		0.6	2.4		212		5	29	16	175					2.11		0.3		0.00	11		0.22	9.7	192		0.07
53	8075466	608103	4050202		0.7			139		6	27	22	195	2				2.10		0.5		0.00	12		0.20	7.7	245		0.07
54	8075467	609797	4050701		0.5	2.9		148		3	26	11	252		13			1.35		0.3		0.00	7			9.1	133		0.05

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map	Sample	UTM	UTM	Ag	Al	As	B	Ba	Be	Br	Ca	Ce	Cl	Co	Cr	Cs	Cu	Dy	Eu	Fe	Hf	K	La	Li	Lu	Mg	Mn	Mo	Na
Point	Id.	East	North	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
				ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	%	ppm	ppm	ppm	%	ppm	ppm	%
55	8075470	606703	4067004		0.7	3.1		169		3	31	11						1.95	0.2	0.3		0.00	9			6.4	320		0.05
56	8075518	651595	4077703		0.5	3.2				3	38	15			11			1.82		0.4		0.46	7		0.09	0.6	115		0.03
57	8075519	653496	4079702		0.9	7.9				5	33	20						2.27	0.3	0.6		0.66	13		0.19	2.0	172		0.03
58	8075520	652102	4080798		0.7	3.6				4	22	16	115		19			1.90		0.5	2	0.53	11		0.16	5.1	101		0.03
59	8075521	652201	4081798		0.7	2.1				7	23	21						2.84		0.4		0.00	15			7.5	183		0.07
60	8075525	651099	4083600		1.2	2.9				2	21	13		1	12			2.33		0.4	1	0.91	7			2.6	291		0.04
61	8075529	645504	4093799		0.9	11.4				3	37	19			12			1.80		0.5		0.79	10			0.8	124		0.03
62	8075530	646498	4091398		1.0	9.4				3	30	18			19					0.7		0.91	9		0.20	1.7	304		0.04
63	8075531	648296	4089897		1.1	10.4					36	20		3	25			2.06	0.4	0.9		0.00	10			0.7	370		0.04
64	8075532	640002	4045301		1.6	51.0					27	32		4	34	3		2.25	0.8	1.4		1.16	14		0.30	4.9	248		0.06
65	8075533	642701	4048299		0.7	4.1				4	32	16	137		13			1.70		0.4		0.00	10		0.11	6.1	178		0.07
66	8075534	643797	4049105		0.5	4.0				4	26		198					2.16		0.3		0.00	8		0.25	11.0	163		0.06
67	8075535	644501	4050903		0.4	2.4				3	21	9	291		10					0.3		0.00	5		0.14	9.0	101		0.05
68	8075536	641002	4053099		1.4	3.5		205		3	26	21	127	3	16			2.15	0.4	0.7		0.82	13			6.4	471		0.09
69	8075537	642098	4055003		0.7	7.0				4	28	9	173					1.61	0.2	0.5		0.57	8			7.1	222		0.06
70	8075538	646096	4058598		0.8	2.4				2	14	11	178					2.11		0.4		0.60	7			7.8	120		0.03
71	8075539	646301	4059699		1.3	5.1				5	24	22		2	19					0.7	3	1.08	13		0.20	7.6	271		0.07
72	8075540	646896	4060998		1.6	10.7		170		3	27	24			33			2.07		1.4		1.70	14			4.9	364		0.06
73	8075541	648896	4065204		0.6	3.7				4	37	11						1.62		0.2		0.54	7			2.9	97		0.05
74	8075542	637996	4049197		0.5			123			25	14	153		11			1.68	0.2	0.4		0.00	9		0.27	10.3	138		0.05
75	8075543	639597	4047605		0.5	5.6		115		3	24	10	240					1.33		0.3		0.00	8			10.5	123		0.05
76	8075544	640500	4049305		0.5	3.0		178		4	27	17	193	2	10			1.91		0.3		0.00	10		0.16	10.8	184		0.07
77	8075545	640801	4050598		1.2	5.4				4	29	20	145	3	25			2.52	0.3	0.8	1	0.83	14		0.33	6.2	367		0.08
78	8075546	642298	4059599		0.4	1.5				2	26	10	205							0.3		0.00	6			10.8	107		0.05
79	8075547	642501	4057605		1.0	3.4				3	28	21	180		31			2.04		0.7	2	0.78	12		0.20	6.9	248		0.07
80	8075548	641905	4056396		1.2	4.4				3	28	23	153					2.14		0.8		0.99	12			7.0	248		0.07
81	8075556	615502	4058897		0.5	6.3				4	29	13	183		17			1.57		0.4		0.00	9		0.11	9.5	164		0.05
82	8075557	612304	4060796		0.5	6.1				3	32	11	174		20			1.63		0.4		0.43	7			7.7	124		0.05
83	8075558	612796	4062102		0.5	3.2				2	17	7	251		8			1.11		0.2		0.00	4		0.13	9.8	143		0.04
84	8075559	612296	4055904		0.5	6.0		193		3	20	15	222		12			2.41		0.4		0.00	7			10.3	212		0.07
85	8075560	619001	4073302		0.6	6.5		168		4	27	14	236		23			2.04		0.3		0.00	10		0.14	9.6	148		0.06
86	8075561	618904	4075198		0.3	6.0				3	34	10								0.2		0.00	5			3.6	86		0.02
87	8075562	619799	4077497		0.3	5.0				1	21	6	163		6			0.97		0.2		0.00	3			6.2	83		0.03
88	8075579	647499	4088596		0.6	6.9				4	37	14								0.5		0.00	8			0.0	262		0.03
89	8075580	646801	4085199		0.4	4.3				3	37	9						1.29		0.3		0.00	8			3.5	108		0.03
90	8075581	647899	4074797		4.1	5.9		473			6	77		17	51			5.34	0.7	2.3	4	3.69	33		0.62	0.9	523		0.38
91	8075582	647502	4073004		3.2	5.6		387		2	3	50		7	40			5.10	0.6	1.9	6	2.36	25		0.52	0.8	318		0.27
92	8075583	645679	4069000		3.4	5.7		382			9	70		7	41			5.75		2.2	9	2.76	31		0.79	1.2	335		0.34
93	8075637	609201	4067901		1.2	2.6		209		3	29	22	133	3	17			3.09		0.6		1.31	14		0.22	7.2	221		0.05
94	8075638	609802	4069794		0.6					4	25	16	215	2	13			2.27	0.7	0.4		0.00	10		0.17	7.6	331		0.05
95	8075639	607198	4069595		0.5					3	25	9	178		14			1.82		0.4		0.33	8		0.16	9.6	118		0.04
96	8075640	605799	4069401		0.5	3.7				4	25	12	266	1	13			1.91	0.2	0.3		0.00	9		0.23	9.3	146		0.05
97	8075641	603997	4069300		0.0	3.8				3	19	15			25					0.4		0.56	12		0.23	0.0			0.05
98	8075642	603704	4069896		0.3	1.9				3	23	9	332							0.2		0.00	6		0.16	10.7	111		0.05
99	8075643	601797	4068898		0.4	2.7				3	25	12	143		15			1.39		0.2		0.00	8			10.5	120		0.05
100	8075644	600297	4071897		1.1	6.9		166		4	32	25	89	2	16			2.49	0.4	0.6	2	1.03	16			1.1	177		0.05
101	8075645	599701	4071801		1.6	7.3		231		3	28	28		3	28			2.67	0.4	0.7	3	1.67	16			1.3	214		0.06
102	8075646	599999	4070694		0.9	5.3		183		4	22	26	103	4	16			2.66	0.3	0.7	2	0.54	14		0.15	6.6	233		0.05
103	8075647	599799	4070305		0.4	4.7				2	23	10	257					1.48		0.3		0.00	7			11.0	86		0.04
104	8075648	598796	4069806		0.5	4.2				4	25	13	190					1.37		0.4		0.00	9		0.14	10.5	115		0.05
105	8075649	597300	4069499		0.6	8.4		113		3	29	17	130					1.52		0.6	2	0.53	9		0.27	3.2	128		0.03
106	8075650	597498	4068502		0.4	5.1				3	26	10	213					1.25		0.4		0.00	8			11.8	124		0.04
107	8075651	598701	4065599		0.5					3	24	10	188		17			1.75		0.4		0.00	10		0.12	10.2	100		0.04
108	8075652	600200	4063497		0.9	4.6		155		4	28	24	115	2	21			2.42		0.6		0.00	13		0.22	0.9	236		0.05

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map	Sample	UTM	UTM	Ag	Al	As	B	Ba	Be	Br	Ca	Ce	Cl	Co	Cr	Cs	Cu	Dy	Eu	Fe	Hf	K	La	Li	Lu	Mg	Mn	Mo	Na
Point	Id.	East	North	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
				ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	%	ppm	ppm	ppm	%	ppm	ppm	%
109	8075653	602800	4066400		0.7					6	38	22	108		21			2.86	0.3	0.4		0.00	15		0.26	3.3	212		0.07
110	8075654	603604	4063403		0.7			231		4	30	20	117		12			2.16	0.3	0.4		0.00	12		0.24	4.6	175		0.10
111	8075657	637197	4058895		0.8	8.4		136		2	31	15	112		28			1.31		0.8		0.76	10		0.15	3.8	275		0.05
112	8075658	637097	4061201		4.3			286			27	40		5	34			4.40	0.4	1.6	3	2.07	25		0.34	3.1	850		0.20
113	8075659	635602	4066404		0.5	5.1				4	30	14	182		20				0.5	0.3		0.00	8		0.17	8.1	208		0.05
114	8075660	639301	4063601		0.8	2.9				1	21	12						2.08		0.3		0.54	7			0.9	156		0.03
115	8075661	643598	4060996		0.9	6.1				5	29	19	116					2.22		0.6	5	0.00	11			6.5	228		0.06
116	8075662	644102	4062903		0.9	31.5				4	32	18						1.72		0.7		0.72	11		0.21	5.7	213		0.06
117	8075663	644495	4064996		0.8	3.8				3	35	15	146						0.3	0.6		0.65	9			5.4	275		0.06
118	8075664	643701	4076601		7.5	5.2		530			0	79		9	63	4		6.47	0.9	2.9	9	4.14	38		0.72	0.9	723		0.31
119	8075665	643799	4077202		3.4	5.2		378		2	5	62		7	52			5.04	0.7	2.2	8	2.59	30		0.52	1.0	267		0.30
120	8075666	643600	4079995		2.8	5.1		777			0	53		4	31	3		3.87	0.7	1.5	8	2.82	26		0.50	0.7	186		0.11
121	8075667	643402	4079004		3.7			480			4	62		6	41	3		4.54		1.8	6	3.40	30		0.75	0.7	210		0.30
122	8075668	631005	4075598		1.0	7.8				2	38	16		3	22			1.80	0.4	0.8	1	0.80	11		0.30	1.0	423		0.04
123	8075669	630204	4073100		0.7						33	15	76		17			1.40		0.4		0.68	8			2.9	194		0.03
124	8075670	630502	4071696		1.5	10.9		189		4	34	18		2				1.66		0.6		0.62	10			0.9	312		0.04
125	8075671	630298	4068696		0.9	13.3		403		4	22	23	113	2	23			1.51		0.7		0.62	13		0.21	3.6	243		0.04
126	8075672	628604	4071499		1.4	9.0		180		1	18	13			13			1.84	0.2	0.5	1	1.13	8		0.14	1.5	315		0.04
127	8075673	626896	4074105		1.6	6.5					27	24			28			1.70	0.3	0.8		1.01	15			6.8	227		0.06
128	8075674	627103	4075805		0.2	3.9				2	25	5	223		15					0.1		0.00	4			11.2	95		0.03
129	8075675	626499	4078003		1.8	8.9				2	20	19	147	4	37			2.11		1.1	2	1.46	14			6.4	205		0.09
130	8075676	625497	4079398		0.4	5.9				2	25	8	143		14			0.95		0.3		0.53	5			7.7	102		0.03
131	8075677	625202	4080703		0.6	9.3					30	12	85		12			1.59		0.4	2	0.64	7		0.20	3.7	108		0.03
132	8075678	623303	4072698		0.7	5.2		194		3	24	14	198		18			1.80		0.4		0.00	10			9.4	150		0.14
133	8075679	627999	4067196		0.7	9.5		161		2	35	15			16			1.60		0.6		0.00	8			3.6	188		0.02
134	8075680	626699	4066300		0.6	7.0		91		2	36	13	106		16			0.98		0.4		0.63	7		0.10	3.7	160		0.03
135	8075681	625996	4064304		1.1	7.7					32	22		2	22			1.46	0.3	0.8		0.91	11			1.5	233		0.03
136	8075682	625798	4062605		0.9	11.7					34	15			22					0.7		0.77	9			2.3	283		0.03
137	8075691	624703	4094000		1.2	31.6		97		3	13	32	109					1.92	0.2	1.1	3	0.94	15		0.28	2.7	100		0.04
138	8075692	626000	4084599		1.0	23.7		169			20	18			16	2		2.05	0.3	0.8	2	0.82	12		0.25	2.0	204		0.03
139	8075693	626199	4086201		0.9	12.0				3	33	15			19			1.72		0.4		0.79	11			1.4	172		0.04
140	8075694	625901	4082900		0.5	10.8				2	24		148		14					0.4		0.00	6			7.1	110		0.03
141	8075695	626501	4088102		0.5	15.5					29	15	105		13			1.33		0.3		0.53	8		0.14	4.0	118		0.03
142	8075717	625698	4048699		0.6	5.7		122		3	21	14	204					1.88	0.5	0.4		0.00	9			9.3	148		0.08
143	8075718	627699	4051302		1.3	7.7		249			25	18	151		16			1.97	0.4	0.9		0.94	12		0.24	6.0	264		0.30
144	8075719	628503	4052603		0.7	3.7				1	10	13	174					1.92		0.4		0.45	7		0.14	5.8	84		0.03
145	8075720	628997	4053098		0.3	4.3				2	23	10	253		11			0.96		0.2		0.00	6			10.3	82		0.04
146	8075721	629599	4053495		0.4			167		2	25	10	179		12					0.3		0.00	6		0.15	10.5	98		0.06
147	8075722	630400	4053196		0.3	5.2		161		2	28	6	180		10			1.11		0.2		0.00	7			7.0	98		0.04
148	8075723	631203	4053297		1.2	7.8				3	28	24			19			2.40		0.6		0.00	13		0.14	3.9	188		0.17
149	8075724	630223	4054247		0.5						24	9	265		12			1.10		0.2		0.00	5			11.3	91		0.04
150	8075725	635799	4068104		3.0	29.3		699			22	43		7	47				0.5	1.8	3	1.42	21		0.17	3.0	1835		0.04
151	8075726	635500	4069498		0.6	13.1		393		2	35	13								0.4		0.00	8		0.14	1.9	1067		0.04
152	8075727	634398	4070302		0.5	11.3		150			36	10			11					0.4		0.00	7		0.16	1.6	558		0.03
153	8075728	641697	4069998		1.2	7.0		261		4	24	27		3	16			3.52	0.4	0.7	2	1.00	17			2.8	285		0.10
154	8075729	634200	4079498		2.4	3.4		581		2	26	23						1.96	0.5	0.7		1.50	15			1.9	213		0.71
155	8075730	633203	4079904		2.7	9.7		762		2	8	23			28			2.39	0.5	0.7		1.11	15		0.20	1.0	179		0.70
156	8075731	627099	4056797		1.4	5.2		129		2	30	22			19			2.19		0.8	2	1.27	14		0.25	3.1	244		0.10
157	8075732	626096	4060598		0.7	10.7				3	34	12	105							0.6		0.60	9		0.15	3.0	246		0.03
158	8075741	617401	4079405		0.5	14.3				3	38	11			17			1.38		0.5		0.00	9			0.7	196		0.02
159	8075742	618902	4079804		0.5	9.5				2	29	10			18			1.91		0.3		0.00	8			4.3	160		0.02
160	8075743	619001	4082900		1.0	9.1		252		5	29	25		9	26	4		3.04	0.5	0.7	1	0.00	16			1.4	424		0.05
161	8075744	616801	4082803		2.1	17.3		264		3	23	27		4	86	3		4.67	0.5	1.7	2	0.86	23		0.39	1.5	232		0.08
162	8075745	616302	4084105		3.1	17.6		290		2	17	35		6	176			7.77		2.7		1.51	36			1.4	282		0.14

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map	Sample	UTM	UTM	Ag	Al	As	B	Ba	Be	Br	Ca	Ce	Cl	Co	Cr	Cs	Cu	Dy	Eu	Fe	Hf	K	La	Li	Lu	Mg	Mn	Mo	Na
Point	Id.	East	North	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA
				ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	%	ppm	ppm	ppm	%	ppm	ppm	%
163	8075746	614703	4086303		5.4	11.4		318		2	13	63		9	81	6		6.08	0.8	2.6	6	1.08	36		0.47	3.4	378		0.23
164	8075747	614398	4087198		0.9	14.5		1293		3	17	19	107		25	6		2.05	0.9	0.7		0.58	11		0.12	2.2	172		0.06
165	8075748	614396	4090605	6.33	1.4	10.4		447		5	18	22			26	5		2.22	0.2	0.6		0.89	15		0.29	0.8	126		0.25
166	8075749	615303	4093303	6.89	1.0	11.7		468		2	17	18		7	29	4		1.87		0.6		0.46	11		0.14	0.9	355		0.05
167	8075750	603005	4092998		1.1	12.1				5	31	21			25	3		2.71		0.6	1	0.00	14		0.26	0.7	287		0.07
168	8075751	602100	4092001		5.7	5.9		1094			0	63						4.61	0.7	1.5		2.87	37			1.0	453		2.25
169	8075752	601301	4090304		5.4			444			13	39		7	118			3.91	0.6	1.7		1.50	23			1.9	384		1.08
170	8075753	601403	4088497		4.0	5.1		593			14	46		13	223			4.89	0.7	3.3		1.29	24		0.43	2.8	547		1.27
171	8075754	601601	4086802		1.2	10.5		245			17	28		1	17	3		2.89	0.4	0.7	2	0.79	18		0.23	1.2	260		0.12
172	8075755	596896	4093104		5.8			661			0	62	178					3.29		0.9	3	4.65	35			0.8	409		2.54
173	8075756	596098	4091299		5.6			848			4	48	181					3.29	0.7	0.8	3	4.78	30		0.24	0.7	331		2.41
174	8075757	597100	4091598		7.2			985			3	68	170			4		3.78	0.7	1.1	4	4.09	41		0.43	0.7	548		2.82
175	8075758	596899	4089798		7.0			903			0	66	210					3.85	0.9	1.4		4.20	35		0.32	0.8	439		2.93
176	8075759	596597	4089695		6.0			953			0	107						6.02		0.8		4.88	46		0.87	0.9	469		1.87
177	8075760	595800	4088498		7.5			880			0	108	195					6.34	0.8	1.4	6	3.89	57			0.7	696		2.51
178	8075761	596002	4086403		6.9			953			3	82						5.36	2.5	0.9	4	4.56	49		0.69	0.7	481		2.46
179	8075762	597300	4081903		6.5			772			0	68						4.43	0.8	0.8	3	4.86	40		0.59	0.0	380		2.34
180	8075770	607001	4062502		1.3	7.1		173			25	22		3	24	3		2.55		0.8		0.97	14		0.14	1.8	377		0.05
181	8075771	610298	4060402		0.6	3.8				4	30	15	135		12			1.78	0.2	0.3		0.00	9			3.8	160		0.05
182	8075772	610801	4061597		0.7	4.0				4	30	21		2	14			2.16	0.3	0.4		0.00	14		0.28	1.7	189		0.06
183	8075773	611105	4063697		0.7	4.9				4	35	16			11			2.35	0.3	0.4	1	0.00	11		0.23	1.7	178		0.06
184	8075774	610300	4065098		0.5			96		4	27	9			13			1.15		0.3		0.00	7			0.6	91		0.05
185	8075775	608601	4065297		0.5	4.3				2	16	9						1.10		0.2		0.00	4			0.6	123		0.03
186	8075776	607598	4063300		1.8	7.5					24	23			24			2.59		0.8		0.82	13			1.7	318		0.04
187	8075777	605900	4067006		0.5			123			28	12	94		11			1.30		0.2		0.00	8		0.14	6.1	104		0.04
188	8075778	598102	4089701		6.1			767			5	69	242					4.59	0.7	0.9		4.90	41		0.37	0.8	363		2.53
189	8075779	596802	4091295		7.0			821			3	105	350					6.31	2.3	1.0	7	4.84	52			0.8	408		2.32
190	DVAF005	529456	4091082									30								0.6							120		0.58
191	DVAF006	531992	4091269									98									14						280		1.31
192	DVAF024	540188	4080432									69								2.0	9						470		1.69
193	DVAF025	541913	4083158									101								2.4	7						390		1.49
194	DVAF027	539033	4085441									102								2.7							490		1.71
195	DVAF028	536495	4087260									63								1.6	7						440		1.48
196	DVAF032	540536	4087966									64								1.2	9						300		10.70
197	GOAF008	539652	4194389	-2.00	8.0		19	971	2		2	81		7	19		10			2.5	-15	2.24	45	29		0.5	594	-4	2.29
198	GOAF018	531829	4194022	-2.00	7.5		22	899	3		2	83		6	20		9			2.4	-15	2.34	46	35		0.7	525	-4	2.04
199	GOAF019	533936	4194696	-2.00	7.8		24	917	2		2	71		5	17		9			2.2	-15	2.68	42	37		0.6	543	-4	2.38
200	GOAF022	524969	4194442	-2.00	7.7		32	923	3		2	82		6	21		11			2.2	-15	2.35	45	38		0.8	548	-4	2.04
201	GOAH020	569585	4179609	-2.00	7.3		22	762	2		1	73		5	19		10			2.4	-15	1.94	41	32		0.7	560	-4	1.67
202	GOBD025	486309	4156028	-2.00	4.3		31	573	2		17	39		7	22		25			2.1	-15	1.26	15	24		1.3	526	-4	0.72
203	GOBD031	490103	4152805	-2.00	6.3		28	621	3		4	68		7	22		16			2.5	21	2.06	35	42		1.5	844	-4	1.57
204	GOBD032	489488	4155358	-2.00	6.9		25	715	3		2	85		8	24		13			2.7	-15	1.90	43	32		0.9	722	-4	1.54
205	GOCD001	491233	4135054	-2.00	7.2		31	261	4		1	151		-4	8		6			1.8	-15	2.85	77	41		0.4	631	-4	2.74
206	GOCD002	494861	4130503	-2.00	7.6		22	842	3		2	105		5	23		11			2.9	-15	2.19	58	35		0.8	716	-4	2.08
207	GOCD004	498050	4127173	-2.00	7.6		25	730	3		2	84		8	27		13			2.7	-15	2.23	45	47		1.0	680	-4	2.08
208	GOCD020	487164	4137500	-2.00	7.1		30	596	3		2	122		7	26		13			2.8	-15	1.98	62	39		0.9	661	-4	1.68
209	GOCD021	488320	4141936	-2.00	7.2		23	815	3		2	59		6	23		13			2.5	-15	2.36	31	42		0.9	660	-4	2.04
210	GOCD023	488154	4149147	-2.00	7.0		22	660	3		1	74		6	21		14			2.3	-15	2.17	35	35		0.7	617	-4	1.93
211	GOCD036	491597	4144927	-2.00	7.4		18	1145	2		2	92		6	20		9			2.9	-15	1.88	49	26		0.7	819	-4	1.83
212	GOCD037	491152	4141378	-2.00	6.9		22	769	3		2	116		7	29		11			3.5	-15	1.65	60	31		0.9	811	-4	1.70
213	GOCD038	491060	4138493	-2.00	7.5		24	840	3		2	87		8	24		16			3.2	-15	1.43	45	28		1.0	654	-4	1.36
214	GOCD039	491778	4148366	-2.00	7.4		20	760	3		1	91		5	18		11			2.4	-15	1.89	45	27		0.7	790	-4	1.75
215	GODE006	520340	4109669	-2.00	7.5		26	748	3		2	75		6	23		13			2.5	-15	2.55	38	44		0.9	705	-4	2.10
216	GODE010	512164	4112649	-2.00	7.3		30	724	3		2	84		6	22		13			3.0	-15	2.53	45	46		0.8	792	-4	2.01

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map Point	Sample Id.	UTM East	UTM North	Ag NAA ppm	Al NAA %	As NAA ppm	B NAA ppm	Ba NAA ppm	Be NAA ppm	Br NAA ppm	Ca NAA %	Ce NAA ppm	Cl NAA ppm	Co NAA ppm	Cr NAA ppm	Cs NAA ppm	Cu NAA ppm	Dy NAA ppm	Eu NAA ppm	Fe NAA %	Hf NAA ppm	K NAA %	La NAA ppm	Li NAA ppm	Lu NAA ppm	Mg NAA %	Mn NAA ppm	Mo NAA ppm	Na NAA %
217	GODE011	510473	4115864	-2.00	7.5		34	702	2		2	67		6	24		14			2.5	-15	2.55	38	51		0.9	598	-4	2.05
218	GODE012	509500	4113533	-2.00	7.6		27	745	2		3	79		9	37		15			3.4	-15	2.36	46	46		1.1	709	-4	2.06
219	GODE013	506836	4114307	-2.00	7.4		26	752	2		2	83		8	29		11			3.3	-15	2.43	44	46		0.9	719	-4	2.20
220	GODE014	504970	4116303	-2.00	7.5		23	783	3		2	137		9	36		12			4.5	-15	2.45	74	49		0.9	1008	-4	2.16
221	GODE039	502928	4118076	-2.00	7.5		29	693	3		2	67		6	21		10			2.5	-15	2.71	36	47		0.7	598	-4	2.33
222	GODE041	521600	4103017	-2.00	7.0		33	689	3		4	107		7	27		15			2.8	-15	2.00	59	46		1.1	690	-4	1.66
223	GODE044	501331	4120295	-2.00	7.4		29	749	3		2	93		6	27		10			2.6	-15	2.35	51	62		0.8	602	-4	2.06
224	GODF005	527555	4103367	-2.00	7.8		22	777	3		3	123		10	34		14			3.7	-15	2.26	67	51		1.2	778	-4	2.10
225	GODF007	522572	4105238	-2.00	7.2		34	669	3		2	69		7	28		17			2.7	-15	2.15	36	46		1.1	622	-4	1.67
226	GODF008	523542	4107903	-2.00	7.2		33	660	3		2	70		7	28		15			2.6	-15	2.20	39	46		1.1	602	-4	1.83
227	GODF009	526941	4100813	-2.00	7.1		23	715	3		2	137		5	19		8			2.5	-15	2.32	79	34		0.7	683	-4	2.14
228	GODF010	529528	4098493	-2.00	7.5		37	702	3		2	96		8	31		17			3.2	-15	2.09	49	47		1.3	692	-4	1.69
229	GODF011	531756	4097280	-2.00	7.5		31	750	2		3	79		6	22		14			2.3	-15	2.40	46	46		1.0	583	-4	1.95
230	GODF012	535307	4099069	-2.00	7.4		29	739	2		3	91		5	25		12			2.6	-15	2.25	56	40		1.0	641	-4	1.97
231	GODF014	535852	4096298	-2.00	7.1		29	704	3		4	95		6	19		100			2.3	-15	2.13	51	42		0.9	583	-4	1.80
232	GODF015	537370	4094973	2.00	7.0		24	671	3		2	93		7	21		11			2.7	-15	2.08	47	34		0.9	616	-4	1.84

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map	Sample	UTM	UTM	Nb	Ni	P	Pb	Rb	Sb	Sc	Sm	Sr	Ta	Tb	Th	Ti	U	V	W	Y	Yb	Zn	Zr
Point	Id.	East	North	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	DNC	NAA	NAA	NAA	NAA	NAA	NAA
				ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1	7074377	606713	4128364	15	20	645	94			8.0		279			8	0.27	0.0	65		16		81	85
2	8034162	606713	4128364													0.00							
3	8075358	629202	4089096						2.9	1.9	1.9				3	0.10	0.8	16			0.8		
4	8075359	630703	4089997						0.4	1.4		349			3	0.00	1.1	10			0.6		
5	8075360	630598	4085800						0.6	3.0		382			4	0.12	1.3	20			0.9		
6	8075361	630301	4095305							1.7	1.5				3	0.00	2.1	9			0.8		
7	8075362	631204	4093300						0.4	2.5					4	0.07	1.0	15	1.5		0.9		
8	8075363	625896	4091599						0.3	1.2		334			3	0.00	1.3	8			0.6		
9	8075364	640995	4094500							1.9	1.5	412			3	0.00	1.1	12			0.9		
10	8075399	624304	4050399						0.3	1.4	1.9	407	2		2	0.00	1.8	14			1.0	61	
11	8075400	624498	4050601						0.4	1.4		458			3	0.00	2.4	10	1.4		1.1		
12	8075401	623204	4051604							1.2	1.8	578			3	0.00	1.9	10			1.0		
13	8075402	625196	4051799					48		1.7		535			4	0.07	16.8	15			1.2		
14	8075403	627604	4054697							1.2		378			3	0.04	1.3	8					
15	8075404	630200	4058696							2.6		459			4	0.09	1.7	19			1.0		
16	8075405	631302	4055596							0.8	0.8	298			1	0.00	1.6	7			0.5		
17	8075406	631804	4063104							4.2					5	0.12	1.5	20			0.8		
18	8075407	631703	4065000						0.4	1.8		370	1		3	0.06	1.2	9			0.8		
19	8075408	632401	4066698							1.4	1.2				2	0.00	2.0	9				63	
20	8075409	641402	4093098						0.3	1.1		426			2	0.06	1.4	8			0.6		
21	8075410	642097	4091998							1.4		314	2			0.07	1.6	9			0.9		
22	8075411	643902	4091097							0.9	0.9	274				0.00		9					
23	8075412	641800	4088998					91	0.6	10.7					10	0.67	2.7	82			4.0		
24	8075413	643299	4088302					140	0.7	12.2	6.5				12	0.48	3.8	66			4.4		
25	8075414	642902	4086498							9.3	5.4				9	0.58	2.0	71			4.2		
26	8075415	643800	4084005							2.8	2.8				7	0.20	1.3	25			1.4		
27	8075416	644496	4082896					109	0.6	8.0					9	0.33	2.5	42			2.7		
28	8075417	643701	4081395							7.7	4.8		2		9	0.37	3.0	46			2.8		
29	8075418	612602	4064607						0.4	1.0					1	0.00	0.8	7					
30	8075419	614399	4065804						0.6	1.1	1.3				1	0.00	1.3	9			0.9		
31	8075420	615698	4066799							1.0	1.1				2	0.00		8					
32	8075421	616800	4069200						0.6	1.0						0.00	1.5	17					
33	8075422	618603	4069901						0.3	0.7					1	0.00	1.3	7					
34	8075423	618697	4070802							0.9			1		2	0.00	1.1	8					
35	8075424	645896	4066695					87		6.3		1892	3			0.30	3.5	42					
36	8075431	605202	4078702					42		3.6					5	0.00	1.3				1.1		
37	8075432	603703	4080205						0.5	1.9	1.7				4	0.06	1.6	12			1.0	60	
38	8075433	604203	4081597							2.3	1.7				3	0.08	1.2	15			0.9		
39	8075434	604198	4083505							2.2	1.6				2	0.00		12			0.9		
40	8075435	604000	4084401							1.5	1.4	254			2	0.05	2.8	9			0.7		
41	8075436	604895	4086897						0.7	2.2					4	0.00	0.9	30			1.2		
42	8075437	605002	4087698							0.5	0.8				2	0.00		7					
43	8075438	608998	4083799						0.4	1.6					3	0.00	1.0	15					
44	8075439	608500	4081595						0.4	1.4		302			2	0.04	1.2	13					
45	8075440	608896	4078505						1.1	1.4					2	0.00	1.3	39			0.8		
46	8075441	611100	4075003					60		5.8	2.9				8	0.18	1.2	34			1.4	121	
47	8075442	637600	4055495						1.0	1.9					2	0.06	1.3	38			0.8		
48	8075443	622801	4050399						0.5	1.2		368	1		2	0.00	2.1	10			1.1		
49	8075444	612396	4051000						0.5	1.6					3	0.06	1.3	10			0.7		
50	8075462	602897	4050105							1.9		402			3	0.00	3.3	13					
51	8075464	601104	4050405							1.2	2.0				3	0.00		9			1.1		
52	8075465	606199	4050100							1.2		275			2	0.00	1.3	8			0.9		
53	8075466	608103	4050202							1.5	1.9	332			3	0.00	1.4	9			0.6		
54	8075467	609797	4050701							1.0	0.9				1	0.00	1.2	8			0.7		

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map Point	Sample Id.	UTM East	UTM North	Nb NAA ppm	Ni NAA ppm	P NAA ppm	Pb NAA ppm	Rb NAA ppm	Sb NAA ppm	Sc NAA ppm	Sm NAA ppm	Sr NAA ppm	Ta NAA ppm	Tb NAA ppm	Th NAA ppm	Ti NAA %	U DNC ppm	V NAA ppm	W NAA ppm	Y NAA ppm	Yb NAA ppm	Zn NAA ppm	Zr NAA ppm
55	8075470	606703	4067004						0.3	1.4	1.4				2	0.00	1.2	8			0.9		
56	8075518	651595	4077703							1.0		360			2	0.00	1.2	5			0.4		
57	8075519	653496	4079702							1.9	2.1				3	0.07	0.8	13			1.1		
58	8075520	652102	4080798						0.3	1.4	1.8	273			2	0.06	0.7	12			0.7		
59	8075521	652201	4081798							1.4					3	0.00	0.8	5			1.1		
60	8075525	651099	4083600							1.4	0.8	343			2	0.00	0.8	13					
61	8075529	645504	4093799						0.3	1.8	1.6	305			3	0.06	1.0	11			0.7		
62	8075530	646498	4091398						0.5	1.8					2	0.00	0.7	11			0.9		
63	8075531	648296	4089897							2.2	1.6				3	0.00	1.2	13					
64	8075532	640002	4045301					41	0.7	3.7	1.9				3	0.11	3.4	23				70	
65	8075533	642701	4048299						0.3	1.7					2	0.06	1.2	11			0.8		
66	8075534	643797	4049105						0.4	1.2		325			2	0.00	1.5	10					
67	8075535	644501	4050903						0.3	0.8	0.9				1	0.00	1.0	7					
68	8075536	641002	4053099							2.4	1.9	383			4	0.00	1.6	14			1.0		
69	8075537	642098	4055003							1.5	1.3	357			2	0.05	1.2	11			0.8		
70	8075538	646096	4058598							1.0		311			2	0.05	2.4	13					
71	8075539	646301	4059699					43	0.5	2.5	2.1				3	0.07	1.6	17			1.0		
72	8075540	646896	4060998						0.5	2.9	2.0				4	0.10	1.4	20			1.0		
73	8075541	648896	4065204							1.4	1.1	354			2	0.00	1.4	8			0.7		
74	8075542	637996	4049197							0.9		444	1		2	0.00	1.5	7					
75	8075543	639597	4047605							0.8			1		2	0.00	1.4	8			0.7		
76	8075544	640500	4049305							1.1		285			2	0.00	1.7	8			0.7		
77	8075545	640801	4050598							2.4	1.9	399			3	0.00	1.3	14			1.1		
78	8075546	642298	4059599							0.8	0.7				1	0.00	1.0	6					
79	8075547	642501	4057605							1.9					3	0.00	1.3	13			0.9		
80	8075548	641905	4056396							2.3		325			3	0.07	1.5	15					
81	8075556	615502	4058897						0.6	1.2		263			2	0.00	1.2	8			0.8		
82	8075557	612304	4060796						0.4	1.2	1.2				2	0.00	1.1	7			0.5		
83	8075558	612796	4062102						0.4	0.7		311			1	0.05	0.8	7			0.4		
84	8075559	612296	4055904						0.6	0.8	1.1	358			2	0.00	1.1	15					
85	8075560	619001	4073302						0.5	1.4	1.6	235			2	0.00	1.3	11			0.7		
86	8075561	618904	4075198						0.6	0.7			1		1	0.00	1.1	7					
87	8075562	619799	4077497						0.4	0.5	0.5	193			1	0.00		8					
88	8075579	647499	4088596						0.3	1.3	1.2				2	0.00	0.8	8			0.5		
89	8075580	646801	4085199							1.1	1.1	244			1	0.00	1.5	8			0.8		
90	8075581	647899	4074797					95	0.7	7.4			5		13	0.33	2.7	46			2.9		
91	8075582	647502	4073004					80	0.5	6.5					8	0.34	2.4	41			2.0		
92	8075583	645679	4069000					81	0.5	7.7	3.1				9	0.41	2.3	52			3.3		
93	8075637	609201	4067901							2.5					3	0.08	1.3	14			1.2		
94	8075638	609802	4069794							1.4	1.4				2	0.06	1.3	12			0.9		
95	8075639	607198	4069595							1.1					2	0.00	0.9	7			0.5		
96	8075640	605799	4069401							1.1	1.4				2	0.00	1.1	9			0.6		
97	8075641	603997	4069300						0.5	1.4	1.7				2	0.00	1.6				0.8		
98	8075642	603704	4069896							0.7			1		2	0.00	0.9	5			0.5		
99	8075643	601797	4068898							0.8	1.2				2	0.00	1.9	8					
100	8075644	600297	4071897							2.3	2.3	416			3	0.06	1.8	14			1.3		
101	8075645	599701	4071801							2.9	2.3	423			4	0.08	1.6	17			1.3		
102	8075646	599999	4070694							1.6		275			3	0.05	1.4	16			1.1		
103	8075647	599799	4070305						0.4	0.9	1.1				1	0.00	1.4	9			0.6		
104	8075648	598796	4069806						0.3	1.0	1.2	253			2	0.00	1.1	8			0.7		
105	8075649	597300	4069499						0.4	1.3		231			2	0.07	1.8	9					
106	8075650	597498	4068502						0.4	0.9	1.1				2	0.00	1.2	8			0.5		
107	8075651	598701	4065599							0.9					1	0.00	1.3	11			0.7		
108	8075652	600200	4063497						0.8	2.3					3	0.05	1.4	36			0.9		

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map Point	Sample Id.	UTM East	UTM North	Nb NAA ppm	Ni NAA ppm	P NAA ppm	Pb NAA ppm	Rb NAA ppm	Sb NAA ppm	Sc NAA ppm	Sm NAA ppm	Sr NAA ppm	Ta NAA ppm	Tb NAA ppm	Th NAA ppm	Ti NAA %	U DNC ppm	V NAA ppm	W NAA ppm	Y NAA ppm	Yb NAA ppm	Zn NAA ppm	Zr NAA ppm
109	8075653	602800	4066400						0.7	1.5		221			3	0.00	1.2	12			1.0		
110	8075654	603604	4063403						0.7	1.3	1.9	1642			3	0.00		11			1.2		
111	8075657	637197	4058895						0.5	1.6		292			2	0.07	1.6	13			0.7		
112	8075658	637097	4061201					60		5.2	3.2				8	0.18	5.7	38			1.5		
113	8075659	635602	4066404							1.0	1.1				2	0.00	1.3	6			0.7		
114	8075660	639301	4063601							1.1	1.1	338			1	0.05	1.0	12			0.5		
115	8075661	643598	4060996						0.4	1.9	1.6				3	0.00	1.3	11			0.8		
116	8075662	644102	4062903							2.0	1.6				2	0.07	1.5	13			0.8		
117	8075663	644495	4064996							1.7	1.4				3	0.00	1.5	9			1.0		
118	8075664	643701	4076601					106	0.7	9.3	6.3		1		12	0.37	3.8	68			3.3		
119	8075665	643799	4077202					76		7.2	4.8				9	0.38	2.4	41			3.0		
120	8075666	643600	4079995					82	1.1	4.7	3.9				8	0.19	2.2	29			2.2		
121	8075667	643402	4079004					101		6.0					10	0.23	2.8	34			2.3		
122	8075668	631005	4075598						0.4	2.3	1.8	327			3	0.07	1.1	15			0.8		
123	8075669	630204	4073100							1.5	1.2	244			2	0.00	1.4	9			0.6		
124	8075670	630502	4071696						0.5	1.8	1.5	406			3	0.08	1.7	18			0.7		
125	8075671	630298	4068696						1.5	2.0	1.9	203			2	0.08	1.0	35			0.8		
126	8075672	628604	4071499							1.6	1.1	385			2	0.08	0.9	17			0.6		
127	8075673	626896	4074105							2.8	1.7				3	0.10		16					
128	8075674	627103	4075805							0.6	0.6		1			0.00	1.1	5					
129	8075675	626499	4078003						0.5	3.3	1.9				5	0.09	1.1	24			0.7		
130	8075676	625497	4079398							1.0	0.8				1	0.00	1.2	6					
131	8075677	625202	4080703						0.5	1.4	1.1	221			2	0.05	3.1	10					
132	8075678	623303	4072698						0.5	1.2	1.5	425			3	0.00	1.5	10			0.8		
133	8075679	627999	4067196						0.4	1.7	1.3				3	0.00	1.5	12			0.7		
134	8075680	626699	4066300							1.2	1.0	412			2	0.00	1.3	8			0.5		
135	8075681	625996	4064304							2.4	1.6				3	0.00	1.0	12			0.7		
136	8075682	625798	4062605						0.4	2.0	1.4				3	0.00		10			0.8		
137	8075691	624703	4094000						1.7	2.7	2.3				5	0.11	0.8	21					
138	8075692	626000	4084599						0.9	2.2	1.6				3	0.00	0.9	24			0.8		
139	8075693	626199	4086201						0.7	1.9					3	0.00	1.3	9			0.9		
140	8075694	625901	4082900						0.6	1.0			1			0.00	1.4	11					
141	8075695	626501	4088102						0.8	1.1		225			2	0.00	1.4	8			0.6		
142	8075717	625698	4048699						0.3	1.3	1.3	234			2	0.00	2.1	10			0.9		
143	8075718	627699	4051302							1.6	1.6	457			2	0.05	1.6	13					
144	8075719	628503	4052603							0.8	1.0				1	0.00	0.9	13					
145	8075720	628997	4053098							0.9		240			1	0.00	1.6	8					
146	8075721	629599	4053495							0.8	0.8	420			1	0.00	2.1	7					
147	8075722	630400	4053196						0.4	0.7		488			2	0.04	1.6	5			0.6		
148	8075723	631203	4053297							2.2		616	2		3	0.08	2.0	16			1.1		
149	8075724	630223	4054247							0.7	0.8	336			1	0.00	1.0	11					
150	8075725	635799	4068104					63		5.7	2.9				8	0.00	1.6	33			1.3		
151	8075726	635500	4069498						0.5	1.5	1.3				2	0.00	1.0	11			0.7		
152	8075727	634398	4070302						0.6	1.3	1.0				1	0.00	1.2	6					
153	8075728	641697	4069998							2.3	2.8	524			4	0.00	1.6	15			1.4		
154	8075729	634200	4079498							2.1	2.0	467			4	0.00	1.3	18			1.1		
155	8075730	633203	4079904						1.1	2.4	2.0				4	0.11	0.9	41			0.8		
156	8075731	627099	4056797							2.8		441			3	0.07	2.0	16			0.9		
157	8075732	626096	4060598						0.2	1.5	1.2	290			2	0.00	1.1	9			0.7		
158	8075741	617401	4079405						0.6	1.6	1.3	321				0.00	1.2	21			0.8		
159	8075742	618902	4079804						0.6	1.3	1.4					0.00	1.2	14			0.7		
160	8075743	619001	4082900						1.0	2.7	2.3	371			4	0.08		25			1.3		
161	8075744	616801	4082803						1.3	5.3		342			5	0.13	3.0	85			2.0		
162	8075745	616302	4084105						1.5	7.9	6.2				7	0.22	5.6	129			3.3		

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map Point	Sample Id.	UTM East	UTM North	Nb NAA ppm	Ni NAA ppm	P NAA ppm	Pb NAA ppm	Rb NAA ppm	Sb NAA ppm	Sc NAA ppm	Sm NAA ppm	Sr NAA ppm	Ta NAA ppm	Tb NAA ppm	Th NAA ppm	Ti NAA %	U DNC ppm	V NAA ppm	W NAA ppm	Y NAA ppm	Yb NAA ppm	Zn NAA ppm	Zr NAA ppm
163	8075746	614703	4086303						1.1	11.5	5.5				10	0.36	3.1	101			2.4		
164	8075747	614398	4087198						1.1	1.8					2	0.08	1.1	41			1.1		
165	8075748	614396	4090605						0.7	2.1	2.1	252			3	0.06	0.9	34			1.0		
166	8075749	615303	4093303						1.5	1.9					3	0.00	1.3	46	2.1		0.9		
167	8075750	603005	4092998						0.6	2.0	2.0	251			3	0.08	1.3	14			1.0		
168	8075751	602100	4092001							5.3		584			7	0.16	3.7	32			2.1		
169	8075752	601301	4090304							6.8			2		5	0.31		78			1.6		
170	8075753	601403	4088497							15.2	3.8	484			4	0.52	0.7	107			2.0		
171	8075754	601601	4086802						0.6	2.2					4	0.07	1.3	27			1.1		
172	8075755	596896	4093104							2.0	3.3				15	0.00	2.5	10					
173	8075756	596098	4091299							3.0					9	0.07	2.6	10			1.1		
174	8075757	597100	4091598							4.0		469			12	0.08	2.8	15			1.3		
175	8075758	596899	4089798							3.3		520			10	0.00	2.6	16			2.4		
176	8075759	596597	4089695							3.3			6		15	0.00	3.1	14			2.3		
177	8075760	595800	4088498					132		4.1		24100	5		17	0.12	3.7	18			2.4		
178	8075761	596002	4086403							3.1					19	0.12	2.7	11					
179	8075762	597300	4081903					104		2.7		449			13	0.11	2.8	12			1.8		
180	8075770	607001	4062502							3.1	2.1	299			3	0.08	1.7	30			1.0		
181	8075771	610298	4060402						0.6	1.1	1.5	1412			2	0.00	0.8	7			0.8		
182	8075772	610801	4061597						0.6	1.4	2.3				3	0.00	1.1	11			1.1		
183	8075773	611105	4063697						0.5	1.4	1.9				2	0.00	1.2	11			0.8		
184	8075774	610300	4065098						0.5	0.9		211			2	0.00	1.0	7					
185	8075775	608601	4065297						0.3	0.6	0.7				1	0.00	0.8	8					
186	8075776	607598	4063300							2.8		343			3	0.10		39					
187	8075777	605900	4067006							0.9		305			2	0.00	0.9	6					
188	8075778	598102	4089701							2.7					13	0.12	3.0	14			2.5		
189	8075779	596802	4091295					117		3.0		12430			19	0.10	4.9	11			2.4		
190	DVAF005	529456	4091082							1.6					-4	0.00	2.6						
191	DVAF006	531992	4091269							1.2					12	0.00	3.3	-10					
192	DVAF024	540188	4080432							6.2					14	0.00	3.7	100					
193	DVAF025	541913	4083158							6.0					17	0.00	3.0	60					
194	DVAF027	539033	4085441							7.8					19	0.00	3.4	40					
195	DVAF028	536495	4087260							4.3					10	0.00	3.6	70					
196	DVAF032	540536	4087966							3.4					19	0.00	6.0	50					
197	GOAF008	539652	4194389	17	9	685	28			5.0		631			12	0.32	3.4	69		14		64	84
198	GOAF018	531829	4194022	15	8	449	26			5.0		459			16	0.26	3.7	61		16		66	60
199	GOAF019	533936	4194696	15	9	459	24			5.0		466			7	0.26	4.0	57		14		62	62
200	GOAF022	524969	4194442	15	8	600	27			5.0		460			17	0.26	4.0	56		14		62	66
201	GOAH020	569585	4179609	14	7	446	21			5.0		368			13	0.28	4.1	55		14		64	70
202	GOBD025	486309	4156028	22	16	414	-10			5.0		341			3	0.22	3.6	58		12		49	39
203	GOBD031	490103	4152805	17	12	733	28			6.0		330			11	0.27	3.3	56		15		84	58
204	GOBD032	489488	4155358	19	13	780	19			6.0		384			12	0.30	4.3	68		15		72	66
205	GOCD001	491233	4135054	33	4	331	24			4.0		157			13	0.17	4.7	24		26		71	67
206	GOCD002	494861	4130503	22	11	532	19			6.0		411			14	0.41	4.2	71		18		68	81
207	GOCD004	498050	4127173	19	11	602	18			7.0		481			17	0.37	3.5	75		17		57	89
208	GOCD020	487164	4137500	25	12	566	26			6.0		357			18	0.36	4.3	67		20		71	138
209	GOCD021	488320	4141936	17	12	653	18			6.0		376			6	0.35	3.6	62		16		64	78
210	GOCD023	488154	4149147	19	11	504	24			6.0		355			11	0.30	3.7	57		14		61	64
211	GOCD036	491597	4144927	21	9	508	14			7.0		373			11	0.45	3.2	66		17		66	99
212	GOCD037	491152	4141378	25	12	526	19			7.0		413			13	0.46	4.1	90		20		79	91
213	GOCD038	491060	4138493	17	9	720	16			6.0		544			13	0.38	3.6	84		16		71	97
214	GOCD039	491778	4148366	19	10	373	23			6.0		336			13	0.31	3.7	52		16		62	65
215	GODE006	520340	4109669	18	14	465	28			5.0		381			14	0.31	3.7	57		14		70	80
216	GODE010	512164	4112649	21	10	446	21			5.0		368			9	0.38	4.0	68		15		82	81

(-) less than indicated value

SILT SAMPLE ANALYSES
(NURE samples)

Map	Sample	UTM	UTM	Nb	Ni	P	Pb	Rb	Sb	Sc	Sm	Sr	Ta	Tb	Th	Ti	U	V	W	Y	Yb	Zn	Zr
Point	Id.	East	North	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	NAA	DNC	NAA	NAA	NAA	NAA	NAA	NAA
				ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
217	GODE011	510473	4115864	16	12	511	17			5.0		412			11	0.32	3.8	58		15		66	74
218	GODE012	509500	4113533	19	14	729	16			7.0		458			10	0.50	3.7	91		16		71	89
219	GODE013	506836	4114307	22	13	550	24			6.0		454			12	0.47	3.7	87		16		73	84
220	GODE014	504970	4116303	27	15	594	23			7.0		455			16	0.62	4.3	115		21		102	90
221	GODE039	502928	4118076	19	9	470	16			5.0		404			5	0.34	3.9	59		15		62	84
222	GODE041	521600	4103017	25	15	620	24			7.0		406			13	0.36	3.8	60		19		78	120
223	GODE044	501331	4120295	21	8	489	19			6.0		468			15	0.39	3.8	70		17		86	83
224	GODF005	527555	4103367	28	19	817	19			7.0		493			11	0.50	3.6	81		19		85	122
225	GODF007	522572	4105238	19	15	635	22			6.0		360			10	0.34	3.8	61		15		73	90
226	GODF008	523542	4107903	20	15	503	18			6.0		388			8	0.34	4.2	61		15		70	85
227	GODF009	526941	4100813	28	9	487	18			5.0		356			13	0.35	4.3	51		19		75	131
228	GODF010	529528	4098493	22	16	613	29			8.0		358			8	0.40	4.8	75		17		82	96
229	GODF011	531756	4097280	17	13	506	25			6.0		380			12	0.28	3.6	50		16		64	83
230	GODF012	535307	4099069	19	11	479	21			6.0		426			7	0.35	3.7	61		17		67	84
231	GODF014	535852	4096298	23	10	392	29			5.0		496			15	0.30	3.4	58		17		61	77
232	GODF015	537370	4094973	24	12	567	24			5.0		413			15	0.34	3.7	55		17		66	119

(-) less than indicated value

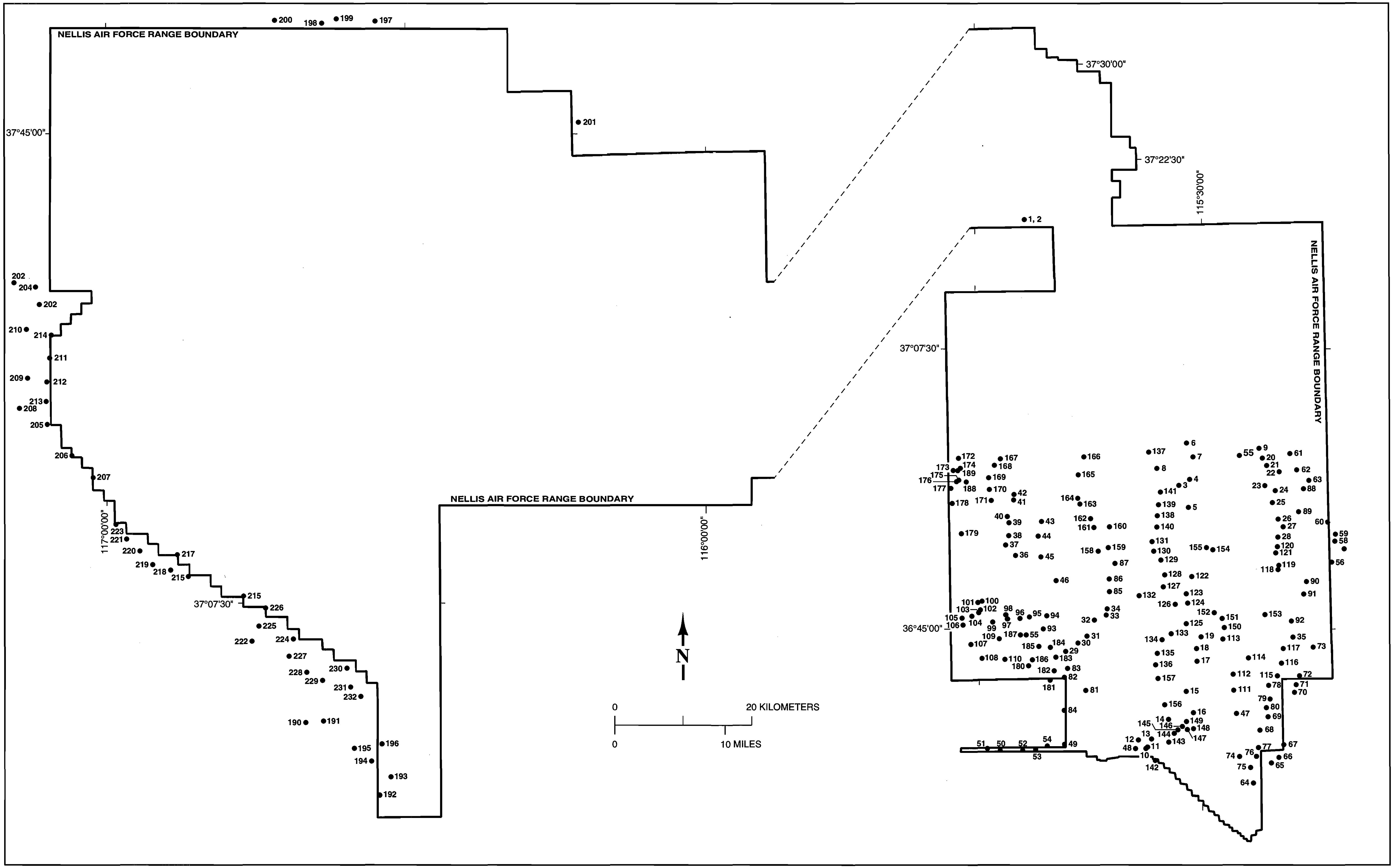

Figure B-1 Location map, NURE stream sediment sample sites, NAFR.

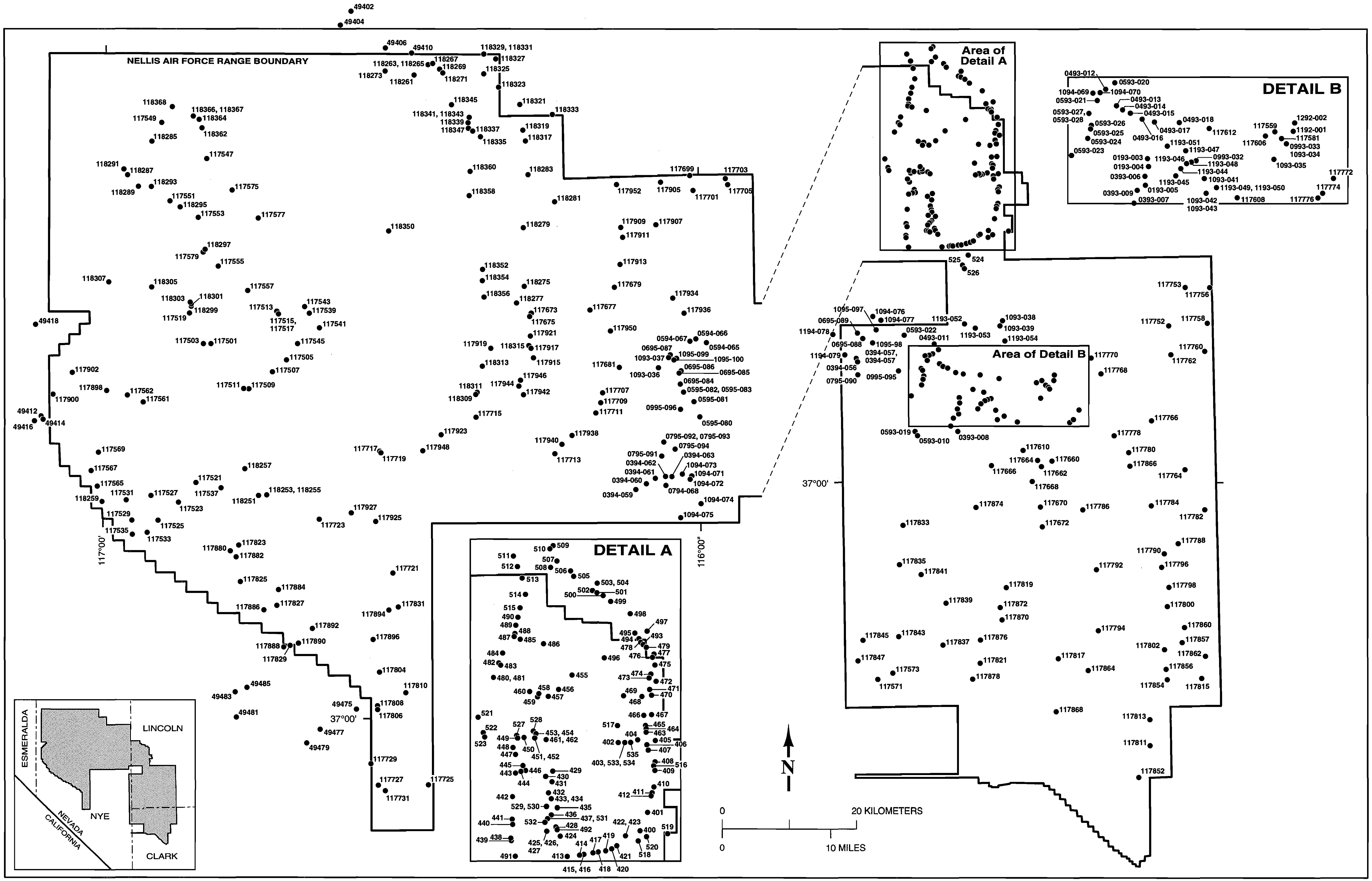

Figure B-2 Location map, silt samples, NAFR.

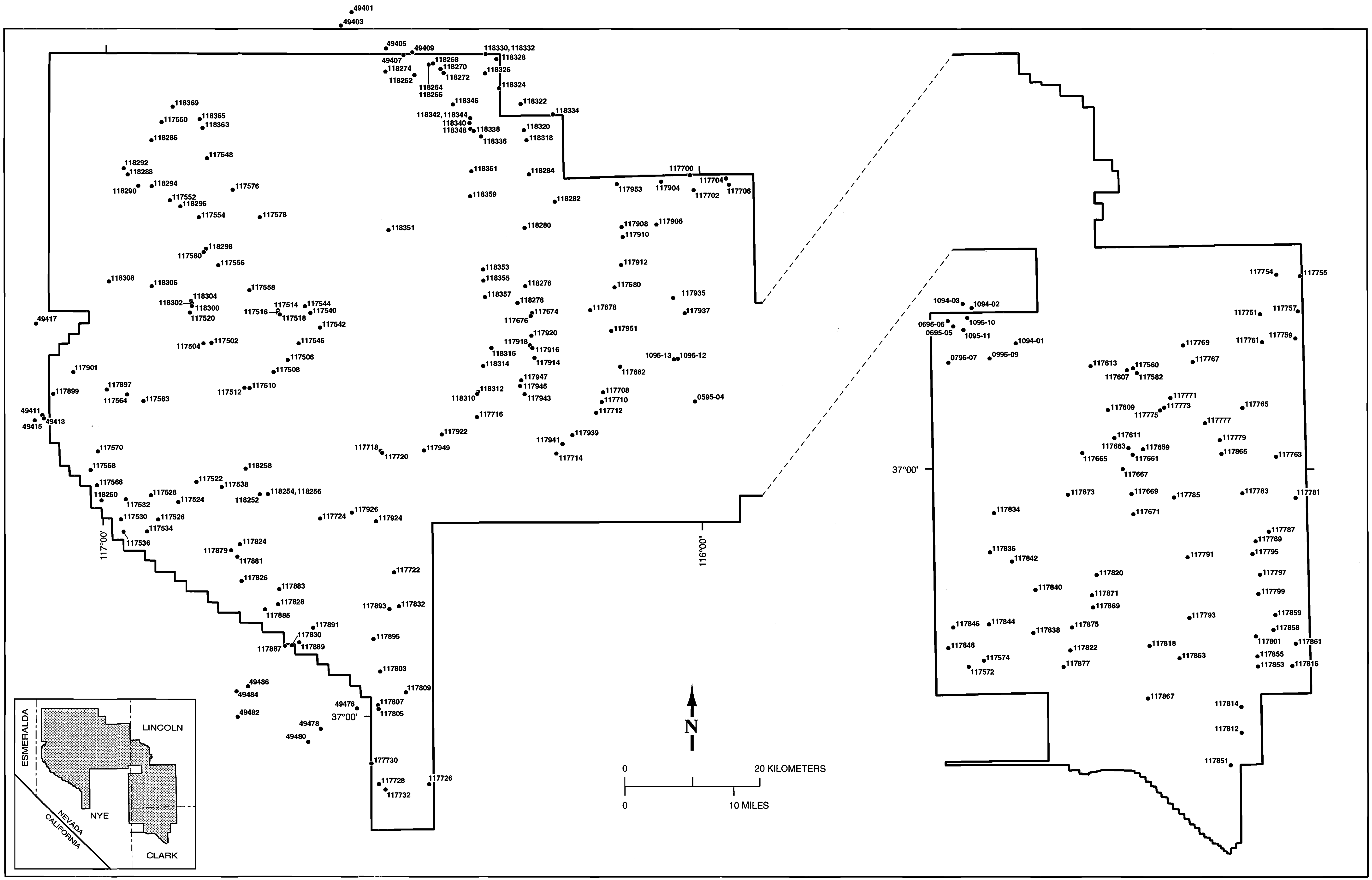

FIGURE B-3 Location map, float chip samples, NAFR.

APPENDIX C

MINE, PROSPECT, OUTCROP SAMPLING DATA

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
Alkali Lake			
	5837	Alkali Lake	Playa sediment, sample from surface to 40 cm depth. Price, 11/13/95
	5838	Alkali Lake	Playa sediment, sample from surface to 40 cm depth. Price, 11/13/95
Antelope Springs			
	5152	Chloride Group	Iron-oxide stained, vuggy white quartz vein material collected from dump of cut; clear quartz crystals in vugs
	5153	Chloride Group	Iron-oxide-stained, vuggy vein quartz; limonite flooding of fracture surfaces; some spots of gray-black mineral; "vein" material is a breccia of clear and white vein quartz cemented by clear quartz, open space between fragments contains clear quartz crystals growing on breccia fragment surfaces
	5154	Auriferous vein Prospect	White vein quartz stockwork, vuggy with clear quartz crystals, iron-oxide-stained fractures, some globular secondary silica and jarosite on fractures, specks blue-black mineral in quartz, possibly argentite (?)
	5155	Shultz vein Prospect	Vuggy, white vein quartz in argillized tuff, iron-oxide-stained fracture surfaces, amber-stained, clear quartz crystals line vugs.
	5156	Thanksgiving vein Prospect	White vein quartz, vuggy, clear acicular quartz crystals coat surfaces in vugs, iron-oxide coatings on fractures
	5157	Auriferous vein, east branch	White vein quartz, iron-oxide on fractures, minor manganese oxide, specks and small clots of black metallic mineral in clear quartz vein material, possibly argentite (?)
	5158	Auriferous vein, east branch	Vuggy vein quartz, yellow-brown iron-oxide stain on fracture surfaces, clear quartz crystals in vugs, surfaces coated with amber iron-oxide staining
	5171	Antelope View Mine	Vein quartz, fractured, rubbly vein with green copper-oxide staining, pyrite blebs in vein material, rock brecciated and cemented with quartz, a quartz-veined stockwork. Jon Price notes follow: Sample 5171 of quartz vein material with pyrite and copper oxide minerals and limonite from crosscut about 30 m down the incline (~30°). The vein is shattered along its entire extent, implying that this is a fault-vein. Vein is at most 0.7 m thick, locally only 0.3 m. Photos 23, 24, 25 are of vein underground. Photos 23 and 24 are from location of sample 5171.
	5172	Chloride Group	Massive, white vein quartz, clear crystals in vugs, minor iron-oxide staining
	5273	Shaft 5273	Sample from dump of shaft about 30 m deep on E-W, vertical zone about 1.5m wide of quartz veinlets, stringers, and stockworks. Quartz, drusy, locally coarsely crystalline, with iron oxides after pyrite. Rare chrysocolla in quartz float near shaft. Rhyolite is silicified and spherulitic with some disseminated pyrite now all oxide. Near contact with Tertiary intrusive.
	5274		Sample from dump of incline shaft dipping 40°SE on mineralized zone striking N45°E, 40°SE in silicified rhyolite. Zone contains silicified, brecciated rhyolite and drusy, crystalline quartz veinlets and stringers. Locally abundant limonite with some associated chrysocolla and rare malachite. Shaft, 20-30m deep, is not shown on topo map. Located a few meters from contact with Tertiary intrusive. Rock type: Rhyolite of Cactus Range.
	5277	Gold Bug Group	Sample of limonitic/hematitic silica vein and altered tuff from decline on ENE-striking fault (see #5278). This is eastern working; #5278=2 declines on same structure to west, and a third shaft occurs still farther west. Limonitic ash-flow tuff (Tau?, according to Ekren, et al.)and siliceous vein with a little preserved pyrite. Vugs lined with hematite-stained acicular quartz veins. Photo #30 (Henry).
	5278	Gold Bug Group	Pyritic ash-flow tuff from dump of 2 declines that follow fault trending N60°E, 55°N in ash-flow tuff (upper unit of Antelope Springs, according to Ekren, et al.) Tuff has disseminated large pyrite crystals (to 2mm) and sericitized biotite. Tuff, N25°W, 40°E. Also, silica vein along fault and possible alunite.
	5282	Mocking Bird vein	Grab sample from dump of small prospect. Rock is moderately to strongly argillized, very weakly chloritized, rhyolite host rock with shattered quartz vein cemented by rock flour and silica. Limonite pseudomorphs after pyrite present, weak to moderate limonite. This is one of a series of small prospects along a N-S zone (1-3 m.) of stockwork quartz veins and veinlets (gen. < 3 cm. thick). One small decline seen, 2 m X 2 m X 20 m, sunk west @45°, looks to be about 1920-1930 vintage.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5283	Mocking Bird vein	Grab sample from dump at collar of decline. Rock is weakly to moderately argillized, weakly chloritized, rhyolite porphyry host rock with shattered quartz stockwork and moderate limonite crusts. Incline west @45°, 2 m X 2 m X 20 m, looks to be about 1920-1930 vintage
	5284	Mocking Bird vein	Dump grab sample from collar of incline. Rhyolite porphyry host rock with irregular quartz veins and veinlets 1-4 cm, some open space filling crystalline quartz. Mineralization consists of pyrite, chalcopyrite, sphalerite (?) and copper oxides, scorodite (as oxide). Incline 2 m X 2 m X 20m (?).
	5285	Antelope Group vein	Dump grab/rock chip sample at collar of inclined shaft. sample is rhyolite porphyry from a structural zone 1-3 m thick, trending N-S, 45°W. One meter strongly silicified, 1-2 m footwall stockwork. Moderate to strong argillization, weak chloritization, strong limonite. Incline west @ 45°, 2 m X 2 m X 10 m.
	5295	Antelope View Mine	Channel chip sample across structurally hosted vein consisting of about 0.3 m of gouge with thin quartz stringers, exposed in 3 m^3 pit, uppermost working to SW of main intersection. Host rock is moderately silicified/welded quartz k-spar porphyry - ash flow, with sericitized plagioclase, patchy silicification and minor limonite. No mineralization noted.
	5296	Antelope View Mine	Sample across 1.5 m wide shear/gouge/quartz vein zone trending N45E, 65N exposed in 5 m^3 dig, water-filled. Host rock is strongly argillized ash flow quartz/K-spar porphyry with gouge and minor limonite, strongly jointed. Stringers of quartz in gouge and clay zone. (SEE SKETCH ON SAMPLE TAG)
	5297	Antelope View Mine	Channel-chip sample across 2-m wide shear zone penetrated by quartz stringers and veins up to 0.5 m thick. Shattered texture resulting from post-vein movement. Host rock is ash flow quartz feldspar porphyry with increasing argillization halo away from vein, slight jarositic tint and stain. Silicification and minor limonite some pseudomorphic after pyrite. Dig looks like start of a decline, now water-filled, exploring the N45E, 65N structure. About 10 m^3 material on dump.
	5298	Antelope View Mine	Grab sample from dump of inaccessible incline about 20-25 m deep driven on N30E, 65 N structure. Main vein is about 0.3 m wide at collar, 1 m wide at 5 m depth down decline. Moderate stockwork developed in host rock of ash flow quartz feldspar porphyry adjacent to structure. Vein is strongly silicified with brecciation and resilicification, and almost no gouge present. Mineralization consists of rare disseminated pyrite grains and small granular masses <<1%, with moderate to strong crusty limonite.
	5299	Antelope View Mine	Channel chip sample across 1.5 m of sheeted zone of silicification and quartz veins up to 2 m wide, trending N15-20E, 65N. Ash flow quartz feldspar porphyry wallrock are weakly silicified for about 2 m adjacent to structure. Mineralation consists of scattered pyrite blebs and moderate limonite.
	5300	Antelope View Mine	Pyritic vein in ash-flow tuff (Tau? Tuff of Antelope Springs?) Several pieces of generally pyritic-limonitic ash-flow tuff and silicified breccia; from largest decline (plunging ~35°W) along west-dipping fault. Photo 36-general mine area; photo 37-this decline-caved entrance. Photo 1- next decline to SW.
	5301	Antelope View Mine	Highest grade material from vein in Tau, Tuff of Antelope Springs. Highly limonitic fault breccia (?) with pyrite and some sphalerite and galena. Some vein quartz with comb structure.
	5302	Antelope View Mine	Sample of altered wallrock, highly altered ash-flow tuff (Tuff of Antelope Springs) with destruction of all feldspars and mafics, cut by 5mm quartz vein. Wallrock contains finely disseminated limonite points after pyrite; some pyrite remains unoxidized.
	5332	Antelope View vein	Grab sample of iron-stained, silicified and bleached rhyolite ash flow tuff from shallow pit at extreme northern end of northerly-striking vein of Antelope View mine. A north-striking, west-dipping fault is apparently present here, but no vein. Sample is to confirm that wallrock here is unmineralized.
	5333	northern Antelope View vein	Chip sample across 1 m- wide zone in silicified ash flow tuff. The zone consists of quartz vein material and silicified tuff. It has a thin gouge zone at top and bottom. The zone has an attitude of N5°W, 45°W. This is about 15 degrees steeper than you see closer to the Antelope View mine. The tuff has an attitude of N75°W, 60°SW in the footwall; thus the vein is at nearly right angles to the compaction foliation.
	5544	Wooden Whim Shaft	Silicified tuff, gossan and jasper along fault, clots of manganese- and iron-oxide-rich gossan and jasper, clots of green copper-oxide minerals in silicified material; hematite-after-pyrite (?)
	5545		Clear and milky white vein quartz, cockscomb texture, with clots and stringers of pyrite, pyrite cellular, fills vugs; rock stained greenish-yellow
	5546		Vuggy, cockscomb quartz cementing silicified rhyolite tuff breccia; iron-oxide spots and staining; spots bornite and chalcopyrite in 2 cm-wide band of quartz; some green copper-oxide

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5650	Prospect 5650	Quartz vein with limonite. Wallrock is ash flow tuff with feldspars altered to sericite(?) Sample was collected from a 20-cm vein trending N35°E, 65°W. Main vein with deeper prospects and declines has variable strike and dip. More veins 1-10 cm wide occur ~50 m farther east.
	5651	Prospect 5651	Quartz vein and breccia with wallrock fragments cutting ash flow tuff. Series of shallow pits along main structure, N50°E, 64°N, ~1.6 m wide, 100 m long, 150 m south of saddle. Vein trend is N71°E, 72°N on south side of vein at outcrop in trench..
	5652	Prospect 5652	Quartz vein and veinlets with limonite, from dump of prospect pit on structure trending N18°E, 75°W with subparallel open-space quartz and limonite veinlets 1 cm wide. Zone of altered (to kaolinite+ sericite(?)) ash flow tuff is about 1 m wide. No thick quartz vein or silicified replacement zone is obvious here. Decline is filled with water at 8 ft; from size of dump, probably not more than total of 15 ft deep. Location E of adits where sample 5544 was collected. Photo 11 & 12 of this prospect looking N, with eutaxitic structure dip E, vein dipping W. Photo #13 of 1 cm-quartz-limonite veins in ash flow tuff.
	5653	Prospect 5653	Sample contains oxidized quartz vein material with limonite from outcrop as well as pyrite (?)-rich material from dump. Vein strikes N45°E, 75°W out across valley with prospect pits and shafts (up to 12 feet deep to water) along strike for 100 m. Flattened pumice in ash flow tuff, N20°E, 40°E. Vein is 0.2-0.3 m wide. Photo 14 of vein.
	5654	Prospect 5654	Quartz vein, oxide (limonitic) from outcrop in prospect pit; sulfide-bearing chips from dump. Vein strikes N48°E, 59°W, 0.2-0.4 m wide, striking out into valley, cutting ash flow tuff. Quartz vein with fractured rhyolite and parallel joints in zone totaling 1 m wide. Small prospect pits up to 6 feet deep along zone about 25 m long.
Antelope Springs west			
	5303	Shaft 5303	Chip sample from vein striking N45°E, dipping 80°SE, cutting bleached rhyolite porphyry. Vein is 1.5m thick, with heavy manganese oxide staining, developed by a 75° incline shaft.
	5532	Jay No. 2 Claim	White vein quartz, silicified quartz vein breccia with spots tetrahedrite, rosettes of malachite, iron-oxide-staining, hematite points
	5533	Jay Shaft, north	Silicified, brecciated vein quartz, slightly vuggy, clots of pyrite and trace amount of chalcopyrite, fine-grained black mineral, some clear quartz crystals in vugs; quartz crystals line cavities and coat vein fragments in silicified breccia; pyrite fills open spaces around quartz crystals.
	5534	Jay Shaft, south	Sugary, white vein quartz; vuggy, with clear quartz crystals in vugs, clots of pyrite; clots of fine-grained black metallic mineral (?), some silvery spots in quartz, possible silver sulfide mineral
	5535	Jay No. 5 Claim	Silicified, brecciated quartz vein, vuggy, with cavities up to 3x18 cm lined with clear, iron-oxide-stained quartz crystals; clots and disseminated pyrite, trace chalcopyrite; fracture surfaces stained greenish yellow from oxidizing sulfides; fine-grained silver-black metallic mineral present (?)
	5536		Hematite- and limonite-stained breccia of kaolinized dacite, minor manganese-oxide staining
	5537		Sugary, white vein quartz, vuggy, iron-oxide stain on surfaces; minor pyrite, some yellow-green oxide staining
	5538	Leaning Windlass Prospect	Silicified, brecciated shear zone; vuggy white and clear, cockscomb quartz cementing the breccia; clear quart crystals line vugs; cinnamon-brown and red-brown limonite coatings on fracture surfaces; hematite-after-pyrite cubes, trace copper staining
	5539		Tan, granular rock, breccia fragments of dacite in tan carbonate matrix, carbonate veining, some quartz in cavities, gossany clots of cellular limonite and black, pulverent manganese oxide on some fracture surfaces.
	5540		Silicified ledge material, dacitic rock flooded with sugary gray quartz, possibly some tetrahedrite (?), minor iron-oxide staining
	5541	Horse Whim Shaft	Outcrop of ledge; iron-oxide-stained, brecciated, and quartz-cemented dacite; bleached rock along ledge margins has cream and pink crystalline mineral, possibly alunite, disseminated throughout.
	5542	Horse Whim Shaft	Silicified dacite, rock completely replaced by silica, rock is dense with only a few vuggy cavities; disseminated pyrite, sericite, and pale tan crystals, possibly sericite
Bullfrog			

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5060	Prospect 5060	Finely granular white quartz vein with specks pale red-brown limonite
	5061	Prospect 5061	Finely granular white quartz vein with specks pale red-brown limonite
	5062	Mayflower Mine	Late-stage calcite(?) cementing fragments of conglomerate; grab sample from dump
	5063	Prospect 5063	Dump sample; limestone cut by carbonate veins, no visible sulfides
Cactus Flat			
	3209	Prospect 3209	Brecciated rhyolite tuff, silicified, opalite, Feox.
	3210	Prospect 3210	Silicified tuff, volcaniclastic, white chalcedonic quartz, red jasper, hematite staining.
	3211	Prospect 3211	Silicified tuff, opalite and chalcedonic quartz, hematite.
	3212	Prospect 3212	Silicified rhyolite tuff, chalcedonic quartz, Feox fracture coatings.
	3213	Prospect 3213	Silicified rhyolite tuff, chalcedonic quartz fracture coatings.
	3214	Prospect 3214	Silicified breccia, silicified volcanic rock, some Feox and Mnox staining.
	5713	Site 3209	Iron-oxide coatings on fault surface in welded tuff, some chalcedonic silica coatings, rock brecciated but unaltered (fresh biotite and feldspar)
	5714	Site 3210	Quartz stockwork in silicified volcanic sediments, some white quartz veining, hematite coatings on fractures, minor manganese-oxide staining
	5715	Site 3211	Brick-red jasper from fault zone in silicified volcanic sediments
	5819	Antelope Lake	Playa sediment, clay and silt; hard clay surface with mud cracks, slight pink cast to some surfaces, iron-oxide-stained webs, possibly some gypsum present. Sample from surface to 25 cm depth. Tingley, 11/7/95
	5820	Antelope Lake	Playa sediment, hard surface, surface broken into mud cracks with small rivulets of clay, shiny surface, very hard clay-silt. Sample from surface to 10 cm depth- would need pick to get greater depth. Tingley, 11/7/95
	5821	Main Lake	Playa sediment, clay-silt, surface coated with 2-3 mm of clay over sandy clay layer, thin lenses of silt/clay; surface very hard. Sample from surface to 20 cm depth. Tingley, 11/7/95
	5822	Main Lake	Playa sediment, sandy clay-silt with some fine-grained quartz sand grains, very hard, surface of buff clay about 1-2 mm thick, then clay-silt with sand grains; surface material clay with fine mosaic of mud cracks. Tingley, 11/7/95
Cactus Peak			
	5265	Shaft 5265	Outcrop sample from shaft about 15m deep. Fine-grained rhyolite tuff and ash-flow Tuff of Antelope Spring(?) Silicified and pyritized zone 2m wide strikes N25°W, high angle, with relict quartz phenocrysts in silicified rock. Rock contains about 10% fine-grained pyrite, mostly oxidized to limonite and hematite.
	5266	Shaft 5266	Sample from outcrop near shaft about 5m deep. Rock is silicified, argillized rhyolitic volcanic containing pyrite, now iron oxides. 0.5m-wide silicified zone trends N40°W with envelope of argillized rock. Relict quartz phenocrysts. silicified zone is brecciated and resilicified; rock is acid-leached with some vuggy silica, fine-grained gray chalcedony, abundant iron oxides. Shaft is on west side of a large color anomaly in bedded tuffs, prominent hematite-red area.
Cactus Springs			

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5151	Shaft 5151	Silicified rib in rhyolite welded ash-flow tuff, clear quartz crystals, coated with red-brown iron oxides, in vugs; possible alunite
	5165	Cactus View Prospect	Clear, vuggy, cockade-structure vein quartz in argillized, welded ash-flow tuff, limonite coatings and crusts on fractures, specks blue-black, metallic mineral
	5166	Cactus View Prospect	Clear vein quartz, vuggy, minor manganese-oxide staining, iron-oxide flooding and points throughout, blue-black metallic mineral, possibly argentite, in clear vein quartz fragments in breccia, breccia is cemented with clear quartz
	5167	Upper Cactus View Prospect	White vein quartz and quartz rubble, quartz-hematite cemented breccia, coatings of jarosite, silicified, brecciated zone with vein quartz cement, points of blue-black mineral in vein fragments.
	5168	Prospect 5168	White vein quartz and argillized welded ash-flow tuff, minor iron-oxide staining, fracture surfaces coated with pale, amber jarosite crystals
	5169	Bailey's Silver Sulfide Claim	White and clear vein quartz, iron-oxide-stained, trace blue-black metallic mineral, possibly manganese oxide (?)
	5170	Bailey's Silver Sulfide Claim	Vein quartz, vuggy, fractured with iron-oxide flooding on fractures, clear quartz crystals in vugs.
	5267	Cactus Nevada (Fairday No. 3) Mine, northeast dump	Dump sample of quartz vein material in Antelope Springs? fm. Alteration consists of sericite and bleaching. Mineralization consists of mostly oxidized pyrite in quartz; blue-black crystalline sulfide also present may be tetrahedrite or enargite (?). Vein quartz is coarsely crystalline with vugs lined with crystals; some vugs lined with sooty black mineral. Vein trends N75E, approximately vertical, 1.5m wide zone of veining and stockworking; looks like low-sulfidation type. Workings consist of several prospect pits.
	5268	Cactus Nevada (Fairday No. 1) Mine, main shaft	Dump sample of quartz vein material. Vein cuts Antelope Springs tuff. Alteration consists of silicification and sericitization with strong bleaching of wallrock adjacent to vein. Quartz vein is 1.5m wide, vertical, trends N55°E, banded with cockade structure, quartz crystals to several cm, local bands of dark sulfide and pyrite several mm thick. Extensive workings consist of a shaft several hundred feet deep, open stopes, large dump, and an old assay lab. Sulfides present are abundant pyrite, sporadic grains of chalcopyrite, galena, and/or sphalerite (XRD analysis of sulfide sample by Li Hsu).
	5269	Adit 5269	Dump sample of bleached, sericitized, silicified wallrock. Open adit strikes N40°W, can be examined. Adit encountered silicified, pyritized rhyolite and narrow quartz vein with pyrite and dark gray to black bands. Silicified rock is sugary, gray, fine-grained quartz; vein is white with black bands several mm wide. Sample of wallrock for XRD. Extensive bleached area. XRD=Essentially quartz with minor amounts of sericite, alunite, and kaolinite.
	5270	Urania Camp Tunnel	Location is not a mine site although shown on topo map as Urania mine. Short caved adit (100') with water seep. Site of old mine camp-several old dwellings here-probably site of Urania mine camp because of water. Native sulfur on dump here probably from partial oxidation of pyrite, also selenite. Dump highly pyritic. Rock type: Ash-flow tuff-White Blotch Springs? Alteration: silicification. Dump sampled.
	5271	Prospect 5271	Outcrop chip sample from silicified ledge of Antelope Springs? tuff. Looks like quartz-alunite alteration; check for alunite with XRD. Minor hematite on fractures. XRD=In addition to quartz as a major phase, the sample contains some amounts of pyrophyllite and diaspore.
	5272	Shaft 5272	Sample of silicified, sericitized, kaolinized Antelope Springs Tuff with fine, disseminated pyrite crystals and some vuggy silica from dump of small shaft, about 20 m deep.
	5275		Select dump sample from adit trending S45°W, about 200m long. Numerous silicified ledges, high- to low-angle, high sulfidation system. Quartz ledge material sorted on dump has banded chalcedonic silica with alunite and clumps of resinous sphalerite, with minor galena and pyrite. Pyrite and sphalerite are locally intergrown with alunite. Photo 18, print roll. Rock type: Antelope Springs Tuff. Alteration: silicification, alunitization, sericitization, marginal argillization.
	5276	Cactus Leona Shaft	Location is adjacent to Cactus Nevada (Fairday) mine. Dump sample from shaft inclined 80°W. Vein quartz on dump with pyrite the only sulfide seen. Quartz is glassy to gray, some replacement of tuff. Shaft bottoms in pyritic, propylitized tuff. Rock type: Antelope Springs Tuff. Alteration: silicification, bleaching.
	5288	Fairday	Rock chip sample across 6-foot wide vein /structure. Rock is strongly argillized, variably silicified, quartz eye porphyry, white to buff, very friable. Some quartz veining up to 5 cm thick. Weak to moderate, fracture-controlled limonite crusts and stains. Appears to be a system of N35E-trending irregular quartz veins, multiple episodes of veining; some crushed and milled quartz, some intact veins. Sample was collected at the base of dump about 25 m N35E of original shaft in small cut.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5289	Fairday	Five-meter channel sample across vein trend in small crosscut pit. Strongly argillized "birds eye" quartz porphyry, with weak fracture-controlled limonite, patchy silicification, and irregular quartz veins 1 cm to 0.5 m thick. Limonite pseudomorphs after pyrite. Vein trends roughly N30-35E, dip variable between 80N and 80S. Veins seem to occur in fault/crushed zone about 2 m wide.
	5290	Fairday	Four-meter channel sample across vein/structure trend. Strongly argillized, variably silicified, strongly tectonized felsic volcanic, probably quartz eye porphyry, with stringers and veins of crystalline quartz. Limonite pseudomorphs after pyrite, and rare sulfide spots. A few orthogonal veinlets (S55E to vertical) to main trend of N30-35E, vertical. Main vein segment 1 m wide.
	5291	Fairday	1.5 m channel sample across vein/structure trending N35E, 80N. Quartz vein and altered tuff porphyry (quartz eye). Strong leaching of feldspar gives a spongy look. Moderate to strong silicification and micro-quartz stockwork, quartz vein about 0.5 m thick. About 1-3% finely disseminated euhedral pyrite cubes, <1 mm. Hanging wall more argillized, soft, gooey. Footwall strongly leached, pyritic, with stockwork quartz veining.
	5292	Fairday	Two-meter chip sample across structure/quartz vein. Felsic volcanic (tuff?) quartz eye porphyry host rock, strongly argillized with complete leaching of feldspar, strong to weak silica flooding and replacement and stockwork veinlets. Main vein pinch and swell, 0.25-1 m with angular relict fragments/breccia of host rock. Open space drusy quartz crystals. 1-3% pyrite.
	5293	Fairday	Three-meter channel/chip sample across strike of vein at south end of N-S trending trench and small pit. Vein is).5-1 m wide bull to crystalline quartz vein with open space crystalline quartz, weak iron stain, and <<1% scattered pyrite blebs and crystals. Wall rock is ash flow tuff-quartz eye(biotite?) k-spar porphyry with incipient to patchy pink-red alliteration of K-spars and groundmass, possible potassic alteration? Stockwork silica veins, strong leaching of feldspars and ferromags, spongy-looking.
	5294	Fairday	Float chip sample from 5 m X 10 m area of dense aphanitic, brick red volcanic with 1-3% finely disseminated euhedral pyrite cubes 1-2 mm, and pyrite casts. Collected as float sample about 50-60m S25E of sample #5292.
	5325	Vanetta No. 4 Claim (Fairday Group)	Chip sample across 4.5 ft wide milky, sacchroidal quartz vein having an attitude of N35°E, 75° NW. Several small pits along the vein trend indicate that it continues for about 30 m. Sparse pyrite occurs in some parts of the vein with dark unidentified mineral. Faint banding locally parallel to walls. Wallrock is light gray, sparsely lithic rhyolite welded tuff.
	5326	Vanetta No. 4 Claim (Fairday Group)	Select sample of dark, pyrite-bearing quartz vein material from vein described at sample site 5325. Best chance for good values from this vein.
	5327	Fairday No. 6 Claim	Select drusy quartz vein matter from very small prospect pit. Attitude of vein cannot be determined. Wallrock is light gray welded tuff. The tuff probably originally had a moderate amount of biotite, but it is altered to sericite in places in this general area.
	5328	Urania Peak gossan float	A piece of hematite/limonite gossan was collected from float on a hillslope. Rock in talus is flow-banded rhyolite; many surfaces are strongly coated with dark colored iron oxides. This type of material if found at a stream sediment site, would be collected in the limonite chip sample. Compare with limonite chip samples in vicinity. The flow-banded rhyolite may intrude or overlie light gray ash flow tuff on Urania Peak. Gossan float must have come from within 100 m or so above the sample site. (see sample 5217)
	5329	War Lord Claim	A select sample was collected from the dump of a small adit, caved at portal. The adit apparently crosscut to an iron-stained silicified zone on the surface that has an attitude of N0°-20°W, ~90°. The iron oxide coatings and gossan are much like sample 5328 and probably represents a similar geologic condition. The most pyritized rock was collected. Wallrock is white rhyolite, locally flow-banded. Silicified ledge is 2-3 m wide, but only 20-30 m long. Feldspars in rock are altered to clay (kaolin?)
	5330	S. of Fairday No. 6 Claim	A chip sample across a 30 cm-wide vitreous and drusy quartz vein cutting rhyolite, exposed in a small pit. Vein strikes N75°E,and dips approx. 50°NW. Some other veins in the area have an attitude of N10°-25°W, ~70°W. Vein material is iron stained.
	5331	S. of Fairday No. 5 Claim	Chip sample across 50 cm of a vein and vein zone. The zone is 1 m or more wide with veins of 6-50 cm within it. It trends N75°E, 70°NW. Drusy, iron-stained, vitreous quartz. the wallrock is olive, biotite-rich rhyolite welded tuff. It is apparently bleached, silicified, and sericitized (biotite) in walls of vein outward for several meters. The welded tuff trends N75°W, 60°SW.
	5395	E of Urania Peak	Rock-chip sample of quartz ledge material. Quartz +/- alunite-replaced Trc? Abundant limonite and jarosite? Iron-oxide probably after disseminations and fracture coatings of pyrite. Dense, but locally well developed "vuggy silica" texture. Sample is from W margin of quartz ledge holding up the entire ridge. Weiss 11/14/95
	5396	E of Urania Peak	Rock-chip sample of quartz-alunite ledge. Fine grained, porous quartz +/- alunite replacement of dense Trc lava. Sample is representative of resistant crest of ridge. Very little or no evidence of multiple pulses/stages of quartz deposition, fracturing, etc. Probably dead! Weiss 11/14/95
	5397	E of Urania Peak	Rock-chip sample of quartz-alunite-limonite rib; replacement of Trc. Nice vuggy silica + alunite replacement of flow-banded rhyolite lava or dike along crest of ridge. Pinkish alunite along flow foliation and pseudomorphing feldspar phenocrysts. Weiss 11/14/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5398	Prospect 5398-NE of Cactus Springs	Rock-chip sample of flow-banded rhyolite lava and lava breccia of Trc, with small phenocrysts; weak silicification. Rock is cut by numerous irregular veins and zone of iron oxide- and silica-cemented hydrothermal breccia. Reddish brown and mustard yellow iron oxides coat fractures and breccia clasts. Major hydrothermal breccia vein approximately 1foot wide trends N25°W, vertical. Weiss 11/15/95
	5399	altered area NE of Cactus Springs	Rock-chip sample of flow-banded rhyolite and lava breccia with small phenocrysts. Iron oxide- and silica-cemented hydrothermal breccia veins, with abundant reddish brown to mustard yellow iron oxide coatings. Sample taken at top of ridge at X6134T. Weiss 11/15/95
	5526		Silicified porphyritic rhyolite, kaolinized, rock laced with veinlets of clear quartz; clear quartz crystals line vugs in silicified rock
	5527		White vein quartz with clear quartz crystals in open spaces, some manganese- and iron-oxide staining; trace of copper-oxide.
	5528		Vein quartz with disseminated pyrite, quartz has sugary texture, vein 1- 2cm thick, has iron-oxide-stained margins.
	5529	Cactus Nevada silver Mine, 75-foot shaft	Vitreous white and clear vein quartz, vuggy, vugs lined with clear quartz crystals, cockscomb quartz veining coats fragments of wall rock; fresh-appearing pyrite cubes disseminated in quartz, minor steely-gray and black sulfides, possibly tetrahedrite; wall rock alunitized--feldspar crystals in porphyritic rhyolite replaced by alunite, also contains disseminated pyrite
	5530	Urania Mine, lower adit	Silicified, brecciated porphyritic rhyolite, white and clear quartz veining, vuggy with vugs filled with clear quartz and late-stage pyrite, open spaces lined with pyrite, some enargite (?) also present
	5531	Urania Mine, upper adit	Silicified, brecciated porphyritic rhyolite, white and clear quartz veining, crystalline pyrite associated with late-stage clear quartz, pyrite lines open cavities in vein quartz, black mineral, possibly enargite, present
	5662	Shaft 5662	Sample of pyrite-bearing silicified ash flow tuff from dump of decline that plunges along footwall of silicified ash flow tuff, N69°E, 41°. Decline goes down at least 25 m along plunge. Fault(?) with abundant kaolinite(?) along which decline was sunk trends N22°W, 41°E. Two small prospect pits occur uphill within 150 m, but not exactly on trend. There is an old iron compressor(?) at this dump. A road leads nearly all the way to the shaft/decline. Dump contains 2 rock types: mostly ash flow tuff with quartz eyes less than 2 mm (5662C), but also quartz porphyry with somewhat smoky quartz eyes up to 4 mm (5662B). This quartz porphyry may be intrusive.
	5663	Shaft 5662	Sample of gossan from dump of same decline as sample 5662. This gossan may have been what attracted the miners here. Eutaxitic structure W of 5663=N72°W,60°S. Photo #22 from pass on north side of Urania Peak, looking NE into heart of Cactus Spring district.
	5664	Urania Peak workings	Sample of gossan = limonite-cemented colluvium from workings WNW of Urania Peak. No real adit at this site. Sample contains fragments of altered ash flow tuff.
	5665	Urania Peak workings	Sample of manganese oxide and limonite-bearing material from shear zone in altered (kaolinitic?) ash flow tuff. Shear zone 3 cm to 1.5 m wide trends N34°W, 74E. This is the main adit in this area, which only goes 2 m into the hill at S34°E, although the shear zone was trenched for approximately 10 m before the adit. A second shear zone, N53°W, 54°S, bounds the altered material. (SEE SKETCH) There is some pyrite-bearing silicified ash flow tuff on the dump (sample 5666).
	5666	Urania Peak workings	Pyrite-bearing silicified ash flow tuff from the dump of the adit at site 5665. Upper adit at Urania Peak contains several sulfate minerals identified by Li Hsu: apjohnite, melanterite, rozenite, and alunogen (more detailed report in file).
	5677	Prospect 5677	Outcrop grab sample from pebble dike or diatreme cutting argillized volcanic rock (sample 5677A). Bedded tuff in prospect pit about 300 ft to west. Urania Peak is S55°W. Sampled prospect is near top of ridge below resistant ledge and about 250 feet S60°Eof saddle on ridge, and above it by about 15 feet vertically. Small conical hill near valley bottom is S42°W. Sample contains sulfides (probably very fine pyrite), and pebbles are silicified. Photos 16 & 17 from below 5677 to W and NW of Urania Peak and altered rocks. -Castor - 4/27/95.
	5712	Urania Peak gossan outcrop	Gossan clots and crusts in brecciated, silicifed zone in flow-banded rhyolite; gossan crusts have ropy texture, have iridescent coatings of bronze and green boytroidal hematite; mostly massive steely hematite with black manganese-rich surface coatings; rock is brecciated and cemented with hematite gossan. This may be the outcrop of the material sampled by Garside (5328).
	5816		Brecciated, silicified quartzite conglomerate, some heavy crusts of iron-oxide, thin coatings of manganese-oxide. Fine-grained sericite on fracture surfaces. Tingley, 11/6/95
	5817		Argillically-altered porphyritic rock, fine-grained muscovite on fractures, feldspars altered to creme-colored clay, rock is silicified and brecciated. Tingley, 11/6/95
	5818	Cactus Turquoise Shaft	Thin fracture coatings and nodules of blue-green, blue, and green turquoise with quartz in silicified, argillically-altered ash-flow tuff. Rock is laced with vuggy, clear quartz veins. Turquoise occurs as clots and fillings in veins and altered wall rock. Tingley, 11/7/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5823	20th Century Mine	Pyrite-bearing (about 3%) altered volcanic rock; most of rock is silica with smaller amounts of pyrophyllite, kaolinite, and pyrite. Rock also contains veinlets of melanterite and is coated with melanterite and rozenite. Chip sample across about 1 m of shear zone exposed in drift. (XRD mineral determinations by Li Hsu, 11/29/95). Price/Tingley, 11/14/95
	5824	20th Century Mine	Grab sample from loose muck at end of drift, crushed silicified volcanic rock along fault structure, melanterite crystals on surfaces, considerable pyrite present, waxy yellow-green alteration mineral (?), also flecks of black metallic mineral, possibly galena or sphalerite. XRD analysis by Li Hsu (11/29/95) determined that grayish rock consists almost entirely of quartz with minor to trace amounts of kaolinite (dickite?) and pyrophyllite. The whitish portion contains more dickite and pyrophyllite than the gray. Tingley, 11/14/95
	5825	20th Century Mine, upper adit	Dense, vuggy silica rock from 1.5 m-wide band exposed in old adit; rock is silicified and contains 1-2% disseminated pyrite in bright dots and crystals. Tingley, 11/14/95
	5826	Urania Peak gossan	Iron-oxide-stained gossan outcrop in silicified ash-flow tuff(?); vugs in gossan are lined with boytroidal, shiny black hematite. Light gray to whitish, dense and compact rock consists entirely of dickite (Li Hsu, XRD-analysis, 11/29/95). Tingley, 11/14/95
	5827	Urania Peak gossan	Altered porphyry, feldspars replaced by white clay (?); stringers of hematite gossan and dull brown jasper, rock brecciated and cemented with shiny black, boytroidal hematite, zone is about 2 m thick. Gossan is along a N45°E-striking, vertical fracture zone. White coatings on the gossan are dickite (Li Hsu, XRD-analysis, 11/29/95). Tingley, 11/14/95
	5828		Dense, welded ash-flow tuff with some fragments of flow-banded rhyolite, laced with narrow hydrothermal breccia veins cemented with dark red-brown jasper; some matrix of breccia is amber, transparent silica. Breccia strikes N45°W, is vertical, and is 12-18 cm thick. Wall rock is silicified. Also is a N15°E, vertical fracture set, some 60°-70°Nw dips on this set; breccia occurs along both sets, and is interlacing. The light brown, fractured, and altered rock consists of quartz, K-feldspar (adularia?) and local calcite; some white spots may contain small amounts of kaolinite in addition (Li Hsu, XRD-analysis, 11/29/95) Tingley, 11/15/95
	5829		Sample from breccia outcrop on top of ridge NW of 5828; silicified breccia with amber silica matrix occurs along N35°E-striking, 70°NW-dipping silicified fracture zone; breccia lenses are up to .5 m wide. Main structural trend here is N30°-50°E, vertical; and N45°W, also vertical. Some NW-trending fractures have up to 15 cm band of dark brown jasper that cuts earlier breccia; are large blocks of flow-banded rock in the breccia. Tingley, 11/15/95.
	5830		Chip sample from outcrop; N15°W, 40°SW-dipping fracture zone in silicified tuff with large blocks of flow-banded rhyolite; rock is silicified, has irregular breccia veining along strike with dark silica matrix, biotite in fragments is slightly altered to white mica. Tingley, 11/15/95
	5831		Hematite breccia that cuts flow-banded rhyolite. Biotite in rock fragments slightly altered, bronze-colored. Price/Tingley, 11/15/95
	5832		Limonite-hematite-bearing breccia that cuts flow-banded rhyolite breccia. Crackle breccia in silicified rhyolite. Price/Tingley, 11/15/95
	5842	Monotony Adit	Dump sample, moderately silicified, argillized rhyolite ash-flow tuff; tuff has clear quartz phenocrysts-some smoky, feldspars white, some quartz veining with clear quartz crystals growing in vugs and open fractures, limonite casts and points; some coatings of late-stage silica. Tingley, 11/17/95
	5843		Outcrop, silicified, argillized, welded ash-flow tuff; N15°W-striking breccia zone along fault, zone of argillically-altered tuff along fault is 2-3 meters wide in outcrop; fractures are coated with dull, cinnamon-brown limonite, limonite floods into wall rock; where exposed in small cuts along strike, structural zone is 18-20 m wide. Exposure in first pit is N15°, 70°SW dip, 8-10cm thick limonite-manganese oxide gossan on fracture surface. Tingley, 11/17/95
	5844		Silicified rhyolite tuff and vein quartz along N45°W-striking, 70°NE-dipping, 1 m wide fault zone; brecciation and vein quartz occurs mainly along the footwall of the structure; fractures are coated with yellow-brown limonite, some jarosite crystals occur on fracture surfaces. Structure is exposed in 1m x 2m x 2m deep pit. Rock is sericitized, fine-grained sericite occurs in breccia matrix. Tingley, 11/17/95
	5845		Dump sample, red-brown to black and yellow-brown gossan in silicified quartz porphyry; possibly contact between porphyry and rhyolite ash-flow tuff (?); are several long trenches along nose of ridge above long adit, also winzes and pits dug down into the zone. Structure is not clear, but trenches trend N45°W, may cross-cut structures. Most of gossan material composed of iron oxides. Tingley, 11/17/95
	5846	Adit 5846	Rhyolite with clear quartz eyes, mostly granular quartz; rock may be porphyry, is highly silicified with coatings and points limonite, some gray mineral, possibly sulfide. occurs in and along thin, dark silica veinlets. Sample taken from dump of long adit driven to cut exposures of trench 5845. Oldest part of dump has porphyry similar to rock exposed at site 4845 newer part is bleached porphyry or tuff. Tingley, 11/17/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5952	altered area NE of Cactus Springs	Rock-chip sample of flow-banded and brecciated rhyolite lava (Trc). Weak silicification, abundant iron oxide coatings and iron oxide- and silica-cemented hydrothermal breccia. Reddish brown to mustard yellow iron oxide coatings. Feldspar phenocrysts are small and fresh! Weiss 11/15/95
	5954	none	Rock-chip sample of rhyolite plug or flow dome. Intensely silicified-complete replacement by white, clear, and light brown very fine grained quartz, locally drusy. Rock was in part flow-banded and in part flow-brecciated Trci prior to alteration. Looks fairly high level. Weiss 11/17/95
	5955	none	Rock-chip sample of ferruginous breccia. Breccia is poorly exposed at south slope of silicified knob. Breccia is composed of silicified clasts of Trc in matrix of brown limonite-hematite-silica. Looks a little like ferricrete. Weiss 11/17/95
Cactus Springs SW			
	5370	none	Float-chip sample of carbonate conglomerate and breccia-MDe(?) Decalcification, iron-oxide-impregnated. Weak green epidote (?) coats fractures. MDe?) is massive-bedded submarine debris-flow breccia and poorly sorted cobble conglomerate. Blocks/clasts are angular, medium gray and dark gray. Limestone, locally approximately 0.5m in max dim. Sample is from approximately 10 feet W of thin Tgp dike. No skarn/contact metamorphism along this or larger dike to the west which is the dike shown on Anderson's map. Weiss 11/6/95.
	5371	none	Rock-chip sample of brecciated, gossanous leached MDe(?) Leached, decarbonatized. Botryoidal to porous limonite and hematite seams and cellular/box work veins, coatings on siliceous clasts. Weiss 11/6/95
	5372	none	Rock-chip sample of gossan after/replacing MDe (?) Same as 5371. Weiss 11/6/95
Cactus Springs West			
	5091	unknown	Grab sample from outcrop of altered, silicified rhyolite. Nearly pure white silica (for whole rock analysis only-no trace element). S. Castor, 12/16/95.
	5092	unknown	Grab sample from outcrop of altered, silicified rhyolite. Nearly pure white silica, may contain minor kaolin (for whole rock analysis only-no trace element). S. Castor, 12/16/95.
	5093	unknown	Grab sample from outcrop of argillized, silicified rhyolite (not for analysis). S. Castor, 12/16/95.
	5127	Adit 5127	Kaolinized rock, iron-oxide and manganese-oxide staining; collected from dump of NW-striking adit
	5128	Adit 5128	Bleached, hematite-stained rhyolite (?), sample collected from dump of NW-striking adit
	5131	Thompson Group, shaft	Silicified tuff, either Tuff of Antelope Springs or White Blotch Springs; alunite replacing feldspar phenocrysts, disseminated pyrite, collected from dump of deep, vertical shaft
	5373	Sleeping Column canyon	Rock-chip sample of sericitized and silicified crystal-rich, densely welded ash flow tuff(?) Ta(?) or Tws(?). Quartz-lined fractures and comb quartz veins </= 3cm wide. Sample is approximately 20% vein and 80% tuff. One chunk marked for thin section. See also 5373B-TS. Thin section specimen with no veins- same outcrop. Weiss 11/7/95
	5374	none - north of turquoise Prospects	Rock-chip composite sample of numerous dark gray to clear granular quartz units +/- muscovite + jarosite + limonite + dark gray specks. Sample consists of approximately 50% vein and 50% wall rock. From outcrops at small unmarked cut in stream wash where N30°-40°W, 40°-50°W fault and shear zone cuts phyllically altered Tlp(?) and/or Tws(?) Veins and fractures are lined with muscovite, <3mm flakes. 5374B-TS- thin section. 5374C-TS - thin section. Weiss 11/7/95
	5375	Prospect 5375; unmarked cut 50' N of 5374	Select rock chip sample of granular dark gray quartz and muscovite vein, approximately 3cm-1cm wide along NW trending fault dipping approximately 45° SW. Dark gray, blue-gray metallic specks-magnetite? Vein is within dense stockwork zone; abundant limonite and jarosite. Weiss 11/7/95
	5376	Prospect 5376; shallow cut about 30' W of 5375	Rock chip sample of quartz stockwork-veined Tlp or Tws(?) Numerous quartz +/- pyrite+/-chalcopyrite+/-magnetite. Veins and veinlets <1mm to approximately 3cm wide-multiple stages of crosscutting veinlets. Classic porphyry-style stockwork in quartz-sericite altered lava? or intrusive. Probably Tlp as has fewer and smaller quartz than Tws. 5376 PS- polished section; 5376TS- for thin section. Check for hypersaline fluid inclusions! See photos. Weiss 11/7/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5377	NE of Thompson Claims area	Float chip/subcrop rock-chip sample of altered Tws with large and abundant quartz phenocrysts; unit considered by Ekren et al. to be Tws- no lithics or eutaxitic structure. Intensely sericitized and silicified with dark gray to clear granular quartz veinlets-weak stockwork. Trace of clear muscovite or very coarse sericite on fractures. Weiss 11/8/95
	5378	N of Thompson Group	Select rock chip sample of gray granular quartz veins </=2cm wide, approximately 80% veins, 20% altered Tws wallrock. Veins carry specks of dark gray metallic mineral. Vein orientations largely N35°E, 65°-80°NW to N50°E, vertical. Veins are spaced approximately 0.3-1m apart. Wall rocks Tws; intensely sericitized and silicified +/- muscovite on fractures. Weiss 11/8/95
	5379	NE of Thompson Group	Rock chip sample of altered Tlp-megacrystic quartz latite porphyry or altered granodiorite porphyry, sericitic alteration. Quartz-limonite veins,<= 2cm wide, trend N05°E, vertical to N45°E, 70°NW. Weiss 11/8/95
	5380	White Patch draw	Rock-chip sample of "ferricrete," iron-oxide (limonite?)-cemented volcanic conglomerate and coarse grained sandstone. Dips gently west and overlies argillically/phyllically altered Tw? or Tlp? with abundant pyrite where intercepted by shafts in vicinity of 5518. Weiss 11/9/95
	5381	White Patch Draw	Rock-chip and dump composite sample of silicified, sheared Tws. Clots and disseminated grains of dark brown sphalerite +/- galena(?), in part oxidized to brown iron-manganese oxide? From shallow, unmarked cut in small side gully approximately 200' N of White Patch Draw main wash. From 5518 to here; N50W (310 degrees). Weiss 11/9/95
	5382	W of "Manganese Well"	Rock-chip sample of quartz-replaced Trc? (dense vuggy silica alteration). Intense granular quartz and alunite replacement. Sample is from wallrock adjacent to alunite-cemented hydrothermal breccia veins. Weiss 11/10/95
	5383	W of "Manganese Well"	Rock-chip composite sample of hydrothermal breccia veins. Silicified clasts, angular to rounded in matrix of white to pink alunite +/- intergrown very fine grained quartz. Composite of two veins, each </=10cm wide. Veins trend approximately N-S to N10W°W, dip vertical to 50°W. Weiss 11/10/95
	5384	none - W of "Manganese Well"	Rock-chip sample of limonite/jarosite?-rich, quartz-alunite breccia/hydrothermal breccia? Abundant brown, red, and mustard-yellow iron oxides and rounded vuggy silica fragments. Weiss, 11/10/95
	5385	none	Rock-chip sample of altered quartz latite intrusive body (Tlp). Quartz-sericite-kaolinite?- iron oxide alteration. Resistant, iron oxide-stained rib trends approximately N30W. Minor to stockwork gray granular quartz veinlets. Also have network of jarosite +/- alunite-filled fractures that cut the quartz veinlets. Tlp here has large quartz phenocrysts. Probable supergene argillic overprint. Weiss 11/11/95
	5386	none-ridge S of Sleeping Column Canyon	Rock-chip sample of iron oxide-stained, altered Tlp, quartz-latite porphyry. Stockwork gray quartz veins. Feldspar phenocrysts all altered to sericite(?) and/or kaolinite(?) From NE- trending resistant rib that forms the nose of the ridge. Abundant limonite +/- jarosite coatings and stain. Weiss 11/11/95
	5387	none-ridge S of Sleeping Column Canyon	Rock-chip sample of stockwork-veined quartz latite intrusive (Tlp). Feldspar phenocrysts altered to sericite(?) or kaolinite(?) Abundant jarosite and limonite coatings and stain. Sample is from top of ridge at 6334T. Weiss 11/11/95
	5388	Prospect along wash S of Sleeping Column Canyon	Rock-chip sample of altered porphyritic? igneous rock (fine-grained phase of Tlp?) from prospect scrape along wash. Stockwork quartz veins/veinlets, argillic-altered or quartz-sericite-altered. Fine grained groundmass. Abundant jarosite, limonite and red iron oxide coatings and stain. Rock is brecciated and silicified. Some late jarosite and alunite filling fractures. Weiss 11/11/95
	5389	Prospect cuts in wash S of Sleeping Column Canyon	Rock-chip sample (composite of chips from several outcrops) of iron and manganese oxide-rich "ferricrete," iron/manganese-oxide cemented breccia or unsorted, non-bedded talus or alluvial? deposit. Overall, "ferricrete" body seems to mantle an irregular, west-dipping surface on limonitic, argillized and silicified Tws(?) Can be traced for several hundred feet in N-S direction. Probably no more than approximately 5-10m in thickness. Weiss 11/11/95
	5390	Windlass Shaft in canyon S of Sleeping Column Cyn	Rock chip/composite sample of "ferricrete," iron-oxide-cemented colluvium or talus of angular blocks and small fragments. Rock is locally gossanous and more or less solid hematite and limonite with vague bedding where clasts are present. Sample includes pieces from lower, middle, and upper parts. Base is indistinct-underlain by iron-oxide cemented blocks and bedrock(?) Ferricrete is approximately 2-3m thick, dips approximately 03° W, crops out over only a small area in canyon bottom. Shallow shaft with remains of windlass and 75-foot trench approximately 1m deep have explored this. It looks like a chemical precipitate, not sedimentary. Weiss 11/11/95
	5391	none	Rock-chip sample of limonite-cemented breccia vein. Vein is approximately 1-5cm wide shear structure? or hydrothermal-breccia? cutting Trc which has been completely replaced by quartz + alunite (+ barite? + andalusite?) Vein trends N25°W, 70°NE. Weiss 11/13/95
	5392	none	Rock-chip sample of altered, porphyritic Trc, with vuggy silica and residual alunite alteration and abundant limonite and hematite; almost gossanous. Sample is from same structure as 5391, but approximately 15 feet to the N. Weiss 11/13/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5393	none-SW of Urania Peak	Rock-chip sample of altered Trc with dense vuggy silica +/- minor residual alunite and late drusy quartz. Late, fine grained, clear to milky quartz infilling and replacement? Dark gray. Outcrop is massive but with steep joints. Vaguely visible quartz veins. Oxidized disseminated sulfide (pyrite?). Weiss 11/13/95
	5394	none; SW of Urania Peak	Rock-chip sample from same site as 5393, but containing dark gray-black bands of metallic phase. Bands of dark gray opaque phase seem to surround lithophysal cavities. No alunite left - pure quartz replacement with vuggy silica texture. Weiss 11/13/95
	5507		Veinlets of porphyritic rhyolite and some quartz cutting kaolinized rhyolite; clots and crusts of hematite/limonite, some manganese oxide. Quartz from deeper in shaft has fine-grained sulfide--probably pyrite, but is tarnished blue-black, possibly enargite, feldspars in rhyolite replaced by sugary, white alunite.
	5508		Sheared, silicified, porphyritic rhyolite with clots of brown and yellow-brown limonite/hematite; open spaces in fractured rock sealed with crusts of gossany hematite, iridescent films on hematite; porphyritic rhyolite is sericitized, has subhedral, clear quartz phenocrysts.
	5509		Sericitized, silicified porphyritic rhyolite, feldspar phenocrysts replaced by sugary, white alunite; contains books of cream-colored sericite, disseminated hematite-after-magnetite (mineral has blue-black coating but rust-red streak), some pulverent, chalky, chyrsocolla fracture coatings, yellow-green iron-oxide staining
	5510		Sericitized, silicified porphyritic rhyolite; biotite altered to cream-colored sericite, contains large phenocrysts of dark feldspar; clots, crusts, and disseminated pyrite, pyrite has dark tarnish; smaller feldspars replaced by sugary white alunite (?)
	5511		Argillically altered porphyritic rhyolite, rock bleached, biotite altered to cream- to golden-colored sericite; fracture coatings of chalky, pale blue-green chrysocolla and/or turquoise; plagioclase crystals replaced by poorly crystalline sericite and kaolinite (XRD analysis by Li Hsu), rock matrix clear quartz, rock cut by veinlets of clear quartz
	5512		Silicified porphyritic rhyolite; rock mostly all quartz; vuggy silica boxworks, quartz veinlets up to 2- to 3cm bounding areas of soft silica with subhedral phenocrysts of clear quartz; fracture coatings of chalky, blue-green turquoise.
	5513		Silicified, porphyritic rhyolite with gossan coatings on fracture surfaces, pyrite in stockworks veining and disseminated throughout rock, greenish iron-oxide staining on fracture surfaces
	5514		Vuggy, cockscomb white and clear quartz veining in sheeted zone in porphyritic rhyolite, rock is 30- to 40% clear, subhedral quartz phenocrysts; rock laced with quartz veinlets from 1mm to 5cm thick; iron-oxide coatings on fracture surfaces and vein walls; open vugs lined with quartz crystals.
	5515	Cactus Range Turquoise deposit	Turquoise nodules and veinlets in kaolinized, sericitized, silicified porphyritic rhyolite, some clear, glassy quartz veining, cavities in rock left by weathered-out feldspar phenocrysts lined with pale amber crystals--jarosite (?); crystalline sericite with trace amount of poorly-crystalline kaolinite replaces original plagioclase phenocrysts (XRD analysis by Li Hsu)
	5516	George Claim	Bleached, white, kaolinized, porphyritic rhyolite, fractures coated with limonite, some clots and veinlets of pale green to pale blue green turquoise
	5517		Kaolinized porphyritic rhyolite with limonite/ hematite gossan crusts and coatings on fracture surfaces, minor manganese oxide coatings
	5518	White Patch Spring, lower shaft	Silicified porphyritic rhyolite, mostly sugary quartz with 1- 5% disseminated pyrite; crystalline sericite replaced original plagioclase feldspar phenocrysts in rock (XRD analysis by Li Hsu)
	5519	White Patch Spring, upper shaft	Silicified porphyritic rhyolite with disseminated pyrite
	5520		Kaolinized rhyolite porphyry, iron-oxide crusts on fracture surfaces, rock cut by numerous fractures; sample taken at mouth of caved adit.
	5521	Manganese Wells Adit	Manganese-oxide-cemented breccia from fault zone in silicified porphyritic rhyolite; soft white alunite/natroalunite forms lens along hanging-wall of structure; sample of breccia only
	5522	Roadside Shaft	Silicified, argillized porphyritic rhyolite, disseminated pyrite; feldspar phenocrysts replaced by sericite (?)
	5523		Argillically altered porphyritic rhyolite, sheared and crushed, directly under ferricrete layer exposed in bank of wash; rock matrix mostly fine-grained, waxy white mineral (sericite, alunite ?) with subhedral clear quartz phenocrysts.
	5524	Powder Box Adit	Porphyritic rhyolite, silicified, with yellowish-tan limonite and pulverent red hematite coatings; no obvious mineralization

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5525		Limonite/hematite and manganese-oxide crusts on fracture surfaces of stockworks zone in rhyolitic welded ash-flow tuff.
	5833		Chip sample of outcrop, tuff and flow-banded rhyolite(?), rock buff-colored on weathered surfaces, brecciated tuff, some fine-grained, rounded breccia fragments; breccia along N70°W-striking, 70°NW-dipping silicified zone; N70°W fractures cut N10°W, vertical fracture set. Biotite in tuff is altered to reddish-bronze. Tingley, 11/15/95
	5834		Dump sample, kaolinized rhyolite tuff, minor silicification, biotite weathered to bronze on surfaces. Some silicified areas in rock with minor disseminated pyrite and specks of fine-grained black mineral (?). Tingley, 11/15/95
	5835		Chip sample, outcrop; flow-banded rhyolite with limonite coating fractures.. Price/Tingley, 11/15/95
	5836		Outcrop, chip sample, granular, banded black and white calcite vein, 35 cm wide, strikes N50°E (variable), vein extends for about 20 m, cuts silicic flow (?) which crops out poorly. Vein is resistant in low outcrop, is a few cm above ground surface.. Price/Tingley, 11/15/95
	5953	area W of Cactus Peak	Rock-chip sample of densely welded devitrified ash flow tuff of Ta (Antelope Springs, undivided). Plagioclase altered to clay and iron oxide; biotite fresh? Rock is red with hematite stain and is cut by innumerable veinlets filled with reddish brown iron oxide and silica. Well developed veins of hydrothermal breccia cemented by reddish brown iron oxide and silica. Veins trend N40°W, vertical and N-S, vertical. Weak silicification? Area of iron oxide shows up bright yellow-brown on TM image. Weiss 11/16/95
	5956	none	Select rock chip sample of quartz-alunite-replaced Trc, flow banded from crest of ridge. Well-developed vuggy silica texture and late drusy fine grained quartz. Weiss 11/17/95
	5957	none	Select rock-chip sample of flow-banded Trc replaced by dense quartz +/- alunite. Heavy hematitic iron oxide along N20°W fracture at crest of ridge. Weiss 11/17/95
	5958	West of Urania Peak area	Float-chip sample of limonite-cemented breccia with clasts of quartz(?) and silicified rock in matrix of yellow to brown limonite and silica(?) From slope on east side of hill X7131T. Weiss 11/17/95
	5959	W Urania Peak area	Sample from dump of unmarked 3m deep cut. Altered densely welded ash flow tuff. Quartz-alunite? or quartz-sericite? alteration with intense limonite and hematitic iron oxide stain and coatings. Cut is on NW-trending fracture zone. Weiss 11/17/95
Cedar Pass			
	5126	Shaft 5126	Sample collected from jasper/gossan outcrop and from dump of shaft; goethite and hematite in jasper breccia; multiple periods of brecciation, some fine-grained pyrite present in chalcedonic quartz.
	5707		Bleached welded ash-flow tuff, feldspars slightly cloudy, altered to albite; micas altered to illite (?) and mostly weathered out; some clots and veinlets of clear quartz, vuggy, with stubby, clear quartz crystals in vugs, minor cinnamon-brown iron-oxide staining. Sample taken from roadcut of road leading to Cedar Peak.
	5708		Welded ash-flow tuff, lithic-rich, less altered than tuff at site 5707; cut by small hydrofrac breccias, some clots altered rock in the tuff; breccia veinlets filled with dark silica and hematite, minor manganese-oxide and iron-oxide staining. Sample from roadcut about 100 meters north of 5707
	5709	South Cedar Pass Prospect	Quartz-crystal-rich welded ash-flow tuff, silicified and cut by stockwork white and clear quartz veining; drusy quartz, some quartz stringers, red jasper with pyrite cubes within it. some manganese-oxide fracture coatings. Sample collected from dump of small prospect pit.
	5710	North Cedar Pass Prospect	Silicified welded ash-flow tuff, drusy quartz and white quartz in sugary white, sericitized (?) tuff, rock is bleached to white, some iron-oxide staining. Sample collected from dump of shallow shaft.
Clarkdale			
	1901	Yellow Gold Mine	N. shaft along fault, silicified rhyolite-tuff breccia, stockwork of quartz veinlets, abundant Fe Ox pods of limonite may contain gold(?)
	1902	Yellow Gold Mine	South adit; opaline silica, veins slightly vuggy, abundant pyrite in dark opaline quartz. Some breccia, extensive hydrothermal alteration. Sample taken 150 feet into adit.
	1903	Wyoming - Scorpion Group	Taken from dump of a small, 30 foot-deep shaft which was sunk on a 12' quartz vein cutting cemented rhyolite breccia; some sulfides present.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	1904	Wyoming - Scorpion Group	From dump above shaft - silica bleached rhyolite tuff fine vitreous quartz vein argillized, bleaching. Minor sulfides.
	1905.1	Unnamed Mine	From shallow inclined shaft sunk on quartz vein system, brecciated silicified.
	1905.2	Unnamed Mine	Sample taken from N-striking 1 ft. wide vein exposed in shaft.
	1906	Clarkdale Mine	Quartz vein cemented, silica breccia, banded, fissure large clots of pyrite.
	1907	Clarkdale Mine	Vein up to 3 feet wide. Highly silicified, hydrothermally altered in a brecciated sediment, which maybe fluvial(?)
	1908	Clarkdale Mine	Pink and beige silica and quartz cemented vein, rhyolite breccia, alunite? Selected from dump near Northern most shaft.
	5097	unknown	Grab sample from outcrop of silica vein cutting altered, bedded tuff at sample site 5096. S. Castor, 12/17/95.
	5098	unknown	Grab sample from outcrop of black carbonate vein cutting altered, bedded tuff at sample site 5096. S. Castor, 12/17/95.
	5215	Yellow Gold Mine	Composite dump/grab sample of altered welded ash-flow tuff and quartz-calcite?-gypsum? veins. Alteration: adularization , quartz veins. Mineralization: limonite, jarosite, gypsum?
	5216	Yellow Gold Mine	Sample for thin section/alteration/age date? work. Welded, devitrified ash-flow tuff. Adularized?, oxidized, wallrock just E of breccia/vein zone. Dense, devitrified Timber Mountain Tuff. Feldspar phenocrysts altered to hard, milky secondary K-spar or albite, biotite gone, probably was pyritic, now gone.
	5217	Yellow Gold Mine	Dump grab sample of quartz vein material from main adit. Banded quartz-gypsum? vein with trace of dark hematite or sulfosalt crystals, very fine-grained, in bands of quartz.
	5218	Yellow Gold Mine	Dump grab sample of argillically?/sericitically(?) altered welded ash-flow tuff with possible alunite (supergene?) veins and surface coatings. Secondary(?) non-effervescent sparkly, fine-grained soft mineral, perhaps alunite? or may be gypsum.
	5219	Yellow Gold Mine	Dump grab sample of unoxidized, pyritic, welded ash-flow tuff, with adularized feldspar phenocrysts and nice disseminated pyrite. Sample for thin section and geochemical.
	5220	Yellow Gold Mine	Rock chip sample from thin, gossany vein in main adit of mine. Thin, irregular, drusy quartz-gossan vein in brecciated, argillically altered, welded, ash-flow tuff. Quartz-gypsum-iron oxide v veins. Sample is from south drift near far end.
	5221	near Yellow Gold Mine	Dump grab sample of banded quartz vein and tuff wallrock from adit dump about 500 ft WNW of Yellow Gold adit. Quartz-calcite? or - gypsum? with trace of very fine-grained gray metallic mineral.
	5222	near Yellow Gold Mine	Dump grab sample from shaft dump about 300 ft NW of Yellow Gold Mine. Rock type same as #5221.
	5223	Adit 2800 ft S of Yellow Gold Mine	Dump grab/rock chip sample from adit 2800 ft S of Yellow Gold mine, iron oxide-silica-calcite-cemented hydrothermal(?) breccia. #5223TS specimen split for thin section
	5224	Adit 2800 ft S of Yellow Gold Mine	Dump grab/rock chip sample of quartz-calcite banded vein material from adit 2800 ft S of Yellow Gold mine; white, sugary quartz, brown calcite. #5224HS =hand specimen split for later reference.
	5225	Adit 2800 ft S of Yellow Gold Mine	Gossanous brown calcite and limonite and minor quartz vein; crudely developed cockade-type vein breccia.
	5226	Adit 2800 ft S of Yellow Gold Mine	Dump grab sample form non-banded vein of sugary fine-grained quartz and fine-grained pinkish calcite. Finely intergrown calcite, sugary quartz and band of coarse brown calcite. #5226HS=hand sample split for reference.
	5227	Adit 2800 ft S of Yellow Gold Mine	Rock chip sample from outcrop at surface on ridge top west of adit. Sample for thin section and age date? Sample pervasively adularized or albitized, dense, devitrified Timber Mountain Tuff, no veins. Sparse, very fine-grained disseminated limonite blebs after disseminated pyrite. Sample, 21 m. S of calcite vein of adit.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5228	1400 ft SSW of Clarkdale Mine	Dump grab/rock chip sample of acid-leached volcanic conglomerate and (?) rhyolite plug? Probable fine to very fine-grained alunite and silica. Alunitic rock along N0-10°E, 65°E fault; adjacent conglomerate is totally silicified (i.e.. jasperoid). probable alunite is softer than typical. Very coarse kaolinite(?),(not greasy, so not pyrophyllite). Sample will likely be dead except for Hg and As. Separate split for age date, no geochem, just XRD on #5228b for alunite. XRD #5228=The pinkish portion of the sample contains much more alunite than quartz; the rest of the sample is mostly quartz. #5228b=The pinkish, fine compact aggregates consist of almost equal amounts of alunite and quartz, maybe more alunite than quartz.
	5229	1400 ft SW of Clarkdale Mine	Dump grab/rock chip sample of altered conglomerate; silicification, adularization?, quartz-calcite veins and quartz replacement. (see #5230).
	5230	1400 ft SW of Clarkdale Mine	Dump grab sample of altered conglomerate, silicified, with quartz and limonite probably after sulfides, limonite fragments.
	5231	1400 ft SW of Clarkdale Mine	Rock chip sample of silicified conglomerate along quartz vein, adularization or albitization? Sample from outcrop just a few meters from #5231(sic).
	5232	1400 ft SW of Clarkdale Mine	Rock chip sample of silicified conglomerate with matrix replaced by very fine-grained quartz, feldspar phenocrysts, and many/most rock fragments replaced by clay(?) #5232TS for thin section.
	5233	Adit 5233	Dump grab/rock chip sample from short prospect adit about 450 ft SW of hill X4828 on topo map. Quartz-calcite veins and brecciated Timber Mountain Tuff with moderately strong adularization of Tma. Quartz, calcite, with sooty hydrocarbon or dark brown carbonate. #5233HS=reference specimens. Vein/cemented breccia just barely exposed in alluvium along W. side of ridge, probably represents fault zone bounding W. side of ridge.
	5234	Adit 5234	Rock chip sample from walls of shallow prospect cut SSW of hill X4828 on topo map. Quartz-calcite and opal veins trending about N0°-10°E, 90°; jarosite-silica-cemented breccia. Abundant hematite, limonite, jarosite. Veins cut altered, densely welded ash-flow tuff, adularization of wallrock.
	5235	Adit 5235	Rock chip sample from shallow prospect cut SSW of hill X4828 on topo map. Massive, argillically altered red-stained zone along N0°-20°W, 65°E exposed fault surface cutting altered welded ash-flow tuff.
	5236	Adit 5236	Rock chip sample from shallow prospect cut SSW of hill X4828 on topo map. Altered ash-flow tuff with black silica-wad-cemented breccia fragments and coatings along N-S fault surface. Adularized wallrock?
	5244	Sample site 5244	Select rock chip sample of adularized(?) Tma cut by white to clear massive to drusy quartz veins less than 5 cm thick. Quartz veins cut iron oxide-silica hydrothermal breccia in outcrop. Sample is both vein and wallrock.
	5245	Sample site 5245	Select rock chip sample of brecciated Tmr, adularized(?) and silicified, with sugary quartz veins/veinlets in and cementing fragments of Tmr.
	5246	Sample site 5245	Select rock chip sample from same outcrop as #5245, but this sample contains coarsely crystalline calcite cementing and filling space between breccia fragments. The calcite is milky to pink, gray on weathered surfaces.
	5247	Prospect 5247	Rock chip sample from dump of shallow (<1m deep) pit. Quartz vein -silicified breccia of Timber Mountain tuff with trace of unoxidized pyrite in some silica-rich fragments. Wallrock tuff is silicified and adularized(?) Large outcrop Tma (sphene) to SW adularized feldspar phenocrysts partly to white illite/sericite(?) Prospect pit on red-orange spot on fault; fault puts Tma to S down against Tmr to N. Base of Tma about 10m to NW; fault trending about N70°-80°E, 80°SE.
	5248	Tolicha Wash Prospect	Rock chip sample from N wall of cut about 1m deep, 5m long in altered Tma. Veins of chalcedonic silica and veins of hydrothermal breccia with silica cut argillically altered densely welded devitrified Tma; overlying Tma is leached. Abundant silica and hydrothermal breccia veins in medium gray, less leached Tma nearby. Prospect pit exposes brightly red-orange iron oxide-stained rock with veins.
	5249	Tolicha Wash Prospect	Rock chip sample of calcite + quartz vein/breccia. Sample represents about 0.3m width of vein that ranges up to 2m in width in places near here. Breccia clasts of silicified Tmr. Vein is along splay of N60°-70°E, steep SE-dipping fault that drops SE down.
	5258	Clarkdale Mine	Limonitic, silicified, brecciated, quartz-veined, flow-banded rhyolite from adit on E side. Adit strikes N75°W; in clay-rich gouge(?) then into rhyolite. Photo #18, CDH.
	5259	Clarkdale Mine	Sample of rhyolite breccia from southernmost shaft in a N-striking line of shafts. Rock has porphyritic rhyolite clasts with pebble breccia matrix; all cut by quartz-calcite veins. Photo #19 (CDH) of N-striking line of shafts. Partially oxidized very fine-grained sulfide (pyrite?) in both breccia fragments and matrix.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5260	Clarkdale Mine	Sample of vein material and propylitically altered wallrock from footwall side of vein. Fine silica veining and brecciated altered wallrock with a thin coating of hematitic material along fracture. Sample taken directly from vein along which the mine was developed, from exposed vein in central part of the mine. Vein material contains partially oxidized very fine-grained sulfide (pyrite?).
	5261	Clarkdale Mine	Interior of vein-fine comb quartz on footwall side grades into massive quartz and carbonate (often removed and evident only due to the bladed holes. Note comb structure at two sides. Vein at this end may have pinched out to pick up again to the north. (See sketch map)
	5262	Clarkdale Mine	Float-dump sample of vein material. Silica breccia with fine black grungy material-possibly oxidized sulfide. Appears to be the interior of the vein at this location.
	5263	Prospect 5263	Vein sample of coarse calcite (siderite?) and banded fine silica along N60°W vein cut by another vein trending N60°E, 45°NW. Wallrock is Ammonia Tanks? Abundant black metallic mineral (hematite?) in vein material.
	5264	Adit 5264	Sample of wallrock at adit S. end of quad., Ammonia Tanks? Rock contains phenocrysts of quartz, Moderately altered alkali feldspar, and biotite. Possibly adularized feldspars.
	5304	Clarkdale Mine	Quartz vein, silicified, cemented breccia containing abundant sulfides: pyrite and ? from main dump, west side of south end of large stope.
	5305	Clarkdale Mine	Sample of altered wallrock for thin section, not for geochem. Collected from main dump at south end on west side of stope. Adularized?
	5306	Clarkdale Mine	Vein material from dump of second shaft from south. Sugary, fine-grained to banded, locally vuggy quartz vein with altered wallrock fragments; leached carbonate.
	5307	Clarkdale Mine	Largely oxidized, mainly altered rhyolite wallrock with smaller amount of thin quartz veins. Sample collected from dump of southernmost shaft.
	5550	Tolicha Wash Shaft	Select dump sample from 3-4m deep shaft. Thin (<0.5 cm) quartz-jarosite veins and fracture coatings, probably oxidized sulfides. Sample is mostly altered wallrock; Tmr with plagioclase altered to sericite or clay, clear sanidine. Many different fracture orientations, mostly near N-S, vertical, and N50°-70°E, vertical to 80°SE.
	5551.1	Altered area in Tolicha Wash	Rock chip sample from outcrop about 10 ft W of shallow cut (5m long, 0-2m deep). Sample consists of black wad(?) along fractures and with clay and quartz in altered Tmr.
	5551.2	Altered area in Tolicha Wash	Same location as #5551.1. Rock chip sample of silicified Tmr with wad coatings, from footwall of fault in cut. Footwall side is clay-altered and silicified.
	5552	Altered area S of Clarkdale	Rock chip sample of altered Tmr with fluted silica and jarosite fracture coatings, from unmarked cut 2m long by 0-1m deep. Cut exposes somewhat argillically altered and bleached densely welded Tmr.
	5553	SW of Yellow Gold Mine	Adularized densely welded ash-flow tuff (Tmr?/Tma?) with <1% irregularly disseminated pyrite/iron oxides. Very thin silica + adularia(?) overgrowths on fractures. Thin section sample to verify complete adularization of feldspar phenocrysts and(?) fluorspar. Probably not much added silica, but very hard and brittle. Rock may be datable; large piece (5553KAR) for possible adularia sep.
	5554	SW of Yellow Gold Mine	Rock chip sample from prospect pit in altered area. Quartz-cemented breccia vein cutting silicified wallrock of TMT (Tma?) Vein trends N25°W, 80°SW. Sample from outcrop 1.5m N of N wall of shallow cut. Cut exposes bright red-orange iron oxide and silicification along fractures and in hydrothermal(?) breccia. A=quartz breccia vein with some remnant pyrite; B=iron oxide-cemented breccia about 7m S of A.
	5555	SW of Yellow Gold Mine	Rock chip sample from altered ridges S and SW of Yellow Gold and N of Tolicha Wash. Sample is from rib of densely welded Tmr(?), silicified ash-flow tuff with stockwork of chalcedonic quartz-cemented breccia and quartz veins. Fractures trending N-S and N30°-50°E localize thin (<5cm) veins of clear to milky chalcedonic quartz and drusy quartz. Resistant ribs/ridges are more silicified, sanidine phenocrsts are clear. 5555H is hand specimen.
	5555.1	SW of Yellow Gold Mine	Same location as #5555; sample 5555V (5555.1) is mainly chalcedonic quartz vein material.
	5556	S and SW of Yellow Gold Mine	Rock chip sample of weakly banded to massive quartz and calcite vein from altered ridges S and SW of Yellow Gold and NW of Tolicha Wash. Chalcedonic quartz has largely replaced blocky to bladed calcite. Vein trends N35°E, 85°SE, 2-4 cm thick, anastomosing vein fills fractures in silicified and brecciated Tmr. Nice fluted silica coatings in this outcrop. Hydrothermal breccia along fractures, cemented by fluted silica and clear to milky chalcedonic quartz.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5557	S and SW of Yellow Gold Mine	Rock chip sample of vein and silicified wallrock from SW part of altered area S and SW of Yellow Gold mine and NW of Tolicha Wash. Very dense Tmr(?) with no visible plagioclase phenocrysts, clear sanidine. Silicified "rib" where fractures are filled with <1cm-4cm thick white chalcedonic quartz veins of many orientations. Vein density is ~ 1-8 veins/m. Veins are mainly sugary, very fine grained, massive, but some are finely banded.
	5558	SW of Yellow Gold Mine	Rock chip sample from shallow decline in rhyolite plug or lava flow. Sample is of silicified, limonitic rhyolite with adularized feldspar (?) and possible trace of very fine-grained disseminated iron oxide after pyrite. Rhyolite here is porphyritic and somewhat brecciated. Decline is about 5 m long; roof is argillically altered rhyolite breccia. Just 100-150 ft up hill to NE is dense, devitrified, silicified, Timber Mountain Tuff. Unclear whether rhyolite intrudes TMt or is overlain by TMt, as contacts are covered with talus and colluvium. Rhyolite shown on Pahute Mesa 100K geol map is Toq - pre-syn/Tolicha peak rhyolitic lavas and domes.
	5559	SW of Yellow Gold Mine	Rock chip sample of flow-banded, porphyritic rhyolitic lava from altered area NW of Tolicha Wash. Rock is silicified with stockwork of thin quartz veinlets and minor limonitic fracture coatings. Contains about 10% phenocrysts, mainly feldspar <3mm. Sanidine is clear to milky; plagioclase is mainly altered to clay. - lesser embayed quartz. Mafics (if any) have been removed by alteration. Sample is from W side of same plug as #5558. Flow banding dips 40°-70°NW to W; strikes N10°W to N30°E.
	5560	prob. "Sarcobatus Flat" clay Prospect	Suite of reference specimens follows - not for chemical analysis. Prospects are dozer scrapes in unwelded to densely welded glass ash-flow tuff beneath dense devitrified (rheomorphic?) ash-flow tuff shown as Tbg (Grouse Mountain tuff) on geol map. Weak, incomplete argillic alteration of glassy tuff; feldspar phenocrysts are fresh; relict green densely welded glassy tuff remains. Devitrified dense tuff is very iron-oxide-stained by weathering(?), with locally abundant thin opal veinlets and fracture coatings. Area seems to be complexly faulted. Locally, dozer scrapes expose thinly laminated calcareous siltstone beneath(?) glassy lower part of Grouse Canyon tuff. Scintillometer needed here.
	5564	Sample site 5564	Rock chip sample of altered rhyolite lava for XRD, not for chemical analysis. Porcelaneous, not rich in alunite. #5564B - hydrothermal(?) breccia of Tyr for geochem - limonitic. #5564C - float of alunitic, devitrified rhyolite from up hill; sulfidic, XRD.
	5565	Clarkdale	Rock chip sample of argillized, silicified volcanic conglomerate. XRD check (or oils) for alunite after feldspathic clasts or in matrix, also to see what clay or phyllosilicate is present. Bedding here trends N15°E, 17°NW.
	5566	Yellow Gold Mine, NW	Rock chip sample of quartz and adularia(?)-cemented altered conglomerate. Silicic alteration, open spaces filled with drusy to massive clear quartz, with possible adularia intergrown with quartz. Rock is hematitic and limonitic with abundant very fine grained disseminated iron oxide grains, probably after sulfides. Conglomerate contains cobbles to less rounded fragments of pre-Cenozoic chert, quartzite, phyllite, coarse-grained granite, as well as TMT-type cobbles.
	5567	Yellow Gold Mine, NW	Rock chip sample from shallow shaft in altered Timber Mountain tuff with thin quartz veins (<2cm). Wallrock tuff is silicified, sericitized. Quartz veins, limonite after pyrite, quartz is drusy to massive comb. Veins are discontinuous, filling fractures along N10°E, 85°W fault surface exposed in 5m-shaft. Fault puts altered Tga to west against altered Tmt to east.
	5568	NW of Yellow Gold Mine	Rock chip sample of altered Ammonia Tanks member of TMt for thin section only, not for geochem. Argillic to complete illitic or sericitic replacement of feldspar phenocrysts and mafics, bleached to a light gray color. Was initially densely welded N. P. crystallized AFT. Occasional altered relict sphene.
	5569	Wyoming-Scorpion area	Rock chip sample of adularized Timber Mountain tuff with quartz vein, NW of Clarkdale mine. Adularia has replaced sanidine and plagioclase phenocrysts. Quartz "overgrowth" veins and drusy veins along fractures (two sets present here: N70°E, vertical; N20°E, vertical). Sample is from a N20°E fracture. Compaction foliation trends N45°E, 3°NW.
	5570	Wyoming-Scorpion area	Dump grab sample from deep shaft near saddle NW of Clarkdale mine. Dump material contains quartz veins, stockwork, quartz-cemented hydrothermal breccia, not exposed at surface. Trace of disseminated pyrite in less oxidized rock. Veins <5cm wide; clear, drusy to massive quartz and fine grained jarosite(?) Seems to be a later stage of fine grained drusy quartz coating coarser clear quartz, associated with very leached porous rocks. Workings could be accessed with ropes.
	5571	Wyoming-Scorpion area	Dump grab sample of red iron oxide-stained quartz vein and quartz-cemented breccia. Quartz and quartz boxwork after calcite - drusy, massive, locally crudely banded. Minor relict pyrite in veins, mostly oxidized. Vein not exposed at surface; working is <50 ft deep. Vein material appears to be an altered conglomerate of map unit Tgm. Hill top above shaft is silicified cobble conglomerate and sandstone of Tgu. Vein chunks on dump up to 25 cm wide.
	5572	E of Yellow Gold Mine	Rock chip sample of quartz vein material with iron oxide after sulfides(?) Vein is very fine-grained, crustiform, banded quartz, about 10-15 cm thick, trending N10°E, 60°E. Vein is hosted by argillically altered Tgu conglomerate just below a dense silicified horizon. Possible alunite in fractures in upper argillically altered Tgu here.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5573	NE of Yellow Gold Mine	Rock chip samples for thin sections only, not for geochem. Alteration suite for Clarkdale-Yellow Gold area. 5573A - flow-banded Tyr with sparse quartz phenocrysts, from top and N margins. 5573B - kaolinite-alunite(?)-quartz/opal(?) altered porous Tgu with rounded cobbles and pebbles of dark chert, light quartzite, etc. from 2-3m below base of overlying Tyrt = top of alteration, about 10-15 m section of unwelded, phenocryst-poor highly opalized altered Tyrt between top of Tgu and base of Ttp/Tss
	5574	SE of Clarkdale/Yellow Gold Mine	Rock chip sample of altered Tma for thin section to check distal facies of alteration associated with Clarkdale area. Argillic +/- adularia replacement of plagioclase?
	5584	Clarkdale Mine	Select dump grab sample of silicified sandstone and conglomerate with disseminated pyrite, from northernmost shaft of Clarkdale mine. Essentially no veins, but ~ 0.5% disseminated anhedral pyrite. Sample is to test for potential bulk-mineable Au-Ag mineralization. -Weiss, 4/8/95.
	5585	Clarkdale Mine	Select dump grab sample of silicified sandstone and conglomerate with disseminated pyrite, from northernmost shaft of Clarkdale mine. Rock is silicified with ~ 10 volume percent quartz veins,-clear, white; chalcedony - very fine grained comb quartz and ~ 0.5% disseminated anhedral pyrite. Probable chlorite in sandstone with quartz and pyrite. -Weiss, 4/8/95.
	5586	Clarkdale Mine	Select dump grab sample of argillically altered sandstone with abundant disseminated and blotchy dark gray and reddish brown earthy mineral in matrix and as clots, commonly concentrated along bedding surfaces. Possible Ag mineralization(?). -Weiss, 4/8/95.
	5600	Yellow Gold Mine	Rock chip/channel sample across 6 inch wide vertical N60W seam of limonitic gouge with calcite and drusy quartz. Sample is from north wall of south crosscut in main adit of mine.-Weiss 4/29/95.
	5601	Yellow Gold Mine	Composite rock chip/channel sample across 1 meter wide N50E-trending, steeply NW-dipping body of vein-cemented breccia with cockade texture. Sample is from southeast end of workings, main adit of mine. May be quartz-adularia vein and vein breccia in dolomite(?) XRD for mineralogy, possible fine grained adularia with carbonate. -Weiss 4/29/95.
	5602	Yellow Gold Mine	Rock chip/channel sample, W to E composite of altered Tyr and quartz-calcite vein. Silicified and adularized wallrock and fragments of wallrock within the vein. Sample spans ~ 1m footwall Tyr with veinlets, ~1 m banded quartz-calcite vein, and ~ 10 cm adjacent hanging wall Tyr with veinlets.-Weiss 4/30/95.
	5603	Clarkdale Mine	Rock chip/channel sample across silicified and adularized Tyr rhyolite. Sample is across veined zone along the "east" fault (see sketch on sample tag). -Weiss 4/30/95.
	5604	Clarkdale Mine	Rock chip sample across silicified breccia of Tgu conglomerate. Rock consists of breccia fragments cemented by clear sugary quartz, quartz veins, veinlets and irregular thin stringers. Rock chip/channel sample across ~ 1 m of outcrop, E to W. -Weiss 4/30/95.
	5605	Clarkdale Mine	Rock chip sample across altered Tgu conglomerate with no veins. Composite chip sample E to W across ~ 5 m through resistant ledge with no quartz veining, located about 50 ft NW of adit. -Weiss 4/30/95.
	5684	Yellow Gold Mine	1.5-foot rock chip sample across vein and hanging wall of vein. Sample consists of carbonate quartz vein and altered volcanic rock (argillized, silicified). Vein trends N-S, 80°W. Mine is stoped a short distance up this vein. Where sampled, this vein is about 10 inches wide and has friable white material and brown limonite along footwall. Also sampled 8 inches of hanging wall which has limonite/hematite stain. Sample is about 90 feet S72°E from portal of mine. - Castor, 4/29/95.
	5685	Yellow Gold Mine	11-foot wide rock chip sample across vein system in adit wall. Silica-carbonate vein and vein breccia with altered volcanic rock clasts and horse. Argillic alteration, some limonite. Sample taken along foot of south wall, N35°W direction. South end of sampled area is in 2-inch wide carbonate vein; moving westward is a 1 foot -wide zone of mixed carbonate vein and altered tuff, a 3 foot-wide altered tuff horse, and a 1 foot- wide zone mainly of vein material. The NW 6 feet of sample is mostly of breccia consisting of clasts of altered tuff in carbonate + silica vein material. - Castor, 4/29/95.
Corral Spring			
	5144	Prospect 5144	Narrow quartz veins in silicified rhyolite tuff, limonite points and staining on fracture surfaces
	5145	Prospect 5145	White and clear, vuggy vein quartz, limonite points and rare flecks of gold with limonite, vein cuts silicified porphyritic rhyolite, wall rock greenish and kaolinized, some areas of blue-black streaking in vein quartz, locally manganese-oxide staining and coatings
	5281	Rose Spring	Sample of slightly altered ash-flow tuff (Tep-Tuff of Pahranagat). Limonite-coated fractures in ash-flow tuff. Feldspars are partly altered to clay, mafic minerals have been destroyed. prospect consists of small dump; adit appears to have been covered by road work, or maybe this is just related to development of spring, but too much rock has been moved.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
Don Dale			
	1467	Andies Mine; MDD Claims 1-15	Select grab sample from various dumps at mine site (open cuts, trenches adits, vertical shaft). Argillized, kaolinized, silicified rhyolite tuff and silicified volcanic breccia with remnant smoky quartz, muscovite crystals, fine grains and stringers of crystalline cinnabar. Surface is stained by iron and manganese oxides and yellow oxide mineral. Bentz/Smith? 12/6/82.
	1468	Don Dale Mine	Select dump sample from adit consists of reddish-brown quartzite, heavily limonite stained. Rock is slightly gossany with iridescent oxides. Fractured quartz porphyry contains disseminated copper- and iron-oxides with sprays of malachite on fracture surfaces. Jarosite(?) occurs on vuggy fractures in gossan. Bentz/Smith? 12/6/82.
	1469	Don Dale Mine; Blue Bird Claim	Sample from outcrop in prospect pit of white to gray quartzite with iron- and manganese-oxide- stained fractures. Small quartz veinlets contain crystalline chalcopyite and pyrite and disseminated sulfides. Vugs are lined with euhedral quartz crystals; very fine quartz crystals coat fracture surfaces. Bentz/Smith? 12/6/82.
	1470	East Section 34 Prospect	Select sample from outcrop in road cut and open cut of gossany, sheared, fractured, brecciated quartz vein in quartzite; heavily manganese- and iron-oxide stained with minor remnant pyrite. Bentz/Smith? 12/6/82.
	3000	Andies Mine; MDDS #14 Claim	Highly altered, iron-oxide-stained volcanic breccia; possible mercury mineralization, from outcrop near top of small hill. Retort about 200 yards north of shaft - photo. Quade 4/18/85.
	3001	April Fool Spring trench	Highly altered, limonite-stained volcanic tuff; sample taken from an outcrop near well in drainage, SE of Andies mine. Quade 4/21/85
	3020	Don Dale Mine-Bluebird #2 Claim (1964)	Selected from dump near small SW-trending adit; iron-oxide-stained vein material in shale and quartzite; rock is brecciated and contains copper-oxide minerals. Quade 4/26/85.
	3021	Outcrop north of Radar Site	Chip sample from outcrop of partly brecciated, strongly iron-oxide-stained quartz vein along fault in altered quartzite. Quade 4/26/85.
	3024	Don Dale Mine	Chip sample from prominent outcrop of kaolinized, argillized rhyolitic (?) breccia, possibly a tuff, with iron oxide along fractures. Rock is brecciated, exhibiting at least two episodes of brecciation and some silicification. Tingley, 4/27/85.
	3026	S. of B. W. Claims 2 & 3	Outcrop of jaspery gossan forming silicified lens along bedding in limestone; sample is mostly massive hematite with vugs lined by botryoidal hematite. Tingley/Quade, 4/27/85.
	3027	B. W. Claim #3	Jasperoid-limonite gossan exposed in small prospect pit in limestone, some jasperoid breccia in thin-bedded limestone striking N30-60°E. Quade 4/27/85.
	3038	Outcropping vein	Outcrop of gossan-like strongly iron-oxide-stained vein 2-3 feet thick, several hundred feet long. Wallrock is altered tuff, partly silicified and brecciated. Quade 4/29/85.
	3048	Sidewinder Prospect	Chipped from vein and selected from dump of prospect, possibly caved shaft or adit. Vein material consists of quartz breccia containing minor amounts of fine-grained sulfide minerals. Vein trends N25°W, vertical, 5-6 feet thick. Quade 5/12/85.
	3049	Blue Streak Prospect	Vein quartz containing minor amounts of iron and manganese oxides. Vein trends N65W, vertical, 4-5 ft wide, and intersects a rubbly shear zone, 5-6 ft wide, trending N30E, 80SE. Sample is from vein and dump of old workings. Quade 5/12/85.
	3050	Big Red Prospect, NW	Sample from manganese- and iron-oxide-stained quartz vein contains pyrite and an unidentified sulfide mineral. Vein trends N30°W, 50°W, intersected by a vertical cross-structure trending N50°E. Two prospect pits, 8' by 8' and 10' by 10' explore the structure. Quade 5/12/85.
	3051	Big Red Prospect, W	Select sample from dump of inclined adit, of partly brecciated gossany vein material, flooded with quartz and containing pyrite and gray sulfides. Vein bears N25°E, 85°N, and is intersected by another vein bearing N80°W, near vertical. Quade 5/12/85.
	3052	Big Red Prospect	Chipped from outcrop of limonite-stained, silicified quartz breccia and vein, 10 feet thick, trending N35°E. Vein is part of a sheeted zone of parallel veins about 1/3 mile across. Quade 5/12/85.
	3053	Axis vein	Sample chipped from quartz vein containing iron oxide and unidentified sulfides. Vein bears N30°-45°E, vertical, about 18 inches wide, opened by a 6 ft by 6 ft by 4 ft deep prospect pit. Vein zone extends NE along strike for 150-200 feet, parallel to axis of ridge. Quade 5/12/85.
	3059	Ridge vein	Sample was taken from outcrop of manganese oxide-rich, brecciated quartz vein bearing N40W, 55SW in a shear zone approximately 20 feet wide. Quade 5/15/85.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	3060	North Section 34 Prospect	Sample was selected from three dumps associated with old shafts; vein quartz containing galena, tetrahedrite, copper sulfides, and iron oxides. Three to four-foot wide vein bears N75W, 85S, explored by very old workings in a partially opalized quartzite. In addition to the 3 shafts, there are numerous prospects and bulldozer cuts. Quade 5/15/85.
	581	Andies Mine	Kaolinized, silicified, rhyolitic welded ash flow tuff, with smoky quartz phenocrysts. Rock is fractured & adjacent rock is strongly stained by red and brown hematite; host rock is cut by breccia zone containing hematite, mica, and pyrite clots. Breccia is cemented by quartz and later pyrite. Tingley 4/2/84.
Eastern Goldfield			
	0448	Free Gold #1 Claims	Vuggy, heavy, iron-oxide-stained gossan and wall rock; some drusy quartz and probable barite; select sample
	0450	THG Claims	White quartz vein material, chalcedonic, finely disseminated malachite, euhedral quartz & opaline fills vugs, drusy quartz coats surfaces, pyrite ghosts, MnO2 stain exposed surfaces, boxworks.
	0451	N. of Nancy Donaldson	Silicified and unsilicified rhyolite surfaces coated with drusy quartz & crystalline calcite, in unsilicified rock feldspars altered, rock limonitic stained, minor boxworks.
	5136	Table Mountain Group	Gossan from mainly clay dump. Mineral Survey No. 4275, claim located June 1, 1906, owned by The Berg Co-operative Mining Company in 1906,
	5137	Mammoth Claim	Dump sample of flow-banded rhyolite(?). Silicification, alunitization; massive ledge of alunite and silica. Deep vertical shaft on south end of altered knob. Some Feox staining and limonite points, but rock mostly alunite, white to pink, sugary crystalline. M. S. # 2626, claim located Jan. 1, 1906, by E. Overfield.
	5334	Nancy Donaldson Group	Select sample of silicified, rhyolitic? ash flow tuff with drusy quartz veins cutting it. Sample attempts to selectively sample the drusy quartz veins. These veins have a platy or intersecting plane texture with drusy quartz crystals growing perpendicular to these seams or "boxworks". Appears to be a late feature, and rare(?) in this district. Wallrock is argillized. Quartz vein material is limonite stained and locally manganese oxide stained. Wallrock is probably rhyolite of Wildhorse Spring. Garside, 9/22/95
	5335	Nancy Donaldson Group	Grab sample taken from dump of an inclined shaft about 35 feet deep containing silicified wallrock and milky vein quartz with lamellar structure (after calcite?) The drusy to milky quartz vein matter is later than silicification in the zone. The shaft explores a N-S, 60°W silicified fault zone in rhyolite of Wildhorse Spring. Some limonite stain on vein material. Garside, 9/22/95
	5336	Nancy Donaldson Group	Chip sample collected across a three-foot silicified zone in an unwelded rhyolitic pyroclastic rock. The silicified zone is exposed just south of a 25-foot deep shaft. The zone strikes N20°E, and appears vertical. The yellowish-brown weathering wallrock is silicified and medium gray with sparse 2-3 mm veinlets of drusy quartz. A recent sample by an exploration company (possibly North Mining Co.) has a sample number 13581 from same ledge. A basalt dike parallels the ledge for some distance. Garside, 9/22/95
	5337	Nancy Donaldson Group	Select sample from dump along a shallow trench on hillside. The sampled material is a banded vein with a central part of bluish chalcedony and outer band of more white to cream calcite. Garside, 9/22/95.
	5338	Nancy Donaldson Group	Grab sample of a10-20 cm wide white quartz/chalcedony vein which cuts greenish white (bleached) rhyodacite or rhyolite. The margins of the vein are bluish chalcedony but the central 90% of vein is spectacular intergrown clear to white quartz crystals up to 4mm diameter and 8 cm long. They are completely intergrown in comb structure. No obvious sulfides, biotite in wall rock may be sericitized. Vein attitude is N45°E, 75°SE. Garside, 9/22/95
	5339	Nancy Donaldson Group	Grab sample from N5°E, 50°E silicified zone in white rhyolitic ash flow tuff. Zone is only a few feet long and 6-8 cm wide; cemented with clear to bluish, slightly manganese-stained chalcedony. Garside, 9/22/95
	5340	Nancy Donaldson Shaft	Select sample of silicified and iron-stained material from dump. Sparse mineralized material on dump is silicified rhyolite tuff(?) with drusy quartz veinlets, some chalcedony, and limonite gossan and coatings. including boxworks after pyrite. No sulfides observed-entirely oxidized. Some quartz after calcite textures as well as hydrothermal breccias. Garside, 9/22/95
	5341	Locality 5341	Select dump sample of gray and brown lamellar calcite vein material from 2-3 cm wide vein. Also adjacent hydrothermal breccia material with dark gray matrix. Other prospects shown on map in the area are in talus/alluvium; nothing in them to sample. They may even be bomb craters. Can't see calcite vein in place, thus no attitude. Garside, 9/22/95
	5342	Locality 5342	Select sample of lamellar calcite and white chalcedony from N40°W, 90° vein, 30 cm wide. West wall is basalt (probably dike); east wall is greenish white crystal-rich ash-flow tuff. Garside, 9/22/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5343	Wildhorse Spring	Grab sample from a 20 cm thick, limonite- and hematite-stained, pebbly volcaniclastic sandstone. Rock is exposed in a small prospect pit about 200 m west of Wildhorse Spring. Area is not obviously mineralized. Garside, 9/23/95
	5344	unknown	Select sample of sparse chalcedony and sacchroidal quartz in 1 cm vein from dump along an east-west striking bleached and slightly iron-stained zone in purple andesite. Adjacent shaft at end of short trench is about 10 m deep. Sample also includes white, lamellar calcite from boulder at end of shaft dump. Garside, 9/23/95
	5345	Unnamed (5345)	Grab of iron-stained rhyolite from dump of ~20 m deep shaft. Iron staining appears to be surficial on rhyolite fragments; rock is relatively fresh. Possibly from weathered zone as shaft is collared in alluvium. Reason for shaft unknown, possibly water. Garside, 9/23/95
	5346	unknown (5346)	Select sample of most mineralized appearing material from dump of approximately 35 m deep shaft. Mush of dump is relatively fresh rock. Sample is limonite-stained and has local chalcedony patches. Similar bluish chalcedony veins were noted to the south; they are probably late deuteric and not epigenetic hydrothermal. Garside, 9/23/95
	5347	unknown (5347)	Grab sample of bluish white slightly iron and manganese-stained chalcedony vein, 5-15cm wide. It has a N35°W, 90° attitude. Iron-staining extends 20-40 cm into wallrock; further away it is fresh, flow-banded rhyodacite. Float of similar chalcedonic material is common in area. This outcrop and float may have prompted shaft at locality 5346. Garside, 9/23/95
	5348	unknown	Select sample from dump of shallow (6 m) shaft, shown as adit on topographic map. Sample is silicified breccia (rhyolite?) and chalcedonic silica. Breccia is limonite-coated; chalcedony contains very fine-grained, disseminated pyrite. Mineralized material is from a northerly-trending, near-vertical (?) fault zone exposed in shaft collar. Some white clay? alteration associated. Garside, 9/23/95
	5349	unknown (5349)	Grab sample of slightly iron-stained, montmorillonitic rhyodacite? Shaft (~6 m deep) is in a yellow, montmorillonitic zone adjacent to alluvium on east. Garside, 9/23/95
	5474	Table Mountain Group	Select dump sample of silicified rhyolite(?) or dacite and quartz vein material. Most of dump is argillized rock; silicified and quartz vein matter is sparse. Shaft (<15m) is in vertical fault zone trending due N. M. S. #4275, claim located June 1, 1906, by The Berg Co-operative Mining Company.
	5475	Dahlonega Claims	Grab sample of silicified and alunitized dacite which forms ledge 2m wide and 10m long. A 13m-long adit parallels the ledge in argillized rock. Selenite veins noted in argillic material. Possibly good for "typical" ledge geochem values. Ledge strikes about E-W. M.S. # 2817, claim located June 30, 1906, by T. M. Davis and A. J. Antunez.
	5476	Vistula No. 1 Claim	Select sample of sparse pyritized rock from dump of shallow shaft, less than 30m deep. Wallrock is silicified, alunitized(?), and locally pyritized rhyolite(?) A shallow drill hole is nearby. M.S. # 4283, claim located April 23, 1907 by The Berg Co-operative Mining Company.
	5477	unknown	Select sample of opalized ash and breccia from beds within a biotite-rich ignimbrite.
	5478	unknown	Grab sample of silicified rhyolite(?) from N20°E, 20°NW silicified zone in rhyolitic welded tuff(?) Zone probably parallels tuff attitude. Adit is 8m long; sample from portal.
	5479	unknown	Grab sample from N10°W, ~90° fault zone in silicified, argillized and alunitized(?) rhyolite tuff.
	5480	unknown	Select sample of silicified rhyolite with heavy limonite/hematite coating, collected from outcrop near small pit.
	5481	unknown	Select dump sample from small pit near sample locality 5480. Silicified and heavily iron-stained rhyolite. Remnant pyrite in one piece. Hilltop is capped with limonite-stained silicified rock.
	5482	unknown	Grab sample from N5°E, 55°E fault zone exposed in small pit just north of shaft. Shaft is probably 20-30m deep. Silicified and alunitized rhyolite.
	5483	unknown	Select material from a N15°W, 65°SW breccia zone in silicified rhyolite(?)
	5484	unknown	Select sample of the material most likely to be ore collected from the dump adjacent to an ore bin. Rock is silicified and heavily iron-stained rhyolite. Barite may be present in some pieces collected.
	5485	unknown	Select sample of silicified and iron-stained rock collected from dump of small shaft. Material represents a 25 cm-wide silicified zone in a N75°W, 65°NE fault which is explored by a shallow inclined shaft. Wallrock is fresh to argillized rhyodacite.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5902	Shaft 5902	Select vein quartz and hydrothermal breccia material from dump of shaft. Two adjacent shafts, each less than 6 m deep. The vein quartz is milky to clear, and banded, varying from clear quartz (crystalline) to milky chalcedony. Vein must be up to 30 cm, based on pieces at surface. Hydrothermal breccia is iron stained and silicified, and matrix supported. Garside, 9/23/95
	5903	Prospect 5903	Select sample from dump of small pit; sample includes drusy quartz vein matter (spotty) and silicified and limonite-stained hydrothermal breccia. The pit is on a N40°W fault, which is either vertical or dips 60°E (in nearby inclined shaft). Rare quartz after lamellar calcite was observed. There are 3 shallow shafts and several pits on this area (only 2 shafts shown on topo map). Garside, 9/23/95.
	5904	Shaft 5904	Grab sample of quartz-black calcite-wad vein material from dump of shaft. A vein with banded and crustiform textures cuts brecciated rhyolite. Attitude is about N50°E, 40°NW. The vein is up to at least 6 m thick. Dumps are black from wad; calcite is commonly lamellar. Very spectacular crustiform banding. Garside, 9/24/95
	5905	Prospect 5905	A grab sample of iron-stained rhyolitic intrusive? breccia was collected in face of 1 m deep pit. (not adit as shown on topo map). The breccia zone is cut by a 5 cm wide vertical chalcedony vein-like body. Sample includes chalcedony and limonite-coated breccia. Garside, 9/24/95
	5906	unknown	Grab sample of iron- and slightly manganese-stained devitrified rhyolite at intrusive contact with vent? pyroclastic material (lithic tuff). Garside, 9/24/95
	5907	Prospect 5907	Grab sample from dump of small pit of iron-stained rhyolite. Rock is locally somewhat porous and bleached appearing. Garside, 9/24/95
	5908	Shaft 5908	Grab sample from a N20°E, 90° quartz-calcite-wad vein which is exposed in shaft sampled previously (#5130). The vein is 1-3 m wide and dark with wad and MnO-stain. Calcite is gray, quartz white to clear. Fault associated with vein has dip slip slickensides (90° rake). Hill to east is apparently capped by iron-stained rhyolite tuff, possibly related to flow banded rhyolite present throughout the district. Garside, 9/24/95
	5912		Select sample of white and bluish chalcedony from a 5cm wide vein having an attitude of approximately N20°W, 75°SW. The vein cuts light cream rhyolite (rhyolite of Cactus Peak) which is locally opalized and cut by thin veinlets of similar chalcedony. Sample from wall of small prospect pit. Nearby rhyolite is glassy to opalized. Similar chalcedony is common in the rhyolite and float from rhyolite in this area; it is most likely late deuteric and not related to hydrothermal metallization. L. Garside, 11/9/95.
	5913		Select sample of iron-stained and opalized rhyolite from dump of very shallow, caved inclined shaft (essentially a deep prospect pit). Most of rhyolite (flow dome?) is unaltered, a few small spots such as this area are iron-stained and somewhat lighter colored. There is no real indication of a mineralized structure; flow banding is N40°W, 40°SW. Possibly the iron-staining etc. is associated with deuteric processes. L. Garside, 11/9/95.
	5914	name unknown	Grab sample from outcrop of silicified and iron oxide-stained zone along a N15°E, 55°E fault in rhyolite. Fault breccia occurs locally. Fault exposed in a small prospect pit. Chalcedonic vein may occur along the fault, but was not sampled. See #5915. L. Garside, 11/9/95.
	5915	name unknown	Select outcrop sample of chalcedony (white and brownish, locally banded) and drusy quartz which occurs as a spotty vein along a N15°E, 80°E fault in silicified rhyolite tuff breccia (Trct). The tuff breccia in this area is iron-stained over an area of 200m wide and several hundred meters long and having a northerly strike. An approximately 50ft deep shaft was sunk on vein, but there is little vein matter on dump. Sample taken from outcrop. Iron-staining is somewhat like that in vein area of "South of Mud Lake" district. Chalcedonic vein is up to 20cm wide in an 80cm or so wide silicified fault zone. L. Garside, 11/9/95.
	5916	name unknown	Outcrop grab sample from across approximately 25m wide silicified and brecciated zone in rhyolite. No prospects at sample site. On east side of north-trending iron-stained zone (see 5915). Rock cairn with unreadable notice nearby. L. Garside, 11/9/95.
	5917	name unknown	Grab sample of silicified sedimentary volcaniclastic breccia and silicified water-laid? tuff from dump of a 30m deep shaft;, it is not certain what was sought- possibly these silicified breccias were thought to be fault breccia. Rock right at shaft looks like rhyolite of Wildhorse Spring. Bedded tuffs of rhyolite of Cactus Peak are nearby. L. Garside, 11/9/95.
	5918	name unknown	Select sample from dump of rare silicified rhyolite breccia with chalcedony replacement of some fragments. One piece of quartz and chalcedony after lamellar calcite. As in other prospects in this area no sulfides noted. Shaft is about 25m deep. No structure was observed at the surface. L. Garside, 11/9/95.
	5919	name unknown	Grab sample of argillized, purplish rhyolite tuff (?) from dump of 25m deep shaft. The shaft may have been sunk to find chalcedony vein, as float of this material is common near shaft. Apparently did not encounter vein. Most of dump is this argillized tuff; some unwelded ash-flow (related to Trcp?) tuff crops out nearby. L. Garside, 11/9/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5920	name unknown	Grab sample from a 15-75 cm wide, bluish and white quartz-chalcedony vein in rhyolite. The vein has an attitude of N10°E, 65°-80°W and crops out in a pit south of the shaft. The shaft is in maroon argillized tuff just like that sampled at 5919, and they are probably on the same structure. Apparently neither hit vein material. The vein has a sheeted appearance, with selvages of rhyolite. Some drusy quartz in cavities. Locally quartz crystals 3mm wide and 1cm long are found. Photos 29 and 30 of vein in pit. L. Garside, 11/9/95.
	5921	Free Gold Mine, stope adit	150cm wide chip sample across face at south end of the S10°E stope. Silicified breccia; hematite and late? kaolinite and earlier? barite. Late yellowish mineral may be arsenic-rich oxide mineral. A N55°W 60°S fault seems to define the footwall of the stoped zone. The hanging wall is controlled by a N10W, 45W fault. Both structures are poorly defined. L. Garside, 11/11/95.
	5922	Free Gold Mine, stope adit	A 135cm wide chip sample was taken across a silicified fault zone (northeast strike, 90 degree dip) which cuts the adit east of the main stoped area. Powdery hematite occurs with crystalline barite (up to 7mm diameter, or so). The chip also includes breccia of silicified volcanic rock and scattered, patchy white kaolinite. L. Garside, 11/11/95.
	5923	Free Gold Mine, stope adit	A 120 cm wide chip sample of breccia similar to 5921. Taken in hanging wall of N55°W, 70°SW fault. L. Garside, 11/11/95.
	5924	Free Gold Mine, stope adit	An 80cm wide chip sample from across widest part of fault and breccia zone. Powdery hematite, white 5mm kaolinite veinlets in a breccia of silicified volcanic rock. Fault is northwest trending and dips 70° SW. L. Garside, 11/11/95.
	5925	Free Gold Mine, stope adit	Grab sample in small "stope" off main adit (lower long adit) at the Free Gold mine. This adit had over 750ft of workings. This sample taken more than 240ft in from portal, then right (south) for about 50ft. Very strong hematite as powdery material in silicified breccia. L. Garside, 11/11/95.
	5926	Free Gold area	Grab sample from outcrop of silicified and iron-stained rock that originally was probably rhyodacite with sparse large quartz phenocrysts. L. Garside, 11/11/95.
	5927	none	A select sample from area of outcrop of several square meters. Attempt was made to sample most silicified and brecciated material. The rock is vertically flow banded, silicified rhyolite. It was originally locally spherulitic. The breccia areas sampled are most likely flow-related, although they could be tectonic (less likely hydrothermal). Adjacent hornblende rhyodacite is only propylitized. L. Garside, 11/12/95.
	5928	none	Grab sample of silicified rhyolite from dump of small prospect pit. Rock locally has a vuggy silica texture; no sulfide minerals or iron oxides. Purpose for pit unknown. L. Garside, 11/12/95.
	5929	none	Grab sample from a 1m wide fault zone (N80°W, 90°) that is exposed at portal of 15ft long adit. Moderate to weak silicification, spotty argillization, and very sparse iron oxides occur in the fault. Wall rock is rhyodacite? L. Garside, 11/12/95.
	5930	none	Select grab sample from outcrop of an area where the rhyodacite is cut by a network of silica veinlets about 2-3mm wide. These veinlets are essentially silicified fractures; spacing is about 2cm in rectilinear pattern. Rock is iron stained (hematite) and some 1-2cm silicified zones have stronger hematite concentration including specks <0.5mm diameter that appear spherical - do not appear to be pyrite replacement. No boxworks noted at all - check hard sample with binocular microscope. Silicified and iron stained zone appear to strike E-W and is 7-8m wide. Photo 34 of network. 2-3mm veinlets of alunite? noted also. L. Garside, 11/12/95.
	5931	Free Gold, northeast adit	Select sample from portal of 25ft long adit. Sampled material is from an irregular mass, 1x2m, of hematite and limonite-rich silicified rhyodacite. The limonite appears derived from hematite, as residual blebs remain. L. Garside, 11/12/95.
	5932	name unknown	Select sample from silicified and hematized zone, 15-50cm wide along a N40°W to N30°E fault that dips steeply east. This area is quite weakly mineralized compared to the strong hematite, etc. on hill top to south (sample 5480). A short adit here (25ft long); fault is at portal. L. Garside, 11/12/95.
	5933	none	Grab sample from several alunite veins which cut alunitized (?) rhyodacite. The alunite veins are commonly a few mm to 2cm wide and transect the rock in a variety of directions and inclinations. The alunite veins are fine grained, cream, and have border zones of 1-3mm or more of hematite. Some veins are apparently entirely or almost entirely hematite. L. Garside, 11/12/95.
	5934	name unknown	Select sample of strongly silicified and hematized rhyodacite from a 100+ft long shallow trench, apparently dug looking for a structure? Sample taken 60 ft from east end of trench. Rock here locally has a few feldspar ghosts; also the scattered large, corroded quartz phenocrysts indicate Ashley's Td unit. L. Garside, 11/12/95.
	5935	name unknown	Select sample of silicified rhyodacite from hanging wall of N80°E, 80°N fault. The fault wall is argillized for a few feet before silicification begins again. Fine fluorite crystals on fracture surfaces - possibly late? Small pit at site. L. Garside, 11/12/95.
	5936	name unknown	Grab sample of 5-10cm wide silicified and hematized hydrothermal? breccia along N5°W, 90° fault in rhyodacite. Small pit at site. L. Garside, 11/12/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
Eden			
	2785	Eden Mine	Quartz vein material selected dumps includes strong pyrite and minor gray streaks of sulfides.
	2786	Southern Gold Mining Co.	Iron stained tuff with minor silicification and no visible mineralization, was being mined from along a shear zone and treated in a nearby mill.
	2787	Southern Gold Mining Co.	Chipped from outcrop (discovery ledge)? above and east of mill. Highly silicified iron-stained material in rhyolite country rocks.
	2788	Prospect	Chipped from exposed vein in a prospect...iron stained quartz vein approximately 3-4 feet wide.
	2789	Prospect adits and shaft	Selected from dumps...quartz vein and silicified rhyolite from a prospect shaft and two adits pyrite and unidentified sulfides.
Gold Crater			
	5100	Gold Crater Mine (Hub Claim)	Silicified, argillically-altered tuff with clear, euhedral quartz phenocrysts; fine-grained, disseminated pyrite; highest silica zones have clots of blue-black sulfide; lots of gypsum on dump; dump is yellowish-green from oxidizing sulfides and is cemented. Sample site is dump at shaft on northwest flank of small silicified knob.
	5101	Gold Crater Mine (Polly lode, W edge of Hub Claim)	Silicified, argillized, andesite, with fine grained pyrite, some clots and stringers of pyrite; parts of rock flooded with silica with floating books of sericite that have replaced feldspar, lots of gypsum on dump
	5102	Pius Kaelin Group, Manxman patented Claim	Silicified dacite/rhyolite tuff, massive and spongy silica replacement, rock has vuggy open spaces, clots and stringers of fine-grained pyrite, blue-black enargite intergrown with euhedral barite crystals as late-stage fracture fillings. Sample taken at pipe-tripod shaft
	5103	Water Tank Shaft	Silicified, dacite/andesite, disseminated pyrite, clots of blue-black mineral, possibly enargite; rock completely replaced by silica, sites of feldspar crystals now voids lined with acicular, clear quartz crystals intergrown with pyrite; sample collected from dump of deep, timbered shaft
	5177	Shaft 5177	Bleached, silicified dacite; rock is composed mostly of quartz with former feldspar sites now cavities lined with small, stubby, clear quartz crystals. Boytroidal coatings of pale green scorodite; minor manganese and iron- oxides
	5178	Shaft 5178	Silicified dacite, rock vuggy appearance from cavities left after feldspar leached out, tiny stubby quartz crystals line cavities; minor iron-oxide staining; quartz crystal surfaces display an iridescent sheen due to thin coating of iron oxide
	5179	Tripod Shaft	Silicified dacite (?), totally replaced by quartz, vuggy appearance from feldspar cavities, some gossan points throughout rock and larger clots in cavities, minor manganese oxide, clear, boytroidal silica on fracture surfaces
	5180	Shaft 5180	Silicified dacite (?), pale gray-white with clear, stubby quartz crystals in open cavities left after feldspar leaching; iron-oxide staining on surfaces, gossan clots in larger vugs; some rock brecciated and cemented with hematite gossan, minor manganese-oxide staining
	5181	Shaft 5181	Silicifed dacite (?), open cavities coated with boytroidal silica and a later mixture of calcite and amorphous opaline silica; rock cut by hydrothermal breccia, breccia cemented by quartz, hematite, some manganese-oxide (XRD analysis of calcite and opaline material by Li Hsu)
	5182	Tell Me O Claim; Travertine pit	Carbonate vein, thin-banded travertine laced with clear silica veinlets, some manganese-oxide in thin, hairline streaks along strike
	5183	Mother Lode Claim	Gossany rubble of silicified dacite, hydrothermal breccia, fragment supported, open matrix, cemented by silica and hematite-limonite gossan
	5184	Shaft 5184	Massive jasper-hematite gossan, red-brown and dark brown jasper with gossan clots; rock brecciated and cemented with silica and limonite-hematite; fracture coatings of clear, boytroidal silica with inclusions of yellow-brown limonite.
	5185	Adit 5185	Brecciated, iron-oxide-stained, moderately kaolinized, welded ash-flow tuff; biotite partially altered to chlorite; cinnamon-brown iron-oxide staining on fracture surfaces; possibly a hydrothermal breccia--a micro-breccia cemented by quartz
	5186	Pit 5186	Kaolinized, welded ash-flow tuff; rock punky, white, banded with red hematite streaks, some goethite veinlets, minor quartz; rock cut by numerous thin, hydrothermal breccias; breccias are cemented with quartz and goethite

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5187	Breccia outcrop	Hydrothermal breccia in argillized, welded ash-flow tuff, bed and brown gossany matrix, some black manganese-oxide coatings; open breccia, fragment supported.
	5190	Peacock patented Claim	Dump grab sample of strongly silicified, felsic/intermediate? volcanic. Strong acid leaching surrounds shaft/mineralized area. 1-3% pyrite(?) as small blebs. Sample collected is rubble/shatter zone cemented with silica and alunite and other clays. Fragments <<1% sulfide. Most of the sulfide occurs as granular blebs on fragment surfaces and in matrix. Weak Fe oxides - strong sulfate (gypsum) on dumps. -Calloway, 4/26/95
	5191	Prospect 5191	Channel sample 15-20 ft across silicified ledge which is part of a N60-65 E, 15-25N-trending system of silicified "ledges" with strong argillized envelopes. Silicification seems to preserve original textures of felsic porphyry protolith. Intense argillization destroys textures. Moderate to strong limonite +/- hematite, weak, fracture-controlled alunite. Knob is also cut by a N10-15E, 50-60E-dipping "weakly defined" structural feature (fault/shear). -Calloway, 4/26/95
	5192	Manxman patented Claim	Select high grade rock chip sample from small "pebble dike" like zone with strongly leached felsic volcanic fragments coated with fine drusy silica. Zone occurs on jasperoid-like ridge in felsic volcanic host. Sequence of events: (1) initial strong acid leaching of felsic volcanic, forming silica sponge texture (2) Fracturing, weak to strong, with fragment rotation (3) Silica introduction. -Calloway, 4/26/95
	5193	Manxman patented Claim	Dump grab sample of leached and silicified felsic volcanic with irregular stringers, veinlets, veins, and small knots of jasperoidal silica with 1-3% very finely disseminated pyrite, from same location as sample 5192. -Calloway, 4/26/95
	5194	Prospect 5194	Dump grab sample of rhyolite porphyry with K-spar, plagioclase, and quartz phenocrysts. Feldspars are strongly leached but rock is not silicified. Abundant lithic and other volcanic clasts in porphyry - probably a flow. Cut by small NW-trending shear. Quartz stringers, limonite after pyrite, <<1%. -Calloway, 4/26/95
	5195	Manxman patented Claim	Area chip (subcrop) sample of jasperoid with complete texturally destructive silica replacement; <2% very fine disseminated pyrite, ~5% oxidized. Fracture-controlled alunite, strong limonitic crusts on open fractures. Moderate to strong staining. Occurs at SW end of NE-striking silicified structure. -Calloway, 4/26/95
	5196	Iccariz Claims (from notice on ground)	~1m composite channel sample of rhyolite porphyry flow or small plug. Strong silica and pyrite alteration with total destruction of feldspar -> quartz. Approximately 1-2% pyrite patches up to 10% (total). 5196-dark blue gray, complete silica replacement, 1-3% pyrite, taken from either side of shattered pebbly zone with angular, clast-supported breccia coated with fine, drusy quartz, strongly limonitic (see sketch on sample tag). -Calloway, 4/27/95
	5197	Iccariz Claims (from notice on ground)	High grade dump grab sample of leached, silicified, pyritized rhyolite porphyry - jasperoid from small adit dump. About 75-100 ft of adit was driven SW to intercept a silicified and pyritized rib. Looks to be either a preferentially silicified unit/structure/dike?? Prefer structural w/silicified volcanic halo. (?) No develop. noted. < 1% pyrite. -Calloway, 4/27/95. (GET CALLOWAY TO INTERPRET THIS!)
	5201	Gold Crater Mine (Hub Claim)	Leached and silicified porphyry lava, well-developed, vuggy silica alteration, no visible sulfides; Mnox coatings on some fractures
	5202	Gold Crater Mine (Hub Claim)	Altered biotite-bearing lava or plug, sericitized biotite, feldspar phenocrysts altered to clay+/- sericite; possibly small clots of alunite
	5203	Water Tank Shaft	Argillized and silicified lava, unusual green mineral coating fracture surfaces, sample taken from silicified know about 200 feet north of water tank
	5204	Water Tank Shaft	Non-silicified, unoxidized rock from dump of shaft, rock argillically altered, possible alunite, small clots of steely blue-black metallic mineral, enargite(?)
	5549	Shaft 5549	Silicified, alunitized rhyolite tuff, stringers, clots, and disseminations of pyrite, pale green mineral in oxidized rock fragments (?), manganese-oxide-coated phenocrysts in bleached, kaolinized rock
	5668	Peacock patented Claim	Outcrop grab sample from silica ledge 3-4 feet thick, E-W, 45°N, top of ledge marked by a N60°W48°N shear plane with slicks plunging 15°ESE. Rock in hanging wall and footwall of ledge is argillized volcanic and/or volcaniclastic rock (samples 5668A and 5668B, respectively). Photos 8 (shear plane) and 9 (ledge from east). -Castor - 4/26/95.
	5669	Prospect 5669	Loose dump grab sample of altered volcanic rock with altered feldspar phenocrysts, ??sparse quartz phenocrysts. Argillic alteration with local silicification and local limonite. Grab is from SW-most prospect pit in a cluster of pits which are all elongate and have various orientations (probably NOT bomb craters). Photo 10. -Castor - 4/26/95. Located between Black Eagle and Tell Me O Claims.
	5670	north edge of Peacock patented Claim	Chip sample across 5-foot wide ledge of gray, vuggy, fine-grained silica with local limonite, possibly some sulfide. Part of silicified ledge - 5 feet thick in pit; upper contact N70°W, 55°N against argillic red volcanic rock. Lower contact irregular and looks like a breccia. Silica contains a few quartz phenocrysts. Photo 11- pit from SW. -Castor - 4/26/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5671	Red Lion Claim	Chip sample from siliceous ledge 4 inches to 2 feet thick, trending N20°E, 25°E. Wall rock is strongly argillized (sample 5671A). Hand sample is across whole ledge in main part. Limonite and pyrite (trace) are present. -Castor - 4/26/95.
	5672	Red Lion Claim	Dump grab sample from silicified ledge in white, strongly argillized rock. Ledge is about 2 feet thick, trending N25°W, steep E(?). Limonite is present. -Castor - 4/26/95.
	5673	Polly lode	Outcrop grab sample from silicified ledge about 2 feet thick, trending N45°W, 70°W, in argillized rock. Limonite is present. Photo 13. -Castor - 4/26/95.
	5674	Junction of Hub, Manx Maid and Polly Claims	Dump grab sample from silicified ledge 2-3 feet wide, trending N80°W, 80°N, in strongly argillized country rock. Limonite is present. Photos 14, 15. -Castor - 4/26/95.
	5675	Polly lode	Outcrop grab sample from pit. Silica ledge trends S65°E from shaft toward 5101 workings. Rock is silicified, fine-grained volcanic - different from previous samples in grain size of original rock. Limonite and jarosite are present. -Castor - 4/26/95.
	5676	Prospect 5676	Outcrop grab sample of silica ledge trending N80W, mod. S dip in white, argillized country rock (sample 5676A). Just to NE is pit that contains similar silica as 2-foot-wide vein. Limonite is present. -Castor - 4/26/95.
	5678	Prospect 5678	Outcrop grab sample of silica ledge in prospect pit. Prospect pit is third from NE in a poddy NNE-trending silicified zone in white strongly argillized country rock (sample 5678A). Sample 5678B is brown leached altered volcanic rock just about 100 feet south of 5678 prospect pit. Much of rock in this part of area consists of 5678B. Limonite is present. -Castor - 4/26/95.
	5679	Prospect 5679	Dump grab sample of altered volcanic rock from small pit . Rock is argillized with limonite. Ocher-brown rock from pit contains little or no silica; pit just to west is in alluvium. Country rock is like 5678B. Sample 5679A is hand sample only - no geochem. -Castor - 4/28/95.
	5680	Prospect 5680	Outcrop sample of altered volcanic rock from small pit . Rock is partially argillized (especially feldspars) with some limonite and little or no silica. Pit on map is just northeast of sampled pit. Samples 5680A and 5680B are hand samples only - no geochem. -Castor - 4/28/95.
	5681	Prospect 5681	Pit dump grab sample of altered volcanic rock. Rock is argillized with some limonite and hematite. -Castor - 4/28/95.
	5682	Prospect 5682	Outcrop sample of silica ledge with minor limonite, exposed in prospect pit. Ledge strikes ~N75°E and is surrounded by white, strongly argillized rock. . -Castor - 4/28/95.
	5738	Sample site 5738	Rock chip sample from highest ledge on hill adjacent to fault separating somewhat less altered tuff from strongly bleached and variably silicified tuff. Rock type is ash flow tuff , Tuff of Antelope Springs(?). Low sulfidation, plagioclase and biotite are gone, sanidine looks fresh, patchy gray silica in matrix. Some brecciation. - H. F. Bonham, 5/24/95.
	5739	Sample site 5739	Talus float sample of silicified and variably brecciated tuff with Fe and Mn oxides along fractures and in breccia zones. Rock type is Tuff of Antelope Springs(?). Low sulfidation, plagioclase and biotite are gone, sanidine is fresh, matrix is silicified. Tuff overlies weakly propylitized, green-weathering, rhyodacite with abundant biotite Contact does not look depositional; fault or intrusive. Some brecciation. - H. F. Bonham, 5/24/95.
	5740	Pius Kaelin Group, Manxman patented Claim	Select sulfide sample from dump of shaft on ridge crest, with partially collapsed headframe. Shafts on ledge trend N30 E, 80NW to vertical dip. Ledge is 2.5 m wide, margins, quartz-kaolinite; center, vuggy silica. Sulfide at shallow depth, ~10-15 m. Sample of sulfide ore, vuggy silica, pyrite + black sulfide (tetrahedrite?). No alunite observed. Other ledge examined was quartz-kaolin. Host rock type is silicified rhyodacite - H. F. Bonham, 5/24/95.
Gold Range			
	5503	Red Rose Shaft	Iron-oxide-stained, silicified, welded ash-flow-tuff; minor quartz veining along silicified zone; wall rock moderately kaolinized.
	5504	Jay Hawker Claim	Silicified, welded ash-flow-tuff; iron-oxide coatings on fracture surfaces; jasper in irregular masses and veinlets; gossan clots in brecciated rock, limonite-after-pyrite casts.
	5505	West White Blotch Shaft	Moderately kaolinized, silicified, welded ash-flow-tuff from fault zone; clots of white, crystalline calcite along structure.
	91-24	West White Blotch Shaft	West White Blotch shaft, bottom, north rib; calcite with iron-oxide-staining, fault gouge; grab sample
	91-25	West White Blotch Shaft	Shaft, cross-cut face; calcite with iron-oxide-staining, 5% limonite on fractures and in vugs, fault gouge; grab sample

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	91-26	Creek Bank Prospect	Creek Bank prospect east of Gold Range district; hydrothermal, matrix-supported breccia with clasts of clayey rhyolite tuff; grab sample
	91-27	Gold Range camp	Gold Range mine camp float; rhyolite with quartz crystals and pumice fragments, oxidized around fractures
	94-26	0594-G26	Brecciated, kaolinized, moderately silicified volcanic rock, possibly a fine-grained rhyolitic tuff. Only minor phenocrysts of quartz noted, however. Brecciated rock cemented with gossany hematite-limonite fracture surfaces coated with crusts of dark brown, shiny hematite
	95-38	0395-G38	Silicified limestone, possibly silicified fault breccia, surfaces coated by pale creme and white silica, minor limonite stain, some limonite-filled boxworks.
	95-41	0695-G41	Silicified, densely-welded ash-flow tuff; rock is cut by thin chalcedonic quartz veinlets, sulfide casts in veinlets are partially filled with dark hematite/limonite gossan.
Gold Reed			
	5121	Gold Reed Mine-Providence No. 1 Claim	Silicified porphyry, 10-meter-wide silicified rib in argillized porphyry, rock replaced with vuggy silica, some massive and disseminated pyrite,
	5122	Gold Reed Mine-Gold Standard Claim	Pale greenish silica-replaced porphyry, amber crystals (jarosite ?), manganese-oxide coatings on fracture surfaces.
	5123	Mine 5123	Silicified rib in dacite porphyry, massive gossan in rib, red-brown hematite clots, lots of gypsum crystals on mine dump.
	5124	Prospect 5124	Silicified rib in kaolinized dacite porphyry, original feldspars in rib are replaced by white to pink alunite, gossany zone in footwall of rib contains red-brown and cinnamon-brown limonite coatings, some coatings of boytroidal hematite.
	5125	Prospect 5124	Quartz-alunite ledge; same location as sample 5124.
	5159	Adit 5159	Silicified dacite porphyry with an estimated 2% disseminated pyrite, rock brecciated and cemented with quartz, breccia is vuggy with hematite/limonite crusts on breccia fragments
	5160	Adit 5160	Bleached, argillized, silicified dacite porphyry, cavities after feldspar, iron-oxide flooding and clots on fracture surfaces, coatings of amber and red-amber, transparent mineral, probably hematite (?)
	5161	Adits 5161	Iron-oxide-stained, kaolinized dacite porphyry, crusts of hematite and limonite; biotite in wall rock altered to white mica.
	5162	Prospect 5162	Silicified breccia along bedding in quartzite, vuggy white and clear quartz with sparse pyrite cubes, iron-oxide flooding and crusts, vein material has limonite-after-pyrite points
	5163	Prospect 5163	Lens of quartz vein material along bedding in kaolinized shale partings in quartzite; quartz contains minor pyrite, some cinnamon-brown, cellular gossan along with quartz
	5164	Prospect 5164	Specular hematite in lens in quartzite
	5286	Prospect 5286	Dump grab sample of volcanic porphyry (dacite) with accessory hornblende + biotite. Strong sericitization of feldspar, 1-3% disseminated pyrite scattered granular blebs.
	5287	Prospect 5287	Dump grab sample of K-spar biotite porphyry, very strongly argillized (kaolinized) feldspar. Stringers and veinlets of microcrystalline quartz, up to 3 cm strong peacock limonite. Strong leaching of K-spar and mafics adjacent to silica veinlets. no mineralization noted.
	5655	Prospect 5655	Sample of quartz breccia (silicified and broken ash flow tuff) with hematite from prospect with decline along structure trending N63°E, 67°S. 2-m wide ledge of hematite-stained quartz breccia along which a decline was dug to a depth of probably about 7 meters, judging from size of prospect pile and rock fall. Wall rock uphill is quartz- alkali feldspar-rich ash flow tuff, altered to clay adjacent to quartz breccia ledge. Quartz breccia fragments contain quartz eyes of same size as those in the ash flow tuff (~2-3 mm). Ledge extends irregularly (covered by colluvium) for about 80 m to the west. Photo #16 looking N into quartz ledges surrounded by acid sulfate altered rock; peak to right is E-dipping tuff of Cathedral Ridge.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5656	Prospect 5656	Quartz + limonite breccia locally with silicified quartz-eye bearing volcanic rock from zone trending N16°W, 36°E. Wallrock appears to be rich in white clay (kaolinite?), but some pieces also have what appears to be white mica (sericite) after biotite in quartz-poor altered volcanic rock (dacite?) QTb (basalt, +/- fresh, unweathered) found in float and presumably outcrop ~100 m E of this prospect, which is on the east edge of a broad area of apparent acid sulfate alteration, which extends 3 km to the north. Prospects here are developed on and next to the quartz+ limonite+ hematite ledge which has no obvious strike. Photo #17 toward south with Quartzite Mountain in distance. Immediate foreground is essentially unaltered quartz-rich ash flow tuff. Prospect for sample 5656 is near center of photo.
	5657	Adit 5657	Sample of gossan material consisting of quartz + limonite + kaolinite(?), possibly altered dacite from dump at mouth of adit, which goes into hill at S52W, horizontal. Sample appears to be highly altered (to kaolinite) dacite, rather than actual vein. There is no clear structure that was the target of this adit. Photo #18 looking S at Quartzite Mountain. Photo #19 looking SW across quartz ledges surrounded by altered dactite. Dark hill to S with dip to E is fresher dacite (?)
	5658	Adit 5658	Analyzed as GSCN260 geochemical characterization sample, not a mineralized sample. Fresh, unweathered, unaltered dacite from dump at adit.
	5659	Adit 5659	Sample of pyritized, sericitized(?) dacite from dump at adit, collected to test for alteration minerals by XRD. Biotite appears to be altered to sericite(?), sample may be anomalous in gold.
	5660	Sample site 5660	Silicified dacite with 0.3 cm wide quartz-limonite vein. Structure trends N67E, vertical.
	5661	Sample site 5661	Sample of limonite-cemented gravel/colluvium = ferricrete(?). Material has dip along slope of hillside, N73°E, 5°S. Location is about 10 m downhill from quartz ledge.
	5711	Trailer Pass Prospect	Altered dacite flow or intrusive, feldspars kaolinized, rock brecciated and silicified; red hematite stain and gossan in brecciated rock
	5718	Vulcan Claim	Silicified ledge material, minor white alunite, red hematite coatings and fracture fillings, some manganese oxide coatings, leached cavities in silicified rock with some hematite filings, some chalcedonic silica, spots and clots boytroidal manganese oxide
	5719	Gold Standard Claim	Silicified dacite porphyry, vuggy silica with multiple brecciation, clasts up to 8 cm, some alunite
	5722		Ledge outcrop, silicified dacite porphyry, some alunite, iron and manganese oxides; iron-oxide-stained, silicified rock with alunite replacement of feldspar phenocrysts.
	5723		Silicified dacite porphyry, trace of unoxidized pyrite, clear rhombic crystals in vugs, iron-oxide-stained on crystal faces, possibly barite (?)
	5724	White Top Claim	Weakly silicified, kaolinized dacite porphyry, trace of iron-oxide staining. XRD analysis indicates major mineral = quartz, with minor to trace amounts of kaolinite, alunite, (rather poorly crystalline) - by Li Hsu.
	5804	Vulcan Claim	Silicified dacite porphyry, brecciated, iron oxides in silicified matrix, manganese oxide staining; some jarosite present in fragments of brecciated, white quartz. A sugary white mineral, possibly alunite, with disseminated hematite points fills voids in and around quartz. Tingley, 10/2/95
	5805	Vulcan Claim	Greenish, silicified dacite porphyry, vuggy silica rock, spots and crusts of black manganese oxide, hematite flooding of fracture surfaces; some brecciated rock with hematite flooding of matrix. Tingley, 10/2/95
	5806	Montana Claim	Greenish, silicified dacite porphyry, vuggy silica rock, minor manganese and iron oxide staining. Disseminated pyrite occurs in patches in the silicified rock. Tingley, 10/2/95
	5807	Ruin Shaft	Buff, fine-grained, opalized tuff, kaolinized, iron-oxide stained, minor silica veining. Tingley, 10/2/95
	5808	Opal pit	White opalite, fractured and recemented, some chalcedonic material--agate--, amber colored. Tingley, 10/2/95
	5809		Moderately silicified, kaolinized dacite porphyry, some leached cavities, crusts and films of hematite, minor manganese oxide staining. Feldspar phenocrysts in the dacite are altered to kaolinite. Tingley, 10/2/95
	5810		Gossan lenses and hematite flooding in kaolinized, bleached dacite porphyry, some silicification. Tingley, 10/2/95
	5811		Silicified, kaolinized dacite porphyry, hematite and manganese oxide flooding along fracture planes, large, rectangular plates of manganese oxide with iridescent surfaces. Tingley, 10/2/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5812		Silicified dacite porphyry, possibly some alunite, vuggy silica, disseminated pyrite in irregular masses along strike of outcrop, yellow green iron oxides on surface of these masses, kaolinized dacite borders silicified material. Tingley, 10/2/95
	5813		Silicified dacite porphyry, some vuggy silica rock, dots hematite and hematite staining, minor manganese oxide points. Tingley, 10/2/95.
	5814	Lucky Tom fraction	Silicified dacite porphyry, vuggy silica rock, rosettes of manganese oxide-small spherical masses up to 1 mm diameter; hematite flooding and gossany streaks in softer, kaolinized material. Tingley, 10/2/95
Golden Arrow			
	4169	Prospect 4169	Quartz-adularia veining in silicified tuff; massive white and crystalline adularia with overgrowths of clear quartz; some clear quartz filling vugs; limonite in vugs and open spaces; fine-grained, blue-black sulfide mineral in vein quartz
	5050	Prospect 5050	Quartz vein in place, oxidized
	5051	Prospect 5050	Quartz-pyrite vein; taken from same place as 5050
	5052	Prospect 5052	rhyolite cut by hematitic veins, minor clear quartz, scorodite (?), sample from shallow pit and dump
Groom			
	2397.1	Boondock Claim	Select, high-grade sample of massive galena with sparse coatings of lead carbonate, from vein, collected by claim owner (Cowan). 1/86
	3003	NE of Rock Spring	From outcrop of silicified quartz rich microbrecciated sandstone, strongly iron-stained. Quade 4/21/85
	3004	Sample site 3004	Silicified, iron oxide-stained quartzite breccia in outcrop can be traced for over a one-mile distance along the strike. Quade 4/20/85
	3005	Sample site 3005	Exposed shale-sandstone member in limestone approximately 30 ft. thick and strongly altered and iron-stained. Bed strikes N20°E, 50°SE. Quade 4/20/85
	3006	Black Metal Mine	Fine-grained, steel-gray galena with fault gouge in shaly limestone from dumps and ore bin. Incline reported to be 100 feet deep. South shaft is flooded to 25 feet; workings are aligned due N-S. Property is owned by Sheehan. Quade 4/21/85
	3007	Copper Prospect 1	Vein quartz containing azurite, malachite, chalcopyrite and bornite; sample selected from dump and vein outcrop. Vein structure trends N10°E, near vertical. Quade 4/21/85.
	3008	Groom Mine	Replacement ore containing copper oxide minerals, argentiferous galena, and other sulfides, from small open pit north of the old shaft. Small open pit exposes contact between highly deformed blocky shale and broken limestone. Local 18-inch stringer of high grade, finely disseminated argentiferous galena. Ore fills fractures and open spaces. Quade 4/21/85.
	3009	Groom Mine	Replacement ore in limestone, massive limonite and argentiferous galena from outcrop located about 20 m. north of 1864 shaft. Quade 4/21/85.
	3010	New Kahama Mine-Hanus property	Channel-cut sample across a two-foot wide, partly brecciated vuggy white quartz vein with cockade structure and minor iron and manganese oxide staining at the main workings of the property. Vein bears N10°W and dips 50°W, perpendicular to the dip of the quartzite host rock. Vein can be traced along the structure for more than 0.25 mile, and is explored by several prospects. Quade 4/22/85.
	3011	New Kahama Mine-Hanus property	Channel sample cut across 12- to 14-inch thick quartz vein, strongly stained by iron oxides. Located at southern incline of main workings on Hanus property. Quade 4/22/85.
	3012	Kahama Mine-Hanus property	White vein quartz and gouge with strong iron oxide stain; sample cut from small vein crosscutting main vein. Quade 4/22/85.
	3013	Kahama Mine-older Hanus property	Manganese- and iron-oxide-stained vein and gouge exposed in primitive, hand-dug trench about 0.25 mile north of main camp. Vein is on strike from main vein. Quade 4/22/85.
	3015	Gold occurrence 1; Highgrade Claims?	Prospect exposes iron-stained, 6-inch wide vein near strongly oxidized reddish-orange gouge zone in quartzite, with visible pyrite and tetrahedrite in white quartz, similar to material on dump 200 feet below, near crosscutting adit. Quade 4/24/85.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	3016	Highgrade Mine	Brecciated two-foot wide quartz vein with strong manganese oxide staining, minor copper oxides, galena, tetrahedrite. Sample taken from vein and from dump of incline (75°) that follows the vein system, which is hosted by quartzite. Shaft is flooded about 30 feet down. Quade 4/24/85.
	3017	Highgrade Mine	Quartz vein with manganese oxide staining, galena, tetrahedrite. Sample taken from stockpile of ore near cabin below mine workings. Quade 4/24/85.
	3018	Gold occurrence 2	Iron-stained vuggy quartz vein exposed in outcrop along a ridge about 150 feet N20E from stone mine monument. host rock is quartzite cut by faults, crosscutting veins and veinlets. Quade 4/24/85.
	3019	Near Alum Spring	Chipped from outcrop in area of very strong hydrothermal alteration - completely altered volcanic rock with possible mercury mineralization. Quade 4/25/85.
	3022	Fault zone	Chip and float sample of jaspery, silicified, iron and manganese stained fault zone material in quartzite. Tingley, 4/27/85.
	3023	Near Alum Spring	Composite chip sample from several outcrops in zone of strong hydrothermal alteration with possible mercury-gold mineralization. Rock is opalized, with structure trending N60°W to E-W, and flow-banding trending N70°W. Quade 4/27/85.
	3025		Same outcrop as 3024 but in a different area...in a zone of intense brecciation of altered, iron-stained, rhyolitic tuff. Quade 4/27/85.
	3028	Gold occurrence 1	Vuggy quartz vein with manganese- and copper-oxide staining, galena, and tetrahedrite; sample taken from 6-12-inch wide vein outcrop. Quade 4/28/85.
	3029	Gold Prospect 1	Sheared quartz vein material from 0.5-1 ft-wide vein/shear zone containing manganese oxides, pyrite, galena, and tetrahedrite. Brecciated vein material is cemented by silica and fine-grained pyrite. Sample was collected from dump of small prospect adit near ridge. Tingley, 4/28/85.
	3030	Tram workings	Vein quartz and kaolinized gouge material, brecciated and hematite stained, with sulfides, chipped from vein/gouge zone exposed in shallow prospect SW of small adit near head of aerial tram remnants. Quade 4/28/85.
	3031	Jumbo Claims	Partly brecciated, iron-stained, pyrite-rich quartz vein in shear zone cutting silicified quartzite; sample collected from dump of small unmarked shaft. Quade 4/28/85.
	3032	Jumbo Claims	Strongly silicified, breccia containing magnetite and pyrite; sample collected from dump and adjacent prospect pit. Quade 4/28/85.
	3033	Kahama Mine-Hanus property	Brecciated, vuggy, iron-oxide-stained, vein quartz with some cockade structure; selected from dumps of main Hanus property workings. Quade 4/28/85.
	3034	Kahama Mine-Hanus property	Vuggy, iron-oxide-stained quartz vein with minor brecciation, sulfides present; taken from prospect southeast of upper trenches on the Hanus property. Vein trends N10°E, 60°W; bedding trends N-S, 50°E. Quade 4/28/85.
	3035	Gold Butte Claims (1933)	12-18-inch wide, hematite-stained quartz vein cutting shale host rock ; sample collected from vein exposed in location pit. Vein/shear zone trends N50°E, 60°NW. Quade 4/29/85.
	3036	Gold Butte Claims	Brecciated, magnetite-bearing quartz vein fills fault zone cutting quartzite, exposed in outcrop on knob NE of main workings. Vein extends N60°E for more than 200 yards. Quade 4/29/85.
	3037	Gold Butte Claims	Massive magnetite outcrop with botryoidal hematite in a fault breccia cutting quartz/quartzite. Fault zone trends N20°E, 45°NW, with slickensides on footwall Zone is tow inches to one foot thick. Manganese oxides also present; sample collected from prospect pit. Tingley, 4/29/85.
	3039	Groom Mine	Replacement ore from dump contains streaks and clots of : galena, sphalerite, and pyrite in limestone with thin quartz and calcite veinlets; rock is oxidized to dull cinnamon red on surface. Quade/Tingley, 5/11/85.
	3040	Groom Mine	Sample of ore from stockpile at main adit; replacement ore in limestone (and lesser shale) contains argentiferous galena. Quade 5/11/85.
	3041	Groom Mine	Jarosite and limonite fracture coatings chipped from limestone outcrop, some calcite veining. Quade/Tingley, 5/11/85.
	3042	Groom Mine-Tripod Shaft	Select sample of oxidized replacement ore in limestone containing cerussite, galena, and other sulfides. from dump of shaft, stoped to within 20 feet of surface. Quade 5/11/85.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	3043	Groom Mine	Sample taken from outcrop of galena-bearing vein up to two feet thick associated with N-S shear zone. Quade 5/11/85.
	3044	Groom Mine-old 1864 workings	High-grade vein material from dump of shaft and open pit. Sample of replacement ore contains galena, other sulfides and copper-oxide minerals. Quade 5/11/85.
	3045	Groom Mine	Chip sample from brecciated quartzite outcrop north of old mine. Quade 5/11/85.
	3046	Horseshoe occurrence	Ten-foot-wide brecciated quartz vein stained with manganese and iron oxides. Sample is from vein outcrop north of old mine. Vein trends N15°E, 60°W. Quade 5/11/85.
	3047	Boondock Claim	Brecciated white quartz with minor sulfides chipped from outcrop of narrow vein along shear zone, at Boondock claim location monument. Quade 5/11/85.
	3054	Gold Prospect 2	Sample is from small prospect pit on a three-foot-wide quartz vein with iron and manganese oxides, pyrite, galena, and tetrahedrite. Vein bears N80°E, 55°NW along shear zone with about one foot offset of bedding in country rock consisting of thinly interbedded shale with massive quartzite. Quade 5/13/85.
	3055	Chicago/Illinois/Wisconsin Claims	Manganese-stained white vein quartz containing some galena; vein is vuggy and brecciated near fault. Vein bears N30°E, 55°NW, 1-1.5 feet thick, with chlorite selvage on both walls. Shaly country rocks strike N10°W, 40°NE. Sample is from dump and vein outcrop. Quade 5/13/85.
	3056	Wheelbarrow Adit Chicago/Illinois/Wisconsin Claims	Sample of vein quartz containing galena, iron and manganese oxides taken from dump and vein at the Wheelbarrow adit. The 75-foot adit follows 1-2-foot-thick quartz vein bearing N-S, 40°W. Drag pieces of brecciated vein material are in the footwall. Claim notice dated 3/10/32. Quade 5/13/85.
	3057	North end Illinois Claim	Select dump sample of a three-foot-wide quartz vein containing galena and pyrite. Vein bears N20°E, 50°NW and is exposed in a prospect on north side of ridge which is the fourth in a series of north-facing workings. Quade 5/13/85.
	3058	Kahama Mine; Hanus property	Iron oxide-stained quartz vein containing pyrite and galena cuts quartzite. vein bears N80°-85°E, 75°SE. Quartzite host rock strikes N10°W, 40°NE. Sample was taken from dump of inclined shaft on north-facing slope of upper Kahama workings. Quade 5/13/85.
	91-08	Corral	sample from ore pile at corral, assayed 10.2% lead (origin unknown, possibly brought to site from Tempiute?); rock is a garnet skarn-grossular garnet with goethite stain, <1% iron oxide, <1% manganese oxide
Groom?			
	3002	Silver occurrence 1, NE of Rock Spring	Possible sulfide minerals in gossan outcrop with strong limonite/hematite alteration of limestone host rock. Quade 4/21/85
	3014	Tram workings	Partly brecciated quartz vein with iron and manganese oxides, pyrite, tetrahedrite, cutting quartzite with shale interbeds. Vein strikes N40°-50°E, dips 55°-65°NW; adit strikes S40°E, and was apparently intended to crosscut vein exposed on surface about 200 feet above the adit. Sample taken from dump of 270-foot long adit with 65-foot crosscut. Adit dump material is similar to material in prospect on top of mountain. Quade 4/25/85.
Jamestown			
	5104	Franz Hammel Mine	Silica-flooded, alunitized rock, estimated 2-3% of rock consists of clots of fine-grained pyrite, pink and white alunite with intermixed pyrite and some enargite(?) replacing feldspar; some Feox-staining on weathered surfaces; rock on dump is yellowish from oxidizing pyrite,
	5105	Golden Chariot Mine, main shaft	Silicified dacite, clots of massive pyrite, clots of enargite, rock highly siliceous, dump fused by weathering sulfides, lots of white quartz, some drusy material, some specimens appear to be a breccia of earlier quartz-pyrite-enargite replacing and filling feldspar cavities cemented by later quartz. On boundary between Mohawk and Golden Chariot No. 1 patented claims.
	5106	Daisy patented Claim	Brecciated, silicified dacite, rock totally replaced by quartz, cemented with silica and black Mnox, rock fragments contain fine-grained, disseminated pyrite; surfaces are coated with red-brown, drusy crystals, possibly hematite-stained quartz(?) Workings west of Golden Chariot mine.
	5134	Prospect 5134	Silicified rhyolite, gossan clots, iron-oxide-staining; quartz flooding and veining, some chalcedonic quartz; fine-grained, dark metallic mineral, possibly enargite (?)
	5135	Prospect 5135	Silicified rhyolitic tuff, alunitized, alunite replacing feldspar, irregular limonite crusts and coatings

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5173		Silicified rhyolite tuff with fracture coatings of orange-brown mineral (jarosite?); hematite-red iron-oxide staining, minor manganese-oxide, bleached-appearing tuff has abundant euhedral to subhedral quartz phenocrysts
	5174		Silicified, alunitized, rhyolitic welded ash-flow tuff; rock is patchwork of greenish matrix (aggregates of illite and quartz crystals) and pink partially altered alkali feldspar. Boytroidal hematite coats fractures, limonite-after-pyrite points disseminated in rock (XRD analysis by Li Hsu)
	5175	Prospect 5175	Densely-welded rhyolitic ash-flow tuff, possibly an altered porphyry, iron-oxide flooding along fractures and on fracture surfaces; minor veining of clear quartz and gossan clots
	5176	Prospect 5176	Silicified welded ash-flow tuff, jarosite-stained fine quartz crystals coat fracture surfaces
	5198	Prospect 5198	Grab and chip sample from small prospect approximately 4.2 km SE of Golden Chariot mine shafts. Rock consists of strongly silicified felsic tuff adjacent to silicified structure sampled by #5199. Jasperoid-like selvage ~1-2 m wide, weak limonitic stain (yellow to brown.) -Calloway, 4/27/95.
	5199	Prospect 5198	Sample of coarsely fractured opaline to chalcedonic massive amorphous silica from small silica-flooded zone about 2 m thick, exposed in small prospect approximately 4.2 km SE of Golden Chariot mine shafts. Shattered fragments (1-5 cm) of light to dark blue gray translucent silica in fragment-supported breccia with coarse limonitic crusts. -Calloway, 4/27/95.
	5205	Golden Chariot Mine; Mohawk patented Claim	Sample from vesicular porous part of Td unit exposed on NNE-trending ledge about 150 feet E and SE of Golden Chariot shaft and dump; much of Td is dense, silicified, with little alunite; good alunite rosettes and clots only found in vesicles and pumiceous, porous parts of unit
	5350	Golden Chariot Mine; Mohawk patented Claim	Dump sample. Small amount of quartz with pyrite and enargite on dump. Most of dump is quartz-alunite-pyrite altered dacite. Sample is possibly repeat of site 5205 sample.
	5362	Prospect 5362	Rock chip sample from area of shallow cuts in ledge north of Golden Chariot mine area. Breccia of silicic volcanic rock of unit "Td"; strongly limonite-stained and coated, matrix-supported breccia with quartz-alunite matrix. Clasts are replaced by quartz with strong vuggy silica texture. Disseminated dark gray oxide blebs after sulfide are present. Sample is from narrow ledge trending ~ N-S; location is about 30 feet north of 20-foot-long shallow , E-W trench. -Weiss, 6/24/95.
	5363	Prospect 5363	Rock chip sample of altered tuff, leached, silicified ,heavily stained by reddish and yellowish brown iron oxide, weak vuggy silica texture. Rock is representative of much of upper part of ridge: leached and variably silicified (+/- local alunite), lithic-rich tuff (silicic?). Clasts are quartz-replaced fragments of unit Td(?) Many of ledges to north are gently east-dipping. -Weiss, 6/24/95.
	5364	Prospect 5364	Rock chip sample of opalized tuffaceous siltstone with limonite and black to clear opaline silica from are west of Mount Helen. Argillization is along a steeply west-dipping N-S-trending fracture/shear zone. Sample is from ~25 feet NE of prospect cut shown on topo map. Cut is <1 m deep by 3 m long in non-opalized Ts. Ts is poorly exposed due to finely slabby weathering Seems to be dipping gently E(?) Subcrop of thin-bedded Tertiary limestone is exposed downslope to the west, probably under lying the opalized siltstone. -Weiss, 6/24/95.
	5365	Prospect 5365	Rock chip sample of quartz-alunite altered and brecciated Td from area south of Golden Chariot mine. Vuggy silica with alunite +/- kaolinite(?), weak iron oxide, brecciation associated with N80°E to E-W, vertical fractures. -Weiss, 6/25/95.
	5366	Prospect 5366	Rock chip sample of quartz-alunite, vuggy silica-altered, brecciated Td from outcrop southwest of Golden Chariot mine. Rock is rich in alunite after feldspar phenocrysts. Minor late drusy fine-grained quartz. -Weiss, 6/25/95.
	5367	Sample site 5367	Rock chip sample from quartz-alunite ledge of brecciated, vuggy silica-altered Td from south end of ridge southwest of Golden Chariot mine. Minor iron oxides, sparse, late quartz crystals <0.5 cm, sparse, late fine-grained drusy quartz in vugs. -Weiss, 6/25/95.
	5368	Sample site 5368	Rock chip sample of altered lithic-rich tuff or pumiceous lava breccia of unit Td from south end of alunite ridge of samples 5205, 5350. Complete replacement by alunite + quartz, very rich in alunite with individual crystals < 2 mm, porous, with locally sparse, late quartz crystals <1 cm as fracture coatings. -Weiss, 6/25/95.
	5369	Sample site 5369	Rock chip sample of vuggy silica+alunite altered silicic tuff from top of E-W ridge east of alunite ridge of sample 5205. Sample is combination of chips from 2 intergradational alteration types at top of ridge: porous quartz-alunite alteration, and dense total quartz replacement, with very fine-grained chalcedonic silica. Lithic fragments in dense rock commonly have good vuggy silica texture. It appears that tuff matrix was replaced by chalcedony, but some of the lithic clasts were leached. -Weiss, 6/25/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5417	Golden Chariot Mine; main shaft	Dump grab sample of altered, silicified flow-banded rhyolite from large dump at shaft. Much of dump material resembles this sample. Pyrite occurs, especially along some flow bands; no visible sulfosalt. -Castor - 4/25/95. On boundary between Mohawk and Golden Chariot No. 1 patented claims.
	5418	Mohawk Claim	Dump grab sample from shaft located about 750 feet SSW of sample site 5417. Sample is breccia of silica vein and porphyritic volcanic rock in alunite(?) +/- silica +/- limonite; maybe some sulfosalt left; probably not. Lower dump in frame 3 photo (upper dump is green) alunite hill to right and higher. Frame 4 same but closer. - Castor - 4/25/95. Located just W. of main shaft of Golden Chariot mine.
	5419	Golden Chariot No. 1 patented Claim	Dump chip sample from shaft located about 750 feet W of sample site 5417. Just to east is silicified and alunitized (?) zone trending N35°W, about 100 feet long and 20 feet wide. Sample is altered and brecciated porphyritic rock. Alteration is silica +/- clay +/- alunite, with sulfide, mostly pyrite. 5419 dump is on right hand side of photo frame 2; on left is onlapping Spearhead Tuff with light colored pumice fall at base. -Castor - 4/25/95.
	5543		Silicified ledge material, dense, silicified tuff, mostly flint-like quartz, jasper, some gossany coatings, cinnamon-brown limonite, some hematite
	5587	Golden Chariot Mine; main shaft	Select sample from main dump of mine. Sample is of altered silicic lava replaced by vuggy quartz-pyrite alteration and then by clear to white sugary quartz as open space filling and irregular replacement. -Weiss 4/25/95. On boundary between Mohawk and Golden Chariot No. 1 patented claims.
	5588	Mohawk patented Claim	Select sample from dump of shaft located about 600 ft SSE of 5587 at main dump of Golden Chariot Mine. Sample is of altered silicic lava, phenocryst-poor, with quartz, clay, pyrite, alunite(?) alteration. Disseminate pyrite, possible minor disseminated enargite. Rock is relatively soft, argillic. Shaft is probably about 50 feet deep with ladder nearly to top. -Weiss 4/25/95
	5589	Mohawk patented Claim	Select sample from dump of shaft located about 600 ft SSE of 5587. Sample is of quartz vein and extremely silicified breccia, with fracture coatings and disseminated pyrite and enargite. -Weiss 4/25/95
	5590	Golden Chariot Mine; Mohawk patented Claim	Rock chip sample from outcrop 20 feet NE of shaft 5588/5589. Outcrop is quartz-altered (vuggy silica) dense silicic lava; massive, hard, with no veins or veinlets. Rock has been nearly completely replaced by vuggy silica. -Weiss 4/25/95
	5591	Last Chance patented Claim	Rock chip sample across 0.5 meter wide zone of hydrothermal breccia consisting of <5cm diameter angular to rounded clasts of vuggy to dense silica-altered lava in matrix of quartz +/- limonite, locally gossanous. Narrow rib, 50ft N-S, appears to "float" in thoroughly clay-altered rock. -Weiss 4/25/95
	5592	Adit 5592	Rock chip/channel sample over prominent 1.2 meter wide sheeted fracture zone trending N20E, 58W. Sample is all oxidized with nice mustard orange powdery limonite between vuggy silica-altered rock fragments. Sample was taken on north wall, about 1 meter inside a shallow adit located about 1400 feet ESE of main shaft of Golden Chariot mine. Adit is about 4 meters long E-W, into variably argillically altered to vuggy silica-altered porphyritic Toq(?) lava or dome.-Weiss 4/25/95
	5593	sample site 5593	Rock chip sample from top of ridge of intensely silicified purplish gray rhyolitic lava/lava breccia completely replaced by sugary fine-grained granular quartz and irregular late drusy quartz crystals <= 1 cm on fractures and between flow breccia fragments. -Weiss 4/26/95
	5594	Prospect 5594	Select rock chip sample of fault gouge and silicified rhyolite with abundant mustard brown limonite from footwall of N10E, 65E fault surface in 2-m deep cut adjacent to 50-ft inclined shaft.-Weiss 4/26/95
	5595	Shaft 5595	Select dump sample of silicified rhyolite and hydrothermal breccia with gossanous brown to mustard limonite. Shaft is inclined, about 30-40 feet deep, sunk into rubbly, brecciated, silicified rhyolitic or dacitic lava with abundant limonite on fractures. Sample is of dump rocks consisting of matrix-supported hydrothermal breccia and wallrock. Fragments are of silicified rhyolitic Toq/Td(?), in part rounded, cemented by Fe oxides plus silica.-Weiss 4/26/95
	5596	Shaft 5596	Select dump sample of silicified rhyolitic or dacitic lava + flow breccia, vesicular to lithophysal, slightly porous. Unmarked 2-meter deep shaft has been sunk into these rocks, which have abundant to minor, fine- to medium-grained alunite +/- kaolinite intergrown with abundant sugary quartz that replaces the groundmass and phenocrysts. No major preferred fracture orientation noted. Abundant mustard brown limonite.-Weiss 4/26/95
	5597	Prospect 5597	Rock chip sample of altered rhyolite/dacite (Td) with abundant mustard yellow-brown limonite on fracture surfaces. Sample is adjacent to 1-m deep prospect cut on silicified "rib" along N25E, 82E fault, minor hydrothermal (?) breccia as well. Rock is intensely silicified.-Weiss 4/26/95
	5598	sample site 5598	Rock chip sample of altered silicic lava of map unit Td, but could be Toqh. Rock is basically a jasperoid, with intense complete silica replacement and weak limonite. Sparse relict quartz phenocrysts <2mm; trace of relict feldspar phenocrysts altered to illite/sericite(?) or kaolinite(?) Main joint/fracture set ~N20E, steeply NW. Silicified ribs form enechelon ENE trend. -Weiss 4/26/95

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5599	Adit 5599	Select dump sample of altered silicic lava with gossanous replacement by hard, mustard-yellow-brown limonite. Adit trends @N50W in variably kaolinized iron oxide-stained Td with irregular pods and "ribs" of more resistant quartz-kaolinite and quartz-alunite altered rocks, which seem to be controlled by N20-60E, NW and SE-dipping fractures, but form an overall E-W outcrop pattern. Nice alunite-replaced feldspar phenocrysts in rocks above and to south of adit. No veins or pyrite-enargite on dump, but much quartz-alunite altered rock. - Weiss 4/28/95. Located just east of Daisy patented claim.
	5638	Prospect 5638	Dump grab sample from unmarked shallow pit ~ 1.5 m deep, of brecciated, highly limonitic quartz-alunite-altered Td/Tr, with probable disseminated oxidized pyrite, and some fine grained vuggy silica texture. Pit exposes N-S, vertical fault surface separating dense, quartz-alunite rock to east from argillically altered rock to the west. -Weiss 5/23/95
	5639	Golden Chariot No. 2 patented Claim	Dump grab sample of vuggy silica-altered Td, brecciated, cemented by quartz. Vuggy silica replacement, fine grained, overprinted by later fine grained drusy quartz in vugs. Limonite is abundant in certain rocks (this sample). Sample is from unmarked shallow pit ~ 1.5 m deep.. -Weiss 5/23/95
	5640	Sample site 5640	Float/subcrop rock chip sample of hydrothermal? breccia with vuggy silica +/- alunite alteration of fragments. Angular fragments in silica-iron oxide matrix - dense. Sample collected from large area of quartz +/- alunite alteration at top of ridge. Main fracture/joint pattern ~N-S, overprints N-S steep sheeted silica +/- alunite veins/veinlets cutting silica replaced Td/Tr. -Weiss 5/23/95
	5641	Sample site 5641	Rock chip sample of altered Td -quartz-minor alunite?, very dense silica replacement; possible hydrothermal? breccia fragments as ghosts - cemented by very fine grained silica . -Weiss 5/23/95
	5642	Sample site 5642	Rock chip sample taken about 50 feet NE of sample 5641 of quartz - alunite? altered Td/Tr? possible breccia pipe? cutting quartz ledge exhibiting multiple stages of quartz. Abundant limonitic iron oxides, locally well-rounded clasts. Breccia body is ~10-15 feet by 20 feet elongate N-S to NNW. Discontinuous for ~200 feet to the north. Very fine chalcedony, very fine grained drusy quartz - all filling open areas, but still some relict fine grained vuggy texture . Matrix-supported breccia, with matrix = very fine grained quartz/silica with limonite. -Weiss 5/23/95
	5643	Sample site 5643	Rock chip sample taken from resistant silica-alunite ledge east of Jamestown. Rock is brecciated quartz-alunite altered Td/Tr, quartz-rich, fine grained vuggy silica +/-alunite. -Weiss 5/23/95
	5644	Sample site 5644	Rock chip sample of silicified Td/Tr? from silica ledge south of Jamestown. Complete replacement of rock by fine grained quartz with abundant limonite and jarosite on fractures. Nearby outcrop to south is limonitic quartz-kaolinite/sericite? altered Toq. -Weiss 5/24/95
	5645	Sample site 5645	Rock chip sample of vuggy silica altered bedded tuff, unwelded to densely welded lithic-rich ash flow tuff, surge and fall? completely leached and silicified. Tuffs dip ~45°SW, but are highly sheared. -Weiss 5/23/95
	5667	Golden Chariot No. 3 patented Claim	Altered porphyritic rock with quartz phenocrysts and alkali feldspar. Rock is silicified, with alunite veins and replacement of Kspar. Limonite present. Prospect located about 750 feet ESE of Franz Hammel mine. Frame 1 photo. About 300 feet S65°E is shaft in N25°E, 70°W structure that cuts altered rock and is marked by some limonite. -Castor - 4/25/95.
	5683	Prospect 5683	Dump grab sample from small pit located 650 feet south of Franz Hammel mine. Sample is of altered volcanic rock, silicified, with minor alunite, limonite, hematite (some specular). 110 feet N30°W is a small pit or bomb crater in loose pumice below Spearhead. 190 feet N65°W is a bomb crater in hematized volcanic rock. 300 feet N45°W of last pit is a pit or bomb crater in altered volcanic rock. - Castor, 4/28/95.
Jumbled Hills			
	93-18	1093-G18	Rubble breccia, some silica coatings, calcite cement. some fragments appear to be kaolinized, dike or volcanic rock (?). Clear silica coatings on some surfaces, could be a fault zone or hot-spring area (?)
Kawich playa			
	5847		Playa sample, sample collected from about 5 cm below playa surface to depth of 30 cm. Material tan silt/clay, moderately hard, uniform from top of hole to bottom. Tingley, 12/2/95
Limestone Ridge			
	5730	Zabriskie Shaft	Silicified, brecciated vein quartz; streaks and disseminations of bright pyrite, some small crystalline masses, mostly vein fragments with pyrite floating in matrix of darker, clear quartz with pyrite; some clots of pyrite are up to 2-3 mm. Clear and pale green fluorite is present in a post-vein rubble breccia; fluorite forms the matrix of the breccia.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5801		Massive maroon to black and red jasper/gossan, manganese and iron oxides as replacement along shear zone and along bedding in carbonate rock. Tingley, 10/1/95
	5802		White vein quartz with minor gossan points along vein walls. Tingley, 10/1/95
	5803	Adit 5803	White vein quartz with angular fragments of chalcopyrite and bornite, rimmed by melaconite, chalcocite and green copper oxide minerals; vein 10-15 cm thick. Tingley, 10/1/95
	5848		Silicified jasperoid, brecciated and recemented with silica, some manganese-oxide staining, vugs in rock coated with fine-grained quartz crystals, mostly subhedral. Jasperoid formed in thin-bedded carbonate rock containing lenses of tan, brecciated chert. Sample collected from small outcrop about 50 m south of sample site 5909.Tingley, 12/2/95
	5909	Sample site 5909	Grab sample of dark reddish to blackish brown jasperoid, apparently replacing limestone, locally brecciated. The jasperoid zone trends approximately N20°E, 50°SW and is probably a fault zone. Jasperoid is 40 feet wide and is exposed for 60-80 feet along strike. Garside/Bonham, 10/21/95.
Limestone Ridge area			
	5800	Cliff Spring area	Manganese oxide lenses, coatings, and boytroidal masses, along with thick iron oxide coatings; gossan and minor jasperoid fracture coatings in kaolinized rhyolite tuff dike or sill. Tingley, 10/1/95
Mellan			
	5142	Mellan Mine	Silicified tuffaceous sediment, lens in tuff; chip sample from wall of adit at portal
	5143	Mellan townsite Prospect	Silicified tuff with irregular lenses of silicified volcaniclastic sediments, or quartz, could be a large stockwork with irregular lenses of chalcedonic quartz, limonite points and disseminated, very-fine-grained, black metallic, probably pyrite.
	5279	Golden Leo Claim	Upper shaft is on moderately welded ash-flow tuff (Tuff of White Blotch Spring or Wilsons Camp) that contains unaltered sanidine and plagioclase and altered biotite. Tuff has minor limonitic staining; no preserved pyrite. Small adit next to main shaft has fault trending N90°E, 38°N that drops tuff down over bedded, silicified tuff. Sample includes tuff, bedded tuff, and vuggy silica from ore "stockpile".
	5280	Mellan Incline	Lower shaft near #5279. Decline plunges 57°N65°E. Dump has both ash-flow tuff and crystal-rich bedded tuff. Slight iron-staining. Sample consists of tuff, vuggy quartz, and banded silica. Photos 31, 32 (Henry).
	5308	unknown	Select sample from numerous anastomosing chalcedonic veins which cut non-welded rhyolite ignimbrite. Veins form a sort of stockwork locally and are found on a small hill near the townsite. Same location as MG-1 note. Sample taken to evaluate potential of veining on hill.
	5309	unknown	Select, slightly iron-stained, non-welded rhyolite ignimbrite from dump of adit. No obvious veining or mineralization in samples. Adit is accessible.
	5310	unknown	Chip sample across 3 m-wide brecciated quartz vein trending N15°E, 65°-70°E, white to cream, granular to chalcedonic quartz. Locally quartz after lamellar calcite; iron oxides.
	5311	unknown	Select silicified, iron-stained, non-welded ignimbrite from dump of a short adit (15 m, N80°E). No obvious mineralized structure; sporadic chalcedonic veinlets and common drusy quartz in silicified rock.
	5312	Mellan Incline	Select quartz vein material and silicified tuff from dump of inclined shaft (55°, ~N70°E). Most silicification is in younger tuff (Tuff of Wilson's Camp).
	5313	Mellan Incline area	Grab sample of banded, sacchroidal quartz vein material and adjacent silicified wallrock (non-welded rhyolite ignimbrite) from outcrop. The vein is exposed in a 6 m long adit located about 30 m S80°E from the Melllan Incline. Wallrock near vein is strongly iron stained. The quartz vein trends N30°W, 70°NE.
	5314	Mellan Incline	Grab sample of various fragments of quartz vein material which occur in a probable fault breccia zone a few tens of meters NW of the Mellan Incline. At least 1 m of this brecciated and iron-stained quartz vein material is exposed. The alignment of this small pit, another pit, and the shaft suggests that the structure explored by the workings was a N30°W, 55°NE brecciated quartz vein. The dip is reported in an unpublished report by J.K. Turner (in NBMG files). Manganese oxide coatings occur on some vein fragments. One meter of the zone is exposed.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5315	Golden Leo vertical shaft	A chip sample was collected along the entire length of a 7-m adit. The adit is in a fault breccia zone which includes considerable vein quartz. At the portal, sedimentary beds in the Tuff of Wilson's Camp have an attitude of N20E, 20NW. The footwall edge of the fault zone trends N80°W, 35°NW. Sparse Mn oxides occur along this edge. The breccia consists of vein quartz, silicified tuff, and finely crushed vein and wallrock.
	5316	unknown	Grab sample of single piece of non-welded tuff from area of no prospects, for background altered rock. There are no chalcedonic veins in this area, either. the unwelded tuff is essentially everywhere on Mellan Mountain silicified. Iron-staining of surface rock probably results from hydrothermal oxidation of iron-bearing original minerals, Pumice is eaten out, or vuggy quartz; rock rings when hit with hammer.
	5317	Daniels's Lease	Select quartz vein material from a 10-30 cm-wide, irregular, sacchroidal and drusy, locally banded quartz vein. Wallrock is silicified, non-welded rhyolite tuff. Vein attitude is N65°W, 80°NW. The vein is exposed in a 2 m-deep pit above an adit of about the same bearing. The vein may have been the target of the adit.
	5318	Mellan townsite adit	Chip sample across 7 feet of argillized and sheared ignimbrite in adit.
	5319	Mellan townsite adit	Four-foot chip across fault in adit. Winze appears to follow this fault down. Fault strikes NW, dips 55°NE in NW wall of adit.
	5320	Mellan townsite adit	One-foot chip across iron-stained brecciated zone in back part of adit. Represents most likely rock to be mineralized in portion of adit beyond winze.
	5321	Golden Leo vertical shaft	Select sample from dump of ~20 m long adit. Sample is banded quartz vein material with quartz after lamellar calcite texture. Some vein pieces are 30 cm wide, but vein varies from thicknesses of only a few cm. The vein is apparently cut off at the back of the adit by a fault approximately perpendicular to the vein. Vein attitude is N75°E, 90°(?) It strikes generally toward the vertical shaft, and may have been sought underground.
	5322	Daniels's Lease adit	A chip sample across 2 ft was collected where the vein is exposed in the north wall of the adit. Actual vein quartz may be only 0.5-1 ft of this; rest is silicified rock and iron oxide-stained argillized (?) rock. Wallrock in adit is brecciated non-welded ignimbrite.
	5323	Daniels's Lease adit	A chip sample over 20 feet beginning just inside the portal. Iron-stained and argillized (?) brecciated ignimbrite.
	5324	unknown	A select sample of silicified and iron-stained non-welded ignimbrite and sparse quartz vein material was collected from the dump of an inclined (40°NE) shaft over 20 m deep. This shaft is on the trend of the N30°W vein observed near the Mellan Incline. It tests whether the values carry along when the vein is thinner or nearly absent.
	5720	Daniel's lease	Silicified tuff, vuggy silica with clear acicular quartz crystals in vugs, hydrofracture breccia, dark quartz and fine-grained dark mineral, possibly hematite, trace copper oxide mineral, possibly chrysocolla.
Mount Helen			
	5634	Sample site 5634	Select rock chip sample of altered, densely welded ash flow tuff, map unit Ta/Tea (Antelope Springs), with pervasive argillic alteration of plagioclase phenocrysts and mafic accessories; sanidine phenocrysts clear. Rock is cut by numerous to sparse, thin (<2cm) veins of chalcedony +/- pyrite where less oxidized. Sample consists of ~50% vein material, 50% wallrock from altered area of Tea SW of Mount Helen. Entire area is resistant due to variable amounts of silicification and adularization. Whole hill is bleached and discolored by limonite and jarosite coatings. Hill is dominated by 2 major fractures sets: one N-S, vertical to 60°W; another N50°-75°E, vertical. Pyritic chalcedony veinlets occur mainly along NE-striking set. -Weiss 5/20/95.
	5635	Sample site 5635	Select rock chip sample of densely welded, altered Tuff of Antelope Springs (lithic-poor, could be Pahranagat Lakes Tuff??) with plagioclase phenocrysts altered to clay or gone, sanidine phenocrysts clear, biotite locally preserved. Rock is weakly to strongly silicified along numerous steeply-dipping veins of 2 types: (1) clear to light gray chalcedony (2) dark brown iron oxide +/- silica veins with rock fragments - hydrothermal breccia veins. Veins occur along NE- and NW-trending subvertical fractures. Sample is a composite of both vein types and consists of ~50% vein material, 50% wallrock from altered area west of the Gold Crater road in Range 76. -Weiss 5/20/95.
	5636	Sample site 5636	Rock chip sample of bleached and sheared up Tolicha Peak Tuff, map unit Tot. Rock is cut by numerous closely spaced veins/veinlets of hydrothermal breccia. Veins are filled/cemented by chalcedony and very fine grained quartz, locally drusy, with minor limonite. The veins/veinlets are largely irregular, but commonly controlled by steep N10°W and N30°E fractures. Tot here is nearly aphyric, silicified, white, here overlying zeolitized ash flow tuff and surge of Toq, bedded to massive, near-vertical tuffs. No vitrophyre or sign of cooling break. Tot was devitrified before silicification. Sample was collected from altered area SW of Mount Helen in Range 76. -Weiss 5/21/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5637	Sample site 5637	Rock chip sample of altered Tolicha Peak Tuff, map unit Tot with plagioclase phenocrysts gone, possibly adularized, silicified, cut by numerous thin veins/veinlets of chalcedony, very fine grained quartz, drusy quartz, and by veins/veinlets of hydrothermal breccia cemented by chalcedony. Rock is very similar or same as sample 5636. Sample was collected from altered area SW of Mount Helen in Range 76. -Weiss 5/21/95
Mud Lake			
	5911		Channel sample of playa sediments from 1 in below surface of playa to 11 in below surface. Taken in shovel pit. Location 1 mile north of sample 5910. L. Garside, 11/8/95.
Oak Spring			
	94-27	0894-G27	Brecciated hematite gossan. Angular fragments of massive hematite and some pyrolusite cemented by clear, glassy calcite and some selenite (?). Rock is very heavy, possibly some oxide lead minerals present
	94-28	0894-G28	Silicified limestone, brecciated, laced with very thin, clear quartz-carbonate veinlets, specks of hematite, rock stained with hematite-limonite
	94-30	1094-G30	Clots of galena surrounded by cerussite. Rock is an angular quartzite breccia or brecciated, silicified limestone (?) with masses of iron-oxide gossan and white crystalline cerussite.
	94-31	1094-G31	Silicified limestone with clots and points of iron-oxide gossan, rock laced with hair-line veinlets of clear, amber-tinted silica. Vuggy, boytroidal, waxy calcite coating on surfaces, some hematite crystals in vugs.
Oak Springs			
	91-09	Cockeyed Ridge Prospect	prospect on east side of Cockeyed Ridge; tectonic breccia, 3-10% manganese oxide, 10% iron oxide, kaolinite; sample collected from 5-foot channel from prospect adjacent to isolated shaft, wall rock Johnnie Formation (?)
Papoose			
	5146	Kelly Mine, west shaft	Sample from large shaft dump on west side of small ridge; gossany jasperoid in quartzite breccia, coatings of chrysocolla, some cerussite and malachite.
	5147	Kelly Mine, main adit	Dump sample; gossany jasperoid with copper-oxide spots and streaks in brecciated, recemented Prospect Mountain Quartzite, some cerussite clots with manganese and iron oxides.
	5502	Westside Prospect	Gossan, shale horizon; massive hematite and limonite; some manganese oxide minerals
	91-04	Kelly Mine	Kelly adit, face of main drift,; shattered quartzite with abundant hematite and goethite
	91-05	Kelly Mine	Kelly adit, south rib of main drift; sample assayed 3.27% lead; shattered quartzite with abundant hematite.
	91-06	Kelly Mine	Kelly adit, south rib, main drift; shattered quartzite with abundant hematite
	91-07	Kelly Mine	Fines from "bath" (hand-jig tank) located at portal of Kelly adit; material assayed 13.7 oz/ton silver, 11% copper, 6.55% lead, and 3.69% zinc
	91-16	Kelly Mine	Kelly shaft, bottom cross-cut north, face; hematite replaced fault gouge with quartz clasts, gouge supported; sample assayed 14.1% zinc
	91-17	Kelly Mine	Kelly shaft, bottom cross-cut north, east rib; sample assayed 6.32% zinc; quartz and hematite fault gouge, 50% hematite
	91-18	Kelly Mine	Kelly shaft, middle cross-cut north; silica replacement of limestone, vuggy; sample assayed 12.2% lead
	91-19	Kelly Mine	Kelly shaft, middle cross-cut north face; quartz and hematite fault gouge; sample assayed 11.9% lead

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	91-20	Kelly Mine	Kelly adit, winze stope floor; replaced fault gouge, malachite, chrysocolla, cerussite, matrix supported tectonic breccia; sample assayed 12.3% copper, 15.0% lead; grab sample
	91-21	Kelly Mine	Kelly adit, winze stope pillar; cerussite replaced after galena; sample assayed 50.8% lead; high grade grab sample
	91-23	West Papoose Prospect	West Papoose prospect, face; sample contained 1.81 ppm gold; massive hematite with silica, grab sample
	94-20	0394-G20	Iron-oxide gossan, quartzite/silicified limestone recemented breccia; hematite coating fractures and vug surfaces, some manganese-oxide vug coatings, no other sign of metallic mineralization
	94-21	0394-G21	Iron- and manganese-oxide-stained quartzite, staining on fracture surfaces--very minor; no obvious mineralization
	94-29	1094-G29	Limy quartzite, medium-fine-grained. Clear, rounded quartz fragments in carbonate matrix, also rounded fragments of iron-oxide-stained carbonate. Carbonate weathers out leaving rounded open vugs between quartz fragments.
	95-35	0295-G35	Clear and white vein or replacement quartz with leached sulfide cavities; some soft metallic mineral, possibly partially altered tetrahedrite, some cavities contain iron-oxides, malachite, and radiating masses of pale sea-green mineral, possibly aurichalcite; vein material stained with green and blue copper-carbonate staining
	95-36	0295-G36	Hematite-stained quartzite; rock cut by thin hematite-stained fractures. Thin crusts of hematite coat some fractures and staining bleeds away from fractures flooding adjacent rock. Some sulfide casts now filled with hematite and pale yellow-brown limonite.
	95-37	0295-G37	Massive, silicified hematite gossan in quartzite, minor manganese-oxide; some material has banded appearance
Prospector Fault			
	5064	Prospect 5064	Green (talcose?)phyllite in south wall of prospect pit. No mineralization observed.
	5065	SW of Sidewinder Claim	Grab sample of white, iron-stained and bleached, brecciated limestone. Sample was labeled "L2" when collected at site 100m S30°W of adit of Sidewinder? claim.
	5066	Prospect 5066	Select dump sample of iron-stained quartz vein material from dump of 1m-deep prospect pit.
	5067	Prospect 5067	Limonitized and brecciated quartzite(?) in low-angle shear zone (thrust?).
	5068	Sample site 5068	Silicified dolomite; silicification controlled by bedding, accompanying dolomite bleached to light gray above shear zone of sample # 5067. In places, dolomite is dark gray micrite, not bleached, and contains abundant discontinuous chert layers.
	5070	Prospect 5070	Bull quartz vein material with copper oxides
	5400		Grab sample of sheared quartzite. Sample is from near the base of a gouge zone approximately 50 feet thick. Shearing appears to be near horizontal.
	5401		Grab of outcrop in prospect pit. Sample of sheared and brecciated quartzite (shearing N-S, vertical) in prospect pit below nearly horizontal shear in quartzite. No quartz vein material seen. Mineralization: Limonite and hematite.
	5402		Grab sample of outcrop. From zone of sheeted to braided veins--locally breccia with quartz cement, about 10 feet wide and 50 feet long, trending N-S. Veins dip moderately E, in quartzite. Mineralization: Limonite.
	5403		Grab from outcrop. Taken from steep (80° E) east side of limestone rib in shale and quartzite. Strong hematitization of rock with metallic black crystalline hematite on fracture surfaces. Rock type: Dolomite with black limonite after pyrite.
	5420	Prospect 5420	Grab. Quartz vein. Grab sample from massive, milky, sheared and brecciated quartz vein. Spotty iron oxide staining--some hematite staining. No open space textures. Probable attitude is low angle (approximately N80°E, 20°N). Vein is up to 30 cm thick. Photo 14.
Quartzite Mountain			

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5725		Silicified quartzite rubble breccia from fault zone, flooded with hematitic staining; thin streaks and lenses of red jasper, red-brown limonite/hematite points disseminated throughout rock
	5726	Shaft 5726	Breccia in quartzite and shale, minor gossan, hematite and manganese oxide coatings on fracture surfaces and partings; minor argillic alteration in shale.
	5727	Adit 5727	Rubbly white vein quartz, brecciated and recemented by white and clear quartz; some vein fragments display a breccia webbing, matrix is yellow-brown and dark gray-green stained quartz with fragments of clear quartz within it; stubby, clear quartz crystals coat some vug surfaces; minor iron-oxide staining.
	5728		Pale creme-colored argillaceous quartzite with shaly partings; flooded with dull, brick-red hematite staining.
	5729	outcrop	Fault breccia in thin-bedded shaly quartzite, rock flooded with brick red hematite staining; some parting and shear surfaces coated with hematite and manganese oxides, breccia matrix is a mixture of red-maroon hematite and manganese oxide
Queen City			
	5840	Fenceline outcrop, west	Outcrop chip sample, iron-oxide-stained fractures cutting welded ash-flow tuff of Monotony Tuff. Rock has fractured, clear quartz phenocrysts, feldspars are slightly cloudy to chalky-white, biotite altered to white mica. Sample taken from N10°W-striking, 1-meter-wide, vertical silicified rib, fracture spacing 18-25 cm, coatings of limonite up to 2-3 cm; one 4-cm-wide silicified fracture laced with quartz veinlets up to 1 mm wide, has gossan points along it. Tingley, 11/15/95
	5841	Fenceline outcrop, east	Moderately silicified rib in Monotony tuff, limonite coatings and crusts on surfaces on N5°W to NS-striking, 75°W-dipping silicified zone 2-3 meters wide; cross fractures show dull brown limonite bleeding into wall rock; tuff is crystal-rich (quartz and smoky quartz), biotite altered to chlorite, muscovite; some clear silica micro-veining. Small clots of velvety "live" limonite present in microbreccia along some fractures. Tingley, 11/16/95
Rainstorm			
	1900	Unnamed shaft	Sample of vein material from dump of prospect pit next to shaft. Strongly iron-oxide-stained quartz vein, brecciated; some fault gouge. Quade, 3/20/83.
	1918	Rainstorm Prospect	Sample consists of brecciated white quartz vein and quartzite breccia with iron oxides and pyrite taken from a 3- to 4- foot wide vein trending N70°W, 70°NE along fault. Select dump sample from adit that follows a vertical crosscutting structure trending N-S. Bentz/Smith? 12/6/82.
	1939	Rainstorm Mine	Sample taken from sidewall of main shaft at 40-foot level. Brecciated vein with galena, anglesite. Quade, 3/20/83.
	1940	Rainstorm Mine	Rock chip sample of small stringer veinlets taken over a 10-15-foot width. Vein material is silicified, brecciated, with galena, anglesite, stibnite, copper oxides; sample taken from sidewall of main shaft between 100 and 110 feet. Quade, 3/20/83.
	1941	Rainstorm Mine	Brecciated quartz vein material, oxidized, silicified, with galena, anglesite, blue and yellow oxide coatings (copper and antimony?); select sample from mine dump. Quade, 3/20/83.
	1942	Rainstorm Mine	Select dump sample of oxidized vein material and replacement ore, galena, anglesite; sample from shaft dump. Quade, 3/20/83.
	1943	Rainstorm Mine	Silicified quartz breccia from vein system, iron-oxides present; sample from vein exposed in pit. Quade, 3/20/83.
	1944	Rainstorm Mine	Quartz vein with copper and iron oxides, fine stringers of pyrite and dark sulfides; some brecciation. Sample chipped from face 225 feet into main adit. Quade, 3/20/83.
	1945	Rainstorm Mine	Select sample from dump in front of adit. Brecciated quartz vein material with yellow and black oxide coatings; vein contains galena, pyrite, and anglesite. Quade, 3/20/83.
	1946	Rainstorm Mine	Select sample from adit dump. Quartz breccia with iron oxides, galena; almost all of matrix is composed of quartz and pyrite. Quade, 3/20/83.
	91-01	Rainstorm Mine	Rainstorm adit face; iron-oxide-stained GY/RD quartzite

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	91-02	Rainstorm Mine	Rainstorm adit, cross-cut: copper- and iron-oxide-stained quartzite
	91-03	Rainstorm Mine	Rainstorm adit, cross-cut face; gray, brecciated quartzite, 1% iron-oxide stain-limonite, abundant clay
	91-22	Rainstorm Mine	Rainstorm shaft, bottom, hanging wall; sample assayed 25.2% lead, 3.4 ppm gold; quartz-cerussite breccia, 50% quartz fault gouge; grab sample
	94-22	0394-G22	Channel, 24-inch vein; quartzite and vein quartz, most of sample is massive red hematite, there are a few fragments of white vein quartz cutting quartzite; vein material has vugs with residual hematite-after-pyrite filling, some pyrite is present
	94-23	0394-G23	Chip sample, gossan; cellular boxworks gossan, vein quartz with gossan clots and points in quartzite (?); some orange-brown as well as reddish hematite, good boxworks, but not clear what the original mineral was.
	94-24	0394-G24	chip sample, brecciated shale, limestone; solution breccia in silicified (?) sedimentary rocks, possibly silicified limestone breccia cemented by reddish hematite, some manganese oxide and silica veining.
	94-25	0394-G25	Chip sample; hematite points and limonite staining in clayey sandstone; looks like Tertiary sedimentary rock (?)
Reveille Valley			
	5139	Prospect 5139	Opalized rhyolite tuff, rock bleached white with red to orange-red hematite coatings and staining
	5140	Prospect 5140	Opalized rhyodacite porphyry, bands and clots of tan- to cinnamon-brown jasper along fractures, rock brecciated and cemented with quartz, drusy quartz crystals fill cavities
	5141	Prospect 5141	Opalized, silicified rhyodacite, cinnamon-brown limonite staining, lots of opalite
	5150	KAP Claims	Silicified, gossany material from shear zone, some opaline silica clots, iron-oxide in cavities.
	5721	south of CAP Gold Claims	Opalite and opalized dacite porphyry, hematite and limonite staining, rock brecciated along fault zone
	5743	Kennecott & Pegasus Prospect	Rock chip sample from outcrop of silicified ledge of thoroughly silicified ash flow. Feldspar sites leached, some residual kaolin, mostly vugs. Quartz phenocrysts are the only remaining primary mineral. Ledge grades outward to quartz-kaolin rock. Abundant iron oxides after pyrite. Old monument and prospect pit on hillside. Looks like a high-sulfidation system, possibly high-level.
Scottys Junction			
	5206	Sample site 5206	Composite rock chip/grab sample from white to pink tuff in prospect/dozer scrapes near saddle. Weak clay and opal alteration of non-welded, pumice-rich ash-flow tuff, probably in base of Paintbrush Tuff at contact with underlying Tolicha Peak Tuff. Type only v.p.-fresh overlying dense Tp fresh , minor gypsum. Canary-yellow fracture coatings; scintillometer shows only 90 cps on 0.1K setting. 2 photos (Henry).
	5238.1	Altered area on west edge of Pahute Mesa	5238.1 (5238A) is a sample of calcite vein, 3-8 cm thick, trending N20°E, vertical. Vein material is finely banded ferruginous calcite vein about 5 cm thick, (thin section). Very fine disseminated red hematite after pyrite(?) present. 5238.2 (5238B) is pinkish, bleached, silicified, adularized(?) Tolicha Peak tuff wallrock. Wallrock is silicified breccia.
	5238.2	Altered area on west edge of Pahute Mesa	5238.2 (5238B) is pinkish, bleached, silicified, adularized(?) Tolicha Peak tuff wallrock adjacent to calcite vein sampled in 5238.1 (5238A). Wallrock is silicified breccia.
	5239	Altered area on west edge of Pahute Mesa	Rock chip sample of chalcedonic quartz and dark calcite from middle of steeply dipping vein about 1m thick, in alteration area at foot of Pahute Mesa south of Stonewall Mountain. Vein has irregular geometry, probably NW-striking, hosted by intensely brecciated (hydrothermally?) Tolicha Peak tuff.
	5240	Altered area on west edge of Pahute Mesa	Select sample of iron oxide and silica bands from 0.5m-wide vein of silica and iron oxide. Vein trends N20°E, 80°W. Adjacent Ttp is shot with hydrothermal breccia, calcite, opaline (?) silica and red-orange iron oxide blebs.
	5241	Altered area on west edge of Pahute Mesa	Rock chip sample of hydrothermally brecciated Ttp, cemented by ferruginous calcite +/- jarosite. Irregular bodies of hydrothermal breccia cut highly fractured and bleached Tolicha Peak tuff. Calcite vein 0.5m wide occurs about 50 ft to east, banded, trending N70°W, vertical.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5242	Altered area on west edge of Pahute Mesa	Rock chip sample of non-vesicular andesitic lava or plug(?) Rock seems to be pyritic, strongly propylitized (chlorite, calcite, pyrite) andesite beneath clay-altered, unwelded lower Ttp. This is an area of bright yellow-brown color anomaly on LANDSAT data, along base of Pahute Mesa. Area should be looked at in more detail (whole day). Overlying Ttp is bright orange-red with hematite stain. Altered andesite is cut by dark(?) veinlets of pyrite(?), chlorite(?), actinolite(?)
	5243	Altered area on west edge of Pahute Mesa	Rock chip sample from top of low hill formed by resistant ledge of silicified breccia of Ttp. Feldspar phenocrysts are milky. Rock is silicified, adularized(?)
Scottys Junction area			
	5094	unknown	Grab sample from road cut (dozer scrape) of clay-altered, non-welded ash flow tuff (for XRD analysis only) S. Castor, 12/16/95.
	5095	unknown	Grab sample from dozer scrape of clay-altered, non-welded ash flow tuff. Powdery, gritty clay from area where clay may be 4 m thick (for XRD analysis only). S. Castor, 12/17/95.
	5096	unknown	Grab sample from outcrop of altered, bedded tuff. Zeolitization and silicification (for XRD analysis only). S. Castor, 12/17/95.
	5099	unknown	Grab sample from roadcut of clay-altered, argillized ash flow tuff (for XRD analysis only). S. Castor, 12/17/95.
Silverbow			
	2774	Prospect	From open workings a silicified rhyolite breccia, vuggy, bleached iron stained...pyrite and reported Au, Ag.
	2775	Prospect Adit	Chipped from silicified zone in rhyolite, approximately twenty feet into adit, some unidentified gray streaks.
	2776	Unnamed Adit and Shaft	Unnamed adit and shaft in silicified-rhyolite...strong alteration near veining...no visible mineralization.
	2777	Unnamed Crosscut and Shaft	Chipped from vein in adit, quartz rich bleached shear zone, some gray unidentified sulfides with pyrite.
	2778	Blue Horse Mine	Silicified zones with quartz, pyrite in shear zones...eastern end of structure in rhyolite; sample taken at large shaft dump
	2779	Blue Horse Mine	Collected from dump and exposed vein 2-4 feet quartz vein in rhyolite pyrite and unidentified sulfides.
	2780	Blue Horse Mine	Chipped from shear zone, quartz stringers and gouge in rhyolite strongly bleached along shear pyrite and gray unidentified sulfides with possible Ag, Au.
	2781	Large Crosscutting Adit	Silicified vein material in rhyolite; vein contains pyrite and unidentified sulfides; sample taken from adit.
	2782	Unnamed inclines	Sample selected from exposed 3-4 foot vein in shear; some pyrite and gray silver sulfides; wall rock shows argillic white alteration.
	2783	Unidentified Incline	Silicified vein material from shear zone; wall rock bleached white; sample selected from dump and vein; strong pyrite.
	2784	Clark, Newton, Zigler, Prop.	Select dump sample; silicified vein material in pinkish-grey rhyolite; strong bleaching of wall rock near vein contacts.
	5116	Prospect 5116	Silicified, kaolinized rhyolitic non-welded ash-flow tuff, white/bleached outcrop laced with iron-oxide-stained fractures, stockwork system, some fractures have jasper veins, some have chalcedonic quartz veins, drusy, clear quartz crystals on vein and fracture surfaces and in pumice cavities, some red, hematitic flooding
	5117	Prospect 5117	Silicified ledge material, 2-inch to 3-inch-wide, drusy, vuggy quartz vein follows center of ledge, iron-oxide-staining.
	5118	Prospect 5118	Silicified, iron-oxide-stained volcaniclastic rock, contains rounded fragments of white, quartz-crystal welded ash-flow tuff cemented with a matrix of limonite/hematite, some lenses and bands of fine-grained rock (rhyolite flow ?) with disseminated pyrite (?).

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5119	Black Mule Prospects	Chalcedonic vein material, colliform banding of quartz and softer, white mineral, trace of dark mineral along banding, some opaline silica, minor iron-oxide staining. XRD report: Sample 5119 contains mostly quartz with minor amount of kaolinite. The amount of kaolinite varies from band to band, with the whitish powdery one rich in kaolinite.
	5120	Prospect 5120	Silicified, fractured, welded ash-flow tuff, quartz veins up to 1-inch thick, limonitic points in vein material, also gossany jasper veinlets, red-brown fracture coatings.
	5138	Prospect 5138	Silicified rhyolite tuff, white quartz vein material, brecciated and cemented with vuggy quartz, some lamellar quartz-after-calcite.
	5188	Pit 5188	Silicified, adularized, rhyolitic welded ash-flow tuff; quartz veining, stockwork, rock vuggy with clear quartz crystals in vugs; limonite points after pyrite in rock
	5189	Adit 5189	Silicified, argillized, rhyolitic welded ash-flow tuff; some adularia replacement of feldspar, some sericite; also hydrothermal breccia with tiny, bright pyrite cubes in breccia fragments; does not appear to be any pyrite in the clear quartz matrix of the breccia
	5359	Sample site 5359	Sample of altered flow-banded rhyolite plug or dike of map unit Tob, feldspar phenocrysts gone, weakly silicified groundmass, porosity, and along flow bands. Strongly stained by mustard yellow-brown limonite +/- jarosite. No veins/veinlets seen. Argillic and quartz alteration, probably had disseminated pyrite(?) Flow banding trends N0°-10°W, 65°E. -Weiss, 6/23/95.
	5360	Prospect 5360	Select dump sample from shallow (1-m deep) cut in massive, non-banded, phenocryst-rich variety of Tob; highly leached, partially silicified, with chalcedony and drusy quartz in irregular veinlets and open-space fillings. Veins/veinlets best exposed in walls of cut. Trace of unoxidized pyrite in chalcedony veinlets. Iron oxide is reddish brown here. -Weiss, 6/23/95.
	5361	Black Mule Prospects	Composite rock chip sample across ~3-m-wide quartz vein about 75 feet east of an unmarked cut about 3 m long by 1 m deep. Wallrock is leached and silicified, plagioclase and biotite are gone. Banded and brecciated vein is about 3 m wide and trends ~N80°E, 62°S. Boxwork texture after carbonate, probable very fine-grained adularia and quartz bands are white to dull cream color. Fine, crustiform, banded chalcedony and very fine-grained comb quartz, locally drusy. Central and south part of vein is breccia of angular to rounded vein fragments <20 cm in matrix of red iron oxides and silica, with locally abundant limonite; breccia is probably of hydrothermal origin. Vein can be traced for ~1000 feet to east. -Weiss, 6/23/95.
	5610	Nixon Peak Prospect	Rock chip sample of silicified, limonitic rhyolite lava plug from unmarked cut <2m deep on N slope of Nixon Peak. Abundant yellow-brown limonite +/- jarosite; drusy quartz lines small lithophysal cavities. Rock is flow banded, lithophysal, phenocryst-poor with sparse euhedral quartz and feldspar phenocrysts < 1 mm; may have had disseminated pyrite. Abundant limonite and jarosite on fractures. Cut is in talus and soil. -Weiss 5/03/95.
	5611	Nixon Peak Prospect north	Rock chip sample from unmarked cut in talus <2m deep on N slope of Nixon Peak @7240 ft.. Rock is finely flow banded, phenocryst-poor rhyolite lava plug, devitrified, lithophysal, with small sparse phenocrysts of quartz and ?? < 1 mm. Rock is silicified with drusy quartz lining cavities. Groundmass K-spar and feldspar phenocrysts are altered to white clay/sericite? Cut in talus slope apparently to get to white altered rhyolite lava. -Weiss 5/03/95.
	5613	Nixon Peak Prospect SE	Rock chip sample from unmarked shallow cut in talus on SE slope of Nixon Peak. Rock is limonite-stained, silicified, brecciated rhyolite lava of Nixon Peak, devitrified, with abundant limonite coatings. -Weiss 5/03/95.
	5614	Nixon Peak Prospect	Rock chip sample from unmarked shallow cut <2 m deep in talus. Pit in Qac has chunks of extremely silicified Tob - rhyolite of Nixon Peak. Two rock types present: white to light green brecciated and silicified rock, and limonitic light brown flow-banded rock. -Weiss 5/03/95.
	5615	Prospect #5615	Rock chip sample from unmarked shallow cut in subcrop. Quartz-cemented hydrothermal breccia in argillized, silicified phenocryst-poor rhyolite. Rock is argillized and silicified with drusy fine grained quartz and fine comb quartz veinlets and cement; jigsaw texture; dark gray quartz, possible sulfide? Good-looking rock! -Weiss 5/03/95.
	5616	Shaft 5616	Select dump sample from shallow shaft (~8 m) with remains of wooden structure. Spherulitic brecciated rhyolite with quartz veinlets and drusy quartz. Oxidized, with very little limonite, probably a hydrothermal breccia cemented by quartz. -Weiss 5/03/95.
	5617	Prospect 5617	Rock chip sample of silicified crystal-rich rhyolite ash flow tuff from outcrop at NE end of ~60 foot long trench. Rock is silicified Pahranagat Lakes Tuff(?), nearly flat-lying, cut by numerous thin (<3 cm) N60E and N10W steeply dipping chalcedonic quartz veins with reddish brown iron oxide. -Weiss 5/03/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5618	Shaft 5618	Select dump sample of silicified rhyolite lava and chalcedonic quartz veins from shaft at location of adit symbol shown on topo map. Dark gray silica and dark gray very fine grained metallic mineral as anhedral specks and blebs. 2 rock types in sample: (a) rhyolite replaced by dark gray silica with disseminated very fine grained metallic mineral, and (b) white to clear vein quartz with lamellar calcite replacement. Shaft is sunk on rubbly pumiceous rhyolitic lava flow breccia, silicified, cut by irregular stringers of chalcedonic to coarse comb quartz, commonly drusy. Rock is partially to completely replaced by silica and quartz. -Weiss 5/03/95.
	5619	Shaft 5619	Select dump sample of altered, phenocryst-poor, silicified, flow-banded, brecciated rhyolite lava with chalcedonic silica replacement and veinlets of comb quartz and drusy coarse quartz crystals, from shallow shaft with water @ 2 m depth. Orientation of veins at this location is not clear. -Weiss 5/03/95.
	5620	Prospect 5620	Rock chip sample of silicified, argillically altered, partially welded rhyolitic ash flow tuff ("False Fraction"). Thin brown chalcedony veins (<3cm) along N30W, 75SW fractures: wallrock is silicified with very fine grained quartz as replacement and lining relict pumice and cavities. Strongly brown- yellow brown limonitic stain, pervasive and as coatings. Sample is a composite of veins and wallrock. 5620TS for thin section. -Weiss 5/04/95.
	5621	Prospect 5621	Rock chip sample of chalcedony vein with ~1%-<0.5% disseminated pyrite. Tf wallrock is silicified, adularized, with biotite altered to clay/sericite. Thin chalcedony vein with abundant limonite coatings, ~4 - 2 cm thick, N50-60W, 75SW, partly oxidized. -Weiss 5/04/95.
	5622	Prospect 5622	Composite rock chip sample of limonitic chalcedony veins and wallrock from several different veins and stringers in unmarked 1m X 2m cut in resistant Tf. Limonitic chalcedony veins after opaline silica. Wallrock pervasively altered (argillization, adularization?) w biotite -> sericite, plagioclase -> clay/sericite? Sanidine is fresh (?) to milky. Veins are < 4 cm wide, with many orientations, but main fracture orientation is ~N30°-50°W with steep SW dip. -Weiss 5/04/95.
	5623	Shaft 5623	Select rock chip sample of limonitic chalcedony vein ~2-5 cm wide from unmarked 4m deep shaft. Adjacent wallrock is silicified and adularized(?) Vein fills fracture trending ~N50°W, vertical and forms a long, linear "rib" ~20-30 ft wide held up along this and parallel veinlets. Shaft has trees for collar timbers, and goes down on non-resistant, thoroughly argillized Tf ash flow tuff. -Weiss 5/04/95.
	5624	Prospect 5624	Select dump sample of quartz + chalcedony +limonite vein and about 50% wallrock from shallow pit about 1m deep. Vein in pit trends N50-55W, vertical; actually 2-3 veins a few cm apart, <5 cm wide. Wallrock immediately adjacent to vein is silicified but feldspar phenocrysts and biotite are altered to clay/sericite. A few cm or more away from veins, the wallrock is porous, argillically altered, but with some added very fine-grained quartz. -Weiss 5/04/95.
	5625	Prospect 5625	Rock chip select composite sample from 3 different thin veins of chalcedony with limonite and locally unoxidized very fine-grained disseminated pyrite. Veins are < 5 cm wide, at least 4-5 sub-parallel veins trending N50W, vertical to 75SW. Veins are massive to vuggy, but banding is not well-developed. Wallrock is argillized and silicified. -Weiss 5/04/95.
	5626	Stone house Shaft	Select dump sample of hydrothermal breccia and quartz-pyrite veins and breccia from unmarked shaft ~15-20 m deep by stone house ruin in canyon wall. (Maximum vein width is ~ 0.5 m; maximum hydrothermal breccia width is ~ 1 m). Shaft goes down along N50E, vertical structure in limonitic rib of silicified, brecciated Tf. Sample is composite from dump rocks of quartz-pyrite-replaced rock fragments cemented by later quartz with disseminated pyrite and marcasite(?) also pyritic hydrothermal breccia veins. Wallrock pieces on dump contain < 1% pyrite where unoxidized. See suite of hand specimens collected. -Weiss 5/04/95.
	5627	Prospect 5627	Rock chip and select dump sample from 2m x 3m x 10m long cut. Sample is of silicified Tf breccia with fine-grained quartz cement and clast coatings. Abundant mustard-brown limonite. Mm - 10 cm angular fragments of silica-replaced Tf and locally fragments of chalcedony veins - all cemented by veins and coatings of chalcedonic quartz and very fine grained drusy quartz. "Fluted silica" texture! Body of breccia is ~0.5 - 2 m wide between and cut by N20°W to N50°W, 70°NE-dipping to vertical fractures and fault surfaces. Wallrock is sericitized partly welded to densely welded Tf. . -Weiss 5/17/95.
	5628	Prospect 5628	Rock chip and select dump sample from 1m x 2m x 2m long cut in rock. Sample is of pyritic, silicified fault gouge/ breccia of Tf <3cm wide. Gouge occurs along N-S, 80W fracture. Wallrock is silicified, grades out quickly into sericitized welded Tf. Abundant limonite from sulfide weathering. -Weiss 5/17/95.
	5629	Prospect 5629	Rock chip sample of silicified breccia of Tf. Intense silica replacement with chalcedony filling open spaces. Abundant limonite on fractures Trace of disseminated pyrite in most dense silicified rock. Silicification and adularization(?) forms N20W trending linear narrow zones ~10m wide more resistant to weathering than adjacent densely welded Tf, which is argillically altered. Both feldspar phenocryst types <3cm wide. Gouge occurs along N-S, 80W fracture. Wallrock is silicified, grades out quickly into sericitized welded Tf. Abundant limonite from sulfide weathering. -Weiss 5/17/95.
	5700	Pit 5700	White vein quartz in silicified, kaolinized, rhyolitic welded ash-flow tuff, vuggy, quartz crystals in vugs, some jarosite in vugs and on fracture surfaces; minor black metallic specks, possible Ag sulfide

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5701	Adit 5701	Massive, flinty, white quartz vein, some ghost-like silicified inclusions in vein; stained on walls and on some cross-fractures with red hematite and black manganese-oxide; some vuggy material on vein walls with limonite-after-pyrite points
	5702	Trench 5702	Silicified, kaolinized rhyolite; contains large sanidine phenocrysts and slightly smoky quartz phenocrysts, feldspar replaced by adularia and clay, biotite totally altered to sericite; red iron-oxide staining on fracture surfaces, some vuggy quartz and fine quartz veining
	5703	Trench 5703	Silicifed fracture zone in silicified, kaolinized rhyolite; some white, flinty vein quartz, vugs coated with clear quartz crystals, yellow-brown limonite coatings on fracture surfaces, minor jarosite
	5704	Pat Prospect	Silicified rhyolite cut by vuggy quartz veining; gossan points and clots along veins, some pyrite in vein material, specks black mineral, possibly manganese-oxide-iron-oxide mixture, mostly in gossan area along margins of the thin veins.
	5705	Pit 5705	Silicified welded ash-flow tuff; chalcedonic quartz veining, iron-oxide stained fracture surfaces; vein is banded consisting of a breccia zone healed with clear quartz, then white and clear, cockaded quartz vein, then massive chalcedonic vein; jarosite on fracture surfaces
	5706	Big Jim Adit	Bleached, silicified, kaolinized ash-flow tuff; rock is brecciated and cemented with white quartz; some vuggy quartz veinlets with iron-oxide points, jarosite coating fracture surfaces; large euhedral, clear quartz crystals in vugs
	5716	Black Mule Prospects, west	Banded, crustified vein quartz, some chalcedonic quartz, minor pale yellow-brown iron-oxide staining, no visible silver minerals, but some dark gray bands are present in the vein material.
	5717	Black Mule Prospects, west	Silicified boxworks with some drusy quartz along a narrow structure in flow-banded rhyolite
	5731	Blue Horse Mine	Rubble crop grab sample from small prospect pit. Shattered quartz vein about 1 m thick trends approx. N70°W, 30-70°N (very poor exposure). Vein cuts rhyolitic ash flow tuff. Clasts of strongly leached volcanic with white bull to chacedonic quartz. Scattered quartz fragments with up to 3 % disseminated pyrite; matrix is white quartz. Alteration consists of moderate to strong leaching of feldspars with thin hydrothermal breccia and quartz veins/veinlets with up to 3% finely disseminated pyrite (locally). -Calloway, 5/3/95
	5732	Blue Horse Mine	Dump grab sample from collar of 7 m deep shaft. Brecciated quartz vein in acid leached ash flow tuff. E-W vertical structure/vein about 1 m thick. Dump material indicates multi-event vein and silicification +/- finely disseminated pyrite and small anhedral crystals (cubes). Vein quartz varies from bully to banded to chalcedonic. Vein contains fragments of altered host rock + sulfidic quartz vein + bull quartz fragments. 1-2 % disseminated pyrite, very, very fine in quartz. Alteration consists of intense acid leaching of vein fragments and host rocks. -Calloway, 5/3/95
	5733	Blue Horse Mine	Dump grab sample from small (<1 m) hydrothermal breccia zone with injected silica and silica replacement. Fine quartz stockwork with drusy silica on open spaces. Strong crusty limonite. Hillside is cut by a number of these zones with no definite orientation discernible, but trending roughly N85°E, 75°S. Host rock is rhyolite porphyry flow, with strong argillization of feldspar, moderate to strong silicification, very strong limonite, and 1-2% finely disseminated pyrite. -Calloway, 5/3/95
	5734	Blue Horse Adit	High grade dump grab sample of white bull quartz vein material with pyrite and ruby silver, collected on dump of most western and southern adit on the property. Fine drusy bands of pyrite and ruby silver cutting quartz vein material. -Calloway, 5/3/95
	5735	Blue Horse Shaft	Dump grab sample from shaft dump (shown as prospect pit on topo map) of quartz vein and silicified volcanic porphyry wall rocks. Pyrite content gives blue-gray bands to quartz. No ruby silver seen here; might have been cobbed out. Weak to moderate limonite and jarosite stains, and very finely disseminated pyrite <1%. -Calloway, 5/3/95
	5736	Blue Horse Mine	Dump grab sample from dump of large (+1000 ft) workings. Strong acid leaching of vein rock fragments and host rocks. Sample is grab of vein and silicified host rocks, usually with dark gray blue bands of matrix (1-3% pyrite). Host rock is ash flow tuff with hydrothermal breccias and quartz veins. -Calloway, 5/3/95
	5737	Blue Horse Mine	Dump grab sample of oxidized pebble dike/ hydrothermal breccia with strong limonitic crusts and stains. Rhyolitic ash flow tuff host rock is patchily silicified and micro-veined adjacent to breccia zones, with strong acid leaching and silica and pyrite replacement. Pyrite casts < 1%, strong limonite. -Calloway, 5/3/95.
Slate			
	5069	Slate Mine	Green "slate" from small pit; contains abundant fine disseminated pyrite.
South of Mud Lake			

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5129	Prospect 5129	Brecciated carbonate vein, material brecciated and recemented with carbonate, vein cuts silicified rhyolite breccia, silicified breccia fragments in carbonate cement with manganese-oxide coatings and staining
	5130	Prospect 5130	Silicified breccia, fragments cemented with black carbonate and manganese-oxides
	5910		Channel sample of playa mud. Representative channel sample of fine grained playa sediments of Mud Lake from 1 in below surface to 11 in below surface. L. Garside, 11/8/95.
Southeastern			
	5148	Arrowhead Mine, central workings	Sample from dump of workings to east of main shaft; gossany material in quartzite; clots and kernels of massive, steely chalcocite. Chalcocite rimmed by green copper-oxide minerals.
	5149	Arrowhead Mine	Dump sample from prospect cut up-hill to the east of the main shaft; copper-oxide minerals, gossan, possibly some cerussite with chalcocite clots.
	5500	Arrowhead Mine	Dump sample, same location as 5149; small, drusy, yellow-orange crystals, possibly mimetite or wulfenite, on fracture surfaces and in vugs; rock is highly silicified, copper oxide minerals coat fractures.
	5501	Arrowhead Mine, east adit	Dump sample, silicified gouge and quartzite breccia; chrysocolla and other green copper-oxide minerals in quartzite breccia. (sample lost)
	5506	Southeastern west Prospect	dump sample. coatings of green copper-oxide minerals on fracture surfaces of steep fault zone, some iron-oxide staining.
	91-10	Arrowhead Mine	sample from decline; "high grade" grab sample from 2-inch seam in right rib, just above slickenside footwall, est. 10 feet inside portal; tetrahedrite and chalcopyrite in limestone or limy shale, weakly to moderately silicified, some Cu-arsenate mineral.
	91-11	Arrowhead Mine	Sample from 70-foot level of shaft, cross-cut north; silicified breccia with copper carbonate minerals and heavy limonite stain; sample assayed 27.9 oz/ton silver, 4.91% copper, 10.2% lead, and 3.1% zinc. Grab sample of copper "high grade" from west rib, 10-feet inside north X-cut. Contains Cu-arsenate, copper-carbonate, silica, manganese oxide, and drusy quartz
	91-12	Arrowhead Mine	sample from main adit, winze cross-cut; silicified carbonate breccia with abundant secondary copper minerals; sample assayed 7.28 oz/ton silver, 1.84% copper, 4.57% lead, and 1.75% zinc; possible tetrahedrite/tennantite, extreme silicification, 1-5% copper carbonate/malachite, aurichalcite, conichalcite, with copper-arsenate as a secondary mineral.
	91-14	Arrowhead Mine	shaft at main adit; white limestone with trace of copper mineralization
	91-15	Arrowhead Mine	main adit shaft, dolomite tectonic breccia
	93-17	0993-G17	Chip sample, silicified limestone or quartz vein; silicified rock flooded with green copper-oxide staining, some hairline veinlets of chrysocolla. Clots steely chalcocite--chalcocite is brecciated. Some amber crystals, possibly jarosite (?)
	93-19	1293-G19	Silicified limestone, possibly quartzite, flooded with pale green copper-oxide stain. Clots of steely galena, vein and lenses of chrysocolla; pale yellow-green mineral coating fractures (nontronite ?)
	94-32	1194-G32	Brecciated, recemented quartz vein material along a shear structure. Milky white and clear quartz fragments cemented by greenish copper-carbonate-stained quartz. Some fracture coatings of chrysocolla, minor malachite, possibly small points of chalcocite. Main vein structure cut by later thin veins stained with yellowish-green mimetite.
	94-33	1194-G33	Quartz vein/replacement in silicified limestone, white and clear vein quartz, brecciated, clots of heavy, dark gray-black mineral (cerussite) associated with clear quartz. Green oxide copper minerals include chrysocolla, malachite, possibly brochantite, and clots of pale yellow-green mimetite. XRD analysis by Li Hsu determined that fine-grained adularia is mixed with the vein quartz.
	94-34	1194-G34	White vein or replacement quartz with clots of galena surrounded by cerussite. Points of chyrsocolla, coatings of yellow-green oxide mineral (mimetite).
	95-39	0595-G39	Silicified quartz breccia, either in silicified limestone or quartzite (?), pale green and blue copper-oxide staining, some white opal coatings, minor iron-oxide staining
	95-40	0595-G40	Siliceous gossan in limestone breccia; gossan composed of massive and crystalline hematite with soft, yellow-brown limonite filling cavities; rock in a microbreccia with breccia surfaces coated with thin gossan crusts.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	95-42	0795-G42	White and clear vein quartz, slightly vuggy with clear quartz crystals lining some vugs; dark brown and black gossan in vugs. Rock is brecciated and cemented with quartz
	95-43	0795-G43	Gossan, massive replacement ore, steely gray mineral and quartz, rimmed by hematite (?) Steely-gray mineral determined by Li Hsu to be cryptomelane, a potassium-rich manganese oxide (XRD analysis)
Spotted Range			
	5086	unnamed limestone	Chip across 10m of stratigraphic section. Fine-grained gray limestone of Guilmette Formation overlying cherty interval near top of Guilmette and just below Pilot Shale. For whole rock analysis. Castor 11/12/95
	5087	unnamed limestone	Chip across 6m of stratigraphic section. Fine grained gray limestone of Guilmette Formation underlying a five-foot thick cherty interval.. For whole rock analysis. Castor 11/12/95
	5088	unnamed limestone	Chip sample across 30m of stratigraphic section. Fine-grained gray limestone between middle and upper sandstone in Guilmette. For whole rock analysis. Castor 5/18/95
	5089	unnamed limestone	Chip sample across 7m stratigraphic section of fine-grained gray limestone sampled above upper sandstone and below Pilot shale. For whole rock analysis only. No hand samples. Castor 5/19/95.
	5237	Prospect 5237	Rock chip sample of iron-oxide impregnated quartzite (Oe). Strong iron oxides locally in bedding-parallel zone trending N-S, 35°E, about 1m thick, but spreading out from high-angle fractures. Clearly epigenetic, post-quartzite diagenesis.
	5473		Grab sample from dump of 40m-deep shaft collared in Tertiary younger sediments consisting of quartzite cobble conglomerate. At depth, the shaft penetrates black, greasy, organic-rich shale. The shaft is located in the bottom of the wash; it was probably located as a well rather than for mineral exploration. Sample 5473A is for possible TOC and rock evaluation.
Stonewall			
	1226	Sterlog Claim Co.	Banded epidote banded skarn with blob & stringers black & white crystalline silica, blobs crystalline chalcopyrite.
	1227	Stonewall Mountain Silver Mines	Siliceous, gray, fine-grained quartzite quartz vein material oxidized hematite pyrite in veinlets, argillic altered, drusy quartz some silicification.
	5606	Stonewall Spring	Select rock chip sample of quartz vein material. Vein is finely banded with white to clear fine grained to very fine grained comb quartz; dark gray band ~ 1 mm wide. Vein trends N75°W, 72°N; 2 photos. -Weiss 5/01/95.
	5607	Stonewall Spring	Composite rock chip sample across mixture of banded veins and vein-cemented, silicified wallrock fragments. Vein zone trends N80E, 55N with individual veins of 1 m width. Sample is equally weighted to altered wallrock and pure vein chips collected across ~4 m width within wider vein zone.-Weiss 5/01/95.
	5608	Stonewall Spring	Composite rock chip sample across entire 5 m width of quartz vein, east wall. Vein contains delicately banded crustiform fine to medium grained comb quartz, drusy, with no calcite. Wallrock is pyritic. -Weiss 5/01/95.
	5609	Stonewall Spring Adit	Rock chip sample from ~0.5-2.0 m into footwall of quartz vein near mouth of short (20-ft) adit. Sample is of silicified and adularized volcanic rock containing about 1% disseminated, fine grained, subhedral to anhedral pyrite and a few % small feldspar phenocrysts. . -Weiss 5/01/95.
	5630	Prospect 5630	Select dump sample of altered, adularized rhyolite lava breccia cut by thin quartz veinlets and cemented by iron oxides, silica +/- drusy clear quartz - euhedral crystals < 2 mm long. Abundant limonitic and hematitic stain and fracture coatings. Probable flow breccia of phenocryst-poor devitrified rhyolitic lava. Sample is from shallow cut, ~1-2 m deep X 4 m long, on Stonewall Mountain east of Stonewall Spring. -Weiss 5/18/95.
	5631	Shaft 5631	Select dump sample of porphyritic rhyolite lava breccia, adularized, silicified, +/- pyrite. Two rock types: oxidized, iron oxide stained rock and unoxidized rock with 1-2% disseminated, very fine grained, euhedral-subhedral pyrite. No veins seen here. Shaft was sunk on very steep N-dipping fault? contact between rhyolite breccia to the south and dacite to the north. Sample is from dump of shaft ~15-20 m deep at edge of wash on Stonewall Mountain east of Stonewall Spring. -Weiss 5/18/95.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5632	Adit 5632	Composite rock chip sample (90% vein, 10% wallrock) over 2 m wide zone of closely spaced sheeted quartz veins and quartz cemented breccia. Fine- to medium-grained banded comb quartz with drusy open vugs. Wallrock are adularized, silicified, pyritized Tr dome or flow, with chunks of pyritic, very densely welded Tss?? - 0.5 cm lithics of phyllite and quartzite. Veins parallel N75°-80°E, 65°S-dipping fault surfaces and fractures. Sample is from rib and back of adit that is ~5 m long and trends ENE, on Stonewall Mountain east of Stonewall Spring. -Weiss 5/18/95.
	5633	Prospect 5633	Composite rock chip sample across 2 m of a 1-3 m-wide zone of vein and vein-cemented breccia. White to clear and light gray, fine grained, crustiform, banded, comb quartz, locally drusy, and with local boxwork texture after bladed calcite. Vein strikes N80°E, dips 65°S here. Adjacent wallrock is silicified and adularized, flow-banded, porphyritic rhyolite lava/dome. Strong iron oxide coatings; wallrock was probably pyritic before weathering, oxidation. Sample was collected on Stonewall Mountain east of Stonewall Spring. -Weiss 5/18/95.
	5839	Stonewall Playa	Playa sediment, sampled from 2 to 30 cm below surface. Price, 11/16/95
Thirsty Canyon			
	5070.1	unknown	Rock chip grab sample of quartz and chalcedony with minor hematite, replaces non-welded ash flow tuff. Surrounding area is not argillized. Poor outcrop, a jumble of large resistant blocks about 30 ft in diameter. Castor, 10/14/95.
	5071		Grab sample of loose volcanic cinders. Taken from crater area about 6" beneath surface. Not for analysis. Castor, 10/14/95.
	5072		Grab sample of loose volcanic cinders. Taken from south end of cinder exposure east side about 1' below surface. Black cinders. Not for analysis. Castor, 10/14/95.
	5073		Grab of loose volcanic cinders. Taken from west side of butte in area of red cinders. Collected from depth of approximately 1' below surface. Not for analysis. Castor, 10/14/95.
	5074		Chip outcrop sample of silicified non-welded ash flow tuff. From zone that strikes N40°W and is about 20 m long and 3 m wide. Castor, 10/14/95.
	5075	unknown	Grab of large loose boulder. Bedded? silica. White chalcedonic to finely granular silica replacing nonwelded ash flow tuff (?). Has bedded appearance. Castor, 10/14/95.
	5076	unknown	Argillized rock. Same location as 5075. Country rock for 5075. Some other argillized material is well sorted and may be bedded tuff. Castor, 10/14/95.
	5077		Loose cinder grab sample of volcanic cinders. Taken from depth of 6"-1' beneath surface. Not for analysis. Castor, 10/14/95.
	5078		Volcanic cinder. From SW side little black mountain from surface to depth of 1'. Not for analysis. Castor, 10/14/95.
	5209	Gold Eagle Prospect	Rock chip sample at small prospect cut in slope, weakly altered and brecciated rhyolite lava/dome. Clear to dark gray silica veinlets, hydrothermal(?) breccia. Nearby (about 20 ft away) fault surface trends N80°E, 33°S. Phenocryst-poor rhyolite, oxidized, abundant hematite fracture coatings. About 40 ft SW is another shallow pit on fault surface trending N65°E, 35°SE.with slight argillic alteration on hanging wall side, may have had minor disseminated pyrite. ENE-structure continues to SW and to NE.
	5210	Gold Eagle Claim	Rock chip sample of altered rhyolitic lava; silicified, limonitic, phenocryst-bearing (quartz, feldspar), abundant small quartz phenocrysts. Silica-feldspar-stable?
	5211	Gold Eagle Claim	Rock chip sample of red, hematitic, phenocryst-poor rhyolite lava, with silica-hematite veinlets, hematite on fractures. Hematitic fault and hydrothermally(?) brecciated rhyolite lava. Fault surface trends E-W, 50°S.
	5212	Shaft 5212	Rock chip sample at shallow shaft, 20-40 ft deep, not on map. Densely welded ash-flow tuff (Tuff of Sleeping Butte? Tos of Miner, et al.) No mineralization. Dense, silica veinlets on fracture surfaces, plagioclase is somewhat milky. Biotite and hornblende? are fresh. Sample M5212TS for thin section.
	5213	Prospect 5213	Rock chip sample from shallow scrapes in bedded tuff and tuffaceous sandstone, no outcrop. Layered silica and silicified breccia body (may have been opalized tuff) weathering out of tuffs, <50m long and <1m thick, indeterminate attitude or orientation. Locally fragmental, and with quartz phenocrysts. Weak zeolitic alteration of surrounding bedded tuffs.
	5214	Prospect 5214	Rock chip sample of red, hematitic, opalized, lithic-rich tuff surrounded by zeolitic, lithic-rich ash-flow tuff, could be a large (1m-size) fragment. Prospect is shallow pit about 1m deep, 2X3m.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5450		Select dump sample of silicified ignimbrite with quartz, calcite, and purple fluorite in vugs and veinlets, minor limonite staining.
	5581	Sample site #5581	Rock chip sample of brecciated and silicified densely welded ash flow tuff with weak hematite-silica along fractures. Rock is very hard. Brecciation and resistant silicification appear to be localized by intersection of 3 principal fracture sets: N-S, 45W; N10-20W, 40-80SE; and N60W, 70SW. Resistant rock forms a N-S rib. -Weiss, 4/7/95.
	5582	Decline 5582	Rock chip sample of silicified bedded tuff with complete silica replacement, from unmarked shallow decline on south flank of Sleeping Butte. Essentially 100% replacement, probably originally opal, now chalcedony, red, white, clear, and gray. Relict quartz phenocrysts and pumice holes can be seen. Ledge trends ~N65E, 35NW. -Weiss, 4/7/95.
	5583	Shaft 5583	Rock chip sample of iron oxide - silica vein from unmarked shallow (20-30 ft deep) shaft with collapsed timbers near collar, SSE of Sleeping Butte. Vein is about 20 cm thick along N30E, 70NW fault/shear zone. No visible alteration or mineralization. -Weiss, 4/7/95.
Tolicha			
	1909	So. of Landmark Mine	Small inclined prospect on strike with Landmark Mine. Quartz vein breccia, in rhyolite tuff sulfides pyrite.
	1910	Landmark Mine	Sample taken from ore-bin 110 feet into main adit. Free gold was observed in a piece of very strongly silicified vein material, pyrite.
	1911	Landmark Mine	Gouge and hydrothermally altered vein material from a drift on strike of main vein Au, Ag(?) Fe oxides.
	1912	Landmark Mine	Sample from gouge, including breccia material at bottom of 30 foot incline 75 feet into main adit. Au, Ag? silica breccia Fe-oxide.
	1913	Across drainage from Landmark	Selected from dump-massive gray opaline quartz vein brecciated with rhyolite clasts - pyrite in dense vein material. Sulfides. Au(?)
	1914	Life Preserver Group	From dump near 50 foot shaft - quartz vein material, breccia, gray sugary to vitreous very hard. No mineralization observed - Au(?)
	1915	Life Preserver Group	Outcrop next to largest shaft - Quartz breccia and quartz vein intruding flow banded rhyolite. Fine disseminated sulfides.
	1916	Life Preserver Group	From dump near shallow prospect. Fine pebble quartz vein also rhyolite quartz breccia sulfides and possible Au?
	1917	Quartz Mountain Mine workings	From dump selectively, Quartz vein material in matrix of silicified rhyolite - possible sulfides - Au(?)
	5079	Monte Cristo Spring	Outcrop grab sample of non-welded ash flow tuff. Zeolitic alteration and silicification. From gully above Monte Cristo Spring. White color. Not for analysis. Castor, 10/15/95.
	5080	Monte Cristo Spring	Ore pile grab sample of breccia. Silification. One pile at old Mill. This is not a mine site sample. Not for analysis. Castor, 10/15/95.
	5081	unknown	Perlitic rhyolite flow rock. Rhyolite flow is about 35' thick. Upper 20' is partly devitrified. Local Apache tears (sample 5081 A). Overlain by flow banded devitrified and vapor phase- altered rhyolite flow rock (sample 5081 B). Perlite has folded flow foliation. Apache tears comprise about 5% of rock. Not for analysis. Castor, 10/15/95.
	5082		Vitrophyre-ash flow tuff. No mineralization. Not for analysis. Castor, 10/15/95.
	5083		Outcrop grab sample of non-welded ash flow tuff. Hematitic and argillic? alteration. Narrow N25°E, vertical fracture with hematite stain. About 50' to NW is similar feature N30°W, steeply dipping with associated brick red limonitized tuff. Castor, 10/15/95.
	5084		Altered tuff. Chip sample is about 1' wide across 5-10' wide N30°W limonite +/- silica structure in non welded ash flow tuff. Castor, 10/15/95.
	5085		Altered tuff. Argillization, silicification. . Limonite and silica along N40°E, moderately east- dipping structure. Castor, 10/15/95.
	5107	Prospect 5107	Silicified rhyolite breccia, chalcedonic silica flooding, dark silicified streaks cut rock, possibly containing fine-grained sulfides

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5113	Prospect 5113	White/creme vein quartz, massive and fine-grained, cockscomb texture, fine-grained, black mineral along cockscomb bands, some chalcedonic quartz
	5114	Prospect 5114	White, sugary and chalcedonic vein quartz, minor Feox, minor, wispy black streaks, taken from dump ore pile
	5115	Adit 5115	Vein quartz from adit dump; some Mnox staining, Feox-staining, cockscomb replacement texture
	5250	Sample site 5250	Altered rhyolite from area marked on topo map as a prospect, but no evidence of workings; looks like a natural exposure of altered flow-banded rhyolite. From a distance, fan of bleached rhyolite appears to be a dump, but on closer examination it is just the weathering pattern; no pit, shaft, or adit.
	5251		Slightly silicified, iron-stained altered rhyolite flow breccia. Small pit at end of road is just a scrape into the red-colored rhyolite.
	5252	Prospect 5252	Rock chip sample of limonite-cemented breccia along structure trending N48°E, 38°NW. This sample and #5253 and #5254 are from a small string of declines along the main structure.
	5253	Shaft 5253	Silica-veined volcanic, possibly adularized; network texture may represent relict calcite. Volcanic host rock is silicified; plagioclase is sericitized or clay-altered, but some K-spar appears fresh. Possible adularia in wallrock, but no vein adularia recognized. Sample is from decline on same structure trending N48°E, 38°NW as sample #5252.
	5254	Shaft 5254	Limonite sample from decline on same structure trending N48°E, 38°NW as samples #5252 and 5253.
	5255	Shaft 5255	Mine dump sample of breccia-possible hydrothermal origin. Two samples of hydrothermal breccia include clots of altered volcanic material and broken bull quartz vein material. Vein matrix is variably oxidized silica with relict pyrite(?) The metallic phase may have been a sulfide (probably pyrite), now oxidized to limonite-hematite. Photo (#13 of CDH) of adits at #5255 and #5256 from below.
	5256	Adit 5256	Silicified breccia from upper set of adits on silicified breccia vein trending N10°E, 45°W. Sample is representative of vein.
	5257	Adit 5257	Limonitic breccia from propylitically altered ash-flow tuff with minor quartz veins. Adit trends S47°E.
	5404	Life Preserver Claim	Re-sample from grab #5460. Gouge along irregular low angle fault. Radiation = 10,000 cps.
	5405	Life Preserver Claim	Chip across 10-foot wide silicified zone in pit. Same location as 5114. Zone is about N20°E, 7°SW??? and is white to gray-green or brown chalcedony, some limonite.
	5406		Grab from outcrop of rhyolite breccia. Most of the rhyolite in the knob W of Life Preserver Mine looks like this, some is limonitic, and some contains fine-grained ,disseminated pyrite.
	5407	Life Preserver Claim	Chip sample on 8 foot wide vein in silicified zone with assumed NNE trend.
	5408		Flow banded rhyolite, light gray, relatively unaltered, with minor limonite. Flow banding = N40°W, 60°-80° NE. Sparse disseminated limonite after pyrite points.
	5409		Spherulitic rhyolite from outcrop in prospect pit... Mineralization: limonitic, hematitic.
	5410		Outcrop in gully. Crystal-rich ash-flow tuff with abundant black mafics. Greenish color. Feldspar altered to clay? Sample 5410A is same rock. Sample 5410B is same rock(?) but purplish gray.
	5411	Life Preserver Claim	Chip sample across 4-feet wide silicified zone. Siliceous reef. Siliceous zone composed of fine-grained white to gray quartz, massive --no crustiform texture--with minor very fine-grained drusy cavities and patches of limonite-stained quartz. 5411A is silicified fairly spherulitic rhyolite about 20 feet away from vein. Mineralization: trace limonite.
	5412		Grab from dump (prospect). Silicified rhyolite. Silica alteration.
	5413		Grab from dump. Altered tuff. Manganese oxide. Re-sample at or near site 5461 (original apparently lost).
	5414	Sample site 5414	Grab from outcrop. Light green ash-flow tuff, non-welded, some very light pink rhyolite lithics. Argillic(?) Zeolitic(?) alteration.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5415	Sample site 5415	Grab from outcrop. Non-welded ash-flow tuff or volcanic conglomerate. Zeolitic(?) alteration. Locally has bedded tuff interbeds.
	5416		Grab from outcrop. Non-welded (?) ash-flow tuff with very abundant clasts of spheroidal rhyolite. Argillic alteration.
	5421	Life Preserver Mine	Chip sample from 61.5 to 71.5 feet along south wall of adit. Don't pull hand sample from these, crush entire sample. This applies to 5421-5426, 5404. Mine map on 5404 (SBC).
	5422	Life Preserver Mine	Chip sample from S wall and roof of adit from 84-93 feet. Rock type: silicified rhyolite?
	5423	Life Preserver Mine	Chip sample, N wall of drift, chest high, 74-84 feet. Silicified and brecciated rhyolite.
	5424	Life Preserver Mine	Chip sample from S wall of adit less than 1.5 feet from floor. 93-103 feet
	5425	Life Preserver Mine	Chip sample 140-150 feet (to end of adit) of moderately brecciated, flow-banded rhyolite.
	5426	Life Preserver Mine	Chip sample 120-130 feet, moderately brecciated rhyolite.
	5427		Select sample from dump of 1.5m deep prospect pit. Hydrothermally altered ignimbrite (plagioclase has gone to clay) with boytroidal jarosite coatings. 0.5-2.0 mm thick along fractures. There is no vein material; pit is in talus (bedrock at bottom, but now covered). No structure noted. The ignimbrite is light brown weathering, pinkish gray, crystal rich, and appears to have some pumice. Phenocrysts (1-3mm) are plagioclase, sanidine, quartz, and small (<0.4mm?) flecks of altered biotite?, sparse volcanic, lithics 1-3 cm are noted. Sparse disseminated limonite. Rock type: rhyolitic welded tuff. Alteration: argillic ?
	5428		A select sample of rhyolite (ignimbrite?) with limonite along fractures was collected from outcrop near canyon bottom. Prospects shown on map 30m upstream do not reach bedrock (possibly bomb craters). Feldspar is altered to clay (?). A thin ferricrete-cemented talus 0.5m thick is noted here over bedrock. This suggests oxidation of pyrite(?), possibly in wetter late Tertiary, and deposition as iron oxide cement of talus. Rock type: Rhyolite ignimbrite(?). Alteration: bleaching, iron-staining, argillization.
	5429		A grab sample was collected from along N20°E, 90° fault in a 1m deep prospect pit. The fault zone is in flow -banded rhyolite (possibly a flow, as there is low angle flow banding nearby). The zone is about 10-15cm wide and consists of iron-stained breccia (along the fault) of silicified rhyolite. Prospect was apparently developed along this mineralized fault.. Flow banding measured just to the west as E-W, 10°S, but highly variable and somewhat contorted.
	5430		Select mineralized rock collected from dump of 1m deep pit in rhyolite breccia. Sampled material is rhyolite and silicified rhyolite with fracture coatings of limonite. I interpret this entire hill as rhyolite breccia and "microbreccia" (a breccia of fragments and fine-grained rhyolite(?) all less than 1 cm diameter. About 200m west of here on the west flank of the hill I saw "bedding" of alternating coarse and finer breccia (N15°E, 40°NW). I am not sure of origin of this. Most of the breccia is probably flow or intrusive.
	5431		Select, outcrop, and dump. A select sample of silicified and micro-veined hydrothermal? rhyolite breccia was collected from dump and outcrop in small prospect pit. The pinkish rhyolite breccia is stained by Feox and Mnox and has dark microveinlets, usually less than 1mm wide. Rhyolite breccia fragments in some samples are floating on an iron-stained angular breccia which appears as veinlet-like bodies in part. The sampled area is on one side of a rugged outcrop of breccia which trends northerly and has one N10°W, 90° (slicks 90° rake) fault surface within it. Hydrothermal? breccias are noted across a 100m zone.
	5432	Life Preserver area	Chip sample across approximately 1 m wide, milky, locally brecciated, massive quartz vein. The slickensided upper surface of the vein has an attitude of due N, 50°E; The rake of the slickensides is 90 degrees. Vein is exposed in pit with stope below for a short distance. The slickensides seem to indicate normal fault displacement (hanging wall side down). This vein trend continues to the south for nearly 1km and the fault and dumps can be seen on air photos. Wall rock is flow-banded and locally spherulitic rhyolite. Vein seems to be cut off by N50°W, 65°? SW fault. Greenish argillized rhyolite to SE of that fault is sampled in 5433.
	5433	Life Preserver area	Chip sample across 1.3 m of greenish, argillized rhyolite or rhyolite breccia which occurs on SE side of a N50°W, 65°? SW fault which cuts off quartz vein sampled at 5432. Sample TPG5 taken of this greenish material for x-ray identification.
	5434		Grab sample from dump of small prospect pit or bomb crater. Rock is greenish silicic volcanic rock with argillic or sericitic alteration.
	5435		A grab sample of the most iron-stained rock from dump of small, <1m deep, prospect pit in flow-banded rhyolite. Spotty limonite on fractures is the only indication of alteration or mineralization. No obvious reason for prospect. The flow-banding trends N70°E, 55°NW. In the canyon approximately 150 meters to the north bedded rhyolite breccias, surge?, etc. appear to overlie these flows here.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5436		Select sample from 5-7 cm wide hydrothermal? breccia zone along a fault in flow-banded rhyolite (flow?). The sampled fault has an attitude of N80°W 75°S. A nearby similar breccia zone is along a N80°E, 70°S fault. The flow banding is approximately N20°W, 35°NE.
	5458		Select quartz vein material from dump of caved adit. Vein in nearby pit trends N10°E, 75°W and is 1m or more wide. Sacchroidal to locally chalcedonic or banded and crustiform with sparse probable quartz after lamellar calcite. Some limonite and manganese staining with coarse crystalline jarosite, locally. Rare remnant pyrite. Wallrock is flow-banded rhyolite. Wallrock alteration seems to be mainly extensive silicification.
	5459		Select rock sample of rhyolite breccia with limonite after pyrite. Sample taken at portal of caved adit. Rhyolite fragments have (albitized?) plagioclase and possible ghosts of biotite(?) replaced by iron oxides. 5459A+country rock about 50 ft W of 5459. 5459B=silicified air-fall tuff 200 ft W of 5459.
	5460		Chip sample of white, powdery silica-rich? material form wall of lower adit about 25m in from portal - just past winze. This site is the most radioactive noted, 10.000 cps. Adit is about 50m long with some stopes? above. Sample is from more extensive brecciated quartz vein. Wallrock at back end of adit is flow-banded rhyolite. Sample #5460B is hand sample of flow-banded rhyolite from near the dump, for thin section.
	5461		(Sample missing) Select dump sample of argillized, silicified, iron-stained rock was collected from the dump of an adit. One piece contained very fine-grained pyrite(?) The wallrock is probably unwelded ash-flow tuff.
	5462		Select dump sample from one piece of iron-stained, brecciated, recemented, white and light tan sacchroidal quartz vein matter. The shallow inclined shaft here follows a N40°E, 50°SE quartz vein about 75 cm wide. The vein is near the contact of flow-banded, spheroidal rhyolite and light greenish gray altered pumice tuff.
	5463		Select sample of quartz vein material from dump of small prospect pit. Slightly iron-stained, white sacchroidal quartz with occasional pyrite. The vein trend is not clear here. The shaft was put into silicified tuff; pumice is apparently replaced by greenish sericite(?) Sample 5463B (2 pieces) is for XRD of greenish sericitic mineral. Sample 5463A is from a nearby outcrop where a bed-like feature (sampled) occurs between brecciated vein material and brecciated silicified rhyolite or tuff. 5463A is for thin section (Castor). 5463C is ash-flow tuff for lithology from hill 200m south. XRD #5463B=The greenish mineral in cavities is illite, probably 2M2 polytype. The 001 reflection is too broad to be sericite.
	5464		Bleached, brecciated, limonite/hematite-stained rhyolite with quartz phenocrysts. Rock is silicified, with argillic alteration of feldspars. Rock is locally spherulitic, with no flow-banding observed. Scintillometer: 200-250 cps. Sample taken from top of ridge.
	5465		Outcrop chip sample across 3-ft thick shear zone, gouge, breccia. Clay alteration, locally limonitic. No quartz vein. Scintillometer: 250 cps. 5465A is country rock along shear zone. Shear zone trends N45°E, 50°, NW with slicks N 70°W. 5465 B, C are rock samples from about 600 ft NW (see Castor notebook)
	5466		Select sample of only the pyrite-bearing quartz vein material from ore(?) pile on dump of upper adit. Fine, disseminated sparse pyrite in light gray to white, chalcedonic to fine-grained quartz vein material. The trend of adits and shaft and the trend of small prospect pits possibly in search of vein continuation, suggests a north-striking vein system here, although it is not certain.
	5467		Dump grab sample of silicified rhyolite(?) and quartz vein material, all stained and coated by iron oxides. Small pit in wash on isolated outcrop of silicified and iron-stained rock.
	5468		Prospect dump sample of hard, bleached and brecciated rhyolite in contact with light green rhyolite. Alteration: silicification, sericitization(?). Mineralization : limonite. Sample consists of pieces of both types of rock.
	5469		Outcrop and prospect sample of brecciated, silicified, bleached, limonite-stained rhyolite. 5469A is a similar rock, bleached rhyolite with quartz eyes and lithic fragments, minor breccia and hematite.
	5470		Dump sample, prospect pit. Argillized (or sericitized), bleached, non-welded ash-flow tuff with limonite and some gossan. 5470A - bleached and limonitic non-welded ash-flow tuff. 5470B - light blue non-welded ash-flow tuff. 5470C - bleached non-welded ash-flow tuff. 5470D - Rhyolite flow(?), spherulitic, crystal-rich. 5470E - same as 5470D(?)
	5471		Dump grab sample of hydrothermally altered rhyolite with minor limonite on fractures. Pit may be bomb crater rather than prospect pit. This sample should represent average geochemical values for altered but essentially unmineralized rhyolite.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5744	Quartz Mountain	Select dump sample of densely welded ash flow, (NOT rhyolite of Quartz Mountain). Same sample site as #5252-5254, taken to confirm high gold value obtained in 5254. Sample is of brecciated quartz and silicified tuff with abundant iron oxides after sulfides. Several generations of quartz present: early white, sugary, with abundant carbonate replacement textures, and two or more generations of clear quartz in crosscutting stockwork veinlets. Fine grained hematite in early quartz, some adularia. 3 declines with stoping; two with N45°W, 40°NE trends on structures as noted at 5252, and one with N60°E, 50°NW trend. Silicified zones are about 2+ m wide, with silicification and potassic alteration, iron oxides in breccia. - Bonham, 6/8/95.
	5745	Quartz Mountain	Rock chip sample across quartz vein and silicified zone 4-5 meters wide (locally 6-8 m wide). Zone is highly brecciated early quartz, cemented by later quartz + iron oxides after sulfides. Carbonate replacement textures common, adularia replaces sanidine phenocrysts. Zone strikes N5°E, dips 60°-70° NW. Wallrock rhyolite on hill is strongly silicified and cut by stockwork veinlets of quartz. Photos 23, 24, 25. - Bonham, 6/8/95.
	5746	Quartz Mountain	Outcrop chip sample across 50 m of a 60-m wide silicified and brecciated sheeted vein zone with general attitude of N60°E, 80°SE in rhyolite. Prospect pits are nearby, but not on zone. Zone is highly brecciated, silicified, with abundant iron oxides after sulfides. Zone forms ridge crest, approximate dimensions, 60 m by 250 m. Photos 26-29, general views, looking west; also photos 30 & 31. - Bonham, 6/8/95.
	5747	Decline 5747	Select dump sample from silicified and veined zone in rhyolite? Decline 10 m deep sunk on margin of zone which trends N35°E, dip 60°SE. Silicified zone is about 20 m wide. Vein material is brecciated and recemented, contains iron and manganese oxides. - Bonham, 6/8/95.
Transvaal			
	1065	Jim Spicer Claims	Heavily hematite stained rhyolitic ash tuff, kaolinized, quartz phenocrysts.
	5053	Prospect 5053	Silicified breccia, welded ash-flow tuff clasts with feldspar destroyed, quartz phenocrysts, chalcedonic silica in veinlets and pervasive, hematitic, minor finely drusy quartz
	5054	Prospect 5053	same as 5053: silicified breccia, welded ash-flow tuff clasts with feldspar destroyed, quartz phenocrysts, chalcedonic silica in veinlets and pervasive, hematitic, minor finely drusy quartz.
	5055	Prospect 5053	same as 5053: Silicified breccia, welded ash-flow tuff clasts with feldspar destroyed, quartz phenocrysts, chalcedonic silica in veinlets and pervasive, hematitic, minor finely drusy quartz. Sample from N25°E, 60°W-dipping shear zone which separates nonwelded ash-flow tuff on east from breccia containing fragments of welded ash-flow tuff on west. The non-welded ash-flow is limonotized near the shear.
	5056	Prospect 5056	Silicified breccia, possible very-fine-grained sulfides
	5057	Sample site 5057	Bleached and limonitized rock from vertical, N-S shear zone cutting gray welded, crystal-rich ash-flow tuff; some gray chalcedony
	5058	Prospect 5058	Limonitized-hematized breccia; dump grab sample
	5059	Prospect 5059	Limonitized-hematized ash-flow tuff and silicified ash-flow tuff along shear zone; dump grab and outcrop grab sample
	5207	Cat Canyon Prospect	Opaline silica and milky quartz rib exposed in gully (Cat Canyon). Small adit into red tuffaceous breccia exposed along fault. Alteration: silicification. Breccia has clear quartz crystals lining vugs and fracture coatings.
	5208	Buttonhook Wash area	Banded brown and white opaline silica. Shaft destroyed, infilled, no longer clear what was produced. Sample is of best-looking material. Alteration: silicification.
	5451		Sample consists of three lithologies: 1. White, silicified tuff with hematitic hydrothermal breccia. 2. Purple jasperoid with chalcedonic vein. 3. Breccia of white silicified tuff with late limonite from hydrothermal vent. Separate sample of late white veinlets (kaolinite, by XRD). Area workings include a prospect pit to the west, a short shaft with hematitized rock on dump to the east, and an inclined adit about 15 ft long with a 20-ft branch to ESE and a very short branch to the W. Adit explores breccia and white (kaolinite) veins above shear zone trending N85°W, 45°S. (see sketch map)
	5452		Grab and select sample from vein of manganese oxide-stained white and bluish chalcedony up to about 70 cm wide.

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5453		Select dump sample of strongly silicified and pyritized breccia. Protolith probably tuff, from small piece of unoxidized rock found on small dump of prospect pit.
	5454		Outcrop sample of silicified, argillized, bedded tuff with pervasive orange/brown limonite/hematite. No workings at this site.
	5455		Grab sample from the dump of a 10m-deep shaft. Rock in shaft collar is hematite/limonite-coated breccia of silicified ash-flow tuff. The breccia zone is low-angle and appears to lie at the west end of an east-west-striking ledge of silicified and locally brecciated tuff.
	5456		Outcrop sample of very fine-grained argillized(?) thin- bedded tuff, with hematite/limonite stain. (See Castor's notes?)
	5457		Outcrop sample of strongly argillically altered bedded tuff. Clay sample about 30 ft stratigraphically below sample site #5456. Clay layer is about 10 ft thick.
	5472		Select dump sample of sparse drusy quartz vein material and hematite-encrusted brecciated wallrock (crystal-rich, biotite-quartz-feldspar welded tuff). the iron-stained zone is exposed in the wall of a shallow (30m?) shaft along a N10°W, 85°E fault zone. 5472A is a sample of unaltered Timber Mountain Tuff from ridge crest nearby.
	5487	unknown	Vein chalcedonic silica with some incorporated rhyolite tuff wallrock. Botryoidal silica in part.
	5488	unknown	Silicified, argillically altered and iron-stained rhyolite tuff. Sample is from vein zone along border of silica vein sampled in #5207. Alteration minerals: clinoptilolite, cristobalite, goethite, quartz (XRD analysis by Li Hsu).
	5561		Altered glassy tuff from hilltop X4695. Alteration: opal-kaolinite +/- alunite(?) #5561P - porous - XRD; #5561A - dense - XRD, thin section; #5561-alu - porous, sparkly pink alunite(?) - XRD or oils, check.
	5562		Alteration suite from SE part, Transvaal Hills, not for geochem. #5562 = alunitized, porous, sheared tuff near base of Tma with euhedral clear alunite crystals coating fracture surface. #5562H = porous, unwelded ash-flow tuff (lower Tma) opalized (and alunitized?) with 1% very fine-grained disseminated hematite grains, probably after pyrite.
	5563	Shaft 5563	Dump grab sample from shaft (at leadt 25 ft deep) collared in brecciated Tma along NNE fault zone with abundant red-orange iron oxide in partly welded to densely welded ash-flow tuff. Tuff has been weakly silicified after feldspar phenocryst destruction. Occasional breccia cemented by opaline silica and clear alunite. Dense, devitrified Tmr to E of fault is fresh, but, oddly, has abundant fracture coatings of clear drusy alunite, both bladed and tabular.
	5575	sample site 5575	Rock chip sample of silica sinter or silicified tuffaceous sandstone. White, clear, gray to brownish opal and chalcedony, laminated to massive; includes volcanic sandstone about 1.5 m thick here. Sample is from ~6 inch thick section near top of ledge; chalcedony after amorphous silica. -Weiss, 4/5/95.
	5576	Prospect 5576	Rock chip sample of partially welded, originally glassy ash flow tuff exposed in unmarked pit approximately 1m deep X 2 m wide in map unit Tau (of Byers et al., 1976). Porous tuff has been acid-leached, replaced by drusy quartz and vuggy silica. Drusy quartz along fractures and forming irregular veins, with silica filling of porosity near veins and fractures. No consistent vein orientation to measure here. -Weiss, 4/5/95.
	5577	Shaft 5577	Select dump grab sample of acid-leached rock consisting of pure SiO2 after porous ash flow tuff from unmarked shaft ~15-20 ft(?) deep, partly caved. Rock is extremely leached vuggy silica, with chalcedony, drusy quartz over chalcedony after opal. Minor cinnabar associated with dark gray silica and white opalized tuff fragments. -Weiss, 4/5/95.
	5578	Sample site 5578	Rock chip sample of poorly welded, vapor-phase crystallized ash flow tuff (Tcr) with pervasive strong red-orange iron oxide stain. Mn-Fe oxide coats fracture surfaces. Partial argillic alteration of groundmass and plagioclase and mafic phenocrysts; sanidine and biotite phenocrysts are fresh. -Weiss, 4/6/95.
	5579.1	Mammoth(?) Claims; Spicer Claims	Select dump grab sample of limonitic clayey gouge of map unit Tdf (of Byers et al., 1976). Rock is argillically altered yellow-brown to medium gray debris flow tuff from dump of main shaft. -Weiss, 4/6/95.
	5579.2	Mammoth(?) Claims; Spicer Claims	Outcrop rock chip sample of hematitic clayey gouge of map unit Tdf (of Byers et al., 1976). Rock is argillically altered deep ocherous red and light gray debris flow tuff from outcrop about 20 feet SW of main shaft of sample #5579.1 -Weiss, 4/6/95.
	5580	Mammoth(?) Claims; Spicer Claims	Rock chip sample of silicified gouge of map unit Tdf (of Byers et al., 1976) from footwall of slickensided fault surface. Silica and iron oxide. Fault surface trends N30E, 58SE; fault places Tma to SE against Tdf to NW. -Weiss, 4/6/95.
Trappmans			

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5110	Jimmie Burns Claim (M.S. 3766)	Gossany quartz vein with clots and points of limonite/goethite, some hematite-after-pyrite clots, deep red-brown gossan with clear quartz crystals in vugs, kaolinized granitic wall rock. North adit, Trappmans prospects
	5111	Bonanza Claim (M.S. 3766)	White bull-quartz from shaft dump; no signs of metallic mineralization except for gossan clots, hematite-after-pyrite cubes; wall rock silicified granitic. Trappman's prospects
	5112	Bonanza Claim (M.S. 3766)	Vuggy vein quartz with red-brown gossan clots; some Mnox, spongy quartz with gossan filling vugs, minor calcite. Trappmans prospects
	5352	Prospect 5352	Select rock chip sample from shallow cut (<1m X 1m X 2m) by road. Rock is sheared quartz vein and granite with oxidized pyrite, and sparse yellow-green phase as coating. Trace of chrysocolla, abundant brown limonite; can't see much except sheared granitic gneiss/pegmatitic body. -Weiss 5/25/95
	5353	Prospect 5353	Select dump sample from shallow pit (~2m X 2.5m X 0.8m deep). Sample consists of two types of quartz vein material: (A) fine grained drusy quartz with abundant delicate boxworks after sulfides? and minor yellow coatings, and (B) medium grained granular quartz with abundant brown limonite. Type A cuts and fills voids in type B. Pit exposes N25°E, 60°NW fault/shear zone about 1 m wide in weakly foliated granitic gneiss. and granite with oxidized pyrite, and sparse yellow-green phase as coating. Trace of chrysocolla, abundant brown limonite; can't see much except sheared granitic gneiss/pegmatitic body. -Weiss 5/25/95
	5354	Bonanza Claim (M.S. 3766)	Select dump grab sample from shallow cut shown as an adit located about 1000 feet north of main shafts. Sample consists of sheared quartz and granite along flat-lying, east-dipping shear. Trace of greenish copper arsenate?. Gently E-dipping (~ 20°) shear with granular coarse quartz, dark brownish red with iron oxides. -Weiss 5/25/95.
Wagner			
	4170	north shaft	Hematite-stained quartzite breccia cemented with clear, crystalline quartz; some clear, emerald-green, malachite stained quartz crystals, minor azurite with quartz in breccia matrix; some chrysocolla, both massive and crystalline
	4171	Cuprite patented Claim -camp outcrop	Silicified shale and quartzite, breccia zone with abundant iron-oxide gossan; breccia cemented with quartz and calcite; some chrysocolla and malachite crystals; abundant pale-green copper-arsenic mineral (conichalcite)
	4172	Cuprite patented Claim -main shaft	Greenish, fissile shale, worm-tube casts on partings; clots of specular hematite with clear calcite crystals on surface, silica veining, some veinlets and disseminations of fine-grained sulfide--mainly chalcopyrite
	4173	Chalcocite #2 patented Claim -south Prospect	Silicified shaly rock, some quartzite, massive jasperoid with red-brown hematite-after-pyrite casts, some Mn-oxides and possible chalcocite (?), some chrysocolla lenses and veinlets
	4174	Chalcocite #2 patented Claim -south shaft	Quartzite and chalky, kaolinized shale with blue and green copper-carbonate minerals along partings, lenses of melaconite in narrow, cross-cutting fractures; thin veinlets of malachite/azurite/chrysocolla cut rock.
Wellington			
	5132	Prospect 5132	Silicified rhyolite tuff, laced with clear quartz veinlets up to 1-inch thick; pyrite, quartz crystals drusy on fracture surfaces, stockwork quartz veining, some hematite/limonite-after-pyrite casts up to 1/2-inch across, amber jarosite coatings
	5133	Hope Now-Hope Next, main shaft	Rhyolite tuff, silicified and iron-oxide-stained, quartz veining, stockworks, pyrite clots and limonite-after-pyrite, vuggy quartz
	5547	Bellows Adit	Sheared, re-cemented white and clear, vitreous vein quartz with iron- and manganese-oxides coating fracture surfaces; vuggy, clear quartz crystals line vugs; 1 cm-wide quartz veinlets lace wall rock
	5548		Vuggy, white quartz-calcite vein in propylitized rhyolite tuff
Wilsons			
	5108	Pittsburg Group adit	Vein quartz containing irregular clots of bornite(?); vein material is vuggy with euhedral clear and smoky quartz crystals lining vugs, steely metallic mineral, possibly Mnox or specular hematite is present; sample collected from large dump at mouth of S-trending adit
	5109	Pittsburg Group shaft	Sheared, re-cemented vein quartz, vugs and fracture surfaces coated with acicular quartz crystals and adularia crystals, 2-foot-thick section of vein center is rich in Mnox, some earthy-green Cuox-staining; vein cuts silicified, sericitized dacite (?).

MINING DISTRICT	SAMPLE NO.	DEPOSIT NAME	DESCRIPTION
	5351	Shaft 5351	Select dump grab sample from shallow (<20m) decline located south of Wilsons Camp. Quartz vein with minor secondary copper - chrysocolla?, abundant Mn oxides, iron oxides after sulfides? Vein is 0.5 m wide, N70°E, dip steep to SE, vuggy, fine grained drusy clear quartz and fine grained, granular, bluish quartz, boxwork after sulfides, faintly crustiform, banded. Vein cuts adularized breccia of rocks assigned to map unit Ta/Tea. Abundant brown and gray granular calcite in same vein exposed in 1 m deep pit ~20 m to the west. -Weiss 5/25/95
	5355	Adit 5355	Rock chip composite sample of quartz vein, vein-cemented breccia and stockwork-veined volcanic wallrock taken across ~8 m of a N60°E-trending vein/sheeted vein and vein/breccia zone. Sample consists of ` 75%vein, 25% silicified wallrock, and is located about 165 from main adit. -Weiss, 6/20/95
	5356	Sample site 5356	Composite rock chip sample across ~2 m of a N60°E, 77°S-trending vein and sheeted vein zone of quartz with altered wallrock fragments. Sample consists of ` 75% vein, 25% wallrock, Vein is nicely banded with medium to coarse-grained comb quartz and relict boxwork after carbonate. Veins cut silicified and adularized(?) intermediate lava (unit Td). Vein makes at least two en echelon N-steps to west; and can be traced ~ 400-500' overall. -Weiss, 6/20/95
	5357	Sample site 5357	Composite rock chip sample across ~3 m width of vein, sheeted veins, vein-cemented breccia, and silicified wallrock with veinlets. Veins vary from clear, white, banded medium -grained comb quartz with boxwork after carbonate to medium-to coarse-grained drusy comb quartz projecting in from vein walls. Wallrock is highly silicified and adularized sheared ash flow tuff of lithic-poor Tea-type rock. Sample consists of 75% vein, 25% wallrock. -Weiss, 6/21/95
	5358	Sample site 5358	Composite rock chip sample across ~3-4 m-wide vein and vein-cemented breccia zone. Vein + breccia zone trends ~N70°E, 45°N. Quartz is medium-grained comb to granular, clear to white, commonly drusy. Crude cockade structure is developed where quartz bands crustify wallrock fragments. Wallrock is probably adularized, then propylitically altered farther away. Vein is part of a sheeted vein zone about 100 feet wide, see photos ~ 200 feet to southwest. Sample consists of ~50% vein, 50 % silicified wallrock of brecciated Tea. -Weiss, 6/21/95.
	5646	Prospect 5646	Rock chip sample from 1-m wide quartz vein in sheeted vein zone west of main adit up near top of ridge. Veins are spaced 0.5-1 m apart, composed largely of granular, medium grained clear quartz with trace malachite and trace oxides after sulfides. Vein orientation = N60°-70°W, 65°-80°NW. -Weiss 5/25/95
	5647	Prospect 5647	Rock chip sample from ~1 m of a large area (10 X 30 m, NE-SW) of quartz vein and vein-cemented breccia with locally abundant, medium to coarse grained brown calcite, granular to thinly bladed, often leached. Quartz varies from coarse drusy to fine grained granular; weak banding. Collected from ridge top east of main shaft. -Weiss 5/25/95
	5648	Adit 5648	Dump grab sample from adit near ridge top east of main adit , of quartz plus brown calcite. Adit was driven, (probably about 200 feet estimated length) to SE to intersect vein zone at sample site 5647. Variable quartz and calcite grain size and texture, similar to 5647. -Weiss 5/25/95
	5649	Sample site 5649	Select rock chip sample from 6-8 cm wide quartz vein located NW of main adit. Vein is one of 3-4 subparallel veins < 10 cm wide in adularized, silicified ash flow tuff, forms resistant low ridge. Vein orientation is N45°E, vertical. Trace of light pink amorphous or anhedral mineral present, interstitial in coarse grained comb quartz, possibly rhodochrosite? -Weiss 5/25/95
	5741	Wilsons Camp	Rock chip sample across 40 m-wide silicified and sheeted zone trending N30 E, in ash flow tuff zone 130-140 m wide, silicified and cut by sheeted quartz veins 1 m thick to several cm, vertical to NW-dipping. Locally vugs with 2-4 cm quartz crystals; carbonate replacement + brown calcite, crustiform banding, classic low-sulfidation system. Host rock type is silicified and potassically altered Tuff of Antelope Springs(?) intercalated with waterlaid sediments. Mineralization consists of pyrite, Mn oxides, quartz veins. - H. F. Bonham, 5/25/95.
	5742	Wilsons Camp	Rock chip sample across sheeted vein zone in dacite, 2-3 m wide here, but probably is margin of a wider major zone of 5742. Coarse adularia, crustiform quartz, silicified dacite, abundant calcite replacement textures. Potassic alteration, Fe and Mn oxides present. - H. F. Bonham, 5/25/95.
Yucca Mountain			
	5815		Siliceous sinter, silicified sediments and ash-flow tuff, iron-oxides

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
District	Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Antelope	5152	0.614	37.8	0.022	677	-5	0.275	2	-1	0.033	52	-5	110	3	6.26	-0.2	0.7	-0.02	2	0.021	31	0.16	0.014	17.9	-500	6	20	-5
Springs	5153	0.972	28.6	0.106	1975	-5	0.278	2	-1	0.1	58	-5	110	3	6.53	0.6	0.7	0.094	3	0.109	34	0.16	0.022	7.31	-500	7	20	-5
	5154	0.39	72.9	0.616	267	-5	0.384	2	-1	0.028	28	-5	170	3	3.89	0.4	1.5	0.335	1	0.156	16	0.1	0.003	36	-500	3	10	-5
	5155	2.87	46.2	0.075	104	-5	0.637	2	-1	0.026	39	-5	120	4	3.07	0.6	1.9	0.361	2	0.388	23	0.17	0.004	70.7	-500	8	10	-5
	5156	2.77	29.6	0.061	141	-5	0.946	3	-1	0.039	46	-5	130	3	2.71	0.6	0.9	0.09	2	0.202	26	0.19	0.006	120	-500	6	10	-5
	5157	143	39.9	1.54	593	-5	0.463	6	-1	0.038	44	-5	140	4	2.6	0.5	0.9	0.183	3	4.14	26	0.15	0.009	35.2	-500	6	10	-5
	5158	1.86	150	0.589	167	-5	0.682	3	-1	0.311	30	-5	160	3	4.36	0.5	1.3	0.045	1	0.918	16	0.14	0.012	83.5	-500	3	10	6
	5171	31.1	108	0.581	3655	-5	5.74	5	-1	0.077	28	-5	230	-3	140	0.4	1.6	0.319	1	3.79	15	0.12	0.012	182	-500	4	10	-5
	5172	0.852	27.4	0.011	283	-5	0.37	2	-1	0.027	38	-5	180	-3	5.17	0.4	0.6	0.276	2	0.032	24	0.1	0.014	18.7	-500	5	10	-5
	5273	208	31.3	1.34	223	-5	0.68	1	-1	0.863	39	-5	280	-3	340	0.7	0.5	0.38	1	1.04	21	0.12	0.016	68.2	-500	7	10	8
	5274	332	48.3	0.466	330	-5	6.1	3	-1	0.905	40	-5	260	-3	2288	0.2	0.7	0.389	1	0.52	23	0.22	0.017	257	-500	6	10	11
	5277	8.08	121	13.2	455	5	0.954	-1	-1	0.068	18	-5	210	4	11.2	0.2	4.4	0.649	1	1.5	10	0.06	0.011	60.8	-500	3	-10	7
	5278	0.804	9.88	0.712	790	-5	0.422	1	-1	0.04	54	5	130	6	8.94	0.7	1.7	0.818	3	0.234	32	0.13	0.093	22.2	-500	8	20	7
	5282	1.95	98.1	0.095	1112	-5	1.5	3	-1	0.163	21	-5	130	-3	8.64	0.3	1.7	0.384	1	0.026	13	0.1	0.004	146	-500	3	-10	-5
	5283	45.9	148	0.53	334	-5	1.9	9	-1	0.146	27	-5	370	3	11.4	0.4	1.5	0.846	2	0.075	16	0.09	0.012	166	-500	4	10	8
	5284	589	129	0.973	816	-5	3.68	3	-1	6.53	15	-5	320	-3	4995	-0.2	1.4	0.412	1	0.936	9	0.06	0.007	120	-500	2	-10	5
	5285	3.09	161	0.251	253	-5	0.53	3	-1	0.056	39	-5	250	-3	7.67	0.4	1.5	0.328	2	0.053	23	0.13	0.015	18.4	-500	5	10	5
	5295	5.06	23.8	0.042	41	-5	0.543	2	-1	0.051	67	-5	170	6	7.25	0.7	0.7	0.513	4	0.052	38	0.22	0.005	27.3	-500	12	20	6
	5296	0.592	23.2	0.024	160	-5	0.466	2	-1	0.018	59	-5	30	14	7.46	0.4	0.6	0.312	4	0.045	33	0.22	0.005	18.6	-500	12	20	-5
	5297	29.1	113	0.678	332	-5	1.16	3	-1	0.028	26	-5	360	-3	90.4	0.2	0.9	0.621	2	0.639	15	0.11	0.006	101	-500	5	10	8
	5298	12.9	80.6	0.156	763	-5	0.963	2	-1	0.086	32	-5	230	-3	144	0.5	1.4	0.326	1	1.44	17	0.11	0.007	74.8	-500	5	10	6
	5299	28	276	0.094	158	-5	0.827	4	-1	0.151	28	-5	350	3	432	0.8	1.6	0.587	1	9.51	17	-0.05	0.007	84.6	800	4	10	5
	5300	2204	159	4.24	766	-5	30	-1	-1	3.07	31	-5	180	4	1188	0.5	3.3	0.185	2	3.3	19	0.11	0.015	65.1	-500	5	10	9
	5301	4419	188	30.9	746	-5	29.7	-1	-1	49.7	37	5	220	3	3004	0.7	5.8	0.62	3	2.83	26	0.21	0.059	863	-500	11	10	8
	5302	-5.85	3.98	0.006	685	-5	0.092	-1	-1	-0.151	75	-5	160	6	-1.34	0.7	0.8	0.507	4	0.022	42	0.23	0.011	3.47	600	11	30	8
	5332	0.374	29.8	0.008	241	-5	0.283	2	-1	0.022	81	-5	60	6	1.83	0.7	0.8	0.246	4	0.06	47	0.32	0.010	4.52	600	16	30	5
	5333	0.982	68.3	0.056	304	-5	0.758	2	-1	0.052	29	-5	120	4	4.22	0.4	0.9	0.264	1	0.152	18	0.14	0.061	71.9	-500	3	10	6
	5544	192	706	0.562	589	6	1.86	24	-1	3.51	22	7	150	-3	9976	1	3	0.631	-1	236	14	0.09	0.454	327	2300	2	10	9
	5545	22.4	287	0.27	3185	6	1.8	1	-1	0.532	111	11	150	-3	-10.2	0.8	4.7	0.249	3	0.083	57	0.42	0.060	114	-500	19	40	9
	5546	64.1	193	9.49	7546	6	2.02	1	-1	0.956	11	-5	380	-3	2774	0.3	1.8	0.366	-1	2.11	6	-0.05	0.010	32.6	-500	-2	-10	8
	5650	0.405	3.48	0.006	-10	-5	0.259	2	-1	0.008	11	-5	220	-3	1.06	0.2	0.2	0.168	-1	-0.015	6	-0.05	-0.002	2.77	-500	2	-10	6
	5651	0.718	39.9	0.03	279	-5	0.312	1	-1	0.043	16	-5	250	-3	6.45	0.3	1.1	0.451	1	0.188	9	-0.05	0.004	9.04	-500	2	-10	-5
	5652	1.05	17.5	2.38	323	-5	0.282	2	-1	0.019	17	-5	80	3	1.37	-0.2	0.8	0.206	1	0.06	10	0.07	0.003	8.54	-500	2	-10	-5
	5653	6.7	76.4	0.571	-10	-5	1.53	3	-1	0.776	34	-5	140	5	5.54	0.7	0.9	0.496	2	1.37	19	0.12	0.150	152	-500	5	10	17
	5654	9.23	52.8	2.3	-10	-5	3.56	3	-1	1.46	23	-5	130	3	6.83	0.4	1.3	0.174	1	0.545	13	0.12	0.022	289	-500	3	10	28
Antelope	5303	-1.39	20	0.004	196	5	0.568	-1	-1	1.4	81	10	240	-3	4.34	1.2	1.2	0.119	2	0.104	46	0.26	1.370	14.9	-500	11	30	19
Springs	5532	874	50.2	0.062	109	-5	2.19	42	-1	3.05	119	-5	220	-3	3781	1.1	0.8	0.494	3	0.374	84	0.22	0.011	67.2	700	9	40	8
west	5533	250	36.5	0.576	7557	-5	59.2	1	-1	1.82	11	-5	330	-3	1431	0.3	0.9	0.346	-1	0.944	7	-0.05	0.005	39.4	-500	-2	-10	9
	5534	26.6	13.2	0.036	481	-5	1.69	1	-1	1.49	47	-5	190	-3	160	0.8	0.7	0.332	1	0.445	25	0.16	0.008	12	-500	3	20	9
	5535	167	54.7	0.324	760	-5	10	1	-1	0.157	6	-5	450	-3	892	0.3	1.7	0.431	1	0.298	3	-0.05	0.006	20.3	-500	4	-10	8
	5536	-0.228	77.2	0.002	1594	-5	4.91	1	-1	0.065	86	-5	30	-3	27.2	0.6	11.5	15.6	3	0.188	59	0.12	0.007	19.9	-500	10	20	-5
	5537	2.63	8.16	0.008	617	-5	0.684	1	-1	0.12	3	-5	460	-3	20.5	0.2	1.1	0.289	-1	0.079	2	-0.05	0.040	27.3	-500	-2	-10	7
	5538	342	63.7	1.08	1451	-5	9.83	10	-1	6.04	24	-5	220	3	1874	0.6	0.7	0.376	1	6	14	0.08	0.009	7.31	1000	4	10	8
	5539	-0.579	8.06	0.0003	4221	5	0.189	2	38	0.148	92	16	160	-3	-0.75	1.6	5.6	1.16	3	1.17	53	0.17	0.120	3.03	2100	5	30	-5
	5540	-0.044	3.1	0.001	250	-5	0.215	1	-1	0.014	3	-5	330	-3	1.74	0.2	0.3	0.203	6	0.029	2	0.16	0.036	4.57	-500	15	-10	11
	5541	0.136	12.4	0.013	11770	-5	1.75	1	-1	0.043	57	-5	130	-3	12.7	0.3	2.1	1.57	8	0.163	31	0.16	-0.002	4.6	-500	13	20	6
	5542	0.202	2.89	0.013	14036	5	0.944	1	-1	0.045	59	-5	220	-3	3.08	1.1	1.1	0.98	9	0.329	31	0.29	-0.002	4.51	-500	14	20	8
Bullfrog	5060	0	1.89	0.07	-10	-5	1.02	1	-1	-0.10	-3	-5	260	-3	7.39	-0.2	0.3	-0.5	-1	-0.10	1	-0.05	0.002	2.50	-500	-2	-10	7
	5061	1	20.80	0.42	82	-5	0.27	-1	-1	-0.09	10	5	360	-3	12.70	0.4	0.5	-0.5	1	-0.09	5	0.05	0.192	11.20	-500	-2	-10	15
	5062	1	51.60	1.46	102	-5	-0.23	1	16	-0.09	39	-5	100	5	4.07	0.5	0.6	1.2	2	0.28	22	0.14	0.103	1.22	1200	7	10	9
	5063	0	4.56	0.14	-10	-5	0.50	1	29	-0.09	-3	-5	-10	-3	3.08	0.2	0.4	-0.5	-1	0.16	1	-0.05	0.113	0.42	-500	-2	-10	5

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
		ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Cactus Flat	5713	0.007	58.6	0.0007	734	-5	0.158	-1	-1	0.081	79	-5	30	4	1.1	0.3	0.9	1.14	3	-0.006	52	0.24	0.051	1.07	16000	17	20	13
	5714	0.086	43.3	0.031	208	5	0.275	1	-1	0.043	47	-5	200	8	3.9	0.3	0.9	1.34	2	0.211	27	0.21	0.019	1.42	700	10	20	17
	5715	0.147	16.9	0.064	97	-5	0.219	1	-1	0.035	33	-5	160	21	2.09	0.5	0.6	0.965	2	0.213	21	0.14	0.018	1.77	800	10	10	15
Cactus Peak	5265	0.05	30.4	0.002	1609	-5	0.245	-1	-1	0.062	63	6	240	-3	8.99	1.1	2.4	1.25	3	0.067	36	0.2	0.003	4.72	4500	11	20	10
	5266	0.043	3.25	0.001	1423	-5	0.163	1	-1	0.023	44	-5	180	-3	6.51	0.7	2	1.26	4	0.152	22	0.14	0.012	2.75	600	13	10	8
Cactus	5151	105	329	0.148	128	-5	12.7	30	-1	-0.14	61	-5	40	-3	502	-0.2	1.6	17.1	4	4.72	33	0.05	-0.002	6.06	9700	3	30	-5
Springs	5165	0.418	16.4	0.006	516	-5	0.281	3	-1	0.021	48	-5	80	5	2.18	0.7	1.4	0.227	5	0.005	28	0.14	0.011	11.9	700	7	10	-5
	5166	0.506	8.46	0.008	482	-5	0.392	2	-1	0.037	51	-5	70	5	1.89	0.8	0.7	0.194	4	0.022	30	0.19	0.011	19.6	900	8	20	-5
	5167	1.53	99.8	0.029	503	-5	2.18	2	-1	0.024	47	-5	110	6	9.99	0.4	5.1	0.698	2	0.115	27	0.1	0.009	276	-500	3	10	-5
	5168	8.39	35.1	0.04	719	-5	0.393	4	-1	0.023	40	-5	100	3	4.45	0.4	1.9	0.997	4	0.345	26	0.1	0.015	35.8	600	6	10	-5
	5169	0.662	9.28	0.011	225	-5	0.361	2	-1	0.015	32	-5	110	5	28.4	0.4	0.5	0.121	2	0.039	19	0.09	0.012	13.2	-500	3	10	-5
	5170	2.07	5.61	0.002	56	-5	0.353	2	-1	0.007	30	-5	150	-3	27.7	0.5	0.5	0.106	2	0.016	17	0.11	0.009	3.66	-500	4	10	-5
	5267	292	69.7	0.421	216	-5	2.81	25	-1	0.866	16	-5	440	-3	195	-0.2	1.1	0.318	-1	0.084	9	0.06	0.006	64.4	-500	3	-10	11
	5268	662	40.9	1.7	166	-5	7.84	3	-1	1.75	14	-5	160	-3	1678	0.3	1	0.172	-1	0.207	7	0.06	0.005	60.9	-500	-2	-10	8
	5269	4.55	2.88	0.033	188	-5	2.27	-1	-1	0.407	12	-5	200	-3	2.2	0.3	0.7	0.218	-1	0.169	6	-0.05	0.002	124	-500	2	-10	9
	5270	-0.228	0.312	0	646	-5	0.266	-1	-1	0.086	31	5	120	-3	3.14	0.5	0.8	0.114	3	0.039	19	0.16	-0.002	2.64	-500	10	10	5
	5271	-0.022	1.3	0	217	-5	0.907	-1	-1	0.032	90	-5	120	-3	2.19	1.1	0.4	0.212	5	0.013	49	0.23	-0.002	1.35	500	13	30	5
	5272	0.04	9.02	0.0009	111	-5	0.091	-1	-1	0.03	15	-5	220	-3	6.36	0.5	1.6	0.511	4	0.018	8	0.11	0.016	7.94	-500	12	-10	6
	5275	114	19.7	0.035	549	-5	25.4	-1	-1	135	31	-5	160	-3	430	2.2	1.1	6.69	2	66	16	-0.05	-0.002	6.19	-500	4	10	10
	5276	6.55	111	0.043	154	-5	0.646	-1	-1	-0.199	22	-5	430	-3	10.5	0.4	1.8	0.555	1	0.592	12	0.08	0.005	90.8	-500	4	10	13
	5288	5.09	61.4	0.041	192	-5	0.488	2	-1	0.033	26	-5	210	8	47.6	0.6	1.2	0.482	2	0.05	14	0.06	0.010	24	-500	3	10	8
	5289	19	41.1	0.06	273	-5	1.08	4	-1	0.081	20	-5	360	4	33.8	0.6	1	0.734	2	0.057	11	0.09	0.013	85	-500	3	10	8
	5290	1.04	29	0.009	2807	-5	0.44	4	-1	0.028	19	-5	150	-3	24.5	0.4	0.8	0.299	1	0.02	11	0.06	0.015	16.4	600	2	-10	6
	5291	1.32	88.8	0.02	2234	-5	0.693	2	-1	0.023	38	-5	220	4	50.3	0.7	1.2	0.713	3	0.04	21	0.12	0.016	43.1	700	4	10	6
	5292	2.16	21.9	0.009	827	-5	0.38	3	-1	0.048	55	-5	110	3	19.9	0.9	1.4	1.75	4	0.042	31	0.16	0.023	2.92	3500	10	20	-5
	5293	20.6	24.7	0.046	766	-5	0.45	5	-1	0.025	39	-5	150	4	26	0.7	1	0.438	3	0.028	23	0.1	0.009	14.9	500	4	10	-5
	5294	3.13	96.9	0.012	1460	-5	0.416	2	-1	0.044	13	-5	210	-3	5.05	0.2	6	1.21	-1	0.063	7	0.12	0.051	8.3	-500	-2	-10	5
	5325	5.05	23.3	0.057	58	-5	1.64	3	-1	0.016	19	-5	250	-3	3.77	0.5	0.5	0.45	1	0.116	11	-0.05	0.004	116	-500	-2	-10	5
	5326	16.3	11	0.014	68	-5	22.3	2	-1	0.231	12	-5	190	-3	712	0.4	0.5	0.407	1	0.179	7	-0.05	0.008	11.9	-500	-2	-10	-5
	5327	8.02	9.16	0.231	342	-5	0.993	2	-1	0.039	41	-5	120	-3	2	0.5	0.7	0.457	1	0.026	23	0.12	0.008	33.5	-500	5	10	-5
	5328	0.381	1947	12.4	630	-5	13.2	4	-1	0.631	41	5	20	-3	33.6	0.9	37.2	14	1	1.64	32	0.08	0.012	11.4	1000	7	10	5
	5329	0.588	-1.99	0.021	1916	-5	0.611	1	-1	0.031	79	-5	120	-3	5.6	0.6	0.6	0.638	7	0.055	59	0.24	-0.002	3.08	-500	16	20	-5
	5330	0.363	3.61	0.004	285	-5	1.19	2	-1	0.022	73	-5	200	-3	5.3	1.7	0.7	0.293	5	0.039	35	0.24	-0.002	10.6	-500	15	30	-5
	5331	1.35	17.4	0.015	208	-5	0.351	2	-1	0.003	38	-5	170	5	1.64	0.6	0.9	0.351	3	0.08	23	0.09	0.008	19	500	3	10	-5
	5394	0.082	2.48	0.011	-10	-5	0.373	1	-1	0.023	3	-5	400	-3	8.25	-0.2	0.4	0.098	3	-0.003	2	0.08	0.009	16.2	-500	13	-10	16
	5395	0.827	6.62	0.016	533	-5	0.504	1	-1	0.018	49	-5	120	-3	23.4	0.3	0.6	0.212	4	0.04	29	0.15	0.008	6.37	-500	14	10	11
	5396	0.026	2.71	0.002	277	-5	0.188	1	-1	0.027	20	-5	240	-3	1.59	-0.2	0.3	0.642	4	0.035	17	0.16	0.008	3.25	2700	16	-10	11
	5397	0.047	3.3	0.016	324	-5	0.808	1	-1	0.027	27	-5	120	-3	1.51	-0.2	0.7	0.992	4	0.044	22	0.06	0.009	2.39	1800	14	-10	10
	5398	0.03	6.84	0	349	-5	0.169	2	2	0.066	61	-5	90	4	2.56	0.6	0.9	1.02	5	0.019	40	0.15	0.018	1.44	16000	17	10	14
	5399	0.029	4.82	0	390	-5	0.186	1	-1	0.079	52	-5	120	-3	2.45	0.4	0.7	0.556	4	0.037	36	0.16	0.023	1.06	12000	17	10	17
	5526	1	2.23	0.0002	111	-5	0.618	1	-1	0.143	16	-5	310	-3	18.2	0.2	0.4	0.886	3	0.045	9	0.07	0.020	3.85	1600	13	-10	6
	5527	6.79	6.21	0.008	220	-5	0.402	-1	-1	0.086	21	6	220	-3	101	0.5	0.8	0.034	1	0.072	12	0.09	0.037	6.52	-500	3	10	10
	5528	0.728	8.52	0.002	657	5	2.3	1	-1	0.067	57	-5	310	-3	20.6	0.4	0.9	0.774	4	0.05	35	0.14	0.002	4.66	800	12	20	6
	5529	175	31.7	0.229	151	-5	2.36	-1	-1	1.4	17	-5	200	-3	191	0.8	0.5	0.416	-1	0.092	8	-0.05	0.005	234	-500	2	10	11
	5530	35.4	49.1	0.063	61	-5	15.3	1	-1	7.87	20	6	290	-3	924	0.9	1.9	0.446	6	2.77	11	0.28	-0.002	163	-500	15	10	9
	5531	10.7	17.8	0.151	306	-5	4.15	1	-1	0.012	89	6	170	-3	277	0.7	4.3	1.14	5	2.42	57	0.12	-0.002	8.88	-500	13	20	9
	5662	0.345	2.09	0.006	462	-5	0.555	2	-1	0.03	55	-5	50	4	1.28	0.5	0.3	0.321	4	0.221	33	0.32	0.003	1.58	14000	16	20	-5
	5663	0.06	55.9	0.068	1157	-5	17.6	1	-1	0.216	115	-5	20	-3	39.4	0.6	39.9	12.8	4	0.153	85	0.16	0.005	115	-500	12	20	-5
	5664	0.122	102	0.001	501	-5	0.269	4	1	0.101	75	-5	30	5	8.56	0.6	21.1	3.28	2	0.097	45	0.11	0.008	3.09	2000	3	20	-5
	5665	0.286	8.89	0.002	704	20	0.375	2	1	0.894	65	360	20	7	2.37	0.8	5.4	0.376	3	0.091	37	0.23	9.78	11.4	900	9	20	17
	5666	9.17	38.3	0.058	318	-5	1.26	4	-1	0.238	25	-5	80	-3	323	0.3	0.5	0.383	-1	0.172	13	-0.05	0.010	12.8	-500	-2	10	8

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	Ni XRF ppm
	5677	0.513	1.07	0.006	529	-5	0.236	1	-1	0.016	34	-5	90	-3	1.1	-0.2	0.1	0.245	3	0.018	28	0.1	0.002	3.67	-500	11	10	-5
	5712	4.21	181	0.522	6260	-5	10.3	1	-1	0.199	51	-5	20	-3	116	0.3	45.4	14.8	4	34.4	39	0.17	0.011	30.8	-500	19	10	16
	5816	0.119	27.8	0.007	1162	-5	0.447	1	-1	0.115	25	9	160	-3	5.05	0.5	4.7	0.103	2	0.029	14	0.15	0.055	18.1	-500	7	10	21
	5817	0.169	79.5	0.001	1067	-5	0.817	1	-1	0.029	148	-5	100	5	10.8	2.1	7.3	1.57	5	0.012	77	0.23	0.010	2.11	1700	14	50	16
	5818	0.319	8.65	0.031	365	-5	0.755	1	-1	0.098	94	-5	90	3	2278	0.6	2.7	0.418	4	-0.007	63	0.26	0.009	66.4	2100	11	30	12
	5823	0.117	5.74	0.006	290	-5	0.959	1	-1	0.24	89	5	130	-3	23.9	1.2	2.4	0.186	7	0.02	56	0.2	0.006	23.7	-500	15	30	13
	5824	1.91	36.3	0.006	989	-5	1.71	1	1	8.87	71	12	80	-3	5476	3.1	3.2	2.07	6	0.159	42	0.14	0.006	7.32	500	8	30	14
	5825	24.9	126	0.201	423	-5	13.4	-1	-1	0.177	13	14	350	-3	728	1.1	3.9	0.106	4	12.6	8	0.14	0.007	7.39	-500	15	-10	39
	5826	5.53	402	0.742	167	-5	1.56	1	-1	0.139	73	-5	30	-3	57.4	-0.2	3.3	1.46	5	9.73	55	0.3	0.007	35.5	-500	25	10	8
	5827	0.048	293	0.134	5585	-5	1.84	-1	-1	0.292	187	-5	100	-3	23.7	2	35.6	15.4	5	0.206	100	0.35	0.011	57.9	-500	13	70	15
	5828	0.016	4.15	0.002	429	-5	0.223	2	2	0.05	76	-5	110	-3	1.57	0.5	1.3	0.866	4	0.009	56	0.13	0.015	1.04	13000	17	20	15
	5829	0.023	16.3	0.0006	371	-5	0.25	1	-1	0.027	49	-5	150	-3	1.17	0.8	1.6	2	4	0.013	35	0.18	0.029	4.13	13000	15	10	18
	5830	0.026	8.74	0.0003	376	-5	0.214	1	-1	0.054	49	-5	100	3	1.63	0.3	0.9	0.823	4	0.036	37	0.11	0.022	1.25	19000	15	10	16
	5831	0.026	2.04	0	405	-5	0.224	1	-1	0.024	57	-5	190	3	1.42	0.5	0.6	0.524	3	0.016	41	0.12	0.010	1.91	14000	15	10	16
	5832	0.021	8.57	0	380	-5	0.172	1	-1	0.07	39	-5	120	-3	1.51	1	1.2	1.5	4	0.011	27	0.28	0.016	0.609	11000	15	10	15
	5842	0.024	155	0	466	-5	0.253	1	-1	0.113	72	7	110	-3	4.23	0.7	4.1	1.48	5	0.343	41	0.3	0.140	7.67	-500	15	20	12
	5843	2.1	19.8	0.006	331	-5	4.64	1	-1	0.246	55	-5	100	-3	25.8	0.8	2.9	0.368	3	0.03	34	0.14	0.016	50.5	17000	11	20	12
	5844	1.43	41.3	0.005	944	-5	3.79	2	-1	3.22	41	38	60	5	49.9	0.6	8	0.251	2	0.057	23	0.2	0.517	212	-500	7	10	17
	5845	1	23.6	0.015	330	-5	0.65	1	-1	0.3	31	-5	130	3	11.1	0.5	6.1	1.54	2	0.017	18	0.14	0.017	34.6	-500	7	10	15
	5846	0.108	5.97	0.003	1528	-5	0.202	1	-1	0.019	91	-5	190	3	8.91	0.6	3.3	4.25	4	0.075	55	0.12	0.012	3.53	1400	13	30	13
	5952	0.079	7.19	0.0003	489	-5	0.199	2	-1	0.108	61	-5	190	3	4.08	0.4	1.1	1.01	4	0.022	43	0.16	0.030	2.15	12000	16	20	16
	5954	0.044	7.24	0	518	-5	0.252	1	-1	0.094	19	-5	390	3	3.1	0.2	0.6	0.197	4	0.143	10	0.15	0.027	4.46	-500	16	-10	15
	5955	0.042	1496	0.0008	698	-5	0.257	2	1	0.203	26	7	180	-3	4.84	0.5	7.4	1.42	3	0.374	14	0.23	0.032	13.9	-500	13	10	17
Cactus	5127	0.768	27.7	0.01	806	5	5.78	-1	-1	0.949	63	-5	180	-3	75.2	0.5	3.5	3.64	5	0.989	40	0.23	0.006	6.96	2000	14	10	7
Springs	5128	0.044	191	0.0002	312	-5	0.222	1	-1	0.22	58	15	50	-3	55.2	0.6	5.6	14	4	0.087	37	0.16	0.002	30.6	500	15	10	11
west	5131	0.21	4.75	0.003	827	-5	1.37	-1	-1	0.195	95	9	240	-3	9.2	1.6	2.5	0.462	6	0.059	52	0.22	0.010	2.64	600	13	40	13
	5370	0.087	13.9	0.002	769	-5	0.489	2	4	0.075	77	9	150	5	19.4	1.5	3.8	0.572	8	0.016	39	0.48	0.033	1.87	500	20	30	30
	5371	0.166	31	0.002	1389	29	0.218	2	2	0.592	40	180	50	3	16.2	0.8	23.6	0.876	3	0.03	20	0.31	3.82	2.97	-500	8	20	86
	5372	0.106	14.9	0.006	1217	16	0.248	2	-1	0.221	49	130	90	3	23.1	1.7	26.6	0.926	7	0.029	25	0.54	0.838	2.34	600	12	20	82
	5373	0.068	4.41	0.0009	34	-5	0.612	1	-1	0.502	64	-5	110	-3	2.77	0.4	1.2	0.361	3	0.012	37	0.26	0.027	10.8	600	12	20	9
	5374	0.377	3	0.005	297	-5	0.943	2	1	0.081	56	-5	230	-3	61.9	0.5	2.4	0.801	4	0.038	34	0.14	0.010	74.3	1300	9	20	14
	5375	0.262	3.38	0.007	252	-5	1.4	2	-1	0.031	18	-5	130	-3	31.2	0.5	5.6	1.5	3	0.026	11	0.05	0.009	40.9	2300	6	-10	13
	5376	0.315	1.61	0.005	540	-5	0.46	1	-1	0.031	19	-5	170	-3	41.2	0.4	3.7	1.74	4	-0.002	11	-0.05	0.009	15.8	800	7	-10	12
	5377	0.07	0.477	0.003	140	-5	0.338	1	-1	0.036	54	-5	100	-3	9.33	-0.2	0.3	0.18	5	0.007	31	0.26	0.012	9.66	800	19	20	13
	5378	0.077	2.43	0.002	39	-5	0.748	2	-1	0.05	20	-5	230	-3	21.9	-0.2	1	0.407	3	0.016	12	0.1	0.009	63.4	700	13	-10	14
	5379	0.586	1.4	0.017	527	-5	0.688	2	-1	0.055	67	-5	130	-3	93.5	0.4	2.3	0.827	3	0.035	43	0.1	0.013	57.7	600	9	20	12
	5380	0.015	24.9	0.0003	920	7	0.397	2	-1	0.132	39	6	30	-3	5.84	0.5	25.2	1.73	4	0.03	24	0.18	0.052	10.9	1000	12	10	14
	5381	169	10.9	0.009	-10	-5	196	2	-1	2.15	17	-5	390	-3	139	-0.2	0.5	6.55	8	0.334	10	0.21	0.046	50.1	-500	32	-10	-5
	5382	4.72	21.3	0.024	40	-5	1.18	1	-1	0.035	12	-5	210	-3	4.6	-0.2	0.5	-0.103	3	1.03	7	0.19	0.010	2.85	700	14	-10	13
	5383	5.21	12.4	0.011	201	-5	4.03	1	-1	0.053	13	-5	200	-3	7.32	-0.2	0.3	0.013	2	0.441	8	0.12	0.008	3.33	8000	10	-10	11
	5384	1.92	1260	0.018	374	-5	1.55	2	-1	0.886	35	-5	30	-3	203	-0.2	5	1.8	2	0.121	30	0.09	0.016	13.8	7100	11	10	9
	5385	0.166	9.72	0.003	682	-5	0.37	2	-1	0.086	79	-5	150	-3	14.8	0.8	0.6	0.896	6	0.039	51	0.16	0.009	8.89	500	15	20	13
	5386	0.157	16.3	0.002	687	-5	0.471	2	-1	0.065	82	-5	130	-3	27.9	0.4	1.9	1.06	6	0.048	50	0.1	0.010	10.7	-500	16	30	11
	5387	0.105	2.82	0.004	735	-5	0.442	2	-1	0.094	78	-5	180	-3	14.4	0.5	2	2.2	4	0.012	47	0.1	0.010	11.1	1300	11	30	14
	5388	0.636	21.8	0.012	233	-5	1.49	2	-1	0.14	28	-5	150	-3	130	-0.2	1.1	0.44	5	0.014	16	0.09	0.009	38.8	800	11	-10	14
	5389	0.119	44.4	0.003	2199	-5	1.89	2	-1	0.076	64	-5	60	-3	284	0.6	25.1	2.48	4	0.08	39	0.15	0.014	157	900	11	20	13
	5390	0.031	33.6	0.005	1700	-5	0.654	3	-1	0.226	30	-5	40	-3	37.6	0.2	36.2	8.01	2	0.113	16	0.13	0.018	40.8	-500	8	10	9
	5391	0.142	72.4	0.011	388	-5	1.72	1	1	0.073	46	-5	80	-3	103	0.4	5.3	10.9	4	0.024	33	0.12	0.012	2.96	1800	15	10	9
	5392	0.18	318	0.079	1981	-5	9.33	1	-1	0.102	73	-5	140	-3	111	0.8	12.4	21.1	5	0.046	41	0.29	0.016	8.46	1400	17	20	16
	5393	0.077	7.11	0.003	46	-5	0.403	1	-1	0.027	11	-5	250	-3	4.54	-0.2	0.3	0.139	4	0.007	6	0.12	0.008	14	1000	13	-10	14
	5507	31.5	7.81	52.4	394	-5	5.04	1	-1	0.095	34	-5	150	-3	62.3	0.2	2.1	1.02	2	1.39	19	0.06	0.002	30.9	500	6	10	7

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
District	Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5508	0.15	6.83	0.015	145	5	0.759	1	-1	0.063	67	-5	190	-3	31.6	0.7	1.7	0.459	3	0.025	47	0.06	0.003	94.7	1100	13	20	6
	5509	0.176	2.6	0.007	1392	5	0.419	1	1	0.074	80	-5	120	-3	234	1	1.3	1.58	4	0.035	46	0.24	0.003	43.9	13000	11	30	8
	5510	0.268	4.88	0.008	472	5	0.351	1	-1	0.063	87	6	70	-3	154	1.3	1.3	1.49	4	0.07	49	0.17	-0.002	30.2	13000	8	30	9
	5511	0.137	0.956	0.003	1315	7	0.145	1	-1	0.063	40	-5	120	-3	77.8	0.6	0.8	1.54	5	0.026	25	0.12	0.004	6.04	20000	11	10	5
	5512	0.83	5.63	0.007	112	6	0.314	1	-1	0.155	85	-5	190	-3	1292	1	5.8	1.05	1	0.032	47	-0.05	0.006	24.5	2700	-2	30	14
	5513	0.059	4.37	0.0003	1131	8	0.228	1	-1	0.618	74	-5	100	-3	3.57	0.9	2.2	1.21	6	0.046	43	0.29	0.007	2.14	6300	11	30	10
	5514	0.127	1.53	0.004	391	8	0.8	1	-1	0.12	27	-5	280	-3	7.89	0.2	1.3	0.344	2	0.034	16	0.1	0.034	33.2	500	12	10	6
	5515	0.334	3.82	0.009	630	10	0.823	1	-1	0.118	72	-5	110	-3	1459	1.3	6.6	0.806	3	0.057	36	0.22	0.007	28	3900	8	30	7
	5516	0.279	14	0.006	737	10	0.45	1	-1	0.11	20	-5	90	-3	790	0.5	3	0.099	3	0.04	10	0.12	0.009	34.1	1300	10	-10	8
	5517	0.074	1.25	0.002	567	9	0.919	1	-1	0.107	50	-5	130	-3	17.8	0.4	2.7	1.16	4	0.02	29	0.23	0.011	91.1	700	12	20	7
	5518	0.045	0.413	0	1159	10	0.289	1	-1	0.043	61	8	80	-3	1.08	0.7	2.5	0.441	5	0.058	37	0.23	0.005	1.17	2900	13	20	7
	5519	0.041	0.437	0	1155	10	0.3	1	-1	0.023	65	12	80	-3	1.86	1	3.5	0.523	5	0.043	37	0.24	-0.002	1.76	3200	13	20	10
	5520	0.088	16.4	0.002	1196	-5	1.27	7	-1	0.394	36	-5	80	3	78.5	0.5	5.2	1.13	4	0.028	24	0.11	0.017	97	6800	9	10	7
	5521	0.549	28.1	0	577	-5	0.408	1	-1	0.032	48	-5	90	-3	20.7	0.6	9.7	0.853	3	0.041	26	0.12	0.002	8.86	9900	8	20	7
	5522	0.24	6.21	0.003	785	-5	0.535	1	-1	0.082	95	-5	100	-3	3.02	0.9	0.8	0.259	5	0.044	59	0.31	0.017	2.04	-500	13	30	7
	5523	0.046	3.97	0.0008	1304	-5	0.554	1	-1	0.017	63	-5	50	-3	1.81	1	4.2	1.35	4	0.029	36	0.28	0.020	10.4	1500	15	20	5
	5524	0.148	46.8	0.007	801	-5	1.01	1	-1	0.087	81	-5	150	-3	68.4	0.3	3.7	3.3	5	0.061	52	0.12	-0.002	81.8	1100	12	20	5
	5525	0.019	10.8	0	1159	8	0.185	-1	-1	0.663	43	8	40	3	111	0.8	9.3	0.685	4	0.063	25	0.22	0.051	8.28	10000	9	10	15
	5833	0.03	1.71	0	430	-5	0.238	1	-1	0.027	88	-5	70	3	0.422	0.5	0.8	0.773	5	-0.017	59	0.23	0.026	0.925	25000	18	20	13
	5834	0.024	0.075	0.0002	335	-5	0.173	1	-1	0.031	57	-5	40	-3	0.54	0.8	0.5	0.556	2	0.004	36	0.22	0.028	0.272	12000	16	20	11
	5835	0.028	6.27	0	507	-5	0.251	1	1	0.066	64	-5	50	3	1.19	1	1.9	1.7	4	0.032	45	0.23	0.030	1.08	22000	17	20	13
	5836	0.023	46.5	0.0002	-10	-5	0.203	2	39	0.197	3	-5	-10	-3	1.81	-0.2	0.1	0.113	-1	0.021	3	-0.05	0.270	0.169	-500	3	-10	12
	5953	0.019	7.76	0.0002	489	-5	0.175	1	-1	0.064	81	-5	140	3	1.69	0.4	1.6	0.844	3	0.009	50	0.36	0.027	0.794	7800	19	30	15
	5956	0.022	1.29	0.007	-10	-5	0.253	1	-1	0.023	-3	-5	240	-3	2.45	-0.2	0.3	0.03	4	0.015	1	0.07	0.008	2.45	-500	14	-10	13
	5957	0.04	98.7	0.004	283	-5	1.89	2	-1	0.067	41	-5	240	-3	6.24	-0.2	3.5	2.66	4	0.016	33	0.11	0.012	9.01	1100	15	-10	14
	5958	0.357	13	0.004	648	-5	2.03	2	-1	0.111	30	-5	140	-3	75.6	0.7	3.1	5.94	4	0.062	19	0.1	0.012	2.71	-500	11	10	13
	5959	0.214	65	0.023	1573	-5	6.27	1	-1	0.022	111	-5	60	-3	6.85	0.7	4.3	6.6	5	0.006	101	0.14	0.006	9.17	1200	16	20	10
Cedar Pass	5126	0.03	110	0	20	-5	0.055	1	-1	0.038	3	-5	230	-3	2.69	0.3	7.3	0.844	-1	0.057	1	-0.05	0.012	12.4	-500	-2	-10	12
	5707	16.6	32.8	0.127	117	-5	0.191	1	-1	0.09	53	-5	70	7	6.33	1	0.7	0.324	3	0.024	32	0.22	0.094	1.68	-500	14	20	15
	5708	0.023	2.38	0.0006	296	-5	0.644	1	1	0.114	84	-5	50	9	0.522	1.1	1.1	0.585	3	-0.007	49	0.48	0.168	0.5	7800	22	30	14
	5709	5.14	74.3	0.055	318	-5	0.897	-1	-1	0.036	41	-5	130	6	4.1	0.4	1	0.485	4	0.172	25	0.16	0.050	68	500	10	10	14
	5710	1.05	213	0.112	44	-5	0.541	1	1	0.044	40	-5	70	7	2.72	0.6	1.3	0.352	2	0.355	23	0.33	0.052	10.3	-500	12	10	15
Clarkdale	5097	0.191	0.191	0.191	-10	-5	0.191	-1	-1	0.017	60	-5	100	-3	0.699	1.1	0.4	0.115	3	0.005	34	0.38	0.04	0.416	7000	23	20	11
	5098	0.283	0.283	0.283	19	-5	0.283	-1	5	0.7	65	-5	40	5	0.86	0.9	0.5	1.79	2	0.016	34	0.44	0.542	1.52	20000	25	20	12
	5215	5.84	181	0.391	193	5	0.079	-1	-1	0.024	70	-5	210	-3	3.34	0.2	1.8	1.06	4	0.698	41	0.71	0.007	1.77	1600	27	20	9
	5216																											
	5217	0.575	0.136	0.011	16	-5	0.008	-1	-1	0.019	68	-5	70	-3	0.589	0.4	0.1	0.236	-1	0.02	79	-0.05	-0.002	0.231	1500	-2	-10	5
	5218	0.512	31.8	0.071	176	-5	0.054	-1	-1	0.018	69	-5	100	-3	1.2	0.4	0.2	0.538	4	0.066	44	0.39	0.002	1.11	700	28	10	-5
	5219																											
	5220	2.03	91	3	147	50	0.034	-1	12	3.24	22	13	110	-3	-10.4	0.4	3.8	0.576	1	7	10	0.2	1.215	2.64	-500	8	10	14
	5221	13.1	156	3.7	117	5	0.033	-1	-1	-0.243	49	-5	240	-3	-0.881	0.3	2.2	1.23	2	0.882	24	0.74	0.008	2.29	500	28	20	8
	5222	6.55	181	2.22	559	17	0.082	-1	-1	-0.009	41	9	240	-3	2.36	0.2	3.8	2.59	3	2.11	20	0.46	0.276	9.15	1100	18	10	18
	5223	2.79	43.6	0.107	210	-5	0.121	-1	-1	-0.037	55	-5	90	5	2.32	0.7	1.6	6.9	4	0.072	29	0.45	0.129	1.25	2700	25	20	9
	5224	2.18	0.711	0.251	-10	60	0.056	-1	5	0.017	-3	-5	250	-3	1.74	0.2	0.3	0.132	-1	0.083	-1	-0.05	0.150	2.24	-500	-2	-10	9
	5225	5.95	26.7	0.932	-10	150	0.061	-1	21	0.05	9	-5	50	-3	3.86	0.2	4	1.78	-1	1.81	4	0.07	1.290	1.32	-500	2	-10	4
	5226	0.854	1.94	0.122	-10	82	0.034	-1	25	0.028	-3	-5	30	-3	0.324	0.4	0.3	0.086	-1	0.113	-1	-0.05	0.431	0.561	-500	-2	-10	-5
	5227																											
	5228																											
	5229	34.8	21.7	4.06	221	9	0.315	1	-1	0.085	24	-5	330	-3	35.3	0.2	0.7	1.24	2	4.36	14	0.12	0.024	3.04	1500	12	10	19
	5230	5.69	38.6	1.09	516	15	0.138	-1	-1	0.131	63	8	180	4	15.3	1.1	1.6	1.83	3	2.3	35	0.3	0.071	0.698	4900	15	20	25
	5231	17.6	18.2	2.15	118	50	0.265	-1	-1	0.104	21	-5	210	-3	6.59	0.4	0.6	0.719	1	2.35	12	0.09	0.050	1.1	600	5	-10	22

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	Ni XRF ppm
	5232	0.025	8.94	0.001	974	-5	0.212	-1	-1	0.041	24	-5	200	-3	3.13	0.3	1.7	1.85	5	-0.015	14	0.2	0.005	0.993	-500	16	10	7
	5233	0.689	11	0.025	115	35	0.019	-1	6	0.099	39	-5	250	-3	2.35	0.2	0.6	1.45	3	0.096	19	0.24	0.261	2.28	4900	17	10	9
	5234	0.702	12.6	0.047	175	25	0.057	-1	-1	0.103	44	11	180	-3	2.43	-0.2	5.4	1.61	3	0.186	23	0.23	0.266	0.8	2700	14	20	17
	5235	0.109	8.48	0.006	488	-5	0.023	1	-1	0.017	108	-5	160	-3	1.5	0.8	1	1.82	6	0.017	61	0.53	0.009	1.76	3400	26	40	11
	5236	0.196	9.28	0.015	319	127	0.264	1	4	0.289	63	8	90	3	3.65	0.4	0.6	1.12	4	0.204	33	0.36	0.669	0.749	3900	23	20	18
	5244	0.092	80.8	0.003	208	-5	0.192	2	-1	0.042	51	-5	240	6	4.63	0.4	0.7	1.1	3	0.058	26	0.26	0.008	1.04	1100	19	20	12
	5245	1.42	16.8	0.081	255	-5	0.453	2	1	0.039	43	-5	170	4	2.29	0.3	0.5	0.535	2	0.39	24	0.12	0.012	0.706	1600	10	10	10
	5246	1.18	17.5	0.175	214	-5	0.41	2	10	0.124	30	-5	180	-3	3.74	0.4	0.4	0.836	1	0.451	17	0.12	0.109	1.57	1100	6	10	9
	5247	1.84	39.2	0.179	179	-5	0.317	1	-1	0.025	59	-5	140	-3	1.65	0.4	0.7	0.278	3	4.62	32	0.18	0.028	0.987	2500	16	20	10
	5248	0.035	4.58	0.0007	126	-5	0.231	2	-1	0.022	83	-5	330	-3	2.62	0.6	0.5	1.16	3	0.07	44	0.34	0.011	2.31	-500	26	30	9
	5249	0.352	5.72	0.024	-10	54	0.196	2	13	0.036	12	-5	90	-3	1.59	-0.2	0.2	0.72	-1	0.185	6	-0.05	0.202	0.432	800	2	-10	6
	5258	0.106	3.01	0.001	263	-5	0.233	-1	-1	0.014	71	-5	180	3	1.77	0.3	0.9	1.03	6	0.039	37	0.4	0.018	1.66	1000	32	30	7
	5259	2.89	9.92	0.818	264	200	0.031	-1	4	-0.552	33	-5	230	-3	-6.25	0.7	0.7	0.85	2	0.02	18	0.11	0.081	2.46	6000	7	10	8
	5260	296	8.95	28.1	106	231	0.295	5	-1	0.014	26	-5	130	-3	46.1	-0.2	0.6	0.515	1	17	13	0.11	0.014	0.79	-500	6	10	10
	5261	111	9.35	20.3	198	206	0.26	2	-1	0.067	19	-5	270	-3	21.2	0.2	0.5	1.22	1	3.96	8	0.18	0.058	2.94	500	5	10	16
	5262	9.64	1.96	0.73	15	58	-0.001	-1	-1	0.336	5	5	240	-3	16	0.5	0.3	0.189	-1	0.774	2	0.07	0.348	1.28	-500	2	-10	38
	5263	3.3	7.08	0.66	-10	86	0.196	1	26	0.06	6	-5	20	-3	0.488	0.2	0.3	0.797	-1	0.165	3	0.05	0.653	1.63	-500	-2	-10	6
	5264	0.988	20.7	0.04	199	-5	0.081	-1	1	0.03	63	-5	90	3	1.2	0.6	0.7	3.06	4	0.086	32	0.52	0.033	0.647	3200	36	20	9
	5304	31.5	15.3	6.95	101	54	0.22	-1	-1	0.057	18	-5	270	-3	219	0.5	0.8	0.623	1	0.74	9	0.05	0.005	1.35	700	6	-10	11
	5305																											
	5306	3.04	5.75	0.495	57	71	0.006	-1	1	0.056	14	-5	190	-3	6.6	0.2	0.4	0.705	1	0.24	8	0.06	0.071	0.727	1600	3	-10	11
	5307	1.22	3.15	0.143	72	14	0.058	-1	-1	0.012	48	-5	190	-3	1.85	0.4	0.7	0.641	4	10.6	24	0.29	0.013	0.766	9200	16	20	7
	5550	1.06	130	0.203	94	-5	0.196	2	1	0.018	55	-5	420	3	3.41	0.4	1.9	1.36	3	1.89	30	0.26	0.005	3.86	4700	19	20	15
	5551.1	0.298	236	0.023	449	6	0.204	2	-1	0.03	57	5	80	-3	2.19	0.3	9.4	4.28	4	0.815	29	0.28	0.006	2.67	700	22	20	8
	5551.2	8.68	767	0.63	158	-5	0.462	2	-1	0.15	126	5	390	-3	8.19	1.5	7.5	16.6	2	5.2	46	0.74	0.006	9.4	500	14	50	12
	5552	0.148	23.5	0.009	185	-5	0.231	3	-1	0.017	83	-5	100	-3	1.36	0.6	0.6	1.16	4	0.446	44	0.34	0.002	0.911	6100	25	30	10
	5553																											
	5554.1	0.13	36.2	0.003	324	6	0.365	3	1	0.119	46	6	500	3	5.78	0.4	0.9	1.2	3	0.962	26	0.19	0.034	3.87	3000	14	10	14
	5554.2	0.391	47.3	0.027	144	-5	0.289	1	-1	0.088	44	-5	210	-3	2.46	0.6	1.1	0.31	2	2.58	22	0.34	0.006	0.851	2200	17	10	10
	5555	0.267	21.7	0.015	109	-5	0.235	2	-1	0.066	60	-5	210	7	2.61	0.9	0.6	1.01	2	0.226	33	0.27	0.020	2.34	7300	19	20	11
	5555.1	0.136	76	0.015	57	6	0.193	2	-1	0.146	13	-5	340	4	3.37	0.3	0.6	0.373	-1	0.777	6	0.09	0.037	1.5	900	3	-10	12
	5556	0.321	2.11	0.004	-10	13	0.203	2	-1	0.068	-3	5	450	-3	4.06	0.5	0.4	0.69	-1	0.168	2	-0.05	0.072	3.74	-500	-2	-10	10
	5557	0.021	13.1	0.0005	71	-5	0.164	3	-1	0.077	66	-5	220	4	3.68	0.4	0.6	0.408	3	0.006	37	0.17	0.018	0.945	7500	13	20	10
	5558	0.132	105	0.108	477	-5	0.286	2	-1	0.116	91	-5	190	6	2.15	0.6	0.8	0.443	5	0.272	50	0.35	0.127	18.4	4400	19	30	8
	5559	0.058	69.5	0.022	226	-5	0.499	1	-1	0.045	75	5	280	4	2.5	0.6	0.8	1.11	4	0.258	44	0.29	0.011	50.9	4000	22	20	12
	5560																											
	5564.1	0.033	4.3	0	0	-5	0.269	1	-1	0.026	25	-5	60	-3	2.1	-0.2	0.5	1.06	3	0.507	22	0.21	0.001	16.7	600	14	-10	-5
	5564.2	0.049	5	0.0002	-20	-5	0.153	2	-1	0.018	10	-5	230	-3	2.45	-0.2	1.1	0.412	6	3.28	8	0.34	0.001	2.61	-500	24	-10	7
	5565																											
	5566	0.155	7.37	0.0008	857	-5	0.326	2	-1	0.023	47	5	270	3	4.85	0.6	1.5	1.35	3	0.112	32	0.18	0.003	2.35	27000	16	20	12
	5567	0.035	2.44	0.002	106	-5	0.206	3	-1	0.016	60	-5	120	-3	1.9	0.7	0.4	0.531	5	0.026	35	0.24	0.010	0.613	-500	17	20	9
	5568																											
	5569	0.099	4.01	0.0008	194	-5	0.154	2	-1	0.112	73	-5	220	-3	3.02	0.7	0.6	1.41	6	0.055	43	0.56	0.023	2.54	23000	22	20	9
	5570	0.351	1.37	0.007	63	-5	0.175	2	-1	0.193	75	-5	150	-3	1.48	0.3	0.3	0.282	5	0.269	44	0.32	0.014	0.68	600	25	20	7
	5571	0.055	10.8	0.0009	29074	-5	0.157	2	2	0.019	200	-5	580	-3	4.53	7.1	1.6	0.559	-1	0.171	67	2.99	0.001	4.73	-500	10	140	27
	5572	0.16	4.54	0.008	130	-5	0.239	3	-1	0.019	13	-5	440	-3	3.72	0.4	0.8	0.555	1	0.047	7	0.26	0.003	3.62	-500	2	-10	10
	5573																											
	5574																											
	5584	1.38	35	0.141	906	-5	0.344	1	-1	0.024	61	-5	130	-3	5.69	0.5	1.5	1.13	5	0.017	38	0.21	-0.002	0.432	22000	10	20	10
	5585	0.806	11.2	0.05	444	-5	0.264	2	-1	0.047	34	-5	190	-3	4.48	-0.2	1.2	0.716	3	0.054	22	0.14	0.002	0.657	11000	9	10	10
	5586	0.101	4.24	0.002	841	-5	0.388	-1	2	0.083	92	15	80	3	20.3	1.1	3	1.01	7	0.016	53	0.3	0.126	0.296	38000	17	30	27

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	NI XRF ppm
	5600	4.16	115	0.047	1390	518	0.187	-1	-1	3.78	97	170	130	8	40.4	1.7	9.2	2.95	2	15.5	24	1.17	3.03	3.79	-500	14	40	249
	5601	1.09	8.52	0.106	85	7	0.138	1	-1	0.007	71	-5	50	-3	0.602	0.3	0.1	0.416	1	0.099	80	0.12	0.003	0.189	1400	5	10	-5
	5602	6.01	14.9	0.896	161	34	0.244	1	-1	0.124	38	-5	210	-3	5.26	0.2	0.6	0.635	3	0.068	21	0.21	0.035	2.54	3000	14	10	8
	5603	0.133	9.84	0.002	308	9	0.268	1	-1	0.136	37	5	190	-3	4.28	0.2	0.5	0.613	4	0.033	19	0.22	0.091	0.921	1100	16	10	11
	5604	0.122	4.56	0.002	207	7	0.308	1	-1	0.108	47	-5	250	-3	3.59	-0.2	0.7	0.338	3	0.041	27	0.28	0.024	2.34	1700	17	20	10
	5605	0.07	5.11	0.0002	426	8	0.219	1	-1	0.15	211	-5	100	-3	5.42	0.8	0.8	1.21	5	0.038	32	0.36	0.083	0.928	14000	22	30	12
	5684	2.76	33.2	0.416	229	38	0.15	1	8	0.144	28	-5	120	-3	1.65	0.2	0.9	0.712	2	4.78	14	0.17	0.251	0.923	-500	11	10	-5
	5685	1.61	48.5	0.61	275	19	0.189	1	11	0.418	42	-5	110	-3	1.58	-0.2	1.4	1.93	2	4.24	20	0.28	0.474	1.34	600	16	10	5
Corral Spring	5144	0.357	2.96	0.003	-10	-5	0.236	-1	-1	-0.085	19	-5	200	4	0.859	0.4	0.3	0.16	1	0.006	10	0.1	0.015	24	-500	7	10	9
	5145	5.39	26	0.061	-10	-5	0.654	-1	-1	-0.022	37	-5	100	4	1.36	0.4	0.4	0.124	2	0.142	19	0.17	0.015	65.3	-500	11	10	7
	5281	-0.052	0.235	0.001	441	-5	0.065	-1	-1	0.052	71	-5	50	5	0.711	0.4	0.8	0.231	3	0.079	40	0.24	0.064	0.289	15000	14	20	8
Don Dale	3000	0.226	11.3	0.0009	678	-5	1.54	1	-1	0.259	46	-5	-10	-3	8.8	0.7	5	1.95	2	22.6	25	0.3	0.010	3.88	2900	11	20	11
	3001	0.065	3.49	0.0007	922	-5	0.342	1	-1	0.035	109	-5	-10	4	5.53	1.9	0.8	0.828	7	0.724	64	0.45	0.011	0.545	15000	21	40	14
	3020	12.8	73.3	0.014	573	-5	5.87	3	-1	4.37	21	-5	10	-3	2786	0.5	8.6	2.35	7	0.309	11	0.12	0.009	7.5	-500	4	10	5
	3038	0.052	19.7	0.01	237	-5	0.459	1	-1	0.074	41	-5	-10	-3	2.01	0.5	7.2	0.628	3	2.77	23	0.11	0.355	44	-500	8	10	11
	3050	290	424	0.711	528	-5	42.2	56	-1	0.416	36	-5	160	-3	492	3.3	4.3	0.291	13	32.9	39	0.22	0.011	144	1900	9	30	14
	3051	158	442	0.792	16895	-5	16.1	3	-1	0.206	24	-5	190	-3	132	0.4	1.7	0.961	7	14.1	15	0.2	0.010	245	-500	7	10	-5
	3052	2.69	503	0.048	1338	-5	0.294	1	-1	0.072	11	-5	160	-3	3.66	0.3	2.9	0.426	2	0.999	7	0.05	0.013	4.32	-500	4	-10	15
Eastern	5136	0.038	27.3	0.0005	1303	-5	0.137	-1	-1	0.146	62	30	30	-3	16.3	1.1	16	2.26	4	0.124	32	0.25	0.151	17.1	1500	9	20	26
Goldfield	5137	0.149	15.4	0.003	665	-5	0.495	-1	-1	0.194	44	-5	230	-3	4.55	0.6	1.3	1.73	4	0.288	32	0.08	-0.002	7.6	1700	13	10	10
	5334	129	8.18	0.547	668	-5	0.4	2	-1	0.173	54	-5	100	4	17	0.3	0.6	0.952	2	0.057	34	0.1	0.163	0.648	900	10	10	16
	5335	2.33	118	0.061	791	-5	0.478	1	-1	0.083	45	-5	70	-3	11.1	0.9	2.5	0.891	-1	0.03	27	0.15	0.022	18.2	8900	10	20	16
	5336	38.3	9.64	0.212	850	-5	0.314	2	-1	0.534	65	-5	110	5	25	0.9	0.5	0.778	3	0.003	41	0.17	0.028	3.08	1300	16	20	17
	5337	-0.081	3.89	0.008	2665	-5	0.23	1	19	0.148	22	-5	50	7	3.06	0.4	0.3	1.44	1	0.015	14	0.06	0.265	1.25	800	5	10	11
	5338	-0.006	0.569	0.0006	-10	-5	0.297	1	-1	0.022	-3	-5	230	-3	1.68	-0.2	0.2	0.36	-1	0.014	1	-0.05	0.020	0.661	-500	3	-10	17
	5339	5.06	19.2	0.008	801	-5	0.281	1	-1	0.08	70	6	110	6	2.42	0.9	1.1	0.767	4	0.031	47	0.11	0.197	3.99	1500	12	20	17
	5340	18.2	378	0.557	1388	-5	0.572	-1	-1	0.457	41	9	40	6	28	0.6	12.1	4.31	3	0.196	23	0.16	0.033	27.5	500	15	10	13
	5341	0.024	3.64	0.0009	591	-5	0.382	1	3	0.146	62	-5	70	10	1.6	0.6	0.5	0.848	3	0.041	41	0.18	0.168	0.452	7000	14	20	16
	5342	0.132	1.39	0.004	12	23	0.275	1	17	0.053	-3	-5	70	-3	0.759	0.2	0.2	0.424	-1	0.058	2	-0.05	0.061	0.168	-500	2	-10	13
	5343	0.03	129	0.0007	789	-5	0.356	1	-1	0.1	56	-5	30	-3	6.09	0.4	5.1	4.23	5	0.088	34	0.2	0.032	1.43	3200	17	20	14
	5344	0.476	34.1	0.459	948	-5	0.34	1	1	0.052	39	15	60	16	6.12	0.8	1.9	1.89	3	1.9	23	0.18	0.077	0.72	1000	7	10	16
	5345	0.043	14.5	0.0007	397	-5	0.36	1	-1	0.043	92	-5	30	6	1.79	1.6	0.8	1.24	3	0.138	65	0.17	0.030	0.544	14000	17	30	14
	5346	0.098	11.3	0.0004	62	-5	0.506	1	-1	0.277	48	-5	80	-3	6.29	0.4	3.9	2.49	4	1.01	27	0.36	0.017	1.23	-500	31	20	16
	5347	0.035	0.749	0.0008	-10	-5	0.297	1	-1	0.02	19	-5	150	-3	1.22	-0.2	0.2	0.544	1	0.055	13	0.11	0.015	0.461	-500	9	-10	15
	5348	5.45	32	0.127	22	-5	0.567	1	-1	0.011	48	-5	90	3	5.27	0.6	2.5	1.44	3	3.01	29	0.12	0.010	13.3	-500	8	10	14
	5349	0.031	8.93	0.013	902	-5	0.379	2	2	0.144	62	18	10	-3	8.31	2	3.7	1.91	3	0.025	38	0.16	0.072	0.422	9500	13	20	34
	5474	0.329	4.7	0.003	1614	-5	0.574	1	-1	0.062	25	5	350	-3	9.69	0.5	1.6	0.255	4	0.029	12	0.15	0.004	10.3	-500	13	10	11
	5475	0.421	39.9	0.0009	279	-5	0.499	2	-1	1.24	52	-5	320	-3	67.1	0.6	1.1	1.04	4	0.033	31	0.05	0.015	7.26	-500	10	20	12
	5476	1.78	19.7	0.016	760	-5	0.443	1	-1	0.081	44	-5	40	3	5.31	0.3	1.2	0.615	3	0.184	28	0.12	0.004	2.71	900	12	10	-5
	5477	0.269	1387	0.001	795	-5	8.21	-1	-1	0.394	19	-5	60	13	8.98	1.4	5.1	1.86	-1	3.39	10	-0.05	0.019	667	1100	1	10	9
	5478	0.073	58.4	0.419	2119	-5	0.477	1	-1	0.091	80	-5	70	-3	10.7	1.2	10.4	2.86	4	0.297	44	0.08	0.003	6.16	5600	10	30	-5
	5479	0.047	23.9	0.004	1147	-5	0.442	1	-1	0.027	51	-5	100	3	1.71	0.7	3.6	0.995	5	0.077	31	0.12	-0.001	2.62	1100	10	20	5
	5480	0.106	112	0.105	800	-5	0.531	2	-1	0.055	19	-5	290	-3	3.75	0.2	6.7	1.76	4	0.252	9	0.05	0.014	4.69	-500	10	10	8
	5481	1.24	147	0.734	1552	-5	1.63	1	-1	0.023	13	-5	140	-3	4.25	-0.2	10.4	7.93	-1	0.524	8	-0.05	0.004	4.64	-500	12	-10	7
	5482	0.554	280	3.07	2902	-5	41.8	3	-1	0.974	93	-5	40	-3	73.1	0.2	10	39.1	16	0.445	61	0.33	0.001	17.2	2400	60	20	7
	5483	0.42	23	3.53	4897	-5	2.66	1	-1	0.36	22	-5	210	-3	6.25	0.4	2.4	3.24	7	0.18	13	0.05	0.016	2.18	800	20	-10	9
	5484	0.602	82.7	1.29	9866	-5	4.86	2	-1	0.641	29	-5	270	-3	22.1	0.2	4.3	9.56	23	0.252	19	0.14	0.015	3.79	-500	29	10	11
	5485	0.14	39.4	0.002	578	-5	0.747	2	-1	0.027	14	-5	180	-3	6.39	-0.2	2.5	0.699	5	0.019	7	-0.05	0.055	3.92	2200	11	-10	9
	5902	0.035	1.28	0	664	-5	0.205	1	1	0.021	56	-5	110	3	1.84	1.1	0.5	0.943	3	0.41	38	0.2	0.019	0.398	13000	14	20	14
	5903	0.084	25	0.0009	539	-5	0.216	-1	-1	0.091	64	-5	80	6	1.21	0.8	0.5	1.61	3	0.014	41	0.22	0.118	0.517	6700	16	20	15
	5904	65.4	33.1	0.021	-10	73	0.345	1	9	0.185	-3	-5	80	-3	86.6	-0.2	0.2	7.12	-1	0.195	1	-0.05	8.40	13.3	1100	3	-10	12

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	Ni XRF ppm
	5905	-0.103	1.41	0	-10	6	0.21	1	-1	0.027	45	-5	20	3	0.721	-0.2	0.8	0.645	7	0.023	27	0.42	0.054	0.456	27000	53	20	13
	5906	-0.009	9.57	0.0002	-10	5	0.322	2	-1	0.105	66	-5	50	4	0.657	0.3	0.7	0.477	6	0.653	29	0.73	0.293	4.34	26000	55	20	16
	5907	0.029	7.57	0.0008	-10	-5	0.302	-1	-1	0.159	86	-5	20	6	1.02	0.3	2.1	1.67	8	0.223	55	0.59	0.101	3.1	18000	52	30	15
	5908	0.415	2.57	0.004	-10	29	0.212	1	4	0.039	-3	-5	150	-3	1.36	-0.2	0.2	0.018	-1	-0.005	1	-0.05	0.277	0.718	-500	2	-10	12
	5912	0.019	4.96	0.0003	-10	-5	0.197	2	1	0.032	20	-5	260	6	2.17	0.2	0.4	1.1	1	0.027	11	0.21	0.025	0.957	2400	13	10	15
	5913	0.031	1.14	0	-10	-5	0.226	1	-1	0.042	42	-5	40	4	0.386	0.3	0.4	1.21	7	0.126	25	0.28	0.016	0.441	7900	49	20	12
	5914	0.028	1.31	0	-10	-5	0.262	1	-1	0.051	45	-5	80	-3	1.12	0.8	0.6	0.316	7	0.082	23	0.45	0.014	2.16	17000	47	20	12
	5915	0.026	3.75	0.0002	-10	-5	0.249	1	-1	0.185	35	-5	360	-3	3.34	0.3	0.6	0.56	3	0.621	19	0.23	0.065	3.21	1300	24	10	16
	5917	0.04	2.16	0.0004	197	-5	0.231	1	-1	0.156	69	5	120	4	2.63	0.3	0.9	0.933	6	0.426	39	0.47	0.047	1.71	21000	52	30	17
	5918	0.04	1.3	0.006	17	-5	0.187	1	-1	0.016	26	-5	200	7	1.39	0.5	0.5	0.571	3	0.066	16	0.14	0.016	0.692	1200	11	10	13
	5919	0.015	4.98	0.0004	319	-5	0.183	1	3	0.075	56	23	20	18	10.1	1.3	5.1	2.22	4	0.178	30	0.31	0.171	1.15	5700	22	20	28
	5920	0.022	0.842	0	-10	-5	0.22	2	-1	0.044	14	-5	280	-3	1.9	-0.2	0.3	0.429	1	0.061	6	0.2	0.038	0.966	1000	13	-10	13
	5921	0.169	11.7	1.01	5763	-5	2.75	1	-1	0.045	-3	-5	200	-3	4	-0.2	1	0.803	3	0.043	3	-0.05	0.010	0.89	-500	32	-10	12
	5922	0.279	74.6	0.045	198301	-5	3.8	2	-1	0.505	108	-5	90	-3	9.95	1.2	2	1.36	21	0.316	87	0.23	0.008	2.77	600	30	20	19
	5923	0.235	42.7	0.391	6503	-5	2.32	1	-1	0.065	11	-5	140	-3	7.61	0.3	2.3	4.93	4	0.232	9	0.09	0.016	1.38	-500	28	-10	14
	5924	0.266	16.4	0.573	2326	-5	1.72	1	-1	0.054	45	-5	210	-3	4.04	0.4	1.2	0.588	43	0.161	29	0.44	0.009	3.4	-500	16	10	12
	5925	0.259	310	0.002	877	-5	130	1	-1	0.613	23	-5	60	-3	9.77	0.3	15.9	10.2	3	1.59	15	0.08	0.038	15	-500	19	10	8
	5926	0.1	41.5	0.002	779	-5	0.132	1	-1	0.165	83	-5	170	-3	30.6	1.6	11.6	22.3	5	0.183	44	0.16	0.020	4.52	-500	10	30	9
	5927	0.16	8.5	0.01	245	-5	1.4	2	1	0.249	60	-5	240	-3	5.15	0.3	0.4	0.59	4	0.037	45	0.19	0.045	5.68	-500	16	10	14
	5928	0.063	11.3	0.0006	260	-5	0.381	2	-1	0.06	54	-5	90	-3	1.3	0.5	0.7	0.494	4	0.013	33	0.16	0.007	3.76	1100	15	20	12
	5929	0.036	12.6	0.001	257	-5	0.475	1	-1	0.479	71	-5	80	-3	1.18	0.6	0.5	0.313	4	0.274	47	0.18	0.013	2.72	2500	17	20	13
	5930	0.034	27.1	0.003	1257	-5	0.19	1	-1	0.033	80	-5	130	-3	3.66	1.5	4.9	2.45	4	0.486	46	0.19	0.011	4.35	1800	10	30	11
	5931	0.407	791	7.07	2730	-5	17.3	-1	-1	2.74	238	6	50	-3	41.3	3	21.7	25.9	12	0.421	154	0.61	0.077	20.5	3800	43	70	15
	5932	0.03	334	0.011	848	-5	0.211	1	-1	0.013	84	-5	80	-3	1.86	2.3	6.3	2.32	5	0.062	43	0.33	0.008	8.7	1900	14	40	13
	5933	0.021	4.27	0.004	1528	-5	0.189	2	-1	0.024	56	-5	30	3	2.63	3.5	5	1.15	-1	0.021	29	0.12	0.007	0.943	11000	3	30	11
	5934	0.085	40.4	0.0005	2585	-5	0.276	1	-1	0.044	106	-5	40	-3	11.1	1.5	17.3	5.63	4	0.105	63	0.2	0.007	5.53	2700	10	40	9
	5935	0.052	37.2	0.003	780	-5	0.215	2	-1	0.116	53	6	110	-3	9.53	1.6	4	2.78	5	0.124	28	0.22	0.051	2.96	500	11	20	14
	5936	0.078	73.9	0.076	309	-5	0.24	1	-1	0.071	91	-5	100	-3	2.75	2.2	3.9	1.02	4	0.04	47	0.13	0.017	0.823	-500	10	40	11
	5916	0.028	2.46	0	-10	-5	0.176	2	-1	0.067	76	-5	80	3	1.24	-0.2	0.6	0.457	6	1.03	47	0.55	0.035	1.03	21000	48	30	14
Gold Crater	5100	0.462	58.5	0.009	1943	-5	0.49	-1	-1	0.078	75	-5	140	-3	6.77	0.6	1.8	1.79	6	1.25	45	0.15	0.005	1.99	800	14	20	6
	5101	5	484	0.07	1086	-5	3.16	-1	-1	0.126	69	-5	280	-3	48.5	1	1.3	1.29	6	0.214	39	0.19	0.002	3.51	500	16	20	8
	5102	49.9	79	2.41	12391	-5	17.1	4	-1	1.17	107	5	250	-3	70.4	2.1	1.6	12.9	6	148	58	0.24	0.008	10.4	-500	20	40	10
	5103	8	241	0.502	600	-5	4.82	1	-1	0.081	34	-5	210	-3	46.5	0.5	1.6	0.627	7	2.26	21	0.11	-0.002	3.29	500	17	10	5
	5177	27.4	1169	0.737	714	-5	2.21	6	-1	0.488	36	-5	210	-3	203	0.7	2.3	2.65	3	1.11	23	0.06	0.003	6.29	800	14	10	6
	5178	25.8	57.8	3.15	39	-5	3.34	2	-1	0.021	5	-5	340	-3	15.9	-0.2	0.4	0.082	4	2.39	3	0.13	-0.002	3.27	-500	13	-10	6
	5179	1.51	276	0.038	586	-5	3.18	1	-1	0.055	57	-5	220	-3	114	0.6	2.8	1.41	7	3.08	33	0.16	-0.002	4.62	-500	13	20	-5
	5180	70.6	1856	3.91	87	-5	24.8	8	-1	2E-04	7	-5	270	-3	56	0.5	2.3	0.617	2	3.5	6	0.12	-0.002	6.32	700	12	-10	-5
	5181	51.7	877	8.7	361	-5	29.8	1	-1	0.068	18	-5	170	-3	194	1.1	4.7	3.24	4	8.46	12	0.13	0.003	6.07	1800	8	-10	-5
	5182	0.001	202	0.005	185	-5	0.429	1	14	7.44	12	-5	80	-3	6.37	0.3	1.7	2.74	-1	2.9	7	0.08	0.444	15.9	1000	-2	-10	18
	5183	0.594	26	0.287	2429	-5	5.14	1	-1	0.047	58	-5	190	-3	24.7	0.5	3	1.85	4	0.564	38	0.09	0.008	2.66	-500	13	10	5
	5184	1.29	189	0.071	570	-5	1.47	1	-1	0.108	44	5	90	-3	73.8	-0.2	22.3	30	4	1.04	34	-0.05	0.008	17.6	-500	9	10	7
	5185	0.039	16.1	0	1345	-5	0.205	1	-1	0.09	95	-5	70	-3	5.86	1.3	3.1	1.46	5	0.198	55	0.24	0.010	1.93	3400	15	30	-5
	5186	0.053	474	0	1355	-5	0.88	1	-1	0.235	76	-5	110	-3	2.96	0.4	5.4	3.08	5	0.279	49	0.18	-0.002	57.4	2900	12	20	-5
	5187	0.035	109	0.0003	1525	-5	0.21	1	-1	0.047	87	-5	40	-3	5.69	0.9	7.6	2.39	4	0.049	54	0.09	-0.002	4.18	1100	11	30	-5
	5190	0.151	8.76	0.039	1152	-5	0.632	1	-1	0.086	64	5	200	-3	3.71	0.9	0.9	0.969	7	0.077	42	0.17	0.005	5.05	-500	11	20	-5
	5191	0.05	12.1	0.188	1489	-5	0.278	1	-1	0.069	66	-5	120	-3	3.66	0.9	1.1	1.55	3	1.8	41	0.14	-0.002	2.11	-500	10	20	-5
	5192	32.3	55.7	1	3706	-5	9.61	2	-1	0.432	124	-5	340	-3	11.6	1.6	1.4	5.35	9	23.3	79	0.32	-0.002	14.1	-500	29	40	9
	5193	16.6	31	0.877	6076	-5	4.08	1	-1	6.29	21	6	380	-3	23.2	0.4	1.4	2.22	8	16.9	13	0.1	-0.002	4.42	-500	21	-10	7
	5194	17.4	67.3	2.52	3622	-5	52.7	1	-1	0.062	63	-5	230	-3	18.3	0.9	1.4	3.59	5	9.56	38	0.16	0.004	6.61	600	12	20	-5
	5195	0.095	16.9	0.006	695	-5	0.193	1	-1	0.374	45	-5	210	-3	4.51	0.6	1.1	0.48	3	0.162	29	0.09	0.002	2.61	1500	8	10	-5
	5196	1.63	176	2.01	1294	-5	4.13	1	-1	1.08	33	9	440	-3	21.2	-0.2	3.2	0.967	5	20.9	19	0.15	0.141	12	-500	11	10	8

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
		ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5197	2.31	15.6	0.489	1547	-5	5.44	1	-1	0.041	38	-5	240	-3	9.21	0.4	1.3	0.157	5	3.44	23	0.19	-0.002	2.61	-500	14	10	6
	5201	0.694	43.4	0.011	152	-5	0.498	-1	-1	-0.612	8	-5	490	-3	-12.4	0.3	0.5	0.065	6	0.043	4	0.14	0.007	7.64	-500	15	-10	13
	5202	-0.034	16.2	0.033	1473	-5	0.129	1	1	-0.131	128	-5	40	-3	8.99	1.8	1.1	1.31	8	0.066	74	0.29	0.002	5.69	800	19	40	5
	5203	22	14005	0.533	1234	-5	5.81	-1	-1	0.552	63	11	280	-3	983	1.7	2.4	2.13	7	0.235	40	0.2	-0.002	3.97	1300	16	20	15
	5204	0.536	4.55	0.037	1100	-5	6.83	-1	-1	0.014	103	-5	70	-3	4.34	1.3	1	0.693	6	0.11	60	0.13	-0.002	1.42	1300	13	30	4
	5549	138	15425	7.78	411	5	11.4	17	-1	4.89	30	5	160	-3	761	1.9	4.2	0.826	-2	15	25	0.05	-0.002	3.02	1500	11	10	11
	5668	1.62	13.4	0.008	1351	-5	1.9	2	-1	0.021	10	-5	410	-3	9.83	-0.2	0.6	0.146	7	0.021	6	0.14	-0.002	5.78	-500	15	-10	9
	5669	0.052	5.33	0.001	1043	-5	0.53	1	1	0.021	102	-5	40	-3	7.17	1.2	1.1	1.62	6	0.063	61	0.25	-0.002	2.03	-500	14	30	-5
	5670	7.72	5.15	0.504	2421	-5	8.13	1	-1	0.021	20	-5	450	-3	10.3	-0.2	0.7	1.24	5	0.304	12	0.17	0.003	4.44	-500	13	-10	6
	5671	0.791	13.1	0.054	3285	-5	1.39	1	-1	0.021	40	-5	210	-3	8.47	0.6	2.6	1.58	5	0.173	23	0.18	-0.002	1.67	2100	14	10	-5
	5672	28.6	236	0.348	524	-5	9.52	1	-1	0.031	36	-5	310	-3	31.9	0.5	1.9	5.13	3	0.258	23	0.06	-0.002	4.65	1000	7	10	-5
	5673	0.65	7.02	0.008	1921	-5	1.02	1	-1	0.019	5	-5	310	-3	16.4	-0.2	1.6	0.057	5	0.027	3	0.09	0.002	4.91	-500	13	-10	5
	5674	3.93	16.9	0.04	1032	-5	0.324	1	-1	0.018	9	-5	490	-3	19.9	-0.2	0.5	0.119	5	0.373	5	0.08	-0.002	4.57	-500	14	-10	6
	5675	20.6	93.9	0.102	1177	-5	1.36	1	-1	0.03	100	-5	140	-3	32.6	1	4	3.82	6	1.62	57	0.29	0.004	2.21	4000	15	40	-5
	5676	4.02	21.7	1.23	820	-5	5.41	1	-1	0.023	23	-5	500	-3	18.5	0.4	1.7	0.149	7	2.49	12	0.24	0.002	6.59	-500	16	10	8
	5678	0.425	2.94	0.067	-10	-5	0.37	1	-1	0.028	-3	-5	470	-3	5.1	0.2	0.5	0.08	3	0.402	-1	-0.05	-0.002	5.87	-500	14	-10	7
	5679	0.423	51.5	0.021	1991	-5	0.375	1	-1	0.037	104	-5	60	-3	16.9	1	2.1	2.29	5	0.453	60	0.26	-0.002	6.64	-500	14	40	-5
	5680	4.49	52.8	0.05	1544	-5	0.792	1	-1	0.033	94	-5	100	-3	38.6	0.6	2.9	1.84	4	2.28	56	0.23	-0.002	5.14	500	13	30	-5
	5681	0.063	11	0.01	1538	-5	0.302	1	-1	0.027	110	-5	50	-3	6.82	0.9	2.8	2.6	6	0.16	70	0.19	-0.002	2.88	-500	14	30	-5
	5682	6.59	7.69	0.618	2583	-5	0.664	1	-1	0.026	17	-5	380	-3	9.66	-0.2	0.6	0.204	5	5.55	9	0.19	-0.002	5.04	-500	12	-10	-5
	5738	0.043	26.7	0	149	-5	0.273	1	-1	0.077	71	-5	110	-3	1.74	1.2	0.6	1.08	4	0.06	41	0.23	0.003	1.29	6400	13	30	8
	5739	0.072	160	0	382	5	0.285	1	-1	0.176	94	-5	90	-3	1.97	0.7	3	0.74	5	0.254	57	0.29	0.010	3.22	6200	12	30	6
	5740	57	25.9	0.679	6502	-5	12.3	4	-1	0.876	49	5	400	-3	77.4	0.7	1.5	1.2	6	27.2	28	0.16	-0.002	4.71	-500	15	20	10
Gold Range	5503	-0.035	17.2	0	324	9	-1.72	-1	-1	0.012	45	8	100	12	0.211	0.7	2.9	0.779	3	0.116	23	0.23	0.193	2.55	2200	7	10	11
	5504	0.1	223	0	204	10	-0.357	-1	-1	1.13	34	5	210	-3	2.52	0.7	11.5	2.05	1	1.64	18	0.93	0.030	9.6	1000	5	10	9
	5505	0.034	44.4	0.0006	311	9	-0.21	-1	3	0.057	56	14	60	19	1.68	1	6.5	2.54	3	0.289	30	0.39	0.148	1.74	900	7	20	7
	0594-G26	0.059	24.7	0.001	1611	-5	0.202	1	1	0.096	93	5	100	9	3.25	1	2.6	3.54	8	0.252	53	0.36	0.102	3.25	7700	15	30	11
	0395-G38	0.141	65.8	0.003	690	-5	0.302	1	-1	0.071	24	6	120	-3	20.3	0.8	1.8	0.12	2	0.082	13	0.17	0.038	2.17	-500	7	10	43
	0695-G41	0.02	69	0.0008	970	-5	0.217	-1	-1	0.013	123	-5	60	4	-3.84	0.9	2.3	1.05	7	0.326	72	0.29	0.012	0.889	6000	16	40	18
Gold Reed	5121	0.2	5.18	1.57	69	-5	0.32	-1	-1	0.02	8	5	480	-3	8.33	0.4	0.7	0.31	5	46.6	4	0.1	0.010	7.09	-500	12	-10	13
	5122	0.36	13.6	0.507	44	-5	0.514	-1	-1	0.011	6	-5	340	-3	5.59	0.4	0.4	0.062	4	0.227	3	0.1	0.005	2.1	-500	10	-10	6
	5123	0.03	0.738	0.001	443	-5	0.019	-1	1	0.051	38	10	110	-3	19	0.9	7.8	3.51	4	0.025	20	0.14	0.077	1.64	5500	14	10	16
	5124	0.032	40.3	0.004	1491	-5	0.882	-1	-1	0.024	135	6	110	-3	19.6	1.9	8.5	2.18	6	0.1	77	0.16	0.012	5.64	4700	14	40	6
	5125	0.091	21.8	0.003	1103	-5	4.83	1	-1	0.046	116	5	180	-3	8.99	1.4	3.5	0.972	6	0.487	63	0.22	0.015	2.11	7600	13	40	8
	5159	0.002	5.29	0.001	1555	-5	0.69	2	-1	0.046	134	-5	120	-3	3.05	2.2	1.2	0.422	7	1.64	71	0.26	-0.002	0.91	12000	17	60	-5
	5160	0.033	6.7	0.0005	1317	-5	0.182	2	1	0.04	88	-5	60	-3	10.3	1.2	4	4.42	6	0.277	53	0.24	0.018	1.51	22000	18	30	7
	5161	0.029	9.58	0	1198	-5	0.315	3	1	0.067	88	8	50	-3	14.4	1.5	3.9	5.73	7	0.327	49	0.25	0.080	0.753	22000	17	30	19
	5162	0.075	85.2	0.005	676	-5	0.666	2	-1	0.048	91	-5	90	-3	122	0.7	3	0.333	8	0.171	54	0.29	0.008	13.2	-500	9	30	19
	5163	0.153	125	0.004	275	-5	0.708	3	-1	1.16	61	14	100	3	36.3	1.6	4.7	0.479	3	1.16	28	0.29	0.072	6.44	-500	6	30	29
	5164	0.153	35.8	0.033	83	-5	0.348	2	-1	0.026	74	-5	90	-3	9.47	0.6	37.2	1.11	-1	0.09	47	0.26	0.005	12.3	-500	-2	20	-5
	5286	0.059	2.06	0.002	1710	-5	0.315	2	-1	0.024	70	8	250	-3	21.6	0.4	1.2	2.4	7	2.84	53	0.07	-0.002	2.72	500	18	10	12
	5287	0.128	8.17	0.001	1411	-5	0.309	1	-1	0.01	15	-5	260	-3	7.89	0.3	4.8	2.65	6	2.07	8	0.22	-0.002	6.53	-500	19	-10	7
	5655	0.026	0.449	1.94	70	-5	0.253	2	-1	0.038	15	-5	200	-3	2.22	0.2	0.2	0.167	9	0.084	8	0.11	-0.002	0.344	-500	16	-10	6
	5656	0.071	8.47	0.003	879	-5	0.302	2	-1	0.029	159	-5	120	-3	22.8	1.8	9.9	15.8	6	4.44	98	0.2	-0.002	4.71	1000	17	50	-5
	5657	0.035	13.3	0.37	1585	-5	0.439	3	-1	0.015	36	-5	100	-3	8.09	0.4	3.5	2.74	10	0.69	24	0.16	-0.002	2.66	-500	18	10	-5
	5658																											
	5659	0.057	3.27	0.001	779	-5	0.228	2	3	0.086	91	16	60	-3	10.4	1.4	3.6	2.91	6	0.076	49	0.25	0.112	0.369	15000	17	30	21
	5660	0.025	4.04	0.238	828	-5	1.57	3	-1	0.014	83	-5	60	-3	10.1	0.5	5.5	8.66	6	2.35	57	0.18	-0.002	2.1	-500	17	20	-5
	5661	0.043	6.3	0.012	742	-5	0.278	3	-1	0.034	47	-5	50	-3	96.2	0.7	29.9	2.64	3	0.209	26	0.12	0.014	2.2	1900	8	20	-5
	5711	0.052	33.7	0.002	1138	-5	0.506	1	-1	0.035	85	-5	100	-3	3.11	1.3	7.3	1.29	4	1.62	52	0.22	0.010	1.32	2100	14	30	16
	5718	0.097	6.12	0.961	96	-5	0.536	1	-1	0.158	13	-5	250	-3	4.53	0.4	0.4	0.242	16	2.43	6	0.29	0.125	4.37	-500	28	-10	23

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
District	Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5719	0.639	307	0.314	65	-5	0.511	2	-1	0.06	19	6	180	-3	44	1.8	3.6	1.09	3	0.801	12	0.12	0.096	8.17	1000	21	10	18
	5722	0.394	61.6	0.17	910	-5	0.469	2	-1	0.056	75	9	80	-3	6.06	1.7	2.4	1.23	5	0.549	42	0.18	0.042	5.48	5500	16	30	18
	5723	0.096	63.4	0.042	-10	-5	0.81	1	2	0.034	-3	8	120	-3	6.4	-0.2	1.9	0.141	-1	0.199	2	-0.05	0.023	1.78	-500	3	-10	17
	5724	0.023	7.3	0.213	413	-5	0.525	1	-1	0.027	99	-5	80	-3	5.6	0.7	1.1	2.15	8	0.264	62	0.21	0.007	0.812	4200	21	30	14
	5804	0.052	9.73	0.061	420	-5	0.503	1	-1	0.047	70	10	80	-3	-32.6	0.6	2.5	0.857	5	0.476	44	0.15	0.037	4.66	4800	15	20	17
	5805	0.179	38	0.407	63	-5	5.93	1	-1	0.119	18	5	210	-3	12.8	-0.2	3	0.593	5	5.46	11	0.15	0.067	5.86	-500	16	-10	25
	5806	0.244	62.7	0.381	55	-5	7.19	3	-1	0.025	17	-5	200	-3	10.2	0.7	0.7	0.558	7	0.495	9	0.11	0.011	1.35	900	23	-10	14
	5807	0.044	20	0.0006	310	-5	0.318	1	-1	0.015	41	-5	90	6	1.44	0.5	0.3	0.382	2	0.01	25	0.14	0.007	1.09	1300	12	10	14
	5808	0.036	5.53	0.003	-10	-5	0.201	2	1	0.02	-3	-5	140	3	1.39	-0.2	0.2	0.182	-1	0.087	1	-0.05	0.019	0.608	500	3	-10	12
	5809	0.053	32.1	0.0003	929	-5	0.522	1	-1	0.031	94	-5	50	-3	8.2	1.5	7.1	2.73	5	0.048	54	0.25	0.012	15	4700	16	30	15
	5810	0.173	49.3	0.0005	1013	-5	0.414	1	-1	0.042	83	-5	100	-3	11.7	1.8	6	5.72	5	0.158	47	0.29	0.011	11.8	3800	16	30	13
	5811	0.098	46.3	0.009	1607	-5	0.562	1	-1	0.129	104	14	70	-3	13.4	1.9	3.7	1.56	6	2.54	59	0.31	0.081	7.75	10000	16	40	17
	5812	0.174	20.4	0.019	2433	5	0.669	2	-1	0.053	118	6	160	-3	8.87	1.1	2.8	1.82	9	1.16	73	0.35	0.031	4.16	5800	26	40	18
	5813	0.052	153	0.008	209	-5	0.4	1	-1	0.048	33	-5	190	-3	7.02	0.8	2	0.744	9	0.093	19	0.2	0.030	14.1	600	23	10	17
	5814	0.073	31	0.021	416	-5	0.396	1	-1	0.037	44	-5	140	-3	24.4	0.6	6.5	4.79	7	0.144	24	0.18	0.017	5.41	1400	18	10	14
Golden Arrow	4169	13	14.50	0.04	369	-5	-0.25	1	-1	-0.10	26	-5	190	4	89.50	0.5	0.6	-0.5	2	-0.10	16	0.07	0.005	48.10	900	4	10	8
	5050	3	628.00	3.30	986	-5	1.45	-1	-1	-0.10	31	-5	170	8	253.00	0.5	1.9	1.0	2	0.83	16	0.15	0.003	14.20	600	4	10	7
	5051	26	1161.00	0.60	1938	-5	0.52	-1	-1	-0.10	37	-5	220	8	3.53	0.7	2.4	0.9	3	2.80	21	0.15	0.003	25.20	1100	7	10	10
	5052	25	1018.00	18.60	544	-5	0.50	-1	-1	-0.09	32	-5	180	-3	10.10	-0.2	13.4	9.2	1	0.10	19	0.12	0.028	28.90	1200	5	10	9
Groom	3002	0.258	2196	0.002	101	-5	0.603	1	2	0.048	5	-5	20	-3	6.54	-0.2	17.2	0.962	1	13.6	4	0.06	0.015	46.4	-500	7	-10	19
	3003	0.063	19.7	0.0007	-10	-5	0.29	2	-1	0.048	28	-5	10	-3	13.5	0.9	0.7	0.256	2	0.102	10	0.31	0.036	1.15	-500	4	10	12
	3005	0.017	17	0	-10	-5	0.154	1	38	0.05	10	-5	-10	-3	3.11	0.5	0.5	0.233	-1	0.135	5	0.07	0.018	0.039	-500	3	-10	14
	3006	166	137	0.017	2656	-5	-3.81	-10	-10	432	-227	13	-50	-20	1528	-227	1.4	2.23	11	369	-10	-227	0.016	12.8	2500	2	-227	-5
	3007	0.931	792	0.006	92467	-5	0.413	1	1	1.75	75	7	10	6	20490	1.5	3.6	0.556	9	1.55	31	0.48	0.063	0.397	-500	10	30	23
	3008	155	385	0.002	4490	-5	-2.91	5	-1	1.74	13	160	-10	-3	35106	0.2	2.5	1.03	-2	36.4	7	0.1	0.054	29.2	1000	6	-10	304
	3009	37.5	249	0.001	404	-5	-2.96	2	11	-0.427	20	100	10	3	1305	1.6	6.6	0.691	1	8.85	9	0.32	0.432	44.6	-500	6	10	88
	3010	0.298	53.4	1.22	68	-5	0.733	1	-1	0.047	15	-5	-10	-3	16.3	0.4	0.7	0.089	1	0.313	7	0.06	0.009	0.262	-500	3	-10	11
	3011	0.191	87.2	1.99	179	-5	0.877	1	1	0.045	23	-5	10	-3	4.86	0.5	2.3	0.495	3	0.408	12	0.15	0.009	0.533	-500	5	10	12
	3012	0.02	36.6	0.061	383	-5	0.203	1	-1	0.012	28	-5	10	3	1.08	0.8	1	0.161	4	0.632	14	0.16	0.007	0.188	-500	5	10	12
	3014	38	113	0.682	48	-5	9.11	1	-1	1.44	15	8	190	6	266	0.7	1	0.272	2	6.38	7	0.14	0.286	10	-500	4	-10	14
	3015	909	221	0.201	922	-5	-1.31	12	-1	26.1	-5	-5	-10	-3	334	-0.2	1.3	0.414	-1	74.5	-1	-0.05	0.008	14.8	-500	4	-10	-5
	3016	101	363	0.679	108	-5	14.4	2	-1	8.08	-5	-5	250	-3	3493	0.2	0.5	0.225	-1	35.2	1	-0.05	0.007	23.2	500	3	-10	6
	3017	142	446	4.75	497	-5	28.5	3	-1	5.88	-5	-5	10	-3	1167	0.3	1.7	0.525	1	26.8	2	-0.05	0.010	77.3	1800	3	-10	-5
	3022	0.025	599	0.002	85	-5	0.338	-1	1	0.148	17	-5	10	-3	0.293	0.4	2.6	1.08	1	6.45	8	0.08	0.059	16.6	-500	4	-10	11
	3027	0.049	311	0	238	-5	0.234	1	1	0.63	23	5	40	-3	31.4	0.3	16.7	4.78	-1	9.08	14	-0.05	0.041	2.5	1400	3	-10	16
	3028	142	104	0.078	-10	-5	0.592	25	-1	7.18	9	6	250	-3	200	-0.2	0.8	0.285	-1	21	5	-0.05	0.077	13.6	-500	3	-10	13
	3029	109	54.1	0.119	119	-5	0.285	2	-1	8.02	9	-5	230	-3	232	-0.2	1	0.093	1	16.3	5	0.07	0.114	6.55	-500	3	-10	9
	3030	76.4	111	17.9	11	-5	3.33	4	-1	1.08	10	5	210	3	110	0.6	1.6	0.162	-1	38	7	-0.05	0.166	8.55	-500	3	-10	17
	3031	0.684	131	0.011	188	-5	0.321	1	-1	0.581	23	14	10	3	12.7	0.8	4.5	0.204	4	1.06	11	0.13	0.295	15.7	-500	4	10	27
	3032	3.71	250	0.049	127	-5	0.515	1	-1	0.435	21	-5	210	3	118	0.3	4.8	0.37	2	4.28	12	0.05	0.067	13.7	-500	5	10	18
	3033	0.184	42.1	0.522	37	-5	0.542	1	-1	0.021	21	-5	10	-3	3.88	0.4	0.6	0.191	2	0.167	10	0.12	0.007	0.311	-500	4	10	13
	3034	12.1	144	1.95	130	-5	8.21	-1	-1	0.872	24	-5	-10	-3	116	0.5	0.6	0.154	3	5.07	11	0.14	0.008	2.43	500	4	10	12
	3035	0.043	5.69	0.055	-10	-5	0.293	1	-1	0.019	8	-5	-10	-3	0.84	0.3	0.6	0.093	1	0.131	4	-0.05	0.006	0.36	-500	3	-10	8
	3036	0.031	23.9	0.001	235	7	0.191	1	-1	0.067	22	-5	10	7	2.11	0.6	11.5	1.73	2	0.08	11	0.08	0.019	0.804	-500	3	10	15
	3037	0.048	76.8	0.001	1162	-5	0.206	1	-1	0.104	31	10	100	6	20.9	0.4	34.3	2.88	4	3.51	15	0.21	0.018	2.73	-500	7	10	31
	3039	37.7	470	0.001	-10	-5	-0.635	1	15	3.27	10	130	30	3	2418	1.5	8.4	0.294	-1	21.5	6	0.26	0.184	8.17	-500	4	-10	56
	3040	547	221	0.0009	155	-5	-3.45	6	-5	5.92	-10	-20	-20	-20	4354	-2	1.6	0.388	-10	102	4	-0.5	0.042	13.9	1400	2	-20	-50
	3042	106	53.8	0.0003	1994	-5	-2.43	3	1	482	6	8	-10	10	508	-0.2	1.6	3.32	-1	849	5	-0.05	0.043	1.08	-500	4	-10	63
	3043	153	1082	0.001	308	-5	-3.32	4	3	6.49	-5	26	-10	-3	1314	-0.2	11.2	0.903	-1	38.4	2	-0.05	0.045	15.9	-500	4	-10	-20
	3044	205	301	0.004	1840	-5	-2.43	6	-5	2.89	-10	260	-20	-20	43883	-2	5.9	0.52	-10	37.9	7	-0.5	0.066	24.1	900	5	-20	422
	3058	1.88	67.1	2.26	1509	-5	2.39	1	-1	0.075	11	5	-10	-3	37.7	0.7	1.6	0.164	1	1.29	5	0.05	0.008	1.61	-500	2	-10	12

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP	As ICP	Au GFAA	Ba XRF	Be AA	Bi ICP	BR INAA	CA INAA	Cd ICP	CE INAA	CO INAA	CR INAA	CS INAA	Cu ICP	EU INAA	FE INAA	Ga ICP	HF INAA	Hg CVAA	LA INAA	LU INAA	MnO XRF	Mo ICP	NA INAA	Nb XRF	ND INAA	Ni XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Jamestown	5104	0.123	6.88	0.019	1287	-5	1.12	-1	-1	0.151	90	9	60	4	8.82	1.2	3	0.343	6	0.01	53	0.24	0.003	2.68	1200	15	30	9
	5105	190	2742	9.05	785	-5	92.6	-1	-1	55.3	-3	26	80	6	34798	-0.2	7.6	-0.054	4	23	-1	-0.05	-0.002	5.48	11000	10	-10	55
	5106	1.95	432	0.131	2111	-5	2.5	-1	-1	-0.069	33	-5	210	-3	-71.5	0.4	6	0.575	5	0.495	10	0.07	-0.002	7.66	-500	11	-10	7
	5134	0.019	11.1	0	682	-5	0.122	-1	-1	0.052	25	-5	620	-3	5.22	0.2	1.3	0.379	5	2.09	13	0.09	0.012	6.19	-500	14	10	12
	5135	0.029	4.78	0	1669	-5	0.085	-1	-1	0.017	38	-5	480	-3	4.52	0.5	0.7	0.656	7	0.038	23	0.05	-0.002	6.04	-500	18	10	12
	5173	0.078	38.5	0	219	-5	0.272	1	-1	0.046	62	-5	100	3	1.98	0.6	1	0.641	5	0.076	38	0.29	0.020	1.59	-500	16	20	-5
	5174	0.067	3.71	0.002	1004	-5	0.231	1	-1	0.093	77	-5	100	3	2.75	0.6	0.8	0.338	4	0.083	47	0.28	0.011	1.37	9300	11	30	-5
	5175	0.03	5.03	0.0004	773	-5	0.218	1	-1	0.045	109	6	70	4	9.79	2.3	2.2	0.601	6	0.301	62	0.27	0.044	1.38	31000	17	40	9
	5176	0.158	14.7	0.006	2096	-5	0.244	1	-1	0.02	16	-5	320	-3	8.97	0.3	1.7	0.384	7	0.906	9	0.05	-0.002	4.7	700	16	-10	5
	5198	1.51	230	5.74	1703	-5	8.43	1	-1	0.171	22	-5	220	-3	19.1	0.3	1.2	1.69	3	4.97	13	0.15	0.009	21.2	900	12	-10	8
	5199	0.029	142	0.002	142	-5	0.307	1	-1	0.106	5	-5	340	-3	4.1	-0.2	0.8	0.318	-1	0.263	3	-0.05	0.024	11.9	-500	4	-10	8
	5205																											
	5350	190	4255	3.27	593	-5	116	-1	1	34.6	30	16	220	-3	18890	5	2.1	-0.095	-1	77.3	11	0.14	-0.002	39.8	4400	14	-10	16
	5362	0.017	70	0.0006	416	-5	0.755	2	-1	0.055	58	-5	140	-3	2.22	0.8	2.6	1.69	7	2.17	43	0.08	0.007	50.5	900	16	10	5
	5363	0.054	11.8	0.0006	2297	-5	0.326	1	1	0.118	55	-5	220	-3	8.27	0.6	0.7	2.31	5	0.947	37	0.12	0.017	2.42	-500	16	10	5
	5364	0.022	55.3	0.0005	14	-5	0.306	1	-1	0.02	-3	-5	260	-3	2.43	-0.2	1.1	0.285	1	0.005	-1	-0.05	0.002	12.3	500	5	-10	6
	5365	0.481	20.6	0.201	1934	-5	0.886	1	-1	0.145	77	-5	130	-3	2.99	0.7	0.9	1.89	4	0.13	52	0.18	0.025	2.01	5700	14	20	-5
	5366	0.161	9.55	0.01	1012	-5	0.808	-1	-1	0.104	72	-5	140	-3	3.2	0.7	0.7	1.18	5	0	48	0.2	0.014	9.01	4100	13	20	-5
	5367	0.187	7.65	0.043	1303	-5	1.24	1	-1	0.065	55	-5	190	-3	12	0.3	1.2	1.63	5	0.038	35	0.17	0.008	4.48	2400	12	10	-5
	5368	3.52	3.95	0.033	1483	-5	0.878	1	-1	0.106	86	-5	110	-3	2.59	0.6	0.5	1.22	4	0.368	54	0.19	0.015	1.63	4300	13	30	-5
	5369	0.031	5.58	0.003	664	-5	0.205	1	-1	0.069	3	-5	240	-3	3.13	-0.2	0.3	0.316	6	0.162	2	0.16	0.013	2.5	-500	20	-10	-5
	5417	3.78	272	0.207	14	-5	2.13	1	-1	0.162	29	7	310	-3	562	0.5	2.6	0.08	5	0.763	20	0.09	-0.002	9.63	-500	12	10	10
	5418	38.8	1283	2.37	2410	-5	60.6	-1	-1	-0.011	61	-5	140	-3	263	0.4	4.8	6.05	3	0.115	36	0.18	-0.002	2.42	3300	8	20	5
	5419	0.613	16.6	0.063	628	-5	2.11	1	-1	0.06	45	-5	250	-3	135	0.5	2.2	0.532	3	0.312	28	0.06	-0.002	5.92	500	10	10	-5
	5543	0.095	87.1	0.0003	1371	6	0.318	1	-1	0.036	14	-5	270	-3	6.48	0.4	4.3	5.5	8	0.239	9	-0.05	0.003	10.1	-500	22	-10	11
	5587	7.77	8.51	3.77	32	-5	26.9	1	-1	0.017	8	-5	200	-3	115	0.2	2.1	0.053	1	9.74	5	0.05	-0.002	1.16	-500	4	-10	7
	5588	0.788	6.5	0.109	1318	-5	1.58	-1	-1	0.071	92	-5	40	-3	90.5	1.1	1.3	1.4	5	0.17	59	0.2	-0.002	1.38	1400	15	30	-5
	5589	211	2539	2.01	427	-5	98	9	-1	68.5	35	17	240	-3	28502	-0.2	1.2	0.264	5	116	24	-227	-0.002	43.3	10000	13	10	14
	5590	6.11	118	0.219	626	-5	1.41	1	-1	-0.015	22	-5	330	-3	-15.6	0.3	0.3	0.916	5	0.185	15	0.12	0.003	5.43	500	17	-10	9
	5591	1.52	82.7	0.212	140	-5	3.96	6	-1	0.104	4	-5	200	-3	65.7	-0.2	6.1	1.19	3	0.215	2	-0.05	0.012	9.14	-500	12	-10	8
	5592	1.95	11.2	0.085	1511	-5	0.572	1	-1	0.026	9	-5	250	-3	0.869	0.3	2.8	0.268	5	1.21	5	0.15	-0.002	8.52	-500	20	-10	-5
	5593	0.061	10.4	0.013	1485	-5	0.429	3	2	0.203	144	-5	290	-3	2.31	1.1	1.2	0.626	9	0.031	95	0.27	0.021	2.3	7400	10	40	-5
	5594	6.44	177	5.29	1421	-5	3.66	1	-1	0.101	107	-5	210	-3	22.1	1.8	1.8	2.97	5	1.49	59	0.22	0.005	5	1000	18	50	-5
	5595	1.33	113	0.647	1358	-5	1.46	1	-1	0.04	63	-5	120	-3	87.9	0.7	4.1	8.05	5	0.093	36	0.16	-0.002	3.88	1500	12	20	-5
	5596	0.221	16.8	0.162	1271	-5	1.02	1	1	0.026	73	-5	240	-3	2.69	0.7	0.8	1.08	5	0.005	45	0.16	-0.002	4.97	5400	12	20	6
	5597	0.063	33.1	0.003	2179	-5	0.321	1	-1	0.037	72	-5	310	-3	5.89	0.5	2	0.744	7	7.52	48	0.13	0.005	5.95	-500	19	20	7
	5598	0.026	4.05	0	2078	6	0.261	1	-1	0.052	3	-5	460	-3	4.15	-0.2	0.4	0.041	5	0.065	2	0.08	0.014	4.83	-500	17	-10	7
	5599	8.44	1065	0.309	1292	6	21.1	1	-1	0.046	80	-5	30	-3	770	1.1	11.6	23.1	5	0.168	47	0.09	-0.002	3.85	2100	10	20	-5
	5638	0.342	31	0.071	1317	-5	6.07	2	-1	0.025	101	-5	100	-3	8.85	1.2	1.4	2.21	5	-0.004	59	0.22	-0.002	3.98	2600	13	30	-5
	5639	2.94	129	0.217	659	-5	2.04	1	-1	0.016	38	-5	400	-3	20.3	0.2	0.9	0.78	5	0.143	22	0.17	-0.002	5.31	800	14	10	5
	5640	0.055	93	0.0005	1098	-5	0.301	1	-1	0.049	3	-5	230	-3	4.22	0.2	6.3	0.755	5	6.44	1	0.05	0.005	9.78	-500	12	-10	5
	5641	0.039	17.7	0.0008	525	-5	0.247	1	-1	0.107	9	-5	390	-3	7.33	0.3	1.8	0.681	6	1.89	5	0.11	0.017	4.43	-500	13	-10	-5
	5642	0.036	2.53	0	649	-5	0.198	1	-1	0.097	7	-5	260	-3	3.75	0.3	0.4	0.374	7	3.62	3	0.11	0.018	1.14	-500	17	-10	-5
	5643	3.56	12.7	0.035	2875	-5	0.383	1	-1	0.107	13	-5	380	-3	6.06	0.2	1.5	1.85	7	2.88	8	0.08	0.025	10.5	-500	19	-10	5
	5644	0.04	11.5	0.001	2668	-5	0.253	1	-1	0.041	22	-5	330	-3	4.82	0.4	0.9	0.553	7	0.213	12	0.06	0.005	4.37	600	19	10	7
	5645	0.258	2.33	0.005	349	-5	0.302	1	-1	0.068	8	-5	300	-3	2.82	0.2	0.3	0.164	7	0.067	5	0.07	0.011	7.8	-500	18	-10	6
	5667	0.176	16.7	0.009	1628	-5	0.789	1	-1	0.029	88	-5	160	-3	23.2	0.6	1.6	1.47	5	-0.004	57	0.15	-0.002	11.7	-500	13	30	-5
	5683	0.045	10.9	0.001	3308	-5	1.12	-1	-1	0.036	132	-5	100	-3	26.1	0.7	1.7	2.03	6	0.021	96	0.21	-0.002	27	700	14	30	-5
Jumbled Hills	1093-G18	0.09	26.00	0.00	-25	-5	0.02	4	16	0.25	3	5	100	3	20.20	0.2	0.2	0.30	1	0.09	2	0.05	0.007	0.91	3800	-2	10	8
Limestone	5730	0.141	90.4	0.008	-10	-5	0.394	1	1	0.021	6	5	170	-3	4.32	0.2	2.5	0.409	3	0.09	3	0.06	0.009	1.6	-500	3	-10	19
Ridge	5800	0.067	30	0.0007	3171	-5	0.641	1	-1	0.384	103	12	40	-3	3.63	2.4	35.2	1.3	2	0.177	53	0.72	3.02	9.96	-500	9	40	23

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP	As ICP	Au GFAA	Ba XRF	Be AA	Bi ICP	BR INAA	CA INAA	Cd ICP	CE INAA	CO INAA	CR INAA	CS INAA	Cu ICP	EU INAA	FE INAA	Ga ICP	HF INAA	Hg CVAA	LA INAA	LU INAA	MnO XRF	Mo ICP	NA INAA	Nb XRF	ND INAA	Ni XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5801	0.212	101	0.0002	3484	13	0.714	-1	6	0.109	89	27	50	-3	8.31	3.2	30.6	0.447	1	0.145	47	3.08	3.43	28.2	-500	10	40	51
	5802	0.046	1.08	0.0002	16	-5	0.374	2	1	0.072	11	6	160	-3	3.4	0.6	1.8	0.333	2	0.06	5	0.15	0.061	2.13	-500	6	-10	21
	5803	4.73	9.04	0.001	-10	-5	0.384	1	-1	0.539	5	5	170	-3	14084	-0.2	2.3	0.541	1	0.055	2	0.05	0.012	1.36	-500	3	-10	22
	5848	0.109	71.1	0.001	6110	-5	0.199	1	1	0.107	9	-5	280	-3	8.66	-0.2	1.3	1.45	-1	0.041	4	-0.05	0.038	3.33	-500	5	-10	25
	5909	0.197	17.7	0.0007	52	-5	0.244	1	7	0.123	38	-5	230	-3	7.03	1.1	0.6	0.963	-1	0.078	22	0.35	0.031	3.12	-500	7	10	25
Mellan	5142	11.8	80.8	0.079	773	-5	0.43	1	-1	0.153	17	5	440	3	6.9	0.2	1.2	1.28	1	0.925	10	-0.05	0.019	23.7	700	4	-10	14
	5143	0.752	22.9	0.009	452	-5	0.088	-1	-1	-0.035	37	-5	300	4	2.54	0.6	0.4	0.292	1	0.16	21	0.08	0.029	3.28	700	6	10	8
	5279	14.5	23	3.03	545	-5	0.041	-1	-1	0.019	32	-5	180	5	3.32	0.8	0.7	1.68	2	0.91	19	0.08	0.009	1.1	2000	5	10	8
	5280	34.7	39.2	1.7	867	-5	0.152	-1	1	0.039	37	-5	270	4	7.77	0.7	0.7	0.706	1	1.95	20	0.07	0.019	11.5	2900	6	10	12
	5308	0.645	31.3	0.089	322	-5	0.306	2	-1	0.087	31	-5	190	5	2.82	0.4	0.3	0.516	1	0.713	19	0.09	0.008	2.88	600	3	10	11
	5309	0.237	64	0.032	609	-5	0.606	1	-1	0.08	53	11	40	13	7.09	0.5	1.6	1.86	4	0.079	31	0.17	0.049	34.4	12000	11	20	-5
	5310	2.21	26.4	1.5	36	5	0.258	3	-1	0.021	3	-5	120	-3	2.11	-0.2	0.5	0.745	-1	0.413	2	-0.05	0.011	0.776	-500	-2	-10	-5
	5311	11.5	298	0.465	1134	-5	0.458	2	-1	0.074	84	-5	70	5	6.08	0.9	3	5.18	4	5.95	49	0.19	0.007	9.17	2700	10	30	7
	5312	260	19.2	9.72	335	-5	0.322	2	-1	0.017	13	-5	110	-3	20.3	0.2	0.4	0.67	1	2.97	8	-0.05	0.007	3.02	1700	-2	-10	8
	5313	27.2	21.4	7.31	215	9	0.29	4	1	0.057	14	-5	100	3	10.4	0.2	0.5	0.765	-1	2.3	9	-0.05	0.015	1.11	600	-2	-10	-5
	5314	53.5	34.1	13.7	585	-5	0.253	3	3	0.095	13	-5	100	-3	10.4	0.2	0.4	0.534	-1	4.42	7	-0.05	0.144	2.12	600	2	-10	6
	5315	8.84	56.4	3.5	518	-5	0.423	2	2	0.068	47	-5	120	3	6.14	0.4	0.8	2.52	2	1.48	28	0.1	0.017	7.63	1500	6	10	5
	5316	0.42	20.1	0.006	841	-5	0.404	3	-1	0.117	73	-5	240	4	5.39	0.5	0.5	2.04	3	0.095	44	0.22	0.018	3.17	1400	10	20	8
	5317	57	21	6.66	201	-5	0.858	2	-1	0.027	14	-5	170	3	4.65	-0.2	0.5	2.39	-1	9.66	8	-0.05	0.021	57.3	500	3	-10	4
	5318	0.221	53.1	0.066	744	-5	0.455	5	-1	0.045	80	-5	60	27	6.91	0.9	2	2.45	4	1.18	47	0.25	0.012	16.7	11000	18	30	7
	5319	0.219	94.1	0.087	896	-5	0.497	3	-1	0.144	77	8	40	9	10.3	1	2	6.89	4	1.26	43	0.24	0.063	18.2	23000	15	30	12
	5320	0.183	34.9	0.06	453	-5	0.444	3	-1	0.016	36	-5	70	17	1.43	0.5	0.7	2.05	2	0.528	22	0.11	0.017	0.685	15000	10	10	-5
	5321	5.8	8.66	1.58	-10	-5	0.416	2	1	0.031	3	-5	140	-3	1.78	-0.2	0.2	0.465	-1	0.668	2	-0.05	0.009	17.3	-500	-2	-10	-5
	5322	50.6	32.7	3.04	629	-5	0.355	2	1	0.086	71	-5	100	8	2.77	0.6	0.5	3.27	2	21.6	42	0.15	0.027	4.81	1000	10	20	6
	5323	1.43	103	0.098	1312	-5	0.657	2	1	0.367	110	10	50	5	7.28	1	0.9	3.83	4	0.668	67	0.22	0.072	20	2300	15	40	12
	5324	4.98	112	2.76	472	-5	6.43	2	-1	0.129	40	-5	90	14	13	0.4	1.5	1.37	2	1.01	25	0.16	0.011	664	1500	9	10	-5
	5720	325	12.3	33.6	21	-5	0.345	12	-1	0.023	12	-5	130	-3	25.5	-0.2	0.2	0.513	-1	102	4	-0.05	0.012	0.85	-500	3	-10	15
Mount Helen	5634	-0.005	720	0	97	-5	0.357	-1	-1	0.112	84	-5	150	3	1.92	0.6	2.5	0.928	3	2.79	49	0.3	0.002	12.6	4300	11	30	6
	5635	0.023	99.8	0	169	-5	0.192	1	-1	0.047	89	-5	100	3	1.44	0.8	3.3	1.26	4	0.501	56	0.84	0.017	1.38	7100	13	30	-5
	5636	0.025	49.2	0.0002	30	-5	0.154	1	-1	0.044	44	-5	140	-3	1.59	0.3	0.4	0.804	3	0.031	25	0.32	0.002	1.25	10000	21	10	5
	5637	0.048	88.4	0.0004	56	5	0.227	1	-1	0.063	58	-5	100	-3	1.92	0.3	0.6	1.32	4	0.063	30	0.29	0.004	2.52	4300	26	30	5
Oak Spring	0894-G27	0.698	745	0.006	416	14	0.185	1	10	2.18	5	11	20	3	212	0.6	34.4	4.82	1	15.2	3	0.05	0.346	16.5	500	-2	10	31
	0894-G28	0.138	155	0.002	-10	-5	0.185	2	4	0.453	7	5	270	3	77.6	0.2	7.9	1.25	1	2.24	4	0.05	0.030	9.03	500	-2	10	30
	1094-G30	381	688	0.224	-20	-5	-2.63	6	**	15.3	5	17	150	3	2065	**	5.6	13	3	29.6	1	**	0.005	15.1	900	-2	10	-100
	1094-G31	71.1	5414	0.038	30	8	-1.86	2	**	22.5	5	17	130	4	918	**	6.6	6.81	3	6.57	1	**	0.006	16.3	500	-2	10	-10
Papoose	5146	57.2	157	0.12	-10	-5	-2.46	1	-1	10.3	17	-5	280	-3	6544	0.3	10.6	1.41	-1	3.58	9	0.1	0.006	17.6	-500	-2	-10	-5
	5147	81.5	327	0.223	-10	-5	68.6	1	-1	1.25	6	-5	240	-3	7304	0.3	1.1	0.497	1	5.92	3	0.05	0.005	9.66	800	-2	-10	-5
	5502	0.902	1533	0.763	36	8	1341	-1	-1	0.404	4	28	70	-3	105	0.7	42.8	10.4	-1	0.27	3	-0.05	0.089	13.1	600	-2	-10	66
	1092-1	0.02	49.90	0.00	30	-5	0.06	1	1	0.13	10	7	340	3	5.43	0.2	0.9	0.29	1	0.00	5	0.05	0.033	1.58	500	-2	10	26
	1092-2	0.02	89.30	0.00	10	-5	0.03	1	1	0.08	6	14	90	3	9.81	0.2	8.4	0.12	1	0.13	3	0.05	0.028	1.02	500	-2	10	28
	0593-G10	45.10	1342.00	0.10	96	-5	23.80	1	1	1.02	6	5	450	3	742.00	0.2	2.8	1.98	2	1.52	3	0.05	0.010	22.60	700	-2	10	-5
	0593-G11	1.20	38.60	0.00	-10	-5	29.80	2	4	0.56	20	5	200	3	25.90	0.5	1	2.06	2	0.04	11	0.09	0.002	1.14	500	2	10	5
	0593-G12	1.10	184.00	0.24	303	-5	0.15	1	1	0.04	48	5	180	3	6.16	0.5	1.8	0.58	8	0.80	24	0.21	0.001	1.40	500	5	10	7
	0593-G13	0.03	826.00	0.01	320	12	0.46	2	1	1.57	100	7	190	129	56.80	1.5	8.3	2.28	1	0.03	36	0.91	0.340	3.12	1100	7	30	47
	0593-G14	0.13	801.00	0.00	1749	-5	0.16	1	1	5.57	28	29	220	5	28.60	0.4	4.1	1.89	1	0.09	14	0.16	0.096	5.46	500	2	10	28
	0593-G15	0.06	1342.00	0.00	1135	7	0.25	7	12	0.80	34	27	30	6	16.50	0.6	10	0.97	1	-0.01	17	0.32	0.518	24.00	1200	4	10	36
	0394-G20	0.72	836.00	0.00	521	-5	0.09	2	1	0.98	97	15	140	6	255.00	4.5	12.9	1.68	3	0.06	42	0.25	0.009	6.44	500	9	60	47
	0394-G21	0.54	90.60	0.00	130	-5	2.86	1	1	0.54	14	5	420	10	86.90	0.2	2.5	1.05	2	0.13	7	0.09	0.047	4.22	500	2	10	21
	1094-G29	0.117	854	0.004	901	-5	0.444	2	7	0.994	78	16	70	3	9.79	1.6	9.3	2.15	3	0.089	30	0.86	0.700	3.64	500	4	30	26
	0295-G35	288	60.3	0.276	87	-5	419	-1	-3	5.76	-10	12	-20	-3	14403	-1	2.3	0.199	-3	6.76	-3	-1	0.007	6.13	2100	2	-20	-5
	0295-G36	0.253	236	0.004	9498	-5	2.05	2	-1	0.041	27	-5	150	-3	14.5	0.5	10.5	1.34	5	0.124	14	0.14	0.020	1.01	-500	6	10	20

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
District	Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	0295-G37	0.348	470	1.01	313	-5	625	1	-1	0.079	-3	-5	70	-3	67.6	0.2	41.3	4.51	-1	0.135	1	0.05	0.054	8.87	600	7	-10	22
Prospector	5064	0.061	0.844	0.0005	1354	-5	-0.024	-1	-1	0.012	101	17	120	4	40.1	1.5	2.8	1.8	10	0.015	49	0.57	0.024	0.14	2900	28	40	40
Fault	5065	0.017	2.73	0.0002	-10	-5	0.286	1	35	0.051	5	-5	-10	-3	0.665	-0.2	0.1	0.441	-1	0.012	3	-0.05	-0.002	0.093	-500	-2	-10	6
	5066	0.028	7.84	0	-10	-5	0.007	-1	-1	0.033	4	13	160	-3	9.61	0.4	6.5	0.276	-1	0.026	2	0.05	0.009	2.15	-500	-2	-10	33
	5067	0.109	19.7	0.0007	386	-5	0.182	-1	-1	0.052	60	6	80	-3	21.9	1.3	6.1	0.637	12	0.053	30	0.32	0.006	3.04	7300	7	20	15
	5068	0.015	1.35	0.0005	-10	-5	0.035	-1	6	0.019	-3	-5	140	-3	1.32	0.3	0.1	-0.001	-1	0.007	-1	-0.05	0.004	0.684	-500	-2	-10	6
	5070	4.48	8.78	0.002	734	-5	10.1	-1	-1	0.185	4	5	180	-3	4596	0.4	0.6	0.046	1	0.062	2	-0.05	0.019	1.51	-500	-2	-10	10
	5400	0.021	10.9	0	696	-5	0.329	1	3	0.067	18	10	60	-3	104	0.3	2.1	0.283	3	0.007	10	0.09	0.471	12.6	-500	2	10	19
	5401	-0.016	236	0.001	237	-5	0.241	1	3	0.057	15	7	190	-3	30.8	0.4	2	-0.058	4	0.012	7	0.09	0.100	4.27	-500	-2	-10	12
	5402	-0.02	-3.37	0.0006	52	16	0.146	1	-1	0.02	-3	-5	260	-3	1.87	-0.2	0.4	-0.153	-1	0.03	1	-0.05	0.021	0.88	3600	-2	-10	11
	5403	0.009	162	0	132	-5	0.218	1	17	0.237	15	9	10	-3	23.9	0.3	5	0.8	-1	0.036	6	0.08	0.340	1.2	-500	-2	-10	38
	5420	0.027	11.1	0	97	-5	0.126	1	-1	0.029	-3	5	170	-3	2.44	0.2	0.5	-0.083	-1	-0.002	-1	-0.05	0.042	0.749	-500	-2	-10	6
Quartzite	5725	0.017	24.3	0.0008	57	-5	0.243	1	-1	0.044	24	-5	140	-3	2.66	0.4	2.4	0.607	2	0.252	13	0.06	0.020	0.633	1900	4	10	19
Mountain	5726	0.041	6.94	0.0005	253	-5	0.33	1	1	0.124	47	9	130	-3	9.74	1	2.9	0.917	3	0.642	25	0.19	0.056	0.427	-500	9	20	31
	5727	0.082	7.42	0.012	-10	-5	0.498	1	-1	0.019	7	-5	180	-3	8.02	0.2	0.5	0.255	-1	11.8	3	0.05	0.012	1.46	-500	3	-10	15
	5728	0.095	9.52	0.003	270	-5	0.414	1	-1	0.022	89	-5	130	-3	13	0.8	0.9	0.668	12	6.03	45	0.4	0.008	1.41	-500	7	30	19
	5729	0.075	35	0.0009	258	-5	0.756	1	-1	0.122	103	7	120	3	4.7	1.8	1.9	0.519	10	8.86	56	0.43	0.021	0.682	-500	11	40	28
Queen City	5840	2.25	7.49	0.083	572	-5	0.193	1	1	0.065	34	-5	210	-3	18.7	0.3	4.6	1.49	6	0.068	21	0.16	0.012	5.14	600	16	10	15
	5841	0.017	17.8	0	462	-5	0.241	2	-1	0.075	56	13	110	-3	2.93	0.6	5.6	1.19	4	0.232	32	0.32	0.165	4.82	-500	13	20	15
Rainstorm	0593-G16	1.34	8.46	0.01	-10	-5	78.40	1	1	0.08	3	10	440	3	15.50	0.2	2.1	0.15	1	0.42	1	0.05	0.082	17.20	500	-2	10	10
	0394-G22	0.68	97.80	0.25	352	-5	20.40	3	1	0.93	26	8	370	3	84.90	0.5	10.4	3.54	3	0.46	12	0.13	0.037	3.71	500	4	10	15
	0394-G23	3.10	525.00	1.40	10	-5	52.50	1	1	2.93	13	11	420	3	75.50	0.2	20.9	1.89	1	0.07	7	0.05	0.018	25.00	500	-2	10	32
	0394-G24	0.03	300.00	0.00	151	-5	0.15	1	1	6.72	27	47	90	5	41.20	0.4	33.1	3.66	1	0.08	15	0.05	0.289	11.00	500	2	10	75
	0394-G25	2.51	429.00	0.06	-10	-5	8.59	11	1	2.56	30	5	400	6	500.00	1.4	4.7	13.70	5	1.58	13	0.26	0.015	16.80	3100	3	10	28
	0795-G42	0.033	17.2	0	-10	-5	0.186	1	-1	0.164	12	-5	140	-3	3.85	0.2	0.6	0.102	1	0.043	6	0.07	0.023	0.499	-500	3	-10	15
	0795-G43	5.38	465	0.057	16598	-5	0.378	-1	-1	3.15	21	59	90	-3	222	1.9	8.4	0.938	3	0.427	10	0.22	10.9	10.9	-500	5	10	49
Reveille	5721	-0.388	94.4	0.011	1426	-5	0.354	2	-1	0.657	110	70	30	3	4.79	1.7	2.7	1.92	3	0.35	63	0.1	0.184	5.05	700	12	40	21
Valley	5139	0.039	38.3	0	797	-5	0.052	1	-1	0.036	52	-5	150	-3	3.57	0.6	1.7	1.85	4	0.148	30	0.07	-0.002	5.64	1400	12	20	6
	5140	0.031	154	0.0002	2033	-5	0.03	-1	-1	0.248	106	6	110	-3	2.81	1.1	4.2	4.6	5	0.13	62	0.05	0.004	3.09	800	15	40	7
	5141	0.021	217	0.0002	2358	-5	-0.007	-1	-1	0.44	270	8	70	-3	3.25	2.4	8.6	9.69	5	0.086	153	0.06	0.011	3.32	800	11	90	7
	5150	0.081	80.7	0.0005	142	6	0.374	3	-1	0.134	78	-5	130	3	4.25	0.6	6.3	5.76	2	0.775	47	0.12	0.003	21	-500	8	20	9
	5743	0.051	17.6	0.002	950	-5	0.182	2	1	0.034	77	-5	90	-3	4.39	0.8	3.5	1.06	3	0.319	45	-0.05	0.004	2.75	1800	8	20	7
Scottys	5206	0.02	4.19	0.0005	56	-5	0.222	-1	2	0.035	63	-5	20	24	0.8	-0.2	0.5	4.19	4	0.013	35	0.38	0.029	0.498	19000	32	20	6
Junction	5238.1	0.014	6.09	0.0002	-20	-5	0.196	3	37	0.046	-3	-5	-10	-3	1.4	0.4	0.5	-0.006	-1	0.068	1	-0.05	0.029	3.09	-500	-2	-10	6
	5238.2	0.071	18.8	0.001	1916	-5	0.413	2	-1	0.027	69	-5	140	-3	1.82	0.3	0.3	0.164	8	0.238	36	0.31	0.001	14	1400	18	20	9
	5239	0.034	5.8	0.0007	-30	16	0.198	2	10	0.147	-3	-5	130	-3	2	0.2	0.4	0.228	-1	0.965	1	-0.05	0.048	0.604	-500	0	-10	6
	5240	0.079	1245	0.0003	2415	-5	2.81	2	-1	0.057	-3	-5	180	-3	1.58	-0.2	21.5	1.66	1	2.07	1	-0.05	0.004	468	-500	10	-10	12
	5241	0.017	10.5	0.0003	59	-5	0.212	2	8	0.322	61	-5	10	3	1.5	0.5	0.4	1.06	5	0.132	33	0.33	0.059	-0.3	9300	22	20	8
	5242	0.073	5.8	0.0003	1822	-5	0.21	1	7	0.087	103	17	50	10	10.4	1.5	4.4	7.09	6	0.079	58	0.29	0.170	1.32	19000	14	30	10
	5243	0.014	11.5	0	94	-5	0.187	1	1	0.028	50	-5	240	4	2.43	0.4	0.7	0.755	3	0.22	27	0.28	0.021	1.74	8300	22	20	12
Silverbow	5116	5.48	268	0.085	281	-5	0.326	-1	-1	0.059	18	-5	120	15	3.21	0.2	3.7	1.61	1	2.23	11	0.18	0.027	11	-500	10	-10	8
	5117	1.06	103	0.056	188	-5	0.216	-1	-1	-0.511	30	-5	120	10	-6.84	0.4	0.9	0.662	2	0.343	17	0.07	0.016	7.84	1200	11	10	13
	5118	6.2	203	0.151	507	-5	0.331	-1	-1	-0.058	45	5	200	7	17.1	1.1	1.8	0.601	3	1.59	24	0.15	0.002	41.2	1400	6	20	13
	5119	23.4	42.6	2.73	73	5	-0.03	-1	-1	-0.057	8	-5	450	6	4.21	0.4	0.7	0.24	1	0.359	4	0.05	0.004	3.88	-500	-2	-10	11
	5120	0.79	222	0.039	758	5	0.132	-1	-1	0.051	47	6	200	14	2.88	0.7	1.1	1.01	3	0.899	27	0.13	0.024	7.5	4600	13	10	12
	5138	0.153	1063	0.165	670	-5	0.246	-1	-1	0.095	53	-5	90	12	2.91	0.8	6	2.3	-1	1.36	31	0.09	0.015	34.4	2500	9	10	7
	5188	1.61	82.1	0.032	132	-5	0.221	1	-1	0.017	12	-5	430	4	4.2	-0.2	0.9	0.368	-1	0.134	6	-0.05	0.004	4.01	-500	-2	-10	7
	5189	3.23	184	0.073	1153	-5	0.176	1	-1	0.015	71	-5	80	10	3.35	0.9	2.3	1.19	5	0.282	43	0.19	0.007	1.47	1800	11	20	8
	5359	0.054	362	0.002	-10	-5	0.329	2	-1	0.044	42	-5	60	11	1.07	0.3	1.9	2.08	3	0.151	23	0.35	0.004	18.1	10000	33	20	8
	5360	0.375	49.5	0:019	27	-5	0.275	1	-1	0.104	17	-5	170	6	1.49	0.2	0.7	0.388	1	3.01	11	-0.05	0.012	1.44	-500	6	-10	-5
	5361	17.8	10.9	0.292	-10	-5	0.179	1	-1	0.022	-3	-5	200	6	1.99	-0.2	0.3	0.22	-1	0.117	1	-0.05	0.003	1.09	-500	-2	-10	-5

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	Ni XRF ppm
	5610	0.023	29.7	0.013	264	6	0.197	1	-1	0.034	35	-5	190	13	1.72	0.3	0.5	0.933	3	0.217	16	0.49	0.016	2.28	12000	39	10	9
	5611	0.02	24.8	0	-10	5	0.16	1	-1	0.028	34	-5	60	9	0.746	-0.2	0.2	0.562	4	0.052	17	0.38	0.008	0.627	20000	39	10	-5
	5613	0.047	47.9	0.0009	117	6	0.22	2	-1	0.189	42	-5	140	12	4.18	-0.2	0.5	0.939	3	0.167	20	0.55	0.022	1.9	16000	41	20	8
	5614	0.051	4.55	0.014	65	5	0.202	1	-1	0.019	29	-5	120	7	1.04	-0.2	0.2	0.341	3	0.07	15	0.38	0.008	1.08	2700	31	10	-5
	5615	15.4	1.77	0.163	-10	5	6.03	2	-1	0.023	16	-5	250	8	2.18	-0.2	0.3	0.964	2	2.62	9	0.26	0.019	268	-500	20	-10	-5
	5616	4.44	2.61	0.183	-10	5	0.233	1	-1	0.022	22	-5	150	12	2.18	-0.2	0.3	0.424	2	0.915	13	0.23	0.016	0.688	900	23	-10	6
	5617	0.027	42.9	0.02	392	-5	0.263	1	-1	0.129	41	-5	90	5	3.66	0.4	0.6	0.201	2	0.086	26	0.1	0.021	1.02	3600	12	10	6
	5618	40	1.53	0.201	-10	6	0.221	2	-1	0.017	10	-5	380	7	3.54	0.4	0.4	0.241	-1	0.198	6	0.1	0.003	3.39	800	15	-10	7
	5619	6.99	1.14	0.034	-10	-5	0.201	1	-1	0.018	17	-5	100	7	0.957	0.4	0.2	0.381	3	0.118	9	0.27	0.004	0.784	-500	23	-10	-5
	5620	0.32	161	0.023	1860	-5	0.25	1	-1	0.122	50	-5	270	13	4.72	0.2	1	0.542	2	0.206	34	0.14	0.016	3.66	1300	5	10	8
	5621	1.06	263	0.241	696	-5	0.175	1	-1	0.031	27	-5	170	6	2.1	0.7	0.8	0.151	-1	0.528	16	0.06	0.004	1.67	-500	-2	10	-5
	5622	0.366	168	0.01	765	-5	0.25	1	-1	0.03	192	-5	290	15	3.16	2.5	1.1	0.716	1	0.159	89	0.86	-0.002	2.94	1300	7	90	12
	5623	1.02	240	0.194	922	11	0.218	1	-1	0.176	59	-5	290	5	3.01	0.5	1.8	0.492	-1	0.533	44	0.06	0.049	2.27	-500	-2	20	8
	5624	0.304	234	0.022	643	-5	0.264	1	-1	0.028	47	-5	360	12	3.47	0.3	0.9	0.761	2	0.049	31	0.08	0.007	4.32	1800	6	10	8
	5625	1.01	696	0.152	378	-5	0.186	1	-1	0.135	219	-5	320	8	4.81	0.7	1.8	0.312	-1	0.639	147	-0.05	0.022	2.06	-500	-2	70	7
	5626	4.87	489	0.609	698	-5	0.212	1	-1	0.063	16	18	420	9	5.02	0.3	1.7	0.24	-1	0.978	9	-0.05	0.164	5.1	-500	-2	-10	5
	5627	0.253	54.2	0.026	71	-5	0.32	1	-1	0.028	20	-5	180	12	2.13	0.3	0.6	0.665	1	0.154	13	0.05	0.010	9.32	500	7	-10	-5
	5628	2.18	732	0.109	1243	5	1.03	1	-1	0.162	31	-5	160	12	5.79	0.4	2.2	1.7	1	4.33	17	0.18	0.004	51.2	1400	7	10	5
	5629	7.73	385	0.222	590	-5	0.495	1	-1	0.047	23	-5	200	5	4.69	0.3	1.5	0.529	-1	4.55	18	-0.05	0.003	6.82	800	2	-10	-5
	5700	22.6	132	0.386	30	-5	0.269	6	-1	0.014	20	-5	140	10	2.06	0.3	0.7	0.884	1	0.402	12	0.05	0.005	6.8	-500	2	-10	-5
	5701	1.7	196	1.56	533	-5	0.379	1	-1	0.019	48	-5	230	5	3.39	0.6	4.8	2.24	1	6.97	30	0.08	0.002	17.6	700	3	10	-5
	5702	2.33	282	0.602	702	-5	0.231	1	-1	0.027	82	-5	140	10	5.34	1	3.2	4.21	2	15.9	50	0.16	0.003	6.02	1100	6	30	-5
	5703	2.68	57.8	0.232	735	-5	0.178	1	-1	0.036	73	-5	210	6	5.29	1	0.6	3.16	3	0.57	42	0.23	0.002	2.6	-500	6	30	-5
	5704	22.6	146	2.13	602	-5	0.282	1	-1	0.271	67	16	80	5	25.7	1	4.7	2.38	4	1.83	41	0.16	0.043	8.23	500	10	20	17
	5705	4.99	495	0.135	-10	-5	0.306	1	-1	0.03	44	-5	190	5	4.53	0.7	2.1	2.89	2	0.438	26	0.21	0.003	10	-500	8	10	-5
	5706	1.37	131	0.206	81	-5	0.794	1	-1	0.029	45	-5	90	8	9.87	0.5	3.5	1.22	2	0.571	28	0.12	0.011	30.8	-500	10	10	-5
	5716	44.3	16.8	2.46	-10	-5	0.207	-1	-1	0.023	12	-5	190	11	2.46	-0.2	0.3	0.334	-1	0.216	7	-0.05	0.017	2.81	-500	5	-10	15
	5717	1.41	10.8	0.024	189	-5	0.307	1	-1	0.079	40	-5	100	3	2.35	-0.2	1.2	0.459	2	0.302	30	-0.05	0.015	0.823	1800	9	10	14
	5731	0.062	10.5	0.0006	835	-5	0.349	1	-1	0.02	14	-5	370	-3	3.38	0.2	1.5	0.47	-1	1.46	8	-0.05	0.002	3.99	600	-2	-10	7
	5732	39.4	376	0.643	156	-5	0.288	1	-1	0.018	9	5	260	5	8.35	0.3	3.9	0.599	-1	0.102	6	-0.05	0.025	9.94	-500	2	-10	10
	5733	0.225	251	0	1529	5	0.296	-1	-1	0.336	58	9	180	-3	6.95	1	4.6	1.15	3	3.82	32	0.53	-0.002	12.2	-500	8	20	14
	5734	3584	103	23.8	33	-5	0.164	-1	-1	0.046	-3	-5	250	3	75	-0.2	0.4	0.272	-1	0.571	-1	-0.05	-0.002	5.19	1200	-2	-10	-5
	5735	138	248	1.44	125	-5	0.332	3	-1	0.009	3	-5	340	4	4.12	-0.2	1.3	0.5	-1	0.163	3	-0.05	0.003	12.4	-500	-2	-10	6
	5736	10.4	956	0.649	257	-5	0.666	1	-1	0.058	17	-5	240	6	31.7	-0.2	2	0.326	-1	0.086	9	0.06	0.020	37.2	-500	2	-10	6
	5737	7.49	729	0.305	783	-5	0.697	-1	-1	0.016	52	-5	170	12	7.64	0.5	4	1.03	3	0.08	29	0.13	0.012	46.1	500	7	20	-5
Slate	5069	0.019	2.76	0.0003	798	-5	0.087	-1	-1	0.027	109	23	110	4	22.3	1.6	5.7	6.55	10	0.019	56	0.68	0.055	0.09	10000	30	40	57
South of	5129	29.9	7.98	0.025	-10	20	0.192	1	7	0.217	16	-5	150	-3	47.8	-0.2	0.5	0.98	1	0.097	8	0.13	3.000	1.63	500	-2	-10	6
Mud Lake	5130	5.88	15.6	0.006	336	23	0.009	-1	6	0.051	-3	-5	260	-3	3.35	0.5	0.3	0.496	-1	0.047	2	-0.05	0.780	2.45	-500	-2	-10	6
Southeastern	5148	1007	8275	0.013	-10	-5	-2.56	17	-1	339	-3	9	10	-3	35150	-0.2	7.2	34.4	5	38.1	-1	-0.05	0.055	25.1	2700	-2	-10	-5
	5149	840	1737	0.016	-10	-5	-2.06	5	2	1220	-3	-5	130	-3	26332	0.6	0.3	37	-1	41.1	1	-0.05	0.021	83.2	600	-2	-10	5
	5500	403	1028	0.027	-10	7	-0.715	2	7	567	-3	-5	120	-3	13578	0.4	0.3	8.93	-1	12.9	3	-0.05	0.058	57.7	-500	-2	-10	6
	5501																											
	5506	188	1098	0.108	-10	-5	-0.085	-1	-1	320	-3	-5	190	-3	20402	-0.2	0.6	6.26	-1	257	-1	-0.05	0.021	24.9	4200	-2	-10	9
	0993-G17	625.00	4906.00	0.21	11	-5	0.49	**	**	739.00	**	**	**	**	59645.00	**	**	21.80	**	398.00	**	**	0.013	68.90	**	-2	**	11
	1293-G19	1282.00	7928.00	0.00	-10	-5	-4.51	**	**	536.00	**	**	**	**	136688.00	**	**	5.73	**	10.40	**	**	0.011	99.90	**	-2	**	48
	1194-G32	92	4585	0.008	-30	-5	-1.69	5	**	431	5	20	170	3	27371	**	0.3	13.8	6	6.11	1	**	0.033	13.1	1800	-2	10	19
	1194-G33	288	12400	0.027	-20	-5	-2.07	3	**	418	5	18	90	3	39603	**	0.6	19.1	17	13.5	1	**	0.022	20.2	5400	-2	10	3
	1194-G34	619	3912	0.016	-20	-5	-2.28	4	**	143	5	18	110	3	16481	**	0.2	10.9	3	11.7	1	**	0.001	38.5	2100	-2	10	-10
	0595-G39	58.6	2538	0.007	13	-5	-0.379	10	2	238	5	-5	140	-3	28330	1.4	0.4	9.51	-1	1.67	2	-0.05	0.094	29.7	600	2	-10	18
	0595-G40	0.408	76.7	0.006	16	-5	0.273	5	9	0.069	8	-5	10	-3	149	-0.2	18.5	1.99	-1	1.28	4	0.06	0.038	3.91	700	3	-10	36
	5086																											

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
		ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5087																											
	5088																											
	5089																											
	5237	0.048	2.68	0	-10	-5	0.007	-1	-1	0.029	21	-5	460	-3	4.15	0.3	1.2	0.421	1	0.081	11	0.06	0.002	3.75	-500	2	-10	11
	5473	0.265	30.5	0.0009	345	8	0.53	-1	2	0.776	79	11	130	18	21.8	1.6	2.4	2.37	4	0.099	43	0.36	0.018	46.6	1800	13	30	48
Stonewall	5606	12.4	16.5	0.034	171	-5	0.255	1	-1	0.025	14	-5	330	-3	6.15	0.4	0.5	0.865	1	0.069	9	0.05	0.006	5.33	-500	3	-10	7
	5607	0.606	12	0.011	-10	4	0.243	1	-1	0.039	17	-5	240	-3	3.6	-0.2	0.6	0.818	4	0.227	9	0.19	0.009	7.71	800	19	-10	6
	5608	55.2	10.5	0.554	16	-5	1.23	1	-1	0.061	4	-5	350	-3	32.4	-0.2	0.4	1.95	-1	0.063	3	-0.05	0.332	35.3	-500	-2	-10	5
	5609	1.45	8.99	0.002	201	-5	0.644	2	-1	0.347	167	-5	130	3	3.75	0.9	1.2	0.374	9	0.026	95	0.69	0.004	33.2	24000	43	60	-5
	5630	0.055	11.5	0.0005	238	-5	0.211	1	-1	0.091	181	-5	50	5	2.17	0.7	2	1.59	10	0.159	105	0.67	0.011	1.59	10000	44	70	-5
	5631	0.062	20.3	0.001	841	-5	0.527	1	1	0.117	112	-5	90	-3	2.37	0.6	1.4	1.17	8	0.203	64	0.5	0.008	2.72	26000	32	40	5
	5632	13.1	13.8	0.015	42	5	0.909	1	-1	0.017	24	-5	180	3	23.5	0.4	0.8	0.477	1	0.094	14	0.06	0.022	49	-500	4	10	-5
	5633	105	14.2	0.345	32	9	0.274	2	-1	0.092	8	-5	180	-3	8.22	-0.2	0.5	0.479	-1	0.039	5	-0.05	0.031	5.89	-500	-2	-10	5
Thirsty	5070.1	0.028	1.52	0.001	-10	-5	0.36	2	-1	0.054	3	-5	300	-3	3.57	-0.2	0.3	0.261	4	0.031	3	0.05	0.011	2.68	-500	5	-10	15
Canyon	5074	0.018	0.999	0.0004	48	-5	0.185	1	-1	0.049	54	-5	30	-3	0.517	0.7	0.5	0.855	4	0.025	31	0.31	0.039	0.27	11000	22	20	12
	5075	0.025	1.24	0	-10	-5	0.491	1	1	0.024	6	-5	330	-3	2.63	-0.2	0.3	0.368	2	0.038	3	0.05	0.009	3.23	-500	14	-10	16
	5076	0.02	1.17	0	-10	-5	9.11	1	4	0.035	40	-5	70	4	0.848	0.3	0.3	5.5	8	0.069	21	0.29	0.033	0.372	5100	72	10	10
	5581	0.021	3.89	0.002	976	-5	0.208	1	-1	0.15	146	-5	70	-3	2.37	0.5	1.1	1.59	10	0.123	93	0.44	0.058	0.608	23000	29	50	7
	5582	0.096	1.96	0.002	105	-5	1.52	1	-1	0.094	10	-5	230	-3	2.86	0.3	0.4	0.233	4	0.026	6	0.11	0.021	1.48	-500	9	-10	-5
	5583	0.057	21.2	0.001	19	5	0.938	1	-1	0.062	8	-5	240	-3	2	0.2	5	0.324	-1	0.031	4	-0.05	0.033	57.4	700	7	-10	-5
	5209	0.02	0.271	0.0004	132	-5	0.052	-1	-1	0.022	74	-5	70	3	0.809	-0.2	0.5	0.541	4	0.013	40	0.38	0.003	0.537	8000	25	20	7
	5210	0.183	53.8	0.006	413	-5	0.277	1	-1	0.057	84	-5	210	-3	3.22	0.4	0.7	2.46	4	0.082	52	0.28	0.006	3.38	4000	19	30	9
	5211	0.045	20.2	0.0006	79	-5	0.055	-1	-1	0.042	61	-5	150	3	1.93	-0.2	1.3	1.28	4	0.047	33	0.31	0.008	3.32	4700	27	20	9
	5212	0.023	0.809	0	245	-5	0.074	-1	2	0.051	112	-5	40	4	0.743	0.9	0.9	0.855	7	0.054	63	0.48	0.024	0.324	21000	35	40	8
	5213	0.031	1.4	0	-10	-5	0.475	-1	-1	0.037	6	-5	520	-3	3.53	0.3	0.4	0.061	2	0.028	3	0.09	0.003	4.25	-500	7	-10	10
	5214	0.013	5.77	0	36	10	0.053	-1	5	0.079	4	-5	210	-3	1.67	0.2	0.4	0.087	-1	0.037	2	-0.05	0.274	1.83	-500	-2	-10	7
	5450	0.596	102	0.023	1071	5	2.46	-1	1	0.129	163	-5	160	-3	-10.2	0.7	1.5	2.47	7	0.086	106	0.31	0.033	372	6300	17	50	10
Tolicha	5083	0.053	25.8	0.001	357	-5	0.139	1	-1	0.039	135	-5	90	4	1.58	0.6	11.8	1.32	6	0.095	79	0.48	0.013	4.45	12000	30	40	15
	5084	0.033	4.42	0.0005	93	-5	0.177	1	-1	0.019	102	-5	70	-3	0.68	0.3	0.4	0.574	7	0.182	56	0.48	0.009	3.11	13000	35	40	13
	5085	0.021	12.8	0.006	-10	7	0.178	1	-1	0.225	78	-5	120	-3	3.23	0.3	6.4	2.81	4	0.375	39	0.49	0.017	4.78	17000	28	30	12
	5107	22	196	5.23	165	53	0.354	1	-1	0.204	22	-5	370	-3	11.5	-0.2	1	0.874	1	0.699	13	0.15	0.005	20.5	900	8	10	11
	5113	38.8	10.4	20.6	-10	-5	0.129	-1	-1	0.031	-3	-5	500	-3	15.8	0.3	0.5	0.658	-1	0.38	-1	-0.05	0.009	7.09	-500	-2	-10	12
	5114	20.7	3.59	20.9	-10	16	0.113	-1	-1	0.036	-3	-5	540	-3	4.9	0.2	0.4	0.776	-1	0.611	-1	-0.05	0.027	5	-500	-2	-10	11
	5115	2.83	13.6	1.07	740	42	0.202	-1	-1	0.042	-3	-5	410	-3	6.34	0.3	0.7	0.51	-1	0.08	1	-0.05	0.054	20	-500	-2	-10	10
	5250	0.044	11.5	0.006	200	-5	0.306	1	-1	0.045	85	-5	50	-3	0.792	0.6	0.5	0.682	4	0.089	49	0.32	0.015	1.14	9200	24	30	8
	5251	0.024	1.63	0.0002	47	-5	-0.001	-1	-1	0.073	61	-5	110	-3	1.25	0.3	0.6	0.796	4	0.008	33	0.32	0.070	1.29	19000	25	20	7
	5252	3.93	12.2	0.481	307	6	0.043	-1	-1	0.127	50	-5	210	3	15.8	0.4	1	0.925	3	0.066	29	0.14	0.080	1.76	6000	9	10	11
	5253	5.63	5.2	1.97	488	55	0.074	-1	-1	0.047	65	-5	270	-3	5.74	0.4	0.9	0.684	4	0.016	44	0.25	0.028	2.21	10000	17	30	10
	5254	27.1	183	5.7	402	-5	1.91	-1	-1	0.124	44	6	200	-3	478	0.5	3.9	1.06	2	0.275	24	0.12	0.016	279	5100	7	10	16
	5255	2.1	4.86	0.688	272	6	0.095	1	-1	0.064	62	-5	230	-3	6.87	0.8	1.3	0.995	3	0.019	38	0.21	0.021	1.9	6600	13	20	7
	5256	3.4	2.81	3.05	76	9	0.01	-1	-1	0.042	22	-5	260	-3	6.2	0.5	0.4	0.284	1	0.305	10	0.1	0.074	2.62	600	8	10	10
	5257	0.408	8.42	0.14	384	-5	0.152	-1	-1	0.252	83	-5	140	6	3.29	0.5	4.7	2.71	4	1.15	42	0.26	0.795	1.86	9100	17	30	7
	5404	18.1	53.1	46	31032	22.3	0.628	6	-1	0.166	-227	19	80	-3	2.29	14.7	0.4	1.89	11	1.89	68	35.9	0.003	3.86	7100	57	-227	22
	5405	5.33	4.16	1.7	352	-5	0.23	1	-1	0.029	17	-5	230	-3	6.54	0.3	0.3	0.038	1	0.096	9	0.08	0.091	3.92	-500	5	-10	7
	5406	0.335	6.54	0.009	254	-5	0.275	1	-1	0.032	59	-5	240	-3	2.7	0.3	0.3	0.254	4	0.058	30	0.43	0.003	3.58	1000	21	20	13
	5407	7.73	5.75	5.45	80	14	0.193	-1	-1	0.038	3	-5	270	-3	3.25	-0.2	0.3	0.349	-1	0.289	1	-0.05	0.035	1.98	-500	-2	-10	11
	5408	0.701	24.8	0.016	195	-5	0.469	-1	-1	0.021	59	-5	160	-3	2.1	0.7	0.4	1.85	4	0.092	31	0.48	0.006	6.24	11000	27	20	10
	5409	0.309	6.85	0.004	249	21	0.268	1	-1	0.011	62	-5	160	3	1.7	-0.2	0.3	1	4	0.133	33	0.42	0.004	7.68	2200	29	20	12
	5410	0.028	5.01	0	677	-5	0.19	1	-1	0.042	93	-5	110	-3	1.75	0.7	1.3	1.33	6	0.024	53	0.42	0.049	0.871	10000	24	30	9
	5411	9.11	10.1	0.63	190	-5	0.649	1	-1	0.079	13	-5	420	-3	4.96	0.2	0.4	0.234	1	0.101	8	0.07	0.018	58.8	500	4	-10	12
	5412	0.111	15	0.026	133	6	0.222	-1	-1	0.013	42	-5	200	7	1.98	0.3	0.4	0.575	3	0.099	21	0.26	-0.002	1.29	1700	18	10	9

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Ag ICP ppm	As ICP ppm	Au GFAA ppm	Ba XRF ppm	Be AA ppm	Bi ICP ppm	BR INAA ppm	CA INAA %	Cd ICP ppm	CE INAA ppm	CO INAA ppm	CR INAA ppm	CS INAA ppm	Cu ICP ppm	EU INAA ppm	FE INAA %	Ga ICP ppm	HF INAA ppm	Hg CVAA ppm	LA INAA ppm	LU INAA ppm	MnO XRF %	Mo ICP ppm	NA INAA ppm	Nb XRF ppm	ND INAA ppm	Ni XRF ppm
	5413	0.019	4.46	0.001	745	7	0.163	1	-1	0.042	104	-5	140	3	2.45	1	1.8	1.45	6	0.053	59	0.45	0.565	1.3	5100	22	40	9
	5414	0.027	1.44	0.001	488	-5	0.315	1	-1	0.032	99	-5	30	-3	0.589	0.4	0.8	0.761	8	0.041	50	0.51	0.052	0.232	8500	35	40	7
	5415	0.079	12.7	0.001	313	-5	0.324	-1	-1	0.098	79	-5	100	4	1.18	0.5	0.7	1.32	4	0.115	45	0.43	0.093	1.15	7400	25	30	7
	5416	0.031	1.06	0.0004	126	-5	0.16	1	-1	0.056	59	-5	70	-3	0.989	0.5	0.2	0.411	5	0.017	31	0.52	0.004	0.261	5100	32	20	7
	5421	7.49	18	5.1	116	13	0.295	2	-1	0.043	19	-5	200	-3	15.7	0.3	0.3	0.286	-1	1.17	8	0.34	0.011	10.4	800	6	10	9
	5422	1.54	5.12	0.724	112	7	0.243	7	-1	0.016	29	-5	120	-3	2.31	0.6	0.2	0.221	2	0.46	13	0.44	0.004	5.08	3000	11	10	7
	5423	11.6	4.43	14.1	178	16	0.322	2	-1	0.027	44	-5	150	-3	2.26	1.3	0.2	0.449	-1	1.19	16	2.78	0.003	2.58	-500	10	30	10
	5424	0.722	43.2	0.102	186	-5	0.362	4	-1	0.079	62	-5	110	-3	2.38	-0.2	0.7	0.178	4	0.34	31	1.14	0.014	13.7	2200	27	30	12
	5425	0.431	37.1	0.086	201	-5	0.316	19	-1	0.061	70	-5	120	-3	2.12	0.4	0.4	0.441	4	0.18	37	0.76	0.019	9.48	4400	26	30	12
	5426	0.523	34.8	0.092	170	-5	0.281	3	-1	0.07	82	-5	110	-3	2.54	0.7	0.4	0.432	4	0.868	41	1.27	0.009	7.23	1900	27	30	11
	5427	0.028	48.7	0.001	554	-5	0.196	1	-1	0.02	66	-5	50	4	0.975	0.8	1.2	1	8	0.011	39	0.4	0.004	1.54	4300	25	20	6
	5428	0.025	53.2	0.0003	490	-5	0.154	1	-1	0.037	85	-5	40	3	1.17	0.8	1.3	0.661	6	0.007	51	0.41	0.018	1.98	3500	22	30	7
	5429	0.532	29.4	0.033	233	-5	0.983	-1	-1	0.067	73	-5	100	-3	1.64	0.6	1.9	0.752	5	0.172	40	0.57	0.023	62.9	1400	30	30	12
	5430	0.273	28.6	0.005	708	-5	0.428	1	-1	0.057	88	-5	110	4	4.87	0.6	1	1.1	5	0.139	58	0.27	0.009	2.42	4100	22	30	9
	5431	0.033	5.6	0.0004	9	-5	0.254	1	-1	0.102	51	-5	80	-3	1.33	0.6	0.6	0.854	5	0.179	33	0.33	0.205	0.741	14000	27	10	9
	5432	18.2	10.6	21.4	21	10	0.265	1	-1	0.019	-3	-5	240	-3	5.7	0.2	0.3	0.495	-1	0.573	1	0.08	0.030	1.77	-500	2	-10	8
	5433	0.382	40.8	0.306	137	-5	0.356	2	1	0.044	86	-5	30	3	1.68	0.6	0.9	1.63	7	0.077	48	0.74	0.034	4.58	500	31	30	8
	5434	0.073	1.56	0.0008	114	-5	0.241	1	-1	0.013	61	-5	50	-3	0.486	1.2	0.7	0.643	3	-0.006	35	0.46	0.033	0.27	8600	28	20	7
	5435	0.025	2	0.0002	99	-5	0.212	1	1	0.049	53	-5	70	3	1.02	0.8	0.6	0.733	4	0.07	35	0.37	0.082	0.678	18000	23	10	9
	5436	0.11	2.45	0.135	82	-5	0.215	1	-1	0.035	88	-5	70	4	0.886	-0.2	0.6	0.667	4	0.052	57	0.4	0.069	1	16000	21	30	7
	5458	3.07	14.8	0.985	843	40	0.2	1	-1	0.037	3	-5	260	-3	22.5	0.3	0.9	0.452	-1	0.064	1	-0.05	0.011	12.5	-500	-2	-10	9
	5459	0.253	116	0.003	738	8	0.032	1	-1	0.035	122	-5	110	4	2.35	0.9	1.4	0.752	7	0.171	70	0.47	0.007	4.1	7400	20	40	12
	5460	15	26.9	293	1310	90	0.964	10	-1	0.151	-227	13	100	8	1.77	15.4	0.6	1.13	-1	0.836	33	53.2	0.008	3.67	5300	61	-227	-5
	5461																											
	5462	2.54	8.36	0.146	-10	20	0.042	-1	-1	0.044	-3	-5	270	-3	3.7	0.3	0.3	0.089	-1	0.046	1	-0.05	0.022	3.78	-500	-2	-10	8
	5463	12.4	11.5	0.825	102	-5	0.604	-1	-1	0.022	27	-5	210	-3	4.86	0.3	0.5	0.555	1	0.95	15	0.16	0.009	69.4	1800	11	10	9
	5464	0.491	73.2	0.036	453	70	0.076	-1	-1	0.056	67	-5	160	-3	2.46	0.7	0.8	1.09	6	0.103	39	0.3	0.005	1.75	8200	20	20	12
	5465	0.256	534	0.008	522	6	0.187	-1	-1	0.093	106	5	80	4	2.45	1.4	2.4	1.44	5	0.27	57	0.54	0.063	22.9	3100	22	40	12
	5466	19.1	118	12.1	225	350	0.177	-1	-1	0.269	36	-5	310	-3	15.7	0.3	0.8	0.437	1	0.723	17	0.38	0.002	24.3	1100	7	10	13
	5467	0.205	6.32	0.055	346	11	0.068	-1	-1	0.034	47	-5	220	-3	2.71	0.5	0.7	0.42	3	0.541	28	0.17	0.008	2.22	2400	15	10	9
	5468	0.148	23.1	0.011	554	8	0.049	-1	-1	-0.423	115	-5	100	5	-4.86	0.9	0.8	0.726	7	0.195	67	0.39	0.010	5.68	4600	25	40	10
	5469	0.095	1.05	0.003	19	8	0.079	-1	-1	-0.155	58	-5	80	-3	0.669	0.5	0.4	0.33	4	0.036	38	0.32	0.021	0.785	7700	26	20	9
	5470	0.466	472	0.012	1297	33	0.275	-1	-1	0.676	114	10	20	-3	2.9	1.1	14.3	1.73	6	0.119	63	0.4	0.242	26.3	13000	17	40	17
	5471	0.031	293	0.0003	595	9	0.14	-1	1	-0.002	98	-5	50	3	1.14	0.9	1.7	1.29	7	0.08	55	0.39	0.002	4.85	5000	25	30	9
	5744	16	95.4	1.66	720	-5	2.44	1	-1	0.083	85	-5	120	-3	193	1.3	2.1	1.08	5	0.091	53	0.16	0.006	232	7000	13	30	11
	5745	2.46	5.71	0.998	167	15	0.26	1	-1	0.079	26	-5	140	-3	4.64	-0.2	0.5	0.959	2	0.03	16	0.06	0.027	0.823	2200	6	10	-5
	5746	1.3	9.67	0.102	306	-5	0.3	1	-1	0.134	52	-5	90	-3	4.75	0.7	1	0.774	3	0.017	31	0.23	0.041	1.16	6200	15	20	7
	5747	14.7	5.06	3.87	40	14	0.244	1	-1	0.279	27	-5	150	-3	4.93	0.4	1.2	0.752	-1	0.292	12	0.35	0.739	0.724	1000	6	10	6
Transvaal	5053	0	14.20	0.03	696	-5	0.86	-1	-1	-0.10	84	-5	240	9	2.05	0.4	1	0.9	3	1.69	53	0.15	0.008	2.23	3600	8	20	10
	5054	0	9.30	0.00	550	-5	0.26	-1	-1	-0.10	92	-5	190	16	2.05	0.5	1	1.0	4	-0.10	50	0.29	0.012	4.39	4000	18	40	9
	5055	0	5.49	0.02	982	-5	-0.25	1	-1	-0.10	59	-5	210	4	4.83	0.3	1	1.3	3	0.10	32	0.16	0.019	1.99	2300	11	20	10
	5056	0	6.30	0.02	147	-5	1.32	-1	-1	-0.10	57	-5	110	3	33.70	0.4	0.7	1.4	7	0.46	30	0.38	0.029	1.09	7200	25	30	7
	5057	0	-0.98	0.00	150	-5	-0.25	1	-1	-0.10	73	-5	130	3	2.78	0.5	0.6	1.0	4	0.10	42	0.25	0.016	1.12	4900	15	30	5
	5058	0	1.30	0.00	226	-5	-0.24	-1	-1	-0.10	101	-5	110	-3	3.30	0.5	0.4	1.1	5	-0.10	59	0.3	0.011	0.80	6900	20	40	6
	5059	0	13.60	0.02	441	6	-0.23	-1	-1	-0.09	96	-5	190	6	5.07	0.8	2.1	1.4	5	0.58	55	0.22	0.015	3.38	3100	17	30	9
	5207	0.03	4.57	0.0008	280	-5	12.7	-1	-1	0.069	39	-5	480	-3	3.62	0.3	1.1	4.76	3	0.369	23	0.12	0.023	4.54	3800	27	10	7
	5208	0.016	1.29	0	62	-5	0.255	1	-1	0.024	21	-5	340	-3	2.21	-0.2	0.4	0.427	1	0.203	13	0.1	0.021	1.4	3100	8	10	11
	5451	0.692	10.1	0.002	458	-5	0.096	-1	-1	0.013	138	-5	260	-3	-2.11	0.7	0.7	1.88	5	1.46	89	0.26	0.005	1.12	-500	65	40	9
	5452	0.092	2.3	0.002	403	5	0.045	-1	1	0.985	11	9	210	-3	1.54	0.4	0.3	0.244	-1	0.327	6	-0.05	0.551	1.07	-500	2	-10	12
	5453	0.067	4.29	0.002	321	7	0.046	1	-1	0.013	59	-5	140	-3	2.71	0.7	3.9	0.834	4	0.367	34	0.16	0.008	1.27	1900	12	20	9
	5454	0.066	9.61	0.002	281	6	0.348	1	-1	0.037	168	-5	30	-3	4.53	1.7	4.3	1.93	8	0.08	87	0.61	0.005	2.68	500	31	60	5

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Ag	As	Au	Ba	Be	Bi	BR	CA	Cd	CE	CO	CR	CS	Cu	EU	FE	Ga	HF	Hg	LA	LU	MnO	Mo	NA	Nb	ND	Ni
District	Number	ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	CVAA	INAA	INAA	XRF	ICP	INAA	XRF	INAA	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
	5455	0.061	1.22	0.002	570	7	0.062	-1	1	0.022	106	-5	100	11	1.56	0.7	1	0.781	5	0.137	61	0.31	0.012	0.373	6200	19	30	10
	5456	0.064	30.9	0.0007	206	7	0.602	-1	-1	0.077	108	-5	50	-3	5.83	0.7	5.3	1.83	8	0.115	64	0.3	0.006	35.9	1200	28	30	6
	5457	0.053	8.56	0.002	1202	8	0.28	8	-1	0.165	101	12	30	8	12.9	1.2	2.5	3.21	6	0.139	58	0.4	0.053	1.66	15000	22	40	23
	5472	0.029	3.2	0.002	379	9	0.085	-1	-1	0.037	104	-5	120	-3	1.88	0.8	2.8	1.28	8	0.179	61	0.33	0.021	1.22	900	19	30	7
	5487	0.065	5.61	0.0009	-20	-5	0.428	1	-1	0.144	-3	-5	450	-3	9.4	-0.2	0.4	0.529	-1	0.05	1	-0.05	0.004	4.11	-500	0	-10	11
	5488	0.03	6.08	0.001	1420	-5	4.75	1	-1	0.106	81	-5	50	-3	0.889	0.6	0.9	0.862	5	0.169	50	0.3	0.025	0.552	11000	18	30	7
	5561																											
	5562																											
	5563	0.017	1.06	0.0007	229	-5	0.224	3	-1	0.028	91	-5	90	3	2.18	0.6	0.4	0.526	7	0.064	56	0.31	0.010	0.351	8700	21	30	8
	5575	-2.05	7.82	0.002	975	-5	0.222	1	-1	0.011	3	-5	260	-3	1.91	-0.2	0.4	0.087	4	0.392	2	0.06	0.003	1.19	-500	-2	-10	-5
	5576	-0.541	3.51	0.002	15	-5	16.7	1	-1	0.016	3	-5	330	-3	2.07	-0.2	0.3	0.063	3	0.128	1	0.06	-0.002	2.76	-500	14	-10	-5
	5577	0.101	2.14	0.006	525	-5	0.15	1	-1	0.001	-3	-5	210	-3	1.65	-0.2	0.2	-0.025	6	914	-1	0.06	-0.002	1.08	-500	48	-10	-5
	5578	-0.079	6.93	0.0009	221	-5	0.213	2	-1	0.053	139	-5	30	-3	1.67	0.6	0.9	5.26	6	-0.731	81	0.35	0.016	1.35	9900	25	40	-5
	5579.1	-0.002	53	0.084	640	-5	0.252	1	-1	0.121	89	-5	70	28	1.63	0.8	1	1.6	5	-0.117	52	0.36	0.048	3.63	2100	18	30	5
	5579.2	0.397	20.5	0.005	504	-5	0.85	1	-1	0.122	60	6	110	10	2.08	0.4	1	0.725	4	0.043	34	0.28	0.097	52.3	3000	19	20	-5
	5580	0.04	5.45	0.019	606	-5	0.247	1	-1	0.039	70	-5	110	6	1.69	0.4	0.8	0.868	4	0.04	41	0.33	0.024	0.471	4900	15	20	-5
Trappmans	5110	260	4097	0.313	-10	-5	1.57	2	-1	4.9	-3	-5	220	-3	106	-0.2	4.5	0.388	-1	4.4	-1	-0.05	-0.002	3.94	-500	-2	-10	9
	5111	0.728	1019	0.003	368	-5	0.104	-1	-1	0.119	34	19	360	4	11.7	1.1	3.7	0.636	3	0.26	19	0.14	0.150	4.67	3500	17	10	49
	5112	151	2135	0.389	-10	-5	-0.055	13	-1	5.66	-3	-5	210	-3	227	1	5.4	0.258	-1	1.44	1	0.06	0.003	15.1	-500	-2	-10	6
	5352	57	706	0.056	630	7	149	4	-1	10.6	31	17	50	-3	1478	-227	2.5	0.671	7	2.28	24	-227	0.036	4.24	8600	5	10	6
	5353	92.5	2465	2.29	38	7	10.8	3	-1	1.28	12	-5	330	-3	21.7	0.7	1.8	0.448	-1	8.88	8	-0.05	0.002	6.02	800	2	-10	5
	5354	3662	6196	0.777	15	-5	-0.17	1300	-1	50.3	-3	19	170	-3	2829	-227	7.9	0.545	-1	6.71	-227	-227	-0.002	11.9	4600	2	-10	-5
Wagner	4170	0	30.80	0.01	-10	-5	3.27	-1	-1	4.31	15	6	270	-3	3362.00	0.2	2.1	0.5	1	0.91	7	0.07	0.025	3.47	-500	2	-10	32
	4171	1	3591.00	0.07	337	-5	3.38	-1	-1	8.13	80	190	90	3	14697.00	0.9	14.9	1.9	5	11.90	40	0.5	0.602	23.50	700	11	30	52
	4172	0	4.68	0.05	383	-5	2.01	-1	-1	-0.10	39	40	140	3	13.40	0.8	7.9	1.5	8	0.11	18	0.31	0.595	1.20	-500	10	20	51
	4173	35	647.00	1.42	883	-5	40.40	2	-1	14.00	30	510	130	4	22978.00	0.4	15.2	1.6	1	115.00	12	0.48	2.302	17.80	-500	3	10	530
	4174	2	9.01	0.77	1412	-5	4.29	-1	-1	3.22	46	6	140	-3	24752.00	0.9	3.5	1.1	3	193.00	21	0.26	0.003	5.52	-500	7	20	28
Wellington	5132	4.27	208	5.84	800	-5	0.232	-1	-1	0.215	36	-5	170	3	4.14	0.6	6.4	0.192	2	0.733	19	0.15	0.017	31.4	-500	5	10	6
	5133	5.96	33.9	9.54	323	-5	0.23	-1	2	0.24	42	-5	310	-3	3.52	0.6	0.9	0.425	2	0.347	23	0.15	0.208	15.3	-500	7	10	12
	5547	1.93	32.3	0.062	2616	6	0.387	1	-1	0.086	20	12	220	-3	-1.51	-0.2	0.5	0.347	1	0.06	11	0.06	0.835	33.2	-500	4	-10	9
	5548	42.9	79	0.832	140	7	0.363	2	12	0.326	17	-5	110	-3	4.01	0.4	0.9	-0.038	-1	18.6	8	0.09	0.004	20.2	-500	8	-10	5
Wilsons	5108	706	7.99	1.49	190	-5	0.627	1	-1	0.986	20	-5	210	-3	445	0.3	0.5	0.271	1	0.07	12	0.05	0.116	1.38	-500	3	-10	6
	5109	150	9.85	2.25	298	-5	0.089	5	1	1.74	16	6	390	-3	797	0.6	0.7	1.13	1	1.12	10	-0.05	0.739	6.95	-500	2	-10	16
	5351	334	13.4	0.109	20	8	638	37	-1	0.445	18	9	290	-3	331	0.7	0.5	17.9	-1	2.44	9	0.08	0.057	83	-500	-2	10	7
	5355	19	4.2	0.02	350	-5	0.317	2	-1	0.325	21	-5	160	-3	45.3	-0.2	0.4	0.99	1	0.0003	14	0.05	0.141	1.51	900	3	-10	-5
	5356	4.42	3.1	0.009	347	-5	0.195	1	-1	0.47	19	-5	150	-3	75.7	0.3	0.6	1.77	1	-0.02	12	-0.05	0.252	1.32	1200	2	-10	5
	5357	4.75	5.35	0.027	329	-5	0.548	1	-1	0.211	23	-5	180	-3	21.7	0.6	0.4	0.65	1	0.016	14	0.08	0.043	2.47	4400	6	-10	-5
	5358	1.14	9.05	0.003	570	-5	0.415	1	-1	0.271	26	-5	170	-3	10.3	0.4	0.5	1.01	1	0.021	17	-0.05	0.051	2.47	3800	3	10	6
	5646	42.9	4.08	0.055	-10	-5	0.538	3	-1	1.9	-3	-5	460	-3	139	-0.2	0.5	0.907	-1	0.036	2	-0.05	0.074	4.49	-500	-2	-10	9
	5647	30.3	8.36	0.073	34	-5	0.247	2	-1	3.27	4	-5	190	-3	89.8	0.2	0.3	0.413	-1	0.052	3	-0.05	0.246	1.89	-500	-2	-10	7
	5648	26.8	3.98	0.085	84	6	0.258	1	3	3.32	5	-5	320	-3	70.1	0.2	0.5	0.811	-1	0.037	4	-0.05	0.539	2.98	600	-2	-10	7
	5649	14.8	1.52	0.08	261	-5	0.615	1	-1	0.089	7	-5	210	-3	5.02	-0.2	0.3	0.22	-1	0.019	5	-0.05	0.032	1.72	1000	-2	-10	4
	5741	11.5	8.2	0.034	359	-5	0.318	1	1	0.746	28	-5	210	-3	30.1	-0.2	0.5	0.603	1	0.014	18	0.06	0.214	3.25	4600	3	10	5
	5742	4.33	30.8	0.082	717	-5	0.438	-1	-1	0.147	24	-5	160	-3	38.8	0.5	0.8	0.889	1	0.041	14	0.05	0.058	11.7	-500	-2	10	3
Yucca Mt.	5815	0.024	3.04	0.0006	143	6	0.26	1	-1	0.126	14	-5	230	-3	2.57	-0.2	0.5	0.336	-1	0.04	8	0.1	0.202	1.57	600	6	-10	16

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Pb	RB	Sb	SC	Se	SM	Sn	Sr	TA	TB	Te	TH	TiO2	Tl	U	V	W	Y	YB	Zn	Zr
District	Number	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Antelope	5152	47.7	100	2.93	2.3	0.107	3.1	-2	79	-1	-0.5	0.578	7.4	0.11	0.484	1.5	30	-2	13	1	7.78	94
Springs	5153	44.1	110	3.59	2.3	0.011	3.1	-2	43	-1	-0.5	0.441	8.7	0.11	0.37	1.8	-20	-2	15	1.2	53.6	85
	5154	46.2	50	1.56	1.9	0.103	1.5	-2	27	-1	-0.5	0.146	4.8	0.14	0.421	1.5	33	-2	8	0.7	14.2	61
	5155	67.1	60	6.82	2.7	1.4	2.2	-2	57	-1	-0.5	0.612	11	0.08	0.338	4.8	-20	-2	12	1.1	22.7	84
	5156	27.7	60	2.89	1.7	0.328	2.8	-2	25	-1	-0.5	2.15	10	0.08	0.386	4.4	51	-2	15	1.2	31.2	77
	5157	29.3	100	16.1	2	0.832	2.5	-2	38	-1	-0.5	1.22	11	0.08	0.383	2.9	12	-2	12	1	9.68	91
	5158	36	40	3.73	1.1	0.65	2.2	-2	111	-1	-0.5	0.402	5.4	0.04	0.397	5.5	79	-2	14	0.9	13.1	49
	5171	636	40	134	0.9	2.95	1.7	-2	95	-1	-0.5	12.5	5.6	0.03	0.808	2.7	-20	-2	19	1.1	36.1	42
	5172	217	60	4.71	1.5	-0.202	2	-2	24	-1	-0.5	0.264	5.7	0.06	0.684	1.2	22	-2	9	0.7	11.2	62
	5273	178	50	287	1	0.188	1.6	-2	32	1	-0.5	6.74	9.3	0.09	0.325	2.2	-20	-2	9	0.9	73.4	69
	5274	2882	70	153	1.1	0.573	2.1	-2	31	-1	-0.5	89.5	8.5	0.07	0.275	8.5	-20	-2	14	1.2	138	50
	5277	99.7	40	6.43	1.7	0.368	0.9	-2	71	-1	-0.5	0.159	2.2	0.11	0.751	1.6	-20	-2	5	0.5	21.6	53
	5278	9.64	110	1.99	3	0.079	2.9	-2	39	-1	-0.5	0.099	9.7	0.26	0.614	2.7	-20	-2	8	1	13.6	114
	5282	71.2	50	6.29	1	0.109	1	-2	35	-1	-0.5	3.78	6.7	0.09	0.55	1.4	-20	-2	8	0.4	54.1	44
	5283	104	60	10.3	1.6	-0.084	1.6	-2	27	-1	-0.5	42.7	5.7	0.10	0.862	2.6	-20	-2	10	0.7	35.8	60
	5284	7064	-30	362	0.7	13.7	0.7	-2	44	-1	-0.5	83.9	2.9	0.05	0.333	3.6	90	-2	10	0.4	2132	22
	5285	61.2	70	3.58	1.6	-0.098	2.1	-2	21	-1	-0.5	0.741	6.7	0.08	0.909	2.2	35	-2	9	0.8	56.5	70
	5295	45.5	160	3.46	2.5	-0.305	3.7	-2	29	-1	-0.5	1.59	15	0.11	0.761	4.6	32	-2	19	1.6	28.3	135
	5296	6.45	160	1.42	2.4	0.619	3.2	-2	28	-1	-0.5	0.313	14	0.12	0.838	3.9	-20	-2	17	1.6	5.53	126
	5297	936	50	72.5	1.2	0.681	1.5	-2	24	-1	-0.5	12.3	9.5	0.05	0.754	1.6	80	-2	9	0.6	19.4	59
	5298	309	50	41.5	1.1	0.383	1.9	-2	41	-1	-0.5	2.54	8.7	0.04	1.05	2.3	53	-2	10	0.7	21	55
	5299	2647	-30	714	1	1.9	1.6	-2	22	-1	-0.5	6.78	9.8	0.04	0.839	13.9	71	-2	13	-0.2	16.7	50
	5300	5157	40	89.7	1.6	9.62	1.6	88	45	-1	-0.5	697	6.5	0.07	0.655	2.2	-20	-2	11	1	1008	66
	5301	8261	-40	165	2.7	10.9	2.1	405	69	-1	-0.5	1362	8.1	0.11	1.51	2.3	-20	-2	18	1.8	13498	142
	5302	13.4	160	1.38	2.9	0.822	3.9	-2	69	-1	-0.5	-0.07	15	0.12	0.619	2.8	-20	-2	14	1.8	21.4	135
	5332	17.4	160	1.21	2.9	0.038	5	-2	41	-1	-0.5	0.179	20	0.12	0.7	5	-20	-2	23	2	30.1	132
	5333	27.4	50	3.85	1.2	0.142	1.6	-2	46	-1	-0.5	0.572	8.3	0.04	1.59	2.3	-20	-2	10	0.7	30.3	56
	5544	27488	30	1493	2.2	1.36	1.2	-2	33	-1	-0.5	144	1.9	0.09	-1.46	23	19	-2	15	1.6	1191	28
	5545	140	60	2.84	3.9	1.61	6	-2	143	-1	0.8	10.4	6.7	0.10	0.422	6.6	-20	-2	32	2.4	191	166
	5546	901	-30	112	0.4	3.34	0.7	-2	123	-1	-0.5	3.02	2.5	0.03	0.103	2.5	-20	-2	5	0.4	258	26
	5650	9.12	-30	-0.172	0.5	-0.2	0.7	-2	14	-1	-0.5	0.267	2.3	0.01	0.43	0.6	35	-2	6	0.3	3.09	21
	5651	25.8	-30	1.89	1	-0.108	0.8	-2	52	-1	-0.5	0.176	1.9	0.07	0.345	0.8	36	-2	6	0.3	20.4	37
	5652	86.7	50	0.788	1.4	0.054	0.9	-2	23	-1	-0.5	0.136	4.2	0.10	0.38	2.7	65	-2	6	0.4	13.8	45
	5653	1760	40	22.9	1.8	0.951	2.5	-2	69	-1	-0.5	8.37	6.8	0.05	0.904	4.1	30	-2	13	0.9	187	55
	5654	299	-30	25.1	1	1.98	1.4	-2	30	-1	-0.5	5.62	4.5	0.04	0.877	5.1	62	-2	12	0.7	130	45
Antelope	5303	49.4	-30	1.12	0.8	0.353	5.3	-2	107	-1	-0.5	0.201	26	0.16	0.416	2.8	-20	-2	22	1.7	285	74
Springs	5532	1414	-30	517	2.3	1.58	5.3	-2	26	-1	1.1	8.13	29	0.11	0.22	5.6	-20	-2	17	1.9	211	99
west	5533	819	-30	329	0.3	6.47	0.5	-2	149	-1	-0.5	41.5	1.3	0.07	0.418	-0.5	-20	-2	2	0.2	296	38
	5534	171	30	104	1.6	1.25	3.4	-2	60	-1	-0.5	1.8	4	0.12	0.469	1.1	-20	-2	43	1.2	319	57
	5535	126	-30	11.7	0.9	5.93	0.5	16	51	-1	-0.5	48.2	1.5	0.49	0.4	0.5	95	-2	7	0.2	17.7	79
	5536	30.6	-30	4.87	3.9	1.65	3.2	-2	2026	1	-0.5	0.788	9.4	0.66	0.688	3.1	114	-2	12	0.9	41	353
	5537	209	-30	1.1	0.5	0.328	-0.5	-2	54	-1	-0.5	0.603	1.4	0.08	0.308	0.7	-20	-2	2	-0.2	56.9	36
	5538	1313	40	703	0.9	1.15	1.7	-2	70	-1	-0.5	28.8	3.7	0.08	0.403	2.4	-20	-2	12	1.1	168	61
	5539	9.7	40	-0.527	6	0.103	5.3	-2	1798	-1	-0.5	0.112	6.4	0.32	0.266	4.6	20	-2	7	1.2	72.2	206
	5540	1.03	-30	0.126	7.2	0.14	-0.5	-2	76	-1	-0.5	0.132	3.3	1.12	0.358	1.2	244	-2	10	1.2	2.05	198
	5541	5.91	-30	1.61	7.5	0.368	2.8	-2	1626	-1	-0.5	0.21	6.8	0.63	0.204	3.1	107	-2	3	1	9.8	268
	5542	7.71	-30	0.716	8.3	0.33	3.5	-2	476	-1	-0.5	0.291	9.1	0.96	0.4	3.2	177	-2	11	1.8	5.81	368
Bullfrog	5060	3.44	-30	0.57	0.2	-0.97	-0.5	-2	20	-1	-0.5	-0.5	0.6	0.02	-0.49	0.6	-20	-2	-2	0.5	5.23	20
	5061	7.39	-30	0.74	0.6	-0.93	0.9	-2	27	-1	-0.5	0.9	1.2	0.06	0.57	0.9	-20	-2	5	0.5	5.39	70
	5062	5.76	120	1.78	1.5	-0.93	2.6	5	234	-1	-0.5	-0.5	7.6	0.09	-0.46	1.4	-20	-2	12	0.9	17.30	73
	5063	5.99	-30	0.39	0.3	-0.93	-0.5	-2	451	-1	-0.5	-0.5	-0.5	0.02	-0.47	1.3	-20	-2	3	0.2	11.60	20

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	TI ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
Cactus Flat	5713	3	130	9.04	1.4	0.077	3.2	-2	226	-1	-0.5	0.149	15	0.14	0.368	7.2	44	-2	14	1	18.6	104
	5714	5.05	160	3.84	1.8	0.06	2.9	-2	212	-1	-0.5	0.136	6.8	0.12	0.536	2.8	-20	-2	16	1.2	9.37	73
	5715	3.23	150	2.32	1.8	0.045	1.5	-2	161	-1	-0.5	0.125	6.8	0.14	0.461	1.4	23	-2	8	0.8	3.87	66
Cactus Peak	5265	1.78	-30	0.976	5.7	0.327	3.3	-2	872	-1	-0.5	0.394	9.9	0.53	0.191	3.2	109	-2	12	1	44.8	216
	5266	1.85	-30	0.756	4	0.544	2.3	-2	1121	-1	-0.5	1.6	7.3	0.84	0.214	1.3	175	-2	7	0.9	16.2	241
Cactus Springs	5151	32774	-30	717	13.6	20.6	4.7	-10	1616	-1	0.5	4	9.1	0.18	-1.05	8.2	27	-2	32	0.4	49.8	55
	5165	11.1	120	1.08	3.5	0.174	2.3	-2	62	-1	-0.5	0.446	8.4	0.30	0.255	3	34	2	14	0.9	14.8	152
	5166	12.6	100	1.9	3.9	0.12	2.9	-2	65	-1	-0.5	0.444	8.3	0.35	0.414	3.5	91	4	15	1.2	10.8	164
	5167	90	60	8.06	1.2	0.706	2.1	-2	45	-1	-0.5	1.2	8.9	0.10	1.08	1.7	69	2	10	0.6	189	55
	5168	24.2	80	3.9	2.7	0.507	1.6	-2	95	-1	-0.5	6.58	6.8	0.20	0.493	1.8	-20	3	11	0.7	4.91	135
	5169	18.1	60	0.838	1.6	0.059	1.7	-2	47	-1	-0.5	0.935	5.4	0.10	0.489	2	-20	-2	6	0.6	12.7	63
	5170	22.9	50	0.769	1.5	-0.122	1.7	-2	18	-1	-0.5	1.23	5.8	0.08	0.688	1.6	111	-2	10	0.6	15	62
	5267	865	40	5.75	1.1	4.69	0.9	-2	52	-1	-0.5	171	3.7	0.07	0.244	0.9	-20	-2	6	0.5	314	41
	5268	2372	-30	8.44	0.9	21.7	0.8	10	79	-1	-0.5	264	1.5	0.07	0.428	0.5	-20	-2	6	0.5	565	47
	5269	61	-30	3.76	1.1	1.21	0.6	-2	55	-1	-0.5	0.843	2.6	0.05	0.764	1	-20	-2	4	0.2	42.2	37
	5270	2.17	-30	0.268	1.8	0.243	1.1	-2	174	-1	-0.5	0.076	6.8	0.23	0.489	1.7	-20	-2	7	0.9	6.68	148
	5271	7.47	-30	0.415	3.5	0.251	5.1	-2	555	1	0.6	0.221	19	0.32	0.109	3.5	21	-2	11	1.4	2.35	213
	5272	3.13	-30	0.439	1.6	0.338	0.9	-2	119	1	-0.5	0.213	6.5	0.38	0.258	1.3	57	-2	5	0.8	16.9	158
	5275	2416	-30	428	1.5	8.36	3.2	-2	1685	-1	-0.5	-3.34	3.8	0.16	-0.584	2.3	20	-2	7	0.4	17145	184
	5276	9.09	-30	16.7	1.9	1.18	1	-2	68	-1	-0.5	1.26	3.6	0.15	1.33	1.3	-20	-2	5	0.5	-17.8	81
	5288	24.4	70	5.05	1.5	0.171	1.5	-2	167	-1	-0.5	6.86	3.1	0.14	0.706	1.6	37	-2	7	0.4	12.1	89
	5289	12.4	70	2.64	1.7	0.114	1.6	-2	115	-1	-0.5	12.8	3.4	0.12	0.857	1.4	-20	-2	10	0.5	11.7	73
	5290	4.32	70	1.22	1.5	-0.089	1.2	-2	121	-1	-0.5	1.49	3.3	0.11	0.925	1.4	45	-2	7	0.4	9.35	69
	5291	15.2	100	4.69	2.5	0.383	2.7	-2	211	-1	-0.5	2.04	7.7	0.19	0.866	3.1	42	-2	12	0.8	13.7	89
	5292	10.5	170	0.488	4.6	-0.07	3.2	-2	119	-1	-0.5	1.96	11	0.32	1.05	3.3	-20	-2	16	1.2	29	119
	5293	7.89	120	1.35	2.5	0.004	1.8	-2	69	-1	-0.5	8.67	5.7	0.23	0.658	2	78	-2	9	0.7	2.03	125
	5294	10.5	-30	2.37	2.7	1.21	0.8	-2	70	-1	-0.5	4.6	-0.5	0.01	0.666	1.9	-20	6	7	0.7	30.7	12
	5325	28.9	30	10.6	1.1	-0.068	1.2	-2	85	-1	-0.5	2.19	2.2	0.08	1.06	1	-20	-2	5	0.2	5.76	56
	5326	1619	-30	3.66	0.8	17.1	0.9	5	67	-1	-0.5	2.23	1.1	0.06	0.66	0.8	-20	-2	4	-0.2	62.3	35
	5327	175	60	3.5	1.2	0.01	2.2	-2	110	-1	-0.5	10.4	9.6	0.06	0.963	2.4	-20	-2	10	0.9	17.3	50
	5328	255	-30	837	2.9	26.9	0.9	-2	306	-1	-0.5	17	92	0.13	0.849	2.8	150	6	7	1.4	59.4	70
	5329	2.74	-30	-0.513	3.2	0.313	2.1	-2	541	-1	-0.5	0.276	16	0.32	0.97	3.8	-20	7	14	1.7	2.43	252
	5330	6.94	-30	0.413	1.9	0.622	6.8	-2	342	-1	1	0.569	10	0.41	0.641	4	-20	-2	28	1.7	4.76	199
	5331	8.5	60	0.976	2.6	-0.033	1.7	-2	64	-1	-0.5	0.57	4.4	0.19	0.64	1.3	24	-2	9	0.6	2.99	125
	5394	2.73	-30	1.23	0.7	0.093	-0.5	-2	21	1	-0.5	0.164	3.2	0.09	0.212	1.5	-20	-2	-2	0.4	1.49	72
	5395	2.72	-30	0.772	2.4	0.626	2	5	223	1	-0.5	0.187	12	0.16	0.431	3.4	22	-2	4	0.9	4.27	108
	5396	3.81	-30	0.901	2.4	0.298	-0.5	-2	181	1	-0.5	0.145	14	0.13	0.228	3.8	-20	-2	2	1	1.12	100
	5397	10.3	-30	1.36	2.2	0.024	-0.5	2	287	1	-0.5	0.191	8.7	0.12	0.362	2.7	34	-2	3	0.5	1.16	108
	5398	5.87	230	2.26	3.6	0.024	2	-2	158	2	-0.5	0.128	16	0.14	0.378	4.3	30	-2	7	0.9	10.8	112
	5399	8.76	230	2.2	1.6	0.465	1.6	-2	102	-1	-0.5	0.138	15	0.13	0.328	3.7	-20	-2	7	1	8.48	98
	5526	447	30	0.505	0.5	1.69	0.7	-2	40	1	-0.5	0.313	4.9	0.21	0.408	2.5	25	-2	8	0.3	70.4	119
	5527	37.8	70	0.917	3	0.202	1.4	-2	23	-1	-0.5	0.854	3.1	0.13	0.43	1.4	-20	-2	6	0.7	25.6	45
	5528	65.2	50	0.6	1.9	0.538	2.6	-2	325	1	-0.5	1.2	12	0.26	0.278	3.2	34	-2	10	0.9	2.39	159
	5529	1544	-30	7.77	0.7	5.55	1.7	9	101	-1	-0.5	98.6	1.2	0.05	0.923	1.3	-20	-2	6	0.3	338	38
	5530	86.1	-30	532	2.5	9.26	2	11	325	-1	-0.5	5.52	5.2	0.53	0.238	1.6	101	-2	50	1.9	1276	308
	5531	14.2	-30	186	1.4	30.3	3.4	-2	769	1	-0.5	1.8	15	0.13	0.154	3.2	-20	-2	3	0.6	1.98	110
	5662	7.46	110	0.352	3.2	-0.013	2.9	-2	59	1	-0.5	0.165	11	0.27	0.701	3.3	64	-2	17	2	5.19	129
	5663	44.2	-30	16.9	2.2	7.35	1.8	3	275	2	-0.5	5.4	28	0.17	0.561	7.2	158	5	8	1	23.4	110
	5664	8.82	70	2.26	8.7	1.75	2.9	-2	7531	-1	-0.5	0.396	19	0.15	0.833	1.6	150	-2	8	0.6	30.3	153
	5665	16	140	0.875	2.5	0.017	3.9	-2	202	-1	-0.5	0.278	11	0.22	1.92	3.1	83	-2	30	1.6	1315	119
	5666	1154	-30	4.94	1.2	2.95	1.7	-2	68	-1	-0.5	6.59	3.7	0.05	0.532	0.6	47	-2	5	-0.2	30.7	22

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Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TIO2 XRF %	TI ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5677	7.5	110	0.441	1.2	0.241	0.6	-2	110	1	-0.5	0.202	8.3	0.12	0.336	2.5	-20	-2	4	0.7	2.6	86
	5712	97.1	-30	54	3.1	3.93	1.1	-2	455	-1	-0.5	0.73	29	0.24	0.49	7	164	16	6	1	116	127
	5816	4.93	-30	0.809	3.2	1.02	2.3	-2	202	-1	-0.5	0.241	3.3	0.26	0.215	3	104	-2	10	1	122	94
	5817	6.52	90	1.2	9.1	0.644	9.1	-2	503	-1	-0.5	0.858	9.9	0.69	0.181	3	128	-2	12	1.6	12.9	205
	5818	7.87	100	0.491	9.3	0.64	3.5	2	70	-1	-0.5	0.031	13	0.25	0.272	2	58	-2	14	1.6	198	96
	5823	9.07	-30	1.46	3.3	0.621	4	-2	557	-1	-0.5	0.229	18	0.32	0.125	4.4	43	-2	9	1.4	21.2	243
	5824	4.84	-30	31.7	4.1	11.6	5	-2	1142	-1	-0.5	1.02	10	0.27	-0.032	2.1	45	-2	6	0.7	219	223
	5825	45.6	-30	678	8.2	7.93	0.9	166	285	-1	-0.5	4.83	6.9	1.37	0.24	1.8	57	20	6	1.2	50.6	173
	5826	90.3	-30	55.2	4	3.81	1.1	-2	226	2	-0.5	1.93	20	0.30	2.81	8.3	52	-2	8	1.8	22.8	154
	5827	69	-30	41.6	9.1	1.49	11.1	-2	1728	-1	0.9	1.53	49	1.25	0.227	5.5	232	23	19	2	65.6	227
	5828	13.4	220	4.37	2.6	0.11	2.3	-2	111	-1	-0.5	0.14	17	0.13	0.425	3.3	-20	-2	9	0.8	5.7	101
	5829	5.8	220	1.72	2.1	0.195	1.8	-2	135	-1	-0.5	0.171	15	0.12	0.55	4	24	-2	11	1.1	15.2	104
	5830	5.42	230	1.61	2.5	0.5	1.3	-2	138	-1	-0.5	0.09	17	0.12	0.487	3.6	-20	-2	6	0.9	8.92	100
	5831	6.46	170	1.38	1.7	0.073	1.9	6	103	-1	1.1	0.13	17	0.12	0.325	2.1	-20	-2	8	0.9	3.97	94
	5832	4.33	230	3.36	2.4	0.119	1.5	-2	93	-1	-0.5	0.079	12	0.12	0.324	3.1	23	-2	13	1.5	12.2	102
	5842	11.5	-30	6.79	7.9	0.242	4.1	-2	140	1	-0.5	0.131	18	0.60	0.67	4.8	89	13	20	1.8	89.1	145
	5843	148	80	0.629	6.2	1.07	3	-2	168	-1	-0.5	0.535	11	0.39	0.441	3.5	65	-2	7	0.7	32.8	99
	5844	248	110	2.05	6.5	0.598	2.8	-2	174	-1	-0.5	1.05	15	0.21	0.794	18.1	67	-2	13	1.2	263	66
	5845	301	100	0.691	4.2	1.64	2.3	-2	102	-1	-0.5	0.648	9.1	0.24	0.208	2.8	81	-2	7	0.7	17.9	61
	5846	17.7	70	1.41	8.1	0.503	3.6	3	189	-1	-0.5	0.292	16	0.72	0.492	4	162	-2	9	0.9	5.18	160
	5952	9.03	200	2.74	2.3	0.145	2.2	-2	94	-1	-0.5	0.122	17	0.12	0.432	2.8	20	-2	9	1.2	15.7	106
	5954	9.7	-30	1.51	0.6	0.136	1.1	-2	67	1	-0.5	0.108	12	0.13	0.4	3.7	-20	-2	8	0.9	2.89	99
	5955	140	-30	17.1	1.7	0.538	1.5	-2	151	-1	-0.5	0.143	51	0.12	0.315	4.2	113	-2	10	1.7	52	92
Cactus Springs west	5127	29.8	30	4.3	3.9	0.744	1.8	-2	146	-1	-0.5	0.411	17	0.24	0.491	4.2	39	-2	10	1.5	92.4	123
	5128	19.8	-30	20.1	3	1.53	1.6	-2	232	-1	-0.5	0.201	22	0.18	0.601	8	-20	-2	8	0.9	34.7	126
	5131	13.3	40	0.738	6.4	0.67	6.4	-2	1157	-1	0.6	0.198	16	0.45	0.276	2.5	79	-2	17	1.7	25.6	235
	5370	5.26	140	0.674	11.7	0.263	6.1	2	223	-1	0.7	0.69	11	0.82	0.275	3	115	-2	30	3.3	16	246
	5371	9.36	60	0.59	4.6	0.282	3.1	-2	184	-1	-0.5	-0.72	4.6	0.29	0.092	3.4	73	-2	27	1.9	7034	109
	5372	8.92	80	0.833	5.9	0.463	5.3	-2	73	-1	0.8	-0.021	5.5	0.77	0	2.2	82	4	42	3.4	3807	231
	5373	9.87	150	0.539	2.2	0.442	4	-2	46	1	-0.5	0.252	44	0.12	0.348	3.6	-20	-2	13	1.4	3.84	67
	5374	6.52	100	0.361	4.1	0.646	2.5	3	47	-1	-0.5	0.319	12	0.26	0.375	1.6	64	-2	6	0.8	2.48	85
	5375	8.09	110	0.528	3.2	2.59	0.9	-2	91	-1	-0.5	0.235	8.6	0.18	0.751	0.7	44	-2	3	0.3	2.98	75
	5376	13.4	90	0.3	2.1	2.62	1.2	-2	73	-1	-0.5	0.183	9.2	0.26	0.557	0.7	34	-2	4	0.2	1.93	96
	5377	10.3	140	0.395	2.9	0.102	2.6	2	21	1	-0.5	0.151	8.6	0.16	0.233	1.8	24	-2	13	1.8	2.9	96
	5378	9.71	100	1.06	1.8	0.447	0.9	2	23	1	-0.5	0.165	4.5	0.11	0.393	1.1	22	-2	5	0.6	5.51	63
	5379	8.12	90	0.526	3.4	3.55	3	4	98	-1	-0.5	0.28	17	0.22	0.06	3.2	42	-2	5	0.6	6.13	77
	5380	5.51	70	0.498	4.7	0.405	2.2	-2	125	-1	-0.5	0.217	13	0.28	0.221	2.7	66	-2	11	1.3	1141	100
	5381	27369	-30	-0.597	1.4	14.8	1.2	-2	39	2	-0.5	1.46	8	0.33	-1.51	11.6	-20	8	32	1.3	1302	79
	5382	-10.1	-30	70.6	1.3	0.279	0.5	2	48	1	-0.5	0.395	11	0.12	0.156	4.1	-20	-2	6	1.1	2.53	84
	5383	8.79	-30	117	2.4	0.193	-0.5	2	297	-1	-0.5	0.49	9.5	0.09	0.238	3.1	-20	-2	4	0.7	5.48	72
	5384	7.14	-30	166	3.8	0.694	-0.5	5	1308	-1	-0.5	0.503	25	0.09	0.367	4.4	20	-2	7	0.6	53.4	108
	5385	8.26	80	0.543	9.4	0.78	3.5	-2	544	-1	-0.5	0.197	18	0.50	0.332	2.2	88	-2	7	0.8	4.51	180
	5386	31.9	-30	0.413	3.7	0.422	3.9	-2	608	1	-0.5	0.268	16	0.55	0.297	1.9	76	-2	6	0.7	3.35	177
	5387	16.4	80	0.437	5.2	0.968	3.7	3	579	-1	-0.5	0.196	17	0.41	0.31	2	76	-2	5	0.6	7.44	143
	5388	16.7	50	0.541	3.4	1.98	0.8	5	126	1	-0.5	0.193	6	0.16	0.167	0.8	30	-2	3	0.4	11.1	123
	5389	47.7	30	0.868	5.7	0.641	3.1	-2	522	1	-0.5	0.302	16	0.36	0.473	2.8	138	-2	8	1.1	26.1	132
	5390	29.6	60	1.28	5.4	1.55	1.6	-2	127	-1	-0.5	0.256	38	0.45	0.094	3.8	336	2	5	0.6	60.2	101
	5391	48.1	-30	55.3	2.4	1.08	0.7	3	348	1	-0.5	0.837	9.8	0.18	0.287	3.1	75	-2	2	0.5	2.56	111
	5392	85.9	-30	109	5.6	1.56	4.2	30	853	-1	-0.5	1.92	16	1.19	0.244	5.2	140	6	12	1.9	8.99	203
	5393	3.83	-30	2.49	1.4	0.239	-0.5	3	64	-1	-0.5	0.201	5.3	0.16	0.024	1.9	-20	-2	3	0.6	1.46	102
	5507	16.4	50	12.6	2.4	5.15	1.4	-2	360	-1	-0.5	74	10	0.38	0.575	1.6	74	-2	4	0.5	10.4	134

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP	RB INAA	Sb ICP	SC INAA	Se ICP	SM INAA	Sn XRF	Sr XRF	TA INAA	TB INAA	Te ICP	TH INAA	TIO2 XRF	TI ICP	U INAA	V XRF	W XRF	Y XRF	YB INAA	Zn ICP	Zr XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	5508	32	100	0.684	2.2	0.337	2.6	-2	160	1	-0.5	0.306	7.5	0.13	0.243	1.7	-20	-2	8	0.6	13.9	92
	5509	10.3	100	0.177	4.8	0.528	5.2	-2	440	-1	0.6	0.172	13	0.45	0.422	5	73	-2	14	1.5	26.3	194
	5510	13.5	130	0.249	4.5	0.916	5.4	-2	180	1	0.6	0.211	14	0.30	0.433	3.8	51	-2	7	1.1	9.44	120
	5511	6.39	120	0.155	3.6	0.124	1.9	-2	435	-1	-0.5	0.1	14	0.45	0.121	3.5	49	-2	7	0.8	8.48	197
	5512	11.1	40	0.435	4.8	2.8	5.8	-2	86	-1	0.5	0.466	7.6	0.08	0.396	3.6	-20	-2	4	0.2	14.6	36
	5513	4.51	140	0.229	8.2	0.211	4.3	-2	285	1	-0.5	0.178	12	0.56	0.484	3.3	112	-2	13	1.7	13.1	190
	5514	12.2	80	0.455	1.4	0.233	1.7	-2	39	1	-0.5	0.196	8.7	0.14	0.045	1.7	-20	-2	14	0.5	9.48	94
	5515	8.85	80	0.185	13.5	5.28	5.8	-2	108	-1	0.8	0.223	14	0.32	0.308	3.3	54	-2	19	1.7	27.9	100
	5516	9.86	80	0.203	4.3	0.545	1.4	-2	126	-1	-0.5	0.177	3	0.28	0.361	1.7	-20	-2	12	0.9	37.9	126
	5517	9.04	120	0.365	3.3	0.39	2.9	-2	180	1	-0.5	0.24	18	0.26	0.364	4	22	3	11	1.5	16.9	141
	5518	8.65	160	0.155	9.9	0.783	3.1	-2	373	1	-0.5	0.105	10	0.59	0.288	2.8	114	-2	15	1.5	5.65	207
	5519	4.6	170	0.125	12.9	0.688	3.9	-2	505	1	0.5	0.06	11	0.65	0.306	3	151	-2	12	1.6	5.02	222
	5520	19.3	150	0.299	4.8	1.02	1.6	-2	179	1	-0.5	0.338	11	0.33	0.171	3.9	41	3	5	0.6	35.6	145
	5521	8.92	50	4.03	6.4	0.532	3.2	-2	717	-1	-0.5	0.668	9.5	0.26	0.292	2.6	-20	-2	5	1	22.2	109
	5522	44.3	140	0.621	3.5	0.284	4.7	23	77	1	0.5	0.277	15	0.17	0.458	5.1	-20	-2	13	2.1	23.1	124
	5523	4.79	90	0.262	4	1.2	3.7	-2	388	1	-0.5	0.161	13	0.32	0.715	3.4	47	-2	13	1.7	127	203
	5524	31.5	-30	0.396	6.2	1.61	2.8	-2	411	-1	-0.5	0.374	20	0.23	0.316	2.4	38	-2	4	0.7	10.3	165
	5525	6.87	100	0.452	12.6	0.178	2.5	-2	155	-1	-0.5	0.128	10	0.45	0.283	4.8	86	-2	14	1.5	225	129
	5833	3.37	180	0.303	2.9	0.054	3.3	-2	173	-1	-0.5	0.114	24	0.14	0.248	3.6	-20	-2	13	1.3	12.6	109
	5834	3.94	160	0.168	2.2	-0.033	2.5	-2	119	-1	-0.5	0.049	16	0.13	0.178	3.6	-20	-2	12	1.2	9.14	100
	5835	9.29	170	1.32	2.4	0.148	2.2	-2	173	-1	-0.5	0.063	19	0.15	0.359	3.1	-20	-2	11	0.9	8	124
	5836	0.587	-30	0.33	0.3	0.24	-0.5	-2	564	-1	-0.5	0.099	0.5	0.01	0.427	0.9	-20	-2	2	-0.2	5.38	27
	5953	8.77	260	3.91	2.2	0.113	4.5	-2	125	-1	-0.5	0.121	15	0.11	0.535	2.9	-20	2	19	2.2	15	93
	5956	0.904	-30	0.648	0.7	0.158	-0.5	-2	11	-1	-0.5	0.209	3.8	0.12	0.287	2.1	-20	-2	-2	0.5	1.51	102
	5957	12.8	-30	4.27	3	0.585	-0.5	-2	122	-1	-0.5	0.479	14	0.12	0.159	2.2	-20	-2	3	0.6	3.61	98
	5958	18.4	-30	43.7	1.9	0.511	1.6	-2	549	-1	-0.5	0.326	6.4	0.28	0.251	1.5	44	-2	4	0.6	4.65	161
	5959	71.3	-30	9.78	5.6	1.83	0.9	8	549	-1	-0.5	0.44	18	0.46	0.383	3	66	-2	3	0.8	3.57	207
Cedar Pass	5126	0.8	-30	0.873	1.5	0.432	-0.5	-2	26	-1	-0.5	0.141	-0.5	0.02	0.456	0.5	-20	7	2	0.2	11.2	34
	5707	9.11	140	2.28	2.4	0.131	3.3	-2	44	-1	-0.5	0.15	18	0.15	0.32	3.6	22	-2	15	1.5	35.7	79
	5708	11.7	180	0.557	3.3	0.108	4.6	-2	96	-1	-0.5	0.133	24	0.18	0.413	4.5	-20	2	31	3	5.6	104
	5709	27.2	100	3.63	1.8	0.06	2	-2	74	-1	-0.5	0.61	9.6	0.15	0.817	3.2	33	-2	9	0.9	11.9	79
	5710	19.3	90	7.8	2.2	0.06	2.4	-2	23	-1	-0.5	0.162	12	0.10	0.609	2.8	21	7	27	2	32.4	67
Clarkdale	5097	10.8	80	0.178	0.5	0.118	3.4	2	40	1	-0.5	0.144	13	0.08	0.24	1.6	-20	-2	18	2.1	1.97	68
	5098	17.4	110	0.293	0.7	0.063	4.4	-2	210	-1	-0.5	0.133	16	0.09	0.475	2	-20	-2	38	2.8	8.33	92
	5215	10.3	100	1.7	5.7	0.287	3	-2	383	-1	-0.5	0.159	24	0.12	0.31	4.1	-20	-2	27	4.2	3.73	161
	5216																					
	5217	-0.062	-30	0.141	1.9	0.147	-0.5	-2	1219	-1	-0.5	0.15	24	0.02	0.308	1.2	-20	-2	2	-0.2	0.487	118
	5218	5.74	-30	0.57	3.1	-0.046	1.5	-2	619	-1	-0.5	0.123	22	0.15	0.196	2.8	-20	-2	16	2.3	0.923	186
	5219																					
	5220	3.4	-30	1.42	1.3	0.145	2	-2	271	-1	-0.5	0.153	5.8	0.04	12.9	1.5	-20	-2	19	1.7	195	51
	5221	3.08	30	2.42	3.9	0.241	3.8	-2	54	-1	0.6	0.195	16	0.12	0.257	3.2	-20	-2	40	4.4	-7.78	109
	5222	11.5	60	2.56	2.6	0.166	2.5	-2	80	-1	-0.5	0.194	13	0.10	1.08	4.3	-20	-2	21	2.8	64.9	91
	5223	23.1	200	0.873	3	0.135	3.8	-2	87	-1	0.5	0.126	19	0.17	0.1	3	-20	-2	23	3	71.1	146
	5224	1.97	-30	0.281	0.2	0.135	-0.5	-2	556	-1	-0.5	0.113	-0.5	0.01	0.124	-0.5	-20	-2	-2	-0.2	-0.179	57
	5225	6.29	-30	0.364	0.8	0.192	0.8	-2	488	-1	-0.5	0.08	2.2	0.02	0.204	1.8	-20	-2	6	0.5	41.9	30
	5226	4.8	-30	0.17	0.2	0.08	-0.5	-2	1051	-1	-0.5	0.073	-0.5	0.01	0.303	-0.5	-20	-2	2	-0.2	8.72	31
	5227																					
	5228																					
	5229	23.7	130	0.887	1.2	0.161	1.4	-2	113	-1	-0.5	0.072	6.4	0.16	0.584	1	-20	-2	10	1	36	83
	5230	9.21	190	0.922	4.4	0.227	3.6	-2	168	-1	-0.5	0.15	9.4	0.32	0.376	2.1	53	-2	19	2	91.9	138
	5231	8.57	140	0.615	1	-0.038	1.2	-2	216	-1	-0.5	0.123	5.3	0.10	0.513	0.7	-20	-2	9	0.7	38.6	62

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MINE SITE SAMPLES
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Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5232	6.56	-30	0.657	4.2	0.204	0.7	-2	68	1	-0.5	0.113	7.6	0.57	0.252	1.5	127	-2	8	1.2	0.751	187
	5233	6.56	170	1.14	1	0.066	2.5	-2	433	-1	-0.5	0.122	14	0.10	0.361	2.4	-20	-2	15	1.6	28.4	118
	5234	4.3	130	0.372	1.2	0.151	2.7	-2	91	-1	-0.5	0.167	12	0.12	1.79	3.3	-20	-2	18	1.4	29.1	89
	5235	9.95	170	0.361	1.9	0.181	5.7	-2	146	2	0.7	0.145	22	0.23	0.335	3.6	-20	-2	31	3.4	4.19	220
	5236	6.71	250	0.39	1.4	-0.017	4.6	-2	462	1	0.6	0.132	19	0.12	0.93	6.8	-20	-2	25	2.3	91.7	133
	5244	11.3	330	2.69	1.7	-0.226	3.2	-2	141	1	0.5	-0.117	14	0.15	0.087	2.7	-20	-2	16	1.7	10.5	112
	5245	9.93	180	0.911	1.5	-0.307	2.1	-2	89	-1	-0.5	-0.144	12	0.10	0.134	3	-20	-2	5	0.7	23.1	73
	5246	11.4	90	0.816	1.1	-0.28	1.6	-2	519	-1	-0.5	-0.127	7.7	0.05	0.233	1.6	-20	-2	7	0.8	32.1	74
	5247	3.31	210	1.32	1.5	0.171	3.2	-2	91	-1	-0.5	-0.124	18	0.13	0.175	2.5	-20	-2	12	1.5	7.28	97
	5248	2.77	-30	0.957	3.1	-0.152	5.3	-2	40	1	0.6	-0.184	17	0.19	0.031	2.7	-20	-2	23	2.4	3.72	102
	5249	1.53	40	0.724	0.8	-0.329	0.7	-2	2636	-1	-0.5	-0.137	3	0.02	-0.025	1.2	-20	-2	5	0.5	5.23	143
	5258	5.08	210	0.476	0.5	-0.082	5.4	2	41	2	0.8	0.056	15	0.10	0.341	4.4	-20	-2	31	3	5.59	198
	5259	3.57	60	0.97	1.4	0.118	1.7	-2	1454	-1	-0.5	0.153	6.1	0.12	0.145	0.8	-20	-2	7	0.9	-2.67	169
	5260	28.4	140	0.412	0.6	0.918	1.7	9	77	-1	-0.5	0.047	4.2	0.08	0.455	1.5	-20	-2	9	0.8	29	59
	5261	15.8	120	0.534	0.9	0.844	2.3	6	71	-1	-0.5	0.09	4.6	0.08	0.674	2.2	-20	-2	17	1.4	48.7	54
	5262	2.37	-30	0.217	0.6	0.156	0.7	-2	94	-1	-0.5	0.154	1	0.02	0.353	0.6	-20	-2	13	0.5	94.4	29
	5263	6.3	-30	0.077	0.5	-0.344	0.9	2	1918	-1	-0.5	0.074	-0.5	0.01	0.787	-0.5	-20	-2	12	0.5	13.7	59
	5264	13.6	230	0.649	1.7	0.18	4.5	-2	81	2	0.6	0.16	24	0.17	0.112	4	-20	-2	32	3.3	22.4	147
	5304	153	90	0.747	0.8	0.923	0.8	-2	70	-1	-0.5	0.118	3.3	0.07	0.485	0.6	-20	-2	4	0.3	42.7	49
	5305																					
	5306	4.59	30	0.286	1.1	0.11	0.9	-2	697	-1	-0.5	0.199	2.3	0.06	0.184	0.9	-20	-2	5	0.4	11.2	96
	5307	5.48	100	0.365	0.5	1.02	3.6	-2	116	-1	-0.5	0.187	9.2	0.07	0.298	2	-20	-2	19	1.9	22.1	122
	5550	7.44	220	0.804	2.1	-0.199	3.3	-2	87	-1	-0.5	-0.115	19	0.11	0.488	3.7	-20	-2	15	1.7	10.7	83
	5551.1	16.6	140	3.37	2.5	-0.263	4.1	-2	79	2	0.5	-0.131	18	0.14	0.769	7.9	-20	-2	14	2	239	100
	5551.2	9.31	-30	1.94	4.6	0.866	13	-2	141	-1	2.2	-0.048	20	0.27	0.437	9.9	-20	11	66	5.2	41.9	115
	5552	11	310	0.628	2.7	-0.232	5	-2	65	1	0.7	-0.101	29	0.15	0.116	4.7	-20	-2	19	2.4	1.77	113
	5553																					
	5554.1	8.4	150	3.06	1.5	-0.127	2.5	-2	85	-1	-0.5	-0.06	10	0.13	0.318	2.2	-20	-2	10	1.3	11.2	110
	5554.2	8.7	150	3.83	1.3	-0.133	3.5	-2	81	-1	0.5	-0.053	21	0.12	0.281	2.9	-20	-2	19	2.2	9.69	92
	5555	8.38	240	5.29	1.9	-0.299	3.4	-2	44	-1	0.7	-0.097	19	0.12	0.407	3.9	-20	-2	13	2	16.5	90
	5555.1	6.23	50	6.75	0.4	-0.097	0.9	-2	64	-1	-0.5	-0.115	3.1	0.03	0.397	1.9	-20	-2	6	0.7	24.4	31
	5556	1.79	-30	2.95	0.3	-0.281	-0.5	-2	35	-1	-0.5	-0.181	-0.5	0.02	0.311	-0.5	-20	-2	-2	0.2	3.24	21
	5557	3.95	190	2.46	1.4	-0.054	3.3	-2	94	-1	-0.5	-0.094	20	0.13	0.272	2.7	-20	-2	10	1.4	8.61	96
	5558	8.44	160	5.32	1.5	0.089	5.2	-2	46	-1	0.6	-0.056	13	0.14	0.721	6.4	21	-2	26	2.4	52.9	146
	5559	5.77	210	1.69	1.3	-0.117	3.8	-2	46	-1	0.5	-0.067	19	0.13	0.295	3.3	-20	8	15	1.9	7.02	121
	5560																					
	5564.1	16.2	-30	0.655	1.4	-0.188	-0.5	-2	35	-1	-0.5	-0.119	21	0.06	0.151	2.5	-20	-2	6	1.4	14.3	66
	5564.2	4.79	-30	0.359	2.1	-0.204	-0.5	-2	34	1	-0.5	-0.118	24	0.06	0.189	7.3	-20	-2	6	2.3	1.51	160
	5565																					
	5566	7.48	100	0.55	3.7	-0.166	3.2	-2	344	-1	-0.5	-0.053	15	0.36	0.268	2	66	-2	11	0.9	7.67	158
	5567	8.75	70	0.278	1.4	-0.243	3.5	-2	49	1	-0.5	-0.098	16	0.17	0.286	2.4	-20	-2	15	1.5	2.08	140
	5568																					
	5569	14.5	130	0.501	2	-0.13	3.5	-2	103	2	0.7	-0.124	21	0.13	0.367	2.6	-20	-2	31	3.5	5.64	232
	5570	9.33	120	0.357	1.2	-0.276	3.8	-2	30	-1	-0.5	-0.082	16	0.14	0.237	3.1	-20	-2	19	2.2	9.51	121
	5571	1.88	-30	0.441	7.1	-0.268	41.2	-2	1615	-1	12.1	-0.082	-0.5	0.05	0.188	-0.5	-20	23	320	22.5	2.63	429
	5572	1.17	-30	0.552	1.2	-0.033	1	-2	298	-1	-0.5	-0.078	11	0.07	0.28	0.9	-20	-2	17	1.6	1.56	72
	5573																					
	5574																					
	5584	11.9	170	1.07	4.7	0.471	2.9	-2	315	1	-0.5	0.227	8.3	0.47	0.4	1.3	31	-2	15	1	7.94	170
	5585	8.64	160	0.747	3.6	0.202	1.5	-2	172	-1	-0.5	0.192	5.8	0.32	0.368	0.6	28	-2	7	0.5	6.15	107
	5586	12.8	130	1.48	10	0.292	5.4	-2	496	1	0.6	0.206	17	0.76	0.342	2.7	61	-2	24	1.8	26.7	235

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining	Sample	Pb	RB	Sb	SC	Se	SM	Sn	Sr	TA	TB	Te	TH	TIO2	TI	U	V	W	Y	YB	Zn	Zr
District	Number	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	5600	67.5	60	0.856	0.7	0.571	14.6	-2	110	-1	4.2	0.102	8.4	0.07	17.1	9.8	49	4	80	8.1	1756	58
	5601	1.26	-30	0.268	2.1	0.299	0.6	-2	1440	-1	-0.5	0.152	24	0.03	0.179	1.7	41	-2	8	0.4	-0.661	49
	5602	7.73	120	0.657	0.5	0.352	3	-2	142	1	-0.5	0.114	7.6	0.07	0.353	1.9	-20	-2	22	1.5	36.1	94
	5603	9.08	140	8.75	0.7	0.227	2.9	-2	82	1	-0.5	0.172	9.8	0.07	0.931	1.8	-20	-2	20	1.7	44.4	108
	5604	13.7	150	0.721	1	0.102	3.2	-2	219	1	-0.5	0.167	11	0.07	0.47	1	-20	-2	21	1.9	42.4	101
	5605	28.8	160	0.781	1.8	0.387	6.2	-2	79	1	0.8	0.188	16	0.18	0.459	2.5	-20	-2	27	2.6	52.8	149
	5684	3.22	80	0.574	1.1	0.185	2.1	-2	475	-1	-0.5	0.166	9	0.05	0.233	1.7	-20	-2	14	1.1	35.8	66
	5685	7.56	100	0.756	1.5	0.144	3	-2	411	1	-0.5	0.192	13	0.07	0.397	2.4	-20	2	23	1.9	94.4	79
Corral Spring	5144	12.3	40	2.15	0.8	0.144	1.2	-2	25	-1	-0.5	0.183	8.5	0.05	0.25	1.3	-20	-2	6	0.6	0.006	39
	5145	48.8	70	4.43	1.4	0.082	2.3	-2	23	1	-0.5	0.226	14	0.08	0.391	3.9	-20	-2	10	1.2	8.31	58
	5281	20.9	120	0.241	2.5	-0.011	3.6	-2	184	-1	-0.5	0.113	18	0.19	0.292	2.9	-20	-2	15	1.6	14.7	123
Don Dale	3000	26.6	80	0.967	2.1	0.228	3.7	-2	91	-1	-0.5	0.187	14	0.07	0.457	4	-20	5	22	1.9	45.4	72
	3001	7.64	170	0.463	4.6	-0.087	6	-2	128	1	0.6	0.138	23	0.23	0.351	6	-20	-2	29	3	5.09	248
	3020	9465	-30	176	1.2	0.939	1.2	-2	18	-1	-0.5	57.7	3.2	0.13	-0.379	2.3	-20	-2	11	0.8	427	166
	3038	18.4	-30	7.01	6	0.773	2.5	-2	106	-1	-0.5	0.128	9.6	0.34	0.538	10.6	48	9	13	1.2	160	83
	3050	8679	-50	2204	2.4	1.79	6.1	-2	600	-1	-0.5	9.29	5.6	0.35	4.21	6.6	20	10	20	2.8	83.2	486
	3051	40606	-30	368	1	6.14	1.7	-2	289	-1	-0.5	30.5	2.5	0.14	5.3	6.5	-20	11	38	1.5	61.6	84
	3052	140	-30	57.2	0.7	0.177	0.7	-2	48	-1	-0.5	0.655	1.7	0.06	7.77	0.5	-20	-2	2	0.3	16.2	48
Eastern	5136	11.7	-30	1.06	10.2	0.574	4.6	-2	1816	-1	-0.5	0.561	5.4	0.98	0.311	2.4	212	-2	20	1.4	370	139
Goldfield	5137	15.1	-30	0.873	2.3	0.12	0.7	-2	346	-1	-0.5	0.349	15	0.13	0.419	4.1	-20	-2	5	0.6	5.43	125
	5334	28.2	170	1.82	0.8	0.631	2.2	-2	119	-1	-0.5	0.199	10	0.12	0.885	1.2	-20	4	8	0.7	40.4	67
	5335	18.4	160	1.77	8.9	0.424	3.2	2	607	-1	-0.5	0.209	2.8	1.01	0.787	16.1	156	4	12	1	18.2	129
	5336	42.6	320	3.64	1.6	0.934	3	-2	159	1	-0.5	0.187	15	0.12	0.374	3.3	-20	-2	13	1.3	45.4	102
	5337	1.35	40	0.453	1.4	0.122	1.2	2	1258	-1	-0.5	0.13	3.2	0.06	0.367	0.6	26	-2	7	0.4	7.93	66
	5338	0.478	-30	0.276	-0.1	-0.218	-0.5	-2	196	-1	-0.5	0.02	-0.5	0.01	0.776	-0.5	-20	-2	-2	-0.2	2.06	12
	5339	8.62	300	0.566	1.6	-0.101	2.8	-2	156	1	-0.5	0.112	14	0.22	2.56	2.8	21	18	8	0.7	42.8	111
	5340	26.1	180	5.82	15.4	0.473	2.8	-2	690	-1	-0.5	0.197	2.3	1.63	0.507	8.6	283	37	11	1.3	53.1	179
	5341	15.3	170	2.7	1.5	-0.011	2.4	-2	195	-1	-0.5	0.092	13	0.12	0.84	2.5	20	-2	15	1.3	15.1	111
	5342	0.757	-30	0.343	0.2	-0.246	-0.5	-2	1835	-1	-0.5	0.114	-0.5	0.01	0.63	-0.5	-20	-2	3	-0.2	2.47	75
	5343	11.7	-30	3.09	5.1	0.175	3.1	-2	524	-1	-0.5	0.171	15	0.79	0.786	5.7	247	2	6	0.6	27.6	196
	5344	9.48	130	0.535	5.5	0.033	2.4	4	264	-1	-0.5	0.113	6.2	0.38	0.855	2.5	111	3	11	0.9	36.6	90
	5345	3.82	220	0.58	2.5	-0.422	5.4	-2	176	-1	-0.5	0.144	31	0.20	0.924	2.9	25	2	21	1.9	11.5	101
	5346	17.9	-30	1.13	1.1	-0.278	3.4	-2	28	1	-0.5	0.18	15	0.10	0.871	9.7	145	2	25	2.4	10.4	107
	5347	2.25	-30	0.279	0.2	0.034	1.3	-2	20	-1	-0.5	0.154	3.3	0.03	0.841	2.6	-20	-2	8	0.7	4.92	24
	5348	14.5	-30	2.51	5.1	1.83	2.7	-2	203	-1	-0.5	0.145	6.6	0.39	0.636	3.6	96	4	9	0.7	13.7	90
	5349	11.6	80	0.318	6.1	-0.144	3.7	-2	579	-1	-0.5	0.128	7.1	0.56	1.15	9.1	119	-2	18	1.2	15.3	192
	5474	58.9	-30	0.96	3.5	0.259	1.3	-2	2604	1	-0.5	0.702	3.4	0.78	0.499	2.6	162	-2	9	0.9	12.5	
	5475	129	-30	12.3	2.5	0.075	2.8	-2	1709	-1	-0.5	1.68	7.4	0.58	0.585	2.1	83	10	5	0.5	27.2	
	5476	29.9	110	1.61	2.3	2.71	1.7	-2	161	-1	-0.5	1.03	15	0.14	6.72	5.2	-20	-2	7	0.8	11	
	5477	11.5	-30	115	1.6	0.494	2.1	-2	653	-1	-0.5	0.706	1.5	0.07	13.3	6.2	-20	-2	8	0.7	52.9	
	5478	7.12	30	6.21	8.5	0.45	5.3	-2	699	-1	0.6	1.6	13	0.54	0.933	3.6	64	16	7	0.6	12.3	
	5479	3.23	40	3.01	4.8	0.276	2.7	-2	600	-1	-0.5	0.24	12	0.56	0.923	3.1	97	7	7	0.8	3.32	
	5480	17.9	-30	95.2	1.3	1.7	1.1	-2	393	1	-0.5	1.66	3.6	0.50	0.824	2.3	97	35	3	0.4	7.54	
	5481	221	-30	94.7	1.4	25	0.5	-2	468	-1	-0.5	15.2	2.9	0.80	1.72	5.8	179	189	2	0.2	20.1	
	5482	534	-30	6.95	5.9	11.1	2.4	7	1254	3	-0.5	15.5	33	0.56	1.32	17.2	123	25	18	2.3	102	
	5483	82.4	-30	26.1	2.3	0.773	0.8	-2	417	1	-0.5	1.39	10	0.22	0.675	5.2	20	7	7	0.6	35	
	5484	74.4	-30	21.4	4	5.52	1	-2	700	1	-0.5	2.08	9.6	0.57	0.851	4.8	97	22	9	1.1	29.4	
	5485	13.2	-30	0.549	2.3	1.09	0.6	-2	869	-1	-0.5	0.181	4	0.70	0.854	2.7	143	-2	4	0.3	18.9	
	5902	5.9	90	0.41	1.6	0.077	2.9	-2	226	-1	-0.5	0.099	12	0.11	0.449	3.4	-20	-2	12	0.9	9.65	80
	5903	12.6	220	0.631	1.5	-0.193	2.8	-2	165	-1	-0.5	0.069	16	0.12	0.534	3	-20	-2	12	1.5	18.2	93
	5904	99.6	-30	3.42	0.1	-0.142	-0.5	-2	685	-1	-0.5	0.107	-0.5	0.01	0.63	2	38	-2	3	-0.2	294	27

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5905	3.94	220	0.267	0.9	0.05	3.1	-2	18	3	0.7	0.082	22	0.09	0.466	5.4	-20	-2	27	2.9	9.74	163
	5906	12.7	220	0.438	0.5	-0.408	4.9	-2	10	3	0.7	0.007	22	0.08	3.64	11.7	-20	-2	56	4.8	4.33	139
	5907	18.6	320	1.21	0.8	0.204	5.1	-2	35	2	0.6	0.224	22	0.11	0.573	6.3	51	-2	34	3.7	23.9	183
	5908	0.842	-30	0.805	0.1	0.406	-0.5	-2	288	-1	-0.5	0.129	-0.5	0.01	0.315	0.5	-20	-2	-2	-0.2	2.58	14
	5912	4.64	50	0.357	0.3	-0.031	1.7	-2	200	-1	-0.5	0.1	5.9	0.03	0.531	27.7	-20	-2	18	1.3	6.28	40
	5913	5.11	80	0.435	0.6	-0.368	3	-2	29	4	-0.5	0.163	28	0.10	0.579	5.2	-20	-2	15	1.6	3.92	159
	5914	3.61	270	0.562	0.5	0.094	4.1	-2	17	3	0.9	0.151	22	0.07	0.231	5.6	-20	-2	24	3.1	4.66	139
	5915	6.73	110	0.554	0.5	0.102	2.6	-2	23	1	0.7	0.121	8.7	0.04	0.664	7.3	-20	-2	21	1.6	9.33	64
	5917	8.37	200	0.8	2.5	0.271	5.9	-2	77	-1	0.7	0.1	22	0.27	0.621	11.3	-20	-2	30	3	15.4	192
	5918	2.41	-30	1.17	1.2	0.162	1.5	-2	72	-1	-0.5	0.105	4.1	0.15	0.352	1.7	23	-2	7	0.9	2.83	99
	5919	5.17	90	0.409	16.2	0.015	4.7	-2	250	1	0.5	0.14	7.4	1.38	0.337	5.2	139	-2	22	1.9	24.2	164
	5920	3.78	60	0.42	0.1	-0.293	0.9	-2	20	1	-0.5	0.163	12	0.02	0.734	3.6	34	-2	8	1.4	2.61	33
	5921	20.2	-30	6.91	1	0.468	-0.5	3	103	1	-0.5	0.695	2	0.52	0.324	2.2	-20	-2	-2	0.4	3.26	73
	5922	66.4	-30	90.1	7.5	0.581	1.9	41	1724	-1	-0.5	10.8	16	0.29	0.207	9.4	-100	29	14	1.6	26	562
	5923	29.5	-30	16.1	2.2	1.23	-0.5	5	357	1	-0.5	1.48	3.7	0.49	0.392	2.4	-20	2	4	0.5	8.56	119
	5924	35.1	-30	55.3	8.4	0.667	1.7	7	629	-1	-0.5	1.65	17	0.15	0.314	10	-20	22	20	2.9	4.26	710
	5925	96	-30	123	1.5	1.47	1.2	-2	528	1	-0.5	17.3	8.2	0.25	0.593	2.2	145	63	-2	0.7	43	80
	5926	17	-30	8.51	11.2	0.59	7	2	1578	-1	-0.5	0.317	17	0.76	0.374	3.9	322	-2	10	1.1	52.8	189
	5927	10.6	-30	0.993	1.7	0.309	1.3	9	164	1	-0.5	0.29	12	0.15	0.298	6.3	21	-2	8	1.4	10.9	110
	5928	6.71	50	1.52	2.3	0.185	2.7	-2	546	-1	-0.5	0.146	17	0.14	0.466	7	-20	-2	8	1	4.83	106
	5929	19.7	70	1.12	3.7	0.478	2.5	2	193	1	-0.5	0.244	20	0.14	0.657	6.1	44	-2	9	1.4	8.16	101
	5930	4.41	-30	4.29	7.9	0.759	5	-2	546	1	-0.5	0.264	9.7	0.50	0.338	2.7	187	-2	17	1.3	3.51	121
	5931	218	-30	109	10.4	2.09	8.8	27	3073	-1	-0.5	12.7	51	0.54	0.982	12	917	71	27	4	90.1	399
	5932	3.43	-30	4.42	9	1.73	8.1	-2	884	-1	1	1.61	13	0.67	0.543	4.1	135	-2	32	2.7	1.78	185
	5933	3.57	40	0.206	24.6	-0.009	8.8	-2	1944	-1	-0.5	0.163	10	0.08	0.292	-0.5	133	-2	15	1.2	1.89	87
	5934	5.6	40	2.7	7.1	2.2	5.7	-2	1776	-1	-0.5	0.543	22	0.62	0.253	6.2	300	-2	9	1	1.4	180
	5935	10.1	-30	13.6	10.7	1.19	4.5	-2	1907	-1	-0.5	0.834	11	0.74	0.657	4.6	125	12	12	1.1	13.3	202
	5936	2.62	-30	11.7	9.7	1.04	8.9	-2	1342	-1	-0.5	0.495	9.7	0.55	0.321	3.9	162	11	10	0.9	8.74	177
	5916	4.27	210	0.58	0.6	0.158	5.3	-2	19	2	-0.5	0.095	20	0.07	0.384	7	-20	-2	30	3.3	10.5	134
Gold Crater	5100	28.6	-30	1.56	5.6	0.636	2.8	-2	1231	-1	-0.5	1.9	13	0.46	0.444	1.6	50	-2	11	0.9	30.4	345
	5101	13	-30	25.7	3.9	0.36	3.5	-2	585	1	-0.5	1.65	9.5	0.61	0.171	2.9	126	-2	12	1.4	5.65	270
	5102	15228	-30	58.7	3.7	6.54	8.1	-2	1471	-1	0.7	12.5	16	0.46	-0.123	5.1	79	-2	25	1.4	112	215
	5103	104	-30	48.5	2.9	1.32	1.1	-2	525	1	-0.5	1.88	6.2	0.60	0.318	1.6	126	-2	5	0.7	4.84	263
	5177	128	-30	195	2.6	1.22	1.4	38	657	-1	-0.5	47.2	6.9	0.55	0.146	3.1	-20	-2	7	1.2	29.5	194
	5178	12.3	-30	491	1.2	1.42	-0.5	52	66	-1	-0.5	15.3	3.7	0.56	0.278	1.5	-20	-2	6	1	2.33	190
	5179	19.8	-30	152	3.6	1.74	3.1	8	2569	1	-0.5	6.48	10	0.53	0.309	3.1	-20	8	12	1.1	13.4	251
	5180	74.3	-30	678	1	1.38	-0.5	167	162	-1	-0.5	30.4	-0.5	0.54	0.203	0.6	-20	-2	5	1.2	1.66	165
	5181	45.4	-30	870	3.1	3.06	0.8	92	735	-1	-0.5	47.2	5	0.38	0.235	2.3	21	-2	6	1.5	5.11	132
	5182	2.97	30	5.32	2.6	0.443	0.9	-2	561	-1	-0.5	0.302	1.5	0.06	1.24	2.4	26	-2	12	0.6	350	31
	5183	4.48	-30	37.7	2.7	3.34	1.8	-2	1066	1	-0.5	8.15	10	0.49	0.18	2.8	32	-2	6	0.7	13.2	186
	5184	503	-30	8.71	3.3	10.6	1.2	-2	902	1	-0.5	15.2	5.2	1.03	0.415	3	139	-2	6	0.3	37.5	166
	5185	13.3	120	0.777	6	0.282	5.6	-2	297	-1	-0.5	0.18	12	0.66	0.288	4.3	74	-2	26	1.5	60.5	198
	5186	35	50	0.704	4	1.77	2.9	-2	919	-1	-0.5	0.487	17	0.43	0.796	3.6	40	-2	13	0.7	41.9	255
	5187	40.5	60	1.37	5.4	0.708	4.3	-2	785	-1	-0.5	0.984	12	0.51	0.489	3.6	60	-2	13	0.9	33.2	167
	5190	41.9	-30	0.491	5.8	0.827	2.3	-2	2670	-1	-0.5	0.584	8.5	0.85	0.35	2	48	-2	11	1	12	221
	5191	10	-30	1.32	2.8	1.01	3.5	-2	1303	-1	-0.5	0.889	10	0.32	0.517	2.9	26	-2	13	0.8	22.1	147
	5192	2439	-30	60.6	4.3	4.33	6.3	-2	1260	1	-0.5	14	21	0.80	0.334	9.9	-20	5	15	1.7	110	347
	5193	5987	-30	28.4	1.9	6.64	0.9	-2	117	1	-0.5	8.14	6.8	0.58	0.401	5	-20	-2	10	0.6	62.6	234
	5194	998	-30	16.7	3.5	2.02	3.5	-2	814	-1	-0.5	6.07	9.9	0.55	3.34	3.8	33	-2	10	1	11.8	178
	5195	22.6	120	0.627	1.3	0.536	1.9	-2	101	-1	-0.5	0.158	8.2	0.20	0.473	2.3	-20	-2	9	0.6	10	130
	5196	430	-30	31.1	3.2	1.73	1.3	-2	153	-1	-0.5	2.78	6	0.44	13.3	4.8	21	3	7	0.8	168	141

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5197	61.5	-30	9.09	3.5	1.49	1.5	-2	195	-1	-0.5	2.06	6.7	0.46	0.812	4.7	-20	-2	8	0.9	4.36	163
	5201	-3.86	-30	10.4	2.4	0.147	-0.5	-2	60	-1	-0.5	0.282	2.8	0.51	0.335	1.5	79	-2	7	0.9	0.129	205
	5202	3.8	100	0.603	5.4	1.16	6.5	-2	1062	1	0.7	0.448	16	0.63	0.337	3.6	97	-2	22	2.1	2.65	344
	5203	215	-30	213	5.1	1.67	2.4	118	1852	-1	-0.5	72.1	1.9	0.75	1.5	-0.5	134	-2	11	1.3	9	285
	5204	7.87	-30	0.369	4.5	1.14	5	-2	1472	1	-0.5	0.308	12	0.55	0.158	2.5	96	-2	7	0.7	0.843	330
	5549	68.4	-50	586	3.2	5.73	1.4	44	383	1	-0.5	207	-4	0.45	0.565	-3	70	-2	6	0.7	25.6	174
	5668	7.38	-30	20.3	3.1	0.385	0.8	-2	162	-1	-0.5	0.467	5.8	0.51	0.254	2.2	-20	-2	10	0.9	3.85	284
	5669	5.59	-30	0.522	5.2	3.69	5.2	-2	1770	-1	-0.5	1.72	14	0.62	0.421	3.7	40	-2	15	1.6	3.32	242
	5670	71	-30	3.98	3.6	0.539	0.9	-2	262	-1	-0.5	0.857	4.5	0.60	0.234	2.6	-20	2	10	1	4.46	206
	5671	71	-30	0.938	2.6	0.555	2.5	-2	1395	1	-0.5	0.935	5.8	0.54	0.343	1.7	24	-2	8	0.8	3.26	208
	5672	154	-30	64.5	1.4	0.796	1.4	-2	1844	-1	-0.5	1.49	3.9	0.30	0.335	1.6	20	2	7	0.6	4.55	122
	5673	9.09	-30	1.67	1.7	1.47	-0.5	-2	80	1	-0.5	4.88	2.4	0.45	0.338	1.5	-20	-2	5	0.6	10.3	174
	5674	8.7	-30	13.7	1.1	0.099	0.5	-2	17	1	-0.5	0.428	3	0.58	0.323	2.2	-20	-2	5	0.5	1.65	187
	5675	1000	-30	62.6	8.9	11.9	5.9	-2	1525	-1	-0.5	1.88	9.5	0.84	0.303	4	59	-2	22	1.9	7.3	296
	5676	9.61	-30	8.95	5.1	1.08	1.3	-2	44	-1	-0.5	1.23	6.7	0.82	0.341	2.6	-20	3	14	1.5	3.17	262
	5678	2.71	-30	1.47	0.7	0.266	-0.5	-2	14	1	-0.5	0.543	2.2	0.57	0.146	0.8	-20	-2	4	0.3	3.82	121
	5679	14.1	-30	1.77	7.1	1.4	5.9	-2	1886	-1	0.6	1.66	13	0.78	0.215	3.8	67	-2	15	1.8	26.2	220
	5680	71.8	-30	19.4	4.5	4.54	4.3	-2	1198	1	-0.5	3.24	14	0.59	0.269	3.5	39	-2	9	1.4	31.3	197
	5681	15.6	-30	0.773	5.7	0.584	4.7	-2	1811	1	-0.5	1.31	16	0.72	0.337	3.6	69	-2	9	1.2	16.9	194
	5682	11.3	-30	9.62	2.8	2.13	0.8	-2	85	-1	-0.5	0.719	5.5	0.62	0.42	2.9	-20	-2	9	1.1	6.24	203
	5738	10.3	160	2.4	2.8	0.158	4.7	-2	174	1	-0.5	0.145	17	0.11	0.717	8.3	-20	-2	17	1.4	11.4	126
	5739	7.12	190	4.17	6.7	0.267	4.8	-2	316	-1	-0.5	0.181	17	0.11	1.07	11.1	-20	4	24	1.7	290	152
	5740	3091	-30	16.8	2.2	3.3	4	-2	395	1	-0.5	4.67	8.5	0.41	0.426	5.6	-20	-2	10	0.8	83.4	183
Gold Range	5503	8.1	140	1	4.7	0.111	2.5	-2	83	-1	-0.5	-0.014	9.3	0.29	0.464	6.2	37	14	12	1.1	42.7	96
	5504	9.3	-30	6.43	3.9	0.231	2.1	-2	57	-1	-0.5	0.13	4.1	0.06	0.379	1.9	-20	6	42	5.6	68	62
	5505	9.55	30	2.4	7.8	0.207	3.4	-2	316	-1	-0.5	0.134	11	0.33	0.387	7.1	58	-2	22	2.5	135	106
	0594-G26	11.5	320	1.16	4.8	0.142	5.9	-2	137	1	0.7	0.124	17	0.25	0.275	7.7	38	-2	25	2.4	81.6	228
	0395-G38	10.4	40	3.66	5.6	0.779	2.2	-2	29	-1	-0.5	0.209	2.8	0.32	1.64	2	155	-2	13	1	7.91	73
	0695-G41	20.1	380	17.3	4.3	0.237	6.9	-2	120	-1	0.5	0.179	18	0.20	0.537	6.1	61	15	26	1.9	60.6	220
Gold Reed	5121	1.66	-30	7.53	3.5	0.767	0.5	-2	153	-1	-0.5	2.2	3.4	0.64	0.236	0.6	125	-2	6	0.8	3.16	169
	5122	2.98	-30	68.3	2.4	0.567	-0.5	-2	29	-1	-0.5	0.837	1.6	0.44	0.32	0.7	67	-2	5	0.5	-0.785	121
	5123	1.2	-30	0.47	5.4	0.086	2.4	-2	376	-1	-0.5	0.154	4.5	0.79	0.137	1.5	128	-2	9	0.9	104	176
	5124	3.56	-30	6.1	10.3	4.24	6.5	-2	3557	-1	-0.5	1.45	9.1	0.81	0.201	1.7	146	-2	11	1.1	51.7	296
	5125	3.18	-30	2.23	10.9	1.15	6.6	-2	1380	-1	-0.5	1.18	11	0.76	0.203	1.7	158	-2	13	1.6	24.3	269
	5159	2.76	-30	0.465	13.7	0.437	10	-2	3559	-1	1	0.459	11	0.98	0.534	2.7	119	-2	20	1.9	3.16	304
	5160	15.7	70	0.235	11.5	0.65	4.5	-2	827	-1	-0.5	0.392	11	1.05	0.289	2.7	115	-2	17	1.6	27	270
	5161	5.26	80	0.487	10.6	0.374	5.5	-2	799	1	0.5	1.22	11	1.14	0.323	2.6	76	-2	22	1.7	79.6	277
	5162	30.2	30	1.13	3.9	1.74	4.9	-2	632	-1	-0.5	1.29	10	0.30	0.333	2.4	116	9	20	1.9	20.2	237
	5163	98.9	40	3.33	4.1	0.358	6.1	-2	38	-1	0.8	0.485	7	0.20	0.241	3.9	-20	3	29	1.9	300	101
	5164	8.83	-30	4.68	1.7	0.88	3.6	12	41	-1	-0.5	1.59	1.9	0.04	0.267	1.4	19	6	24	1.7	4.27	39
	5286	11.5	-30	1.01	5.1	2.04	1.3	-2	1655	-1	-0.5	2.74	9.9	0.95	2.88	4.3	97	-2	7	0.3	2.04	283
	5287	1.85	-30	1.11	6.4	1.11	1.1	-2	271	-1	-0.5	1.29	5.2	0.89	0.656	2.1	140	-2	12	1.2	7.02	234
	5655	-0.016	-30	0.281	6.4	-0.282	0.9	-2	66	1	-0.5	0.559	3.7	0.96	0.462	2.9	178	-2	9	0.6	1.35	351
	5656	13.9	-30	0.75	9.8	6.04	7.3	-2	3229	-1	-0.5	2.29	16	0.87	0.907	3.8	143	-2	16	1.5	6.72	260
	5657	0.778	-30	0.339	7.4	0.555	1.5	-2	1133	-1	-0.5	0.958	5	1.05	0.671	1.5	84	-2	11	1.1	10.2	341
	5658																					
	5659	8.69	90	0.429	9.9	-0.118	5.8	-2	386	-1	0.5	0.129	9.8	0.83	0.559	2.1	39	-2	21	1.7	81.6	249
	5660	16.7	-30	0.751	6.9	0.726	2.3	-2	3561	1	-0.5	1.52	9.4	0.99	0.601	1.6	47	-2	10	1.3	3.32	302
	5661	4.87	60	0.77	5.3	0.331	3	-2	451	-1	-0.5	0.467	5.8	0.53	0.493	1.1	20	5	10	0.8	132	134
	5711	1.34	-30	1.58	7.2	1.2	4.6	-2	1050	-1	-0.5	1.39	10	0.60	0.382	2.2	122	-2	9	1.1	10.7	200
	5718	1.49	-30	8.01	8.5	0.128	1	-2	168	2	-0.5	0.798	5.3	1.45	0.552	2.3	55	2	14	1.9	13.7	410

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	5719	2.67	-30	446	4.1	6.75	1.6	2	379	-1	-0.5	3.59	2.4	0.79	1.07	3.9	73	-2	8	1.3	8.32	216
	5722	1.36	-30	2.02	6.4	0.328	5.7	-2	2070	1	-0.5	0.272	7.7	0.77	0.568	5.8	86	-2	15	1	14.1	279
	5723	3.28	-30	1.37	0.5	0.023	-0.5	-2	85	-1	-0.5	0.311	-0.5	0.01	0.969	-0.5	-20	-2	-2	-0.2	9.32	10
	5724	3.64	-30	3.18	7.6	0.083	4.9	-2	1686	-1	-0.5	0.364	9.3	0.95	0.548	2.2	101	2	14	1.5	4.97	307
	5804	3.57	40	3.21	6.3	-0.101	3.1	-2	930	-1	-0.5	0.35	6.7	0.61	1.42	3.3	95	-2	10	1.1	9.7	207
	5805	4.54	-30	36.2	3.4	0.524	1.3	-2	725	-1	-0.5	0.724	5	0.69	0.324	1.8	62	2	12	1	16.1	200
	5806	1.26	-30	616	3	0.304	0.9	9	297	-1	-0.5	2.69	2.3	0.98	0.631	-2.2	42	-2	6	1.1	3.06	238
	5807	2.36	150	15.8	1.4	-0.178	2.1	-2	78	1	-0.5	0.056	10	0.14	0.721	4.5	28	-2	8	0.9	3.02	74
	5808	1.05	-30	35.4	0.1	-0.246	-0.5	-2	29	-1	-0.5	0.084	-0.5	0.01	0.649	20.6	-20	-2	2	-0.2	2.14	-10
	5809	5.34	-30	0.866	9.9	1.98	5.9	-2	2163	-1	0.6	0.494	9.6	0.83	0.538	3.8	179	2	17	1.6	26.7	266
	5810	4.74	-30	0.657	9.3	0.984	5.8	6	1290	-1	0.5	0.761	10	0.85	0.748	3.8	214	-2	17	1.9	13.3	247
	5811	1.98	-30	1.84	12	0.966	7.1	-2	1653	-1	0.6	0.573	11	0.82	0.689	3.6	140	-2	19	2.1	19.5	258
	5812	5.62	-30	1.33	10.9	2.13	5.1	8	2289	1	-0.5	0.745	14	1.13	0.68	4.6	121	-2	17	2.5	22.5	395
	5813	1.63	-30	10.6	6.3	0.039	1.9	3	516	1	-0.5	0.215	5.8	1.00	0.351	6.1	82	5	13	1.5	23.9	291
	5814	2.73	-30	1.61	7	0.564	2.5	-2	713	-1	-0.5	1.85	5.7	0.84	0.552	2.2	147	-2	13	1.5	9.42	238
Golden Arrow	4169	99.40	250	4.48	1.2	-0.98	1.7	3	85	-1	-0.5	5.1	5.8	0.10	0.50	3.3	-20	-2	6	0.5	22.00	71
	5050	9.37	130	65.90	3.9	-1.00	2.3	-2	261	-1	-0.5	-0.5	5.2	0.25	0.66	2.4	58	-2	7	0.9	9.65	102
	5051	18.80	130	147.00	4.9	-0.99	2.6	-2	279	-1	-0.5	-0.5	7.8	0.36	4.03	3.5	42	-2	11	1.1	10.10	143
	5052	13.00	50	9.29	2	-0.92	1.9	-2	115	-1	-0.5	-0.5	8.3	0.14	0.59	4.1	-20	4	10	0.8	49.90	68
Groom	3002	7.11	-30	77.1	1.3	0.259	-0.5	-2	16	-1	-0.5	0.188	3.4	0.14	4.64	3.4	-20	-2	2	0.8	117	35
	3003	5.84	-30	1.12	1.2	0.388	3.8	-2	43	-1	0.7	0.196	2.1	0.07	0.392	1.4	-20	-2	17	2	5.26	62
	3005	2.72	-30	12.6	0.5	0.313	1	-2	131	-1	-0.5	0.054	-0.5	0.01	0.417	1.3	-20	-2	9	0.5	8.27	15
	3006	111487	-100	3208	-2	7.44	-227	-2	76	-5	-227	-1.08	-2	0.02	-6.6	-2	25	-2	123	-227	14431	-100
	3007	244	50	103	6.2	0.489	5.8	-2	1704	-1	0.7	-0.836	6.8	0.34	0.018	8.1	-20	-2	45	3.7	437	319
	3008	103408	-30	1220	-100	12.3	0.5	-2	448	-1	-0.5	11.6	4	0.07	-2.35	18	-20	12	284	1.2	-11.7	-100
	3009	102965	-30	145	2.7	7.69	3.6	-2	376	-1	0.8	1.65	3.5	0.08	-5.49	4.1	-20	9	178	2.7	-1.05	-100
	3010	260	-30	21.6	0.8	0.029	1.1	-2	52	-1	-0.5	0.168	2.2	0.05	0.812	1.5	-20	-2	4	0.5	10.6	51
	3011	15.6	30	64.7	1.8	-0.229	2.1	-2	65	-1	-0.5	0.171	5.5	0.13	0.478	2	54	-2	9	1.2	15.9	98
	3012	4.58	40	3.09	2	0.593	3	-2	113	-1	-0.5	0.152	5.3	0.13	0.353	2.1	32	-2	10	0.9	0.701	110
	3014	13123	-30	316	1.4	1.34	1.4	-2	50	-1	-0.5	0.562	1.9	0.09	-0.387	2.5	51	6	16	0.8	34.2	38
	3015	48408	-30	1347	0.8	2.01	-0.5	-2	36	-3	-0.5	0.668	1.6	0.06	-2.68	-0.5	72	4	41	-0.2	70.4	-10
	3016	19554	-30	1648	0.3	3.43	-0.5	-2	45	-1	-0.5	0.416	-0.5	0.02	-1.12	-0.5	-20	5	14	-0.2	85.8	-10
	3017	81401	-30	1647	0.5	4.58	-0.5	-2	38	-1	-0.5	2.16	0.5	0.04	-4.62	-0.5	-20	-2	53	-0.2	31.6	-20
	3022	8.55	-30	41.3	2.4	0.514	1.3	5	96	-1	-0.5	0.164	1.7	0.07	0.521	1.8	81	-2	8	0.7	17.8	67
	3027	27.6	30	87.3	0.9	0.745	0.8	3	313	-1	-0.5	0.178	1.3	0.06	16.8	22.5	139	-2	7	0.5	123	23
	3028	5135	-30	1255	0.7	0.638	0.5	-2	19	-1	-0.5	0.283	2.4	0.06	0.406	-0.5	-20	-2	6	-0.2	39.2	53
	3029	11678	-30	357	0.7	0.487	0.6	-2	26	-1	-0.5	0.322	1.2	0.05	-0.299	1.6	32	-2	11	0.7	55.7	27
	3030	2665	-30	563	3.1	0.341	0.9	-2	44	-1	-0.5	0.361	0.8	0.09	0.425	-0.5	31	3	6	-0.2	48.1	38
	3031	165	-30	13.3	2.1	0.445	1.8	-2	67	-1	-0.5	0.155	3.5	0.12	1.71	1.5	-20	-2	10	0.9	258	128
	3032	967	-30	215	1.8	0.024	1.5	-2	78	-1	-0.5	0.14	2.5	0.15	0.436	1.2	26	5	5	0.7	56.4	54
	3033	28.9	30	40.1	1.2	-0.113	1.7	-2	35	-1	-0.5	0.158	2.4	0.07	0.269	2.1	27	-2	6	0.8	0.878	85
	3034	492	-30	526	1.9	0.575	1.9	-2	61	-1	-0.5	0.353	3.3	0.12	0.618	3.1	24	-2	11	1.6	14.7	134
	3035	4.69	-30	2.25	0.6	-0.409	0.5	-2	66	-1	-0.5	0.195	1.4	0.04	0.301	-0.5	-20	-2	-2	-0.2	0.577	27
	3036	8.43	-30	8.51	1.6	0.513	1.5	-2	210	-1	-0.5	0.111	3.2	0.09	0.375	1.2	26	-2	6	0.6	33.3	75
	3037	11.2	-30	5.4	3	0.195	1.9	-2	83	-1	-0.5	0.183	5.3	0.23	0.437	2.3	98	16	11	1.1	104	155
	3039	40712	-30	1157	2.8	0.857	2.3	-2	96	-1	-0.5	0.381	-0.5	0.04	-2.09	-0.5	-20	-2	45	1.6	955	-10
	3040	105284	-50	3526	2.4	8.84	-0.5	-2	168	-5	-1	1.33	-10	0.03	-5.4	-10	-20	26	384	-5	196	-100
	3042	66791	-30	430	2.7	13.5	-0.5	-2	152	-1	-0.5	-10.8	-0.5	0.08	-4.89	-0.5	-20	-2	62	-0.2	33775	-100
	3043	104054	-50	859	1.9	5.4	-0.5	-2	293	-1	-0.5	1.27	-0.5	0.06	-5.89	-0.5	-20	-2	203	-0.2	1503	-100
	3044	87842	-50	2112	2.4	5.66	-1	-2	253	-5	-1	16.1	-10	0.06	-0.391	-10	-20	-20	263	-5	-17.1	-100
	3058	338	-30	6.96	1.2	0.2	1	2	191	-1	-0.5	0.496	1.6	0.06	0.537	1.8	-20	-2	4	0.5	3.71	47

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
Jamestown	5104	9.55	140	3.54	5.2	0.868	4	5	421	1	-0.5	0.393	13	0.52	0.177	2.6	88	-2	13	1.5	16.8	238
	5105	93.6	-30	17039	1.6	7.4	-0.5	-500	164	1	-0.5	50.6	-10	0.30	5.89	-0.5	45	-2	7	-0.2	132	127
	5106	18.4	-30	231	2.5	3.14	0.7	-2	100	-1	-0.5	3.05	3.4	0.36	0.207	1.3	67	-2	6	0.8	2.93	159
	5134	2.68	-30	0.889	2.5	0.832	0.9	-2	283	-1	-0.5	1.3	4.6	0.52	0.214	1.4	98	3	6	0.6	1.81	231
	5135	2.83	-30	0.399	1.7	0.102	1.5	-2	839	-1	-0.5	0.138	7	0.51	0.301	2.1	92	-2	5	0.3	6.45	307
	5173	32	140	1.32	2.6	0.4	3.1	-2	36	-1	0.5	0.398	20	0.13	0.589	3.8	-20	-2	20	2	3.24	133
	5174	23.3	150	0.717	3	0.084	4.1	-2	76	-1	-0.5	0.25	15	0.14	0.285	3.8	-20	-2	19	1.6	14.7	160
	5175	9.35	50	0.736	6.5	0.158	6.7	-2	443	-1	0.6	0.194	11	0.77	0.43	3.6	49	-2	25	1.6	28.8	297
	5176	13.3	-30	4.54	2.7	0.26	0.9	-2	611	1	-0.5	0.251	2.9	0.94	0.415	3.8	32	5	9	0.3	2.08	315
	5198	614	40	49.7	2.8	1.96	1.2	-2	187	-1	-0.5	5.25	5.2	0.37	8.96	7	23	4	12	0.9	80.3	135
	5199	12.8	-30	17	0.3	0.315	-0.5	-2	52	-1	-0.5	0.247	0.6	0.03	1.19	6.7	-20	-2	6	0.3	22.7	18
	5205																					
	5350	87.2	-30	9098	3.3	4.51	1.2	-460	196	-1	-0.5	131	-0.5	0.43	2.04	1.4	70	-2	6	1.4	1407	181
	5362	15.4	-30	0.936	1.8	0.913	1.5	-2	520	1	-0.5	1.71	10	0.82	2.3	3.2	-20	-2	7	0.5	2.59	284
	5363	5.96	-30	1.17	2.2	0.741	2	-2	796	-1	-0.5	0.52	8.4	0.72	0.442	3.9	24	-2	12	0.8	2.24	218
	5364	0.352	-30	0.4	0.2	0.216	-0.5	-2	26	-1	-0.5	0.18	-0.5	0.01	0.341	1.7	-20	-2	2	-0.2	1.33	114
	5365	10.7	-30	1.27	5.3	0.799	2.4	-2	1178	-1	-0.5	0.905	11	0.44	0.416	2.9	51	-2	11	1.4	2.13	219
	5366	11.2	-30	7.41	3.9	0.624	2.9	-2	674	-1	-0.5	0.496	9.6	0.47	0.516	2.4	30	-2	12	1	2.6	200
	5367	13.4	-30	3.75	3.9	0.656	1.9	-2	499	-1	-0.5	0.595	7.7	0.47	0.478	2.1	29	-2	11	0.9	2.08	191
	5368	16.4	-30	2.4	6.4	0.944	3.9	-2	931	1	-0.5	0.532	10	0.59	0.69	3.3	48	-2	12	1	1.94	213
	5369	1.48	-30	0.808	3.7	0.279	-0.5	-2	66	1	-0.5	0.343	4.3	0.85	0.532	2.7	-20	-2	10	0.8	1.51	263
	5417	6.32	-30	336	1.3	2.06	1.1	61	84	-1	-0.5	8.35	4.8	0.36	0.282	1	-20	4	8	1	7.16	190
	5418	214	-30	2180	3	26.7	2.7	-2	2094	-1	-0.5	15.4	8.4	0.34	1.01	2	52	-2	6	1.5	0.98	150
	5419	6.97	30	3.59	2.6	2.69	1.4	-2	1253	-1	-0.5	0.678	5.8	0.37	0.456	1.1	21	-2	6	0.4	2.2	158
	5543	15.9	-30	0.605	2.2	-0.079	0.7	-2	163	1	-0.5	0.109	8.5	1.27	0.42	7.4	269	-2	3	0.4	4.69	282
	5587	3.2	-30	37.2	0.9	5.35	-0.5	-2	58	-1	-0.5	1.93	2.1	0.16	0.231	1.3	-20	-2	7	0.3	1.06	64
	5588	7.12	-30	2.11	6.1	0.978	3.9	-2	2445	1	-0.5	0.815	12	0.69	0.448	2.7	62	-2	14	1.2	4.73	277
	5589	91.2	-30	14312	3.6	6.83	1.4	777	566	-1	-0.5	93.9	9.1	0.50	0.163	-227	-20	-2	9	-227	1523	183
	5590	18.9	-30	308	1.7	0.711	0.5	-2	166	1	-0.5	0.987	6.1	0.75	0.189	2.1	-20	-2	9	0.7	0.862	251
	5591	14.4	-30	323	1.6	1.05	-0.5	-2	51	-1	-0.5	2.66	0.7	0.43	0.366	1.8	67	3	5	0.3	9.13	158
	5592	34.7	-30	5.02	2.9	0.86	0.5	-2	52	1	-0.5	1.18	3.3	0.78	0.518	2.4	26	5	10	0.7	1.92	197
	5593	9.16	-30	0.43	5.6	0.958	5.4	-2	819	-1	-0.5	1.23	20	0.34	0.349	4	28	-2	10	1.3	4.62	194
	5594	418	-30	44.6	4.7	2.44	9.8	-2	1788	-1	0.7	21.8	15	0.64	6.87	3.4	49	3	16	1.8	12.1	306
	5595	80.1	-30	187	6.7	2.47	3	-2	1127	-1	-0.5	4.4	8	0.62	0.328	2	72	-2	13	1.3	9.49	235
	5596	18.6	-30	2.84	4	0.221	3.3	-2	828	-1	-0.5	0.223	10	0.50	0.248	2.6	40	-2	12	1	6.42	217
	5597	19.1	-30	1.47	2.3	7.08	2.4	-2	1592	-1	-0.5	2.27	12	0.49	0.334	3.3	22	-2	9	0.7	4.1	249
	5598	2.15	-30	0.806	1	0.363	-0.5	-2	32	1	-0.5	1.09	4.2	0.37	0.354	1.9	-20	-2	6	0.5	1.31	191
	5599	219	-30	854	3.4	19.3	3.4	15	1883	-1	-0.5	16.4	9.6	0.46	0.252	2.7	98	-2	10	1.1	8.96	208
	5638	41.5	-30	17.7	5.4	0.698	4.8	-2	1555	-1	-0.5	2.61	12	0.54	0.231	2.9	70	-2	14	1	4.74	213
	5639	11.2	-30	175	2.6	0.866	1.6	33	237	-1	-0.5	1.84	6.9	0.51	0.269	2.4	23	6	12	1	1.14	207
	5640	3.92	-30	1.39	1.4	1.88	-0.5	-2	219	-1	-0.5	1.02	0.9	0.49	0.67	2.3	101	4	7	0.4	2.06	250
	5641	9.25	-30	1.01	2.6	1.92	1.2	-2	637	1	-0.5	2.19	3.6	0.68	0.362	2.7	27	3	7	0.5	3.69	266
	5642	2.53	-30	0.322	1.3	1.06	0.9	-2	649	1	-0.5	1.91	1.7	0.54	0.343	1.5	-20	-2	6	0.5	2.32	272
	5643	32.1	-30	3.23	3.5	1.52	0.7	-2	112	1	-0.5	0.252	2.9	0.74	0.407	3.7	-20	6	9	0.4	3.71	267
	5644	5.44	-30	1.53	2.7	0.323	1.4	-2	298	1	-0.5	0.22	2.3	1.13	0.404	5.4	21	6	10	0.4	5.1	327
	5645	21.5	-30	2.38	1.6	0.242	0.6	-2	38	1	-0.5	0.189	2.8	0.76	0.298	1.6	-20	2	8	0.4	3.93	240
	5667	25.4	-30	0.48	3.4	0.368	3.7	-2	1186	-1	-0.5	0.202	11	0.56	0.297	2	39	5	9	1	2.58	209
	5683	12.6	-30	2.32	4.1	0.65	3.1	5	2370	1	-0.5	0.222	9.5	0.77	0.386	2.7	35	13	9	1.3	3.24	256
Jumbled Hills	1093-G18	42.80	30	6.86	0.5	0.38	0.5	-2	41	1	0.5	0.20	0.8	0.03	0.08	0.8	-20	-2	3	0.2	37.00	25
Limestone	5730	8.1	-30	2.98	0.5	-0.057	-0.5	-2	34	-1	-0.5	0.186	0.9	0.08	0.8	0.6	-20	-2	4	0.5	1.9	96
Ridge	5800	16.6	-30	2.73	12.9	0.011	8.3	-2	164	-1	1.1	0.302	8	0.26	1	18.6	98	13	51	4.6	568	72

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MINE SITE SAMPLES
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Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TIO2 XRF %	TI ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5801	15.4	-30	4.18	41.2	0.339	9.3	-2	254	-1	1.5	0.272	4.7	0.24	1.05	18.3	244	20	225	16.9	824	109
	5802	8.07	-30	0.388	4.5	-0.021	1.2	-2	25	-1	-0.5	0.131	1.3	0.37	0.88	0.8	43	-2	8	0.9	19.2	88
	5803	3.27	-30	0.826	1.3	0.238	-0.5	-2	13	-1	-0.5	-1.03	-0.5	0.13	0.773	1.7	26	-2	4	0.3	13.7	32
	5848	6.88	-30	44.3	0.7	0.048	0.5	-2	98	-1	-0.5	0.159	1.5	0.06	0.253	3.8	-20	45	4	0.2	54.3	23
	5909	4.09	-30	16.1	0.9	0.329	3.1	3	331	-1	-0.5	0.187	1.5	0.06	0.4	11.2	86	5	64	2.1	29	31
Mellan	5142	18	70	4.88	0.9	0.161	1.1	-2	195	-1	-0.5	0.124	4.1	0.08	0.636	32.3	-20	3	5	0.5	17	58
	5143	4.81	80	1.18	1.2	0.27	1.7	-2	136	-1	-0.5	0.171	4.7	0.07	0.25	1.1	-20	3	9	0.6	0.887	61
	5279	5.72	100	5.91	1.1	-0.033	1.4	-2	100	-1	-0.5	0.128	6.5	0.13	0.221	1.7	-20	-2	5	0.4	20.1	73
	5280	9.14	110	6.84	1.2	0.254	1.6	-2	173	-1	-0.5	0.17	6.5	0.14	0.243	4.7	-20	6	5	0.5	10.6	85
	5308	4.21	90	1.12	1	0.008	1.6	-2	164	-1	-0.5	0.145	4.6	0.05	0.674	1.9	65	4	9	0.5	5.66	40
	5309	22.3	150	5.21	3.9	-0.179	3	-2	204	-1	-0.5	0.13	13	0.32	1.35	3.6	72	6	14	1.2	34.4	120
	5310	5.04	-30	21.2	0.3	-0.191	-0.5	-2	169	-1	-0.5	0.131	0.7	0.01	0.627	1.8	37	19	4	-0.2	5.18	14
	5311	25.5	260	13.1	2.7	0.009	4.6	-2	369	-1	-0.5	0.145	12	0.17	0.686	6.2	-20	19	17	1.4	34	128
	5312	14.4	70	5.22	0.5	0.325	0.7	-2	87	-1	-0.5	0.093	2.4	0.05	0.51	4.1	79	2	4	0.3	14.4	31
	5313	7.16	100	16.4	0.5	-0.097	0.8	-2	89	-1	-0.5	0.081	2.1	0.02	0.634	3.9	-20	10	6	0.3	8.74	26
	5314	8.9	80	12.8	0.5	-0.113	0.7	-2	122	-1	-0.5	0.136	2.6	0.03	0.774	6.6	-20	8	5	0.3	6.98	32
	5315	14.5	140	4	1.8	-0.136	2.6	-2	284	-1	-0.5	0.123	7.4	0.09	1	21.6	28	-2	14	0.7	26.5	74
	5316	5.9	190	6.7	1.9	-0.076	3.4	-2	137	-1	-0.5	0.196	11	0.12	0.946	2.3	-20	8	19	1.3	24.8	101
	5317	20	80	2.83	0.7	-0.049	0.7	-2	56	-1	-0.5	0.175	2.3	0.03	1.01	3.7	-20	-2	5	0.2	32.1	27
	5318	29.2	200	1.85	5.9	0.007	4.1	-2	216	-1	-0.5	0.116	15	0.45	0.744	4	47	8	20	1.5	13.9	181
	5319	22.2	130	4.84	6	-0.106	4.6	-2	386	-1	-0.5	0.086	16	0.56	0.698	6.2	65	11	21	1.5	101	188
	5320	20.6	120	16.1	1.2	-0.245	1.5	-2	175	-1	-0.5	0.093	15	0.11	0.812	2.9	-20	9	10	0.6	25.5	61
	5321	2.41	-30	4.38	0.2	-0.191	0.6	-2	99	-1	-0.5	0.158	-0.5	-0.01	0.91	37.8	-20	-2	4	-0.2	5.41	16
	5322	14.1	230	4.76	1.9	0.126	3.4	-2	183	-1	-0.5	0.143	9.2	0.13	0.637	9.1	-20	10	16	1	35.5	104
	5323	21.2	340	3.97	2.1	-0.052	5.4	-2	245	-1	0.5	0.114	16	0.23	0.871	21.9	25	5	25	1.6	101	172
	5324	163	140	43.9	2.2	0.015	2.3	-2	147	-1	-0.5	0.745	11	0.14	1.35	12	53	-2	14	1	54.1	82
	5720	5.94	40	11.4	0.5	0.763	-0.5	-2	43	-1	-0.5	0.094	1.6	0.02	0.866	-0.5	-20	-2	-2	0.3	7.83	13
Mount Helen	5634	36.9	170	20	2.7	0.49	3.7	-2	102	1	-0.5	0.192	14	0.08	1.55	12	-20	2	20	1.7	45.3	109
	5635	10.9	130	5.65	12.7	0.404	3.9	-2	204	-1	0.6	0.215	17	0.08	0.886	4.5	-20	5	56	5.4	60.6	140
	5636	6.94	130	1.56	0.5	0.259	2.9	-2	178	1	-0.5	0.185	15	0.08	0.58	5.7	-20	-2	22	2	13.6	96
	5637	11.6	170	2.72	0.7	0.449	3.5	-2	45	1	0.7	0.205	17	0.09	0.423	4.9	-20	-2	21	1.9	17.1	110
Oak Spring	0894-G27	1141	30	241	2	0.392	0.5	-2	29	1	0.5	0.521	0.5	0.04	1.94	4.4	-20	69	8	0.5	4265	35
	0894-G28	161	30	88.9	0.8	0.301	0.6	-2	24	1	0.5	0.282	0.5	0.03	0.48	2	-20	16	5	0.5	331	31
	1094-G30	79794	60	2185	1.3	2.25	0.5	-20	167	5	0.5	5.23	2	0.01	-4.36	6.3	-20	137	278	227	4748	-50
	1094-G31	56646	60	411	1.3	0.466	0.5	274	30	5	0.5	2.53	2	0.02	-3.25	14.8	-20	192	64	227	1106	-20
Papoose	5146	80654	-30	89.9	0.3	5.95	0.9	5	52	-1	-0.5	0.697	1.3	0.03	-4.76	3.1	-20	21	165	0.9	262	-100
	5147	65379	-30	349	0.3	1.43	-0.5	-2	46	-1	-0.5	4.22	0.7	0.04	-3.92	0.9	-20	26	72	0.3	33.3	-100
	5502	9.95	-30	500	1.2	7.9	-0.5	-2	44	-1	-0.5	97.4	-0.5	0.19	0.995	-0.5	-20	168	4	0.9	383	37
	1092-1	3.40	30	1.94	0.5	0.33	0.6	2	58	1	0.5	0.15	1.3	0.03	0.26	1.2	-50	-2	2	0.2	36.40	36
	1092-2	2.33	30	0.66	3.6	0.25	0.5	3	25	1	0.5	0.16	1.8	0.03	0.36	1.8	-50	2	4	0.2	37.60	37
	0593-G10	15507.00	30	480.00	0.5	3.22	0.6	-50	46	1	0.5	2.94	0.8	0.07	1.97	9	-20	12	15	0.9	104.00	53
	0593-G11	806.00	30	38.40	1.4	0.39	1.7	-2	90	1	0.5	4.51	3.6	0.1	0.15	1.8	-20	3	9	0.8	25.00	74
	0593-G12	3.88	40	7.64	2.8	0.63	3.3	0	42	1	0.5	0.13	8	0.35	0.17	2.4	66	7	13	1.4	1.17	270
	0593-G13	583.00	120	417.00	11.4	0.25	8.6	-50	268	1	1.2	0.18	9.3	0.26	0.33	5.7	37	113	62	6.8	995.00	120
	0593-G14	24.10	30	17.50	2	0.46	1.6	-2	158	1	0.5	0.18	3.2	0.16	16.10	3.4	-20	9	11	0.9	85.90	65
	0593-G15	35.20	30	10.40	4.3	0.39	3.5	-2	125	1	0.5	0.17	3.3	0.09	0.91	8.2	-20	11	25	2.2	305.00	86
	0394-G20	153.00	150	28.50	9.1	0.49	16.9	-2	1015	1	1.6	0.37	4.9	0.9	0.14	15.5	188	7	22	1.9	113.00	115
	0394-G21	128.00	30	18.60	1.7	0.44	0.9	-2	157	1	0.5	0.45	2.4	0.11	0.21	1.8	-20	8	4	0.5	129.00	85
	1094-G29	164	30	77.2	3.7	0.261	7.7	-2	185	1	1.1	0.165	3.9	0.14	0.382	2.9	-20	24	60	5.5	667	99
	0295-G35	42559	-50	1322	1.5	2.55	-0.5	-2	41	-5	-1	4.09	-5	0.01	-2.51	-5	-20	8	29	-2	12.6	-10
	0295-G36	27.4	40	19.1	3.1	0.22	1.6	3	43	-1	-0.5	0.341	3.6	0.21	0.696	1.7	-20	6	6	1	130	131

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	TI ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	0295-G37	9.43	-30	258	0.8	2.31	-0.5	10	24	-1	-0.5	49.3	2.2	0.43	0.624	1.3	69	195	3	0.4	25.1	82
Prospector	5064	1.47	130	0.12	15.1	0	7.1	-2	59	1	0.8	0.117	14	0.91	0.207	5.3	206	-2	33	3.8	50.6	302
Fault	5065	1.62	-30	0.268	0.7	0.111	-0.5	-2	68	-1	-0.5	0.093	-0.5	0.02	0.719	0.5	-20	-2	2	0.3	29.9	20
	5066	2.31	-30	0.392	1.6	0.045	0.5	-2	39	-1	-0.5	0.134	1.5	0.04	0.087	0.8	-20	-2	4	0.3	101	24
	5067	13.7	30	0.491	4.6	0.969	4	-2	52	-1	-0.5	0.141	7.2	0.41	0.234	1.6	70	-2	20	2	78.7	345
	5068	0.17	-30	0.15	0.1	0.144	-0.5	-2	59	-1	-0.5	0.128	-0.5	0.01	0.345	-0.5	-20	-2	-2	-0.2	0.855	20
	5070	2261	-30	-0.294	0.7	4.92	-0.5	-2	51	-1	-0.5	-0.018	0.7	0.05	0.024	1.3	-20	-2	5	-0.2	2.39	32
	5400	29.8	50	0.208	2.4	0.1	1.5	-2	77	-1	-0.5	0.177	2.4	0.13	0.943	11.8	-20	-2	7	0.6	11.4	103
	5401	19.3	-30	0.378	1.2	0.13	1.6	-2	137	-1	-0.5	0.046	3.5	0.10	0.765	2.2	-20	-2	8	0.7	15	146
	5402	0.366	-30	0.05	0.3	0.094	-0.5	2	53	-1	-0.5	0.092	-0.5	0.03	0.315	-0.5	-20	-2	3	0.2	1.31	33
	5403	23.7	-30	0.309	1.6	0.136	2.1	5	273	-1	-0.5	0.126	0.5	0.03	7.57	2.5	-20	-2	12	0.6	104	27
	5420	1.18	-30	0.069	0.2	-0.134	-0.5	-2	30	-1	-0.5	0.116	-0.5	-0.02	0.437	-0.5	-20	-2	-2	-0.2	5.36	20
Quartzite	5725	1.01	-30	0.273	1.6	-0.081	1.2	-2	180	-1	-0.5	0.109	2.7	0.12	0.562	0.9	46	-2	5	0.6	6.12	89
Mountain	5726	3.32	30	0.223	4.5	-0.085	3.8	3	223	1	-0.5	0.125	5.9	0.38	0.694	2.5	51	-2	21	1.5	30.1	112
	5727	30.8	-30	3.6	0.6	0.156	0.8	-2	64	-1	-0.5	0.117	1.3	0.03	0.842	0.9	21	-2	3	0.2	1.63	20
	5728	58.4	-30	11.6	5.1	0.261	6.6	-2	713	-1	0.7	0.157	10	0.32	0.962	2.9	52	-2	33	2.6	1.85	370
	5729	10.4	70	12.7	5.5	0.2	8	-2	134	-1	1	0.16	9.6	0.53	0.902	3.5	69	3	30	3	9.22	291
Queen City	5840	21.4	30	0.994	9.2	0.89	1.4	-2	220	-1	-0.5	0.225	13	0.97	0.27	5.1	131	-2	6	0.7	8.64	199
	5841	15.6	-30	1.52	8.7	0.272	3.6	-2	49	1	-0.5	0.146	15	0.47	0.35	10.5	92	-2	21	2	91.7	113
Rainstorm	0593-G16	54.30	30	1.17	0.2	0.70	0.5	2	23	1	0.5	0.50	0.5	0.02	0.41	0.5	-20	-2	3	0.2	17.90	25
	0394-G22	27.30	40	23.30	5.9	0.42	2	5	119	1	0.5	2.76	2.3	0.58	0.14	1.5	139	13	11	0.8	132.00	103
	0394-G23	186.00	30	1.53	1.8	19.20	1.4	10	21	1	0.5	3.19	1.5	0.07	0.17	24	-20	6	7	0.8	493.00	46
	0394-G24	10.20	50	6.36	4.4	0.24	2.5	3	158	1	0.5	0.18	3.5	-0.42	1.15	35.7	112	8	11	0.9	1069.00	56
	0394-G25	1274.00	30	672.00	3.9	0.90	3	12	40	1	0.5	10.90	3.2	0.18	-0.29	3.6	59	10	18	1.7	830.00	234
	0795-G42	13.3	-30	2.01	0.9	0.095	0.8	-2	15	-1	-0.5	0.131	0.9	0.04	0.449	-0.5	-20	-2	8	0.6	23.4	33
	0795-G43	88.2	40	12.3	4.1	0.175	3.1	-2	632	-1	0.5	0.626	2.7	0.11	5.54	11.2	78	26	17	1.5	203	102
Reveille	5721	3.21	-30	16.3	6.6	-0.084	7.2	-2	1473	-1	-0.5	0.19	14	0.49	4.09	5.5	190	-2	10	0.7	34.3	167
Valley	5139	2.36	-30	1.81	4.6	0.166	2.3	-2	558	1	-0.5	0.131	13	0.36	0.203	3.4	76	-2	8	0.4	4.14	174
	5140	12.3	-30	3.55	5.1	0.07	5.9	-2	1599	1	0.6	0.146	22	0.74	0.286	1.6	112	-2	6	0.3	14.4	260
	5141	4.19	-30	6.62	8.2	0.185	12.8	-2	3918	-1	-0.5	0.169	26	0.55	0.06	2.3	91	-2	6	0.6	24.1	224
	5150	-20	-30	11	2.6	2.49	3.9	4	212	-1	0.5	0.175	15	0.27	0.384	3.5	35	-2	18	0.9	20.3	103
	5743	6.77	-30	0.7	5.4	0.255	3.8	-2	938	-1	-0.5	0.187	15	0.25	0.363	4.7	62	-2	8	0.5	2.56	119
Scottys	5206	11.2	40	0.236	0.8	0.259	3.7	-2	782	2	0.9	0.138	16	0.12	0.45	4.2	-20	-2	21	2.6	9.87	179
Junction	5238.1	2.1	-30	0.996	0.2	-0.092	-0.5	-2	655	-1	-0.5	-0.124	-0.5	0.01	0.051	0.5	-20	-2	2	-0.2	14	22
	5238.2	15.7	200	4.05	0.5	-0.183	4.6	-2	55	1	-0.5	-0.113	15	0.09	0.151	2.8	-20	-2	16	1.9	15.1	112
	5239	28.3	-30	2.37	0.2	-0.147	-0.5	-2	120	-1	-0.5	-0.052	1.1	0.01	0.132	-0.5	-20	-2	2	0.3	27.2	24
	5240	5.19	-30	114	0.2	2.22	-0.5	-2	214	1	-0.5	0.118	6.1	0.05	0.462	10.4	-20	16	5	0.4	29.1	69
	5241	13.4	250	6.97	0.8	-0.155	3.7	-2	117	-1	0.6	-0.124	17	0.08	0.197	5	-20	9	21	2.2	54.3	101
	5242	6.72	100	0.945	8.3	-0.085	6.2	-2	596	-1	0.5	-0.105	11	0.66	0.132	2.8	121	-2	21	1.9	82.9	235
	5243	9	210	7.99	0.6	-0.238	3.2	-2	55	-1	0.5	-0.123	16	0.08	0.251	2.4	-20	8	17	1.8	21	96
Silverbow	5116	21	100	10.7	1.4	0.573	0.8	-2	67	-1	-0.5	0.183	15	0.07	0.27	5.4	-20	-2	6	1.1	17.9	45
	5117	20	200	5.84	1.2	0.613	1.2	-2	107	-1	-0.5	0.188	17	0.10	0.463	7	-20	-2	6	0.7	0.247	66
	5118	6.52	190	33.1	3.8	0.449	2.7	-2	350	-1	-0.5	0.206	7.9	0.36	0.502	20.8	70	7	10	1.2	18	121
	5119	3.09	30	4.37	0.4	0.383	0.6	-2	137	-1	-0.5	0.198	0.9	0.03	0.293	2.8	-20	-2	6	0.3	-2.12	36
	5120	7.84	210	16.3	1.5	0.169	2.1	-2	130	-1	-0.5	0.158	16	0.13	0.676	4.5	-20	12	11	1.2	23.4	84
	5138	11.9	120	199	1.2	0.08	2	-2	161	-1	-0.5	0.165	12	0.14	0.63	3.8	-20	96	6	0.6	35.9	84
	5188	2.41	50	4.2	1	0.343	0.9	-2	96	-1	-0.5	0.21	2.1	0.06	0.681	-0.5	-20	-2	3	-0.2	2.02	21
	5189	9.28	370	2.77	8.4	0.281	3.2	-2	240	-1	-0.5	0.165	13	0.62	1.84	2.6	52	-2	12	1.1	2.57	158
	5359	12.7	400	78.9	1.9	0.148	3.4	-2	33	2	-0.5	0.159	30	0.08	0.281	12.1	-20	5	27	2.6	50.4	75
	5360	6.9	50	3.16	0.6	0.405	0.6	-2	49	-1	-0.5	0.173	11	0.05	0.362	9.6	-20	-2	6	0.3	7.97	37
	5361	2.2	-30	1.87	0.1	0.2	-0.5	-2	102	-1	-0.5	0.183	0.6	-0.01	0.513	0.9	-20	-2	2	-0.2	1.37	10

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	5610	3.93	490	16.8	2.3	0.378	3.5	-2	33	3	0.6	0.167	33	0.06	0.524	9.9	-20	4	27	3.1	6.23	73
	5611	2.34	450	1.83	2.4	0.34	2.6	-2	17	4	0.6	0.163	32	0.07	0.342	10	-20	4	18	2.3	3.02	79
	5613	5.21	500	14.7	2.6	0.276	4.3	-2	35	3	0.6	0.187	38	0.08	0.752	10.7	-20	11	34	3.5	15.6	81
	5614	2.31	220	4.74	2	0.259	3.1	-2	28	3	0.5	0.222	24	0.05	0.338	7.6	-20	5	24	2.7	1.45	63
	5615	578	140	18.4	1.6	0.353	0.9	-2	11	1	-0.5	0.532	24	0.04	0.537	13.1	-20	2	12	1.2	14.8	50
	5616	30.1	300	6.29	2	0.214	1.1	-2	28	1	-0.5	0.197	27	0.05	0.365	6.9	-20	-2	13	1.2	1.45	55
	5617	2.4	320	2.5	1.1	0.14	1.8	-2	162	-1	-0.5	0.193	18	0.10	0.507	8.7	-20	-2	11	0.9	8.73	63
	5618	9.89	-30	88.3	0.4	0.234	0.7	-2	12	-1	-0.5	0.152	4.5	0.01	0.165	5.5	-20	-2	8	1.5	1.09	21
	5619	4.14	130	50.7	2	0.267	1	-2	13	1	-0.5	0.147	25	0.06	0.35	7.5	-20	-2	11	1.4	2.41	56
	5620	5.15	210	14.8	0.9	0.524	2.3	-2	166	-1	-0.5	0.149	8.6	0.13	0.378	3.2	-20	-2	12	0.7	26.1	73
	5621	4.38	30	3.28	0.2	0.51	1.5	-2	359	-1	-0.5	0.171	1.7	0.02	0.232	1.9	-20	-2	11	0.4	13.8	17
	5622	7.13	90	5.62	1.3	0.274	17.5	-2	131	-1	1.8	0.102	6.9	0.07	0.412	4.9	-20	5	83	6.1	8.83	44
	5623	7.01	30	141	0.6	0.363	2.3	-2	70	-1	-0.5	0.177	2	0.01	0.576	1.2	-20	83	8	0.5	18.7	16
	5624	4.82	150	8.21	1	0.266	1.7	-2	212	-1	-0.5	0.169	8.7	0.09	0.864	2.3	21	6	9	0.4	7.29	57
	5625	2.62	-30	11.4	0.9	0.267	7.1	-2	448	-1	-0.5	0.182	1.6	0.02	0.788	7.8	-20	-2	7	0.4	9.87	23
	5626	2.23	-30	12.6	0.3	0.3	0.6	-2	200	-1	-0.5	0.15	1.4	0.02	4.77	1.2	-20	11	5	0.3	18.7	18
	5627	8.87	80	30.8	0.7	0.379	1	-2	40	-1	-0.5	0.159	11	0.06	0.491	2.9	-20	19	7	0.4	11.1	42
	5628	42.5	50	41.3	1.2	0.631	1.7	-2	275	-1	-0.5	0.269	9.9	0.05	1.5	5.9	24	40	12	1.5	55.7	38
	5629	6.05	60	88.9	0.5	0.922	0.7	-2	121	-1	-0.5	0.229	3	0.04	0.295	5.6	23	7	4	0.2	11.9	29
	5700	6.89	80	10.2	1.5	0.277	1	-2	35	-1	-0.5	0.186	4.6	0.13	0.718	1.1	24	-2	7	0.4	1.45	42
	5701	2.47	80	18.4	2.9	0.408	2.5	-2	557	-1	-0.5	0.159	6.8	0.15	0.288	1.7	58	-2	9	0.6	4.97	51
	5702	8.01	250	4.39	3.4	0.527	3.7	-2	268	-1	-0.5	0.183	9.6	0.24	0.444	2.9	36	2	12	0.9	2.06	76
	5703	3.48	-30	9.31	5.2	0.18	4.4	-2	360	-1	-0.5	0.14	13	0.31	0.293	4.2	56	9	16	1.6	7.98	96
	5704	33.9	80	10.2	3.2	0.265	3.4	-2	129	-1	-0.5	0.228	16	0.43	0.496	9.8	37	2	14	1.1	216	134
	5705	8.04	60	20.3	1.7	0.143	2.5	-2	40	1	-0.5	0.214	11	0.12	1.41	2.8	-20	3	10	0.9	5.15	74
	5706	15	110	7.16	2.3	0.38	2.2	-2	37	-1	-0.5	0.238	15	0.20	0.743	4.5	25	-2	13	1	11.1	97
	5716	3.62	50	4.66	0.6	0.212	0.7	-2	136	-1	-0.5	0.111	4.2	0.03	0.547	2.9	24	-2	4	0.3	2.77	22
	5717	16.7	170	0.756	0.8	-0.184	1.3	-2	107	-1	-0.5	0.114	21	0.12	0.629	10.6	-20	-2	6	0.5	26.8	57
	5731	2.36	-30	0.527	0.6	0.369	0.7	-2	136	-1	-0.5	0.113	2.5	0.07	0.868	0.8	-20	-2	4	0.2	4.43	31
	5732	6.01	60	9.04	2.6	1.52	0.6	-2	47	-1	-0.5	0.161	1.7	0.12	0.744	0.5	20	-2	3	0.3	85.4	33
	5733	8.58	-30	16.8	11.6	1.41	4	-2	467	-1	0.7	0.173	11	0.27	0.517	12.7	126	6	47	3.7	159	95
	5734	130	40	828	0.2	101	-0.5	-2	36	-1	-0.5	0.228	-0.5	-0.01	1.31	-0.5	-20	-2	2	-0.2	66.9	-10
	5735	5.92	70	13	1.2	1.89	-0.5	-2	42	-1	-0.5	0.171	0.8	0.02	0.618	-0.5	-20	-2	3	-0.2	2.53	11
	5736	12.2	110	14.4	2.8	1.05	1	-2	54	-1	-0.5	0.182	1.9	0.16	0.795	-0.5	27	-2	7	0.6	15	39
	5737	11.7	220	12.5	8.8	1	3.1	-2	138	1	-0.5	0.232	6.7	0.58	1.6	1.7	92	12	11	1	5.26	117
Slate	5069	8.16	130	0.143	18	0.29	7.8	-2	61	1	1	0.118	15	1.14	0.119	4.7	242	-2	44	4.2	122	288
South of	5129	118	80	2.24	0.5	0.009	1.1	-2	365	1	-0.5	0.145	4.2	0.02	0.462	1.4	-20	-2	11	0.9	148	30
Mud Lake	5130	6.18	-30	0.688	0.5	0.11	-0.5	-2	143	-1	-0.5	0.11	-0.5	0.03	0.397	-0.5	-20	-2	3	-0.2	20.5	31
Southeastern	5148	88441	-30	515	1.2	7.04	-0.5	-20	265	-1	-0.5	27	-0.5	0.02	1.81	11	-20	-20	266	-0.2	458	-100
	5149	73553	-30	242	-0.1	3.08	-0.5	-20	151	-1	-0.5	7.09	-0.5	0.02	-2.92	2.3	-20	-20	77	0.4	3491	-100
	5500	26618	-30	220	0.5	1.5	-0.5	-2	68	-1	-0.5	1.41	-0.5	0.03	-1.67	0.9	-20	-2	22	0.6	5782	-20
	5501																					
	5506	22478	-30	4356	1.1	1.19	-0.5	-20	27	-1	-0.5	4.8	-0.5	0.02	-0.867	10.7	-20	368	17	-0.2	6883	-20
	0993-G17	63700.00	**	13241.00	**	3.81	**	-1000	53	**	**	9.41	**	0.01	-4.31	**	-20	-50	55	**	26201.00	-100
	1293-G19	129618.00	**	5858.00	**	-2.45	**	-1000	103	**	**	41.70	**	0.01	-3.87	**	-20	-50	95	**	11516.00	-200
	1194-G32	56768	60	2786	0.7	0.716	0.5	-20	46	5	0.5	16.5	2	0.02	-1.27	10.3	-20	-50	54	227	5984	-20
	1194-G33	80401	60	2261	0.5	5.76	0.5	-20	68	5	0.5	50	2	0.01	2.86	6.9	-20	-50	112	227	151	-50
	1194-G34	75641	60	1065	0.7	5.45	0.5	-20	211	5	0.5	20.4	2	0.01	-3.4	2	-20	-2	165	227	1086	-50
	0595-G39	17351	-30	675	0.4	0.649	-0.5	-2	28	-1	-0.5	7.22	-1	0.04	1.22	13.5	118	-2	13	-0.2	1125	-10
	0595-G40	295	-30	64.1	0.8	1.12	0.5	4	74	-1	-0.5	0.729	0.8	0.07	0.24	3.8	38	4	4	0.3	448	16
	5086																					

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5087																					
	5088																					
	5089																					
	5237	3.08	-30	0.28	1.4	0.12	1	-2	21	-1	-0.5	0.126	2	0.12	0.217	-0.5	-20	-2	3	0.3	1.39	61
	5473	15.8	100	2.58	13.9	19.3	6.1	-2	252	1	0.5	0.205	11	0.78	0.572	38.3	178	-2	28	2.3	88.5	172
Stonewall	5606	0.897	60	2.66	1.3	0.679	0.8	-2	41	-1	-0.5	0.169	0.9	0.10	0.31	-0.5	-20	-2	8	0.5	5.62	93
	5607	1.55	110	1.26	0.3	0.269	1.1	-2	17	1	-0.5	0.167	5.6	0.04	0.326	1.2	-20	-2	13	1.4	7.99	168
	5608	11.4	50	15.6	0.6	0.529	-0.5	-2	26	-1	-0.5	0.261	-0.5	0.01	2.52	-0.5	-20	-2	4	0.3	16.1	22
	5609	32.1	180	1.93	4.5	0.246	9.9	-2	73	2	1.2	0.284	20	0.15	0.657	4.2	-20	-2	41	4.8	124	303
	5630	15.9	290	0.811	6	0.211	10.3	-2	102	2	1.2	0.214	18	0.28	0.344	4	-20	-2	48	4.7	22.3	373
	5631	10.9	150	1.28	4.6	0.558	6.2	-2	68	1	0.5	0.172	12	0.26	0.377	2.8	-20	-2	31	3.1	49.3	322
	5632	4.26	90	3.03	1.7	0.434	1.5	-2	39	-1	-0.5	0.367	3	0.16	0.718	0.7	20	-2	7	0.4	17.5	57
	5633	4.08	50	2.31	0.7	3.07	-0.5	-2	20	-1	-0.5	0.197	1.2	0.06	0.477	-0.5	-20	-2	6	0.2	7.33	30
Thirsty	5070.1	1.04	-30	0.332	0.3	0.247	-0.5	-2	23	1	-0.5	0.218	1.2	0.04	0.179	1.7	-20	-2	4	0.4	2.87	142
Canyon	5074	6.66	110	0.319	0.5	0.222	3.2	-2	59	2	-0.5	0.128	11	0.09	0.498	4.6	-20	-2	20	1.9	19.4	108
	5075	0.902	-30	0.365	0.1	0.149	-0.5	-2	26	1	-0.5	0.157	1.4	0.06	0.254	2.7	-20	-2	3	0.3	1.7	76
	5076	11	70	0.336	0.7	0.335	2.3	-2	56	1	-0.5	0.55	8.5	0.40	2.08	2.7	-20	-2	18	1.7	15.1	278
	5581	11.6	220	0.99	1.9	0.095	6.9	-2	130	2	0.6	0.178	16	0.25	0.373	3.7	-20	-2	34	2.8	67.3	317
	5582	6.83	-30	0.471	0.2	0.041	0.6	-2	15	1	-0.5	1.56	2.2	0.05	0.367	1.3	-20	-2	7	0.6	2.23	138
	5583	6.03	-30	1.88	0.6	0.245	0.5	-2	31	-1	-0.5	0.216	0.6	0.01	0.365	3.1	-20	3	4	0.2	10.2	35
	5209	3.9	180	0.198	0.9	0.129	4.2	-2	31	-1	0.5	0.085	18	0.12	0.362	3.2	-20	-2	19	2.4	10.1	121
	5210	5.89	220	0.989	0.9	0.029	4.2	-2	50	1	-0.5	0.074	13	0.14	0.509	3.8	-20	-2	15	2	23.3	149
	5211	4.14	220	1.25	0.8	0.092	3.5	-2	24	-1	-0.5	0.124	20	0.11	0.329	2	-20	-2	16	2	6.77	112
	5212	5.47	170	0.309	1.1	0.141	5.7	-2	69	-1	0.7	0.098	18	0.17	0.495	3.4	-20	-2	28	3.3	57.8	213
	5213	0.894	-30	0.403	0.1	0.307	-0.5	-2	16	-1	-0.5	0.269	1.1	0.07	0.206	1.1	-20	-2	5	0.4	0.682	118
	5214	2	-30	0.53	0.3	0.108	-0.5	-2	39	-1	-0.5	0.144	-0.5	0.02	0.366	1.6	-20	-2	3	0.3	2.87	25
	5450	43.1	160	-1.92	2.6	0.378	5.7	-2	83	-1	-0.5	2.41	13	0.25	1.1	11.5	43	3	21	2.4	60.8	266
Tolicha	5083	9.41	21	0.972	1.4	0.291	6.7	-2	111	2	1	0.175	21	0.17	0.226	4.5	38	-2	29	3.2	18.1	159
	5084	7.92	21	0.54	1.1	0.325	6.8	-2	56	1	0.7	0.136	21	0.14	0.35	4.7	22	-2	35	3.5	2.56	161
	5085	22	12	0.789	0.9	0.449	6.9	-2	20	1	1	0.157	12	0.10	0.262	3.6	-20	-2	36	3.1	300	116
	5107	23.9	90	4.79	0.7	-0.055	1.4	-2	59	-1	-0.5	0.165	4.4	0.08	0.882	1.8	-20	-2	15	1.2	40.7	65
	5113	9.63	-30	1.7	0.3	1.15	-0.5	-2	21	-1	-0.5	0.683	0.5	0.01	0.219	-0.5	-20	-2	-2	0.2	21.3	20
	5114	2.12	-30	1.67	1.2	0.283	-0.5	-2	26	-1	-0.5	0.205	1.1	0.01	0.277	0.8	-20	-2	6	0.5	10.7	19
	5115	5.54	-30	1.29	0.3	0.201	-0.5	-2	47	-1	-0.5	0.243	1.4	0.02	1.6	-0.5	-20	-2	2	0.4	26	24
	5250	3.47	160	0.608	1.4	-0.117	4.2	-2	40	1	-0.5	0.077	18	0.14	0.502	5.3	-20	-2	17	1.9	10	120
	5251	7.52	120	0.322	0.7	0.047	3.5	-2	46	-1	0.7	0.12	18	0.10	0.377	2.3	-20	-2	20	2.3	37.3	107
	5252	7.85	110	1.13	1.9	0.158	2.2	-2	93	-1	-0.5	1.19	7.5	0.18	0.663	0.7	26	-2	8	1.1	26.7	105
	5253	7.62	140	0.659	1.3	0.077	3.8	-2	118	-1	-0.5	0.491	13	0.16	0.223	2.2	20	-2	15	1.8	20.5	143
	5254	103	70	13.6	2	0.264	2.2	-2	106	-1	-0.5	21.8	5.5	0.19	1.24	1.5	34	4	11	0.9	84.3	98
	5255	20.6	80	0.903	1.6	0.113	2.2	-2	104	-1	-0.5	0.24	12	0.18	0.294	1.9	-20	-2	10	1.2	14.3	133
	5256	18.8	80	0.403	0.3	0.05	1.6	-2	47	-1	-0.5	0.229	6.3	0.04	0.344	1.2	-20	-2	9	1	23.2	45
	5257	25.9	140	1.59	2	0.311	4.1	-2	182	-1	-0.5	0.34	12	0.17	0.775	1.2	-20	-2	19	1.6	64.9	142
	5404	60.8	-30	1.21	140	0.29	78.7	6	623	-1	31.5	1.45	4700	3.37	0.475	36.5	785	227	2528	250	16	289
	5405	7.73	90	0.805	0.3	0.175	1.1	-2	40	-1	-0.5	0.111	4.7	0.03	0.328	1.1	-20	-2	5	0.7	6.69	37
	5406	8.2	310	0.641	1	0.114	4	3	52	1	0.6	0.111	17	0.09	0.348	3.8	-20	-2	22	2.8	3.58	97
	5407	6.36	-30	0.749	0.1	0.059	-0.5	-2	27	-1	-0.5	0.423	0.8	0.02	0.449	0.5	-20	-2	2	-0.2	7.88	22
	5408	12.3	260	0.462	0.7	-0.035	3.8	-2	55	1	0.5	0.134	18	0.11	1.16	3.7	-20	-2	25	3	2.94	120
	5409	8.18	310	1.29	0.7	0.026	4.3	2	49	1	0.6	0.075	19	0.11	0.393	3.3	-20	-2	25	2.9	2.15	119
	5410	9.38	170	0.447	2	-0.007	5.6	-2	133	1	0.7	0.076	18	0.26	0.48	3.1	-20	-2	21	2.7	18	209
	5411	55.5	40	3.55	0.4	-0.078	0.8	-2	45	-1	-0.5	0.172	3.6	0.03	0.368	1.1	-20	-2	3	0.6	17.9	46
	5412	10.4	190	0.499	0.5	0.017	2.9	-2	34	1	-0.5	0.109	12	0.08	0.476	1.6	-20	-2	18	1.8	2.28	82

(**) interference
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MINE SITE SAMPLES
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Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5413	15.2	200	0.406	2.4	-0.139	6.7	2	66	1	0.8	0.166	19	0.30	0.383	4.2	-20	-2	25	3	129	186
	5414	23.3	180	0.147	0.7	-0.029	6.9	-2	42	2	1	0.15	19	0.14	0.499	4.1	-20	-2	41	4	8.31	215
	5415	14.1	180	0.504	1.5	-0.158	4.2	-2	72	1	0.5	0.122	18	0.17	0.391	4.7	-20	-2	23	2.7	12.8	149
	5416	3.51	220	0.415	1	-0.111	3.7	-2	38	2	0.5	0.124	23	0.15	0.353	4.8	-20	-2	23	3	6.96	135
	5421	10.9	40	0.93	3.2	-0.022	2.3	-2	41	-1	-0.5	0.408	48	0.30	0.583	2.2	37	-2	20	2.5	28.3	42
	5422	8.32	170	0.52	2.6	0.06	3.3	-2	38	1	0.6	0.253	76	0.14	0.549	2.3	-20	-2	26	2.7	9.54	62
	5423	6.2	80	0.523	7.1	-0.016	8.9	-2	45	-1	2.5	0.492	210	0.55	0.509	3.5	85	7	183	21.8	3.82	54
	5424	16.7	340	1.76	2.4	0.02	6.2	-2	57	-1	1	0.133	78	0.15	0.426	4.5	21	2	66	8.4	89.2	108
	5425	17	320	1.03	0.9	-0.282	5.6	-2	46	1	1	0.068	31	0.11	0.539	4.2	-20	-2	45	4.8	33.7	115
	5426	16.1	320	1.03	1.5	-0.121	7.5	-2	48	1	1.8	0.055	68	0.10	0.606	4.4	-20	-2	83	8.5	64.6	111
	5427	5.96	240	1.53	2.9	0.04	3.8	2	64	1	-0.5	0.106	18	0.30	0.474	3.6	35	-2	18	2.4	4.64	218
	5428	9.08	190	0.81	1.9	-0.042	4.6	-2	56	-1	-0.5	0.138	16	0.27	0.419	4.7	23	-2	21	2.4	12.4	182
	5429	42.4	330	5.61	1.9	-0.093	5.1	-2	52	1	0.7	0.175	37	0.11	0.543	5.1	-20	-2	30	3.5	107	118
	5430	8.17	330	2.08	1.8	-0.148	4.3	-2	133	-1	0.7	0.09	15	0.23	0.657	3	20	-2	12	1.9	13.7	165
	5431	13.9	230	0.964	1.2	0.002	2.1	-2	29	-1	0.7	0.097	25	0.11	0.721	4.3	-20	-2	18	2.3	31.3	108
	5432	2.12	-30	0.642	0.9	0.042	-0.5	-2	25	-1	-0.5	0.296	2.5	0.03	0.338	1.4	-20	-2	6	0.7	10.9	25
	5433	20.9	190	1.32	4.4	-0.112	6	-2	65	1	0.8	0.102	34	0.18	0.538	6	30	-2	41	4.8	46.9	180
	5434	3.41	190	0.262	1.7	-0.102	4.5	-2	35	2	0.6	0.087	21	0.14	0.715	5	-20	-2	24	2.9	3.91	107
	5435	8.53	160	0.372	1.4	-0.132	2.2	-2	34	2	0.5	0.144	18	0.11	0.607	3.1	-20	-2	18	2.3	23.5	102
	5436	8.32	290	0.556	1.5	-0.032	3.9	-2	37	2	0.6	0.115	18	0.11	0.469	3.3	-20	-2	23	2.6	25.5	103
	5458	6.45	-30	1.15	0.6	0.157	-0.5	-2	61	-1	-0.5	0.604	2	0.02	0.252	-0.5	-20	-2	-2	0.2	27	28
	5459	6.13	340	3.76	3.6	-0.036	5.6	-2	101	-1	0.6	0.141	17	0.34	1.07	3	44	3	26	3.2	11.8	212
	5460	28.2	210	1.27	105	0.222	-227	-2	232	-1	29	0.195	4800	5.95	0.192	24.8	1446	290	3244	389	13.1	216
	5461																					
	5462	2.61	-30	0.61	0.3	0.17	-0.5	-2	20	-1	-0.5	0.21	3.6	0.02	0.386	-0.5	-20	-2	4	0.2	28	24
	5463	113	70	4.58	0.7	0.23	1.8	-2	32	1	-0.5	0.199	6.8	0.07	0.242	1.5	-20	-2	11	1.1	9.53	60
	5464	6.09	250	2.16	2	0.157	3.1	-2	144	1	-0.5	0.132	14	0.25	0.305	2.4	-20	-2	14	1.9	5.22	171
	5465	5.53	180	5.64	3	0.416	6.4	-2	136	-1	0.7	0.149	19	0.24	1.67	4.1	36	-2	38	3.6	37.8	183
	5466	29.1	90	4.46	0.8	0.174	3.2	-2	71	-1	-0.5	0.211	7.3	0.08	0.509	1.3	-20	-2	32	2.8	74	73
	5467	5.75	100	0.987	1.5	0.077	2.3	-2	67	-1	-0.5	0.106	8.9	0.14	0.335	5.2	-20	-2	10	1.2	6.52	94
	5468	12.2	270	3.18	1.9	0.11	5.7	-2	97	-1	0.6	0.131	18	0.28	0.345	3.9	-20	3	20	2.4	1.23	186
	5469	25.2	200	0.529	1.1	0.052	2.4	-2	23	1	-0.5	0.153	19	0.10	0.38	4.1	-20	-2	14	2.3	5.35	101
	5470	20	120	3.66	5.5	0.292	6.1	-2	125	1	0.6	0.177	25	0.33	1.4	5.9	45	-2	21	2.5	463	232
	5471	7.21	200	2.32	3.7	0.164	5.4	-2	83	1	-0.5	0.138	19	0.33	0.353	4.2	46	-2	22	2.4	7.9	219
	5744	70.4	170	8.6	2.9	0.352	4	-2	186	-1	-0.5	5.26	11	0.35	1.45	2.4	86	7	19	1.2	39.5	175
	5745	9.44	80	0.687	0.8	0.277	1.4	-2	74	-1	-0.5	0.223	4.4	0.09	0.304	1	-20	-2	7	0.5	16.8	63
	5746	15.5	120	1.11	1.2	0.141	3.2	-2	92	-1	-0.5	1.5	10	0.12	0.369	2.3	-20	-2	22	1.6	14.6	103
	5747	28.4	30	3.19	1.1	0.115	3.5	-2	229	-1	1	1.43	3.1	0.03	0.531	1.9	-20	-2	49	2.6	111	26
Transvaal	5053	3.19	150	1.07	1.5	-0.98	3.2	4	107	-1	-0.5	-0.5	10	0.18	-0.49	2.9	-20	-2	11	1.1	4.65	147
	5054	8.67	250	1.37	1.7	-0.95	6.3	6	68	-1	0.6	-0.5	20	0.15	-0.47	4	-20	-2	22	2.1	6.21	127
	5055	5.57	160	0.58	2.2	-0.98	3.9	-2	150	-1	-0.5	-0.5	12	0.22	-0.49	3.1	-20	-2	14	1.3	11.50	116
	5056	10.80	210	0.45	1.5	-1.00	5.7	2	26	-1	0.8	-0.5	21	0.13	-0.50	5.5	-20	-2	33	2.7	16.50	178
	5057	5.49	100	0.27	2.1	-0.98	4.1	3	41	-1	-0.5	-0.5	22	0.17	-0.49	3.7	-20	-2	15	1.6	6.17	113
	5058	5.89	210	-0.24	2.2	-0.97	5.6	5	51	-1	0.6	-0.5	29	0.19	0.53	5.3	-20	-2	17	2.2	10.20	146
	5059	10.90	280	1.04	1.8	-0.93	5.5	2	124	-1	0.6	-0.5	20	0.18	0.47	4.4	-20	-2	18	1.5	28.10	154
	5207	7.99	40	0.825	0.5	-0.091	1.8	-2	52	1	-0.5	0.166	7.6	0.34	0.729	8.4	23	-2	8	0.7	3.67	131
	5208	0.448	30	0.313	0.5	-0.01	1.1	-2	27	-1	-0.5	0.051	4.6	0.08	0.612	5.5	-20	-2	8	0.6	4.03	62
	5451	12.9	-30	-0.738	1.3	0.331	4.5	-2	112	2	-0.5	0.69	34	0.53	0.379	3.9	101	-2	15	1.1	2.34	204
	5452	3.5	-30	-0.202	0.4	0.134	0.5	-2	85	-1	-0.5	0.133	1	0.05	6.22	-0.6	-20	-2	3	0.3	60.1	39
	5453	5.73	90	-0.125	1.1	0.19	2.7	-2	291	-1	-0.5	0.183	9.5	0.15	0.503	1.8	-20	-2	10	1.3	2.08	134
	5454	11.7	-30	0.459	3.5	0.039	11.1	-2	252	2	1.3	0.219	26	0.44	0.17	3.8	78	-2	57	4.5	1.65	269

(**) interference
(-) less than indicated value

MINE SITE SAMPLES
Listed by District or Area

Mining District	Sample Number	Pb ICP ppm	RB INAA ppm	Sb ICP ppm	SC INAA ppm	Se ICP ppm	SM INAA ppm	Sn XRF ppm	Sr XRF ppm	TA INAA ppm	TB INAA ppm	Te ICP ppm	TH INAA ppm	TiO2 XRF %	Tl ICP ppm	U INAA ppm	V XRF ppm	W XRF ppm	Y XRF ppm	YB INAA ppm	Zn ICP ppm	Zr XRF ppm
	5455	3.22	210	0.327	2	0.205	5.3	-2	121	1	-0.5	0.151	20	0.18	0.323	2.7	21	-2	17	2	6.33	138
	5456	9.05	-30	0.923	9.7	0.366	3.5	-2	541	1	-0.5	0.174	25	0.67	0.135	3.6	143	-2	14	1.8	2.67	227
	5457	7.67	210	0.31	8.1	0.192	5.4	-2	475	-1	-0.5	0.192	21	0.56	0.347	7.2	82	-2	21	2.6	17.7	227
	5472	4.09	-30	0.583	3.3	-0.062	4.5	-2	208	-1	-0.5	0.098	14	0.41	0.302	1.9	46	-2	21	2	8.74	314
	5487	17.2	-30	1.53	0.1	0.033	-0.5	-2	16	-1	-0.5	0.257	0.5	0.02	0.644	7.2	-20	-2	-2	-0.2	3.68	
	5488	25.3	170	0.619	1.3	0.163	4	2	375	-1	0.6	0.253	17	0.24	0.609	9.7	-20	-2	19	2	8.79	
	5561																					
	5562																					
	5563	3.38	210	0.422	2.3	-0.25	4.4	-2	48	-1	0.5	-0.125	28	0.19	0.184	4.1	-20	-2	17	1.8	4.9	140
	5575	3.36	-30	1.22	0.2	0.917	-0.5	-2	23	1	-0.5	0.219	1.2	0.01	0.135	2.9	-20	-2	3	0.3	0.978	140
	5576	8.42	-30	0.403	1.1	0.162	-0.5	-2	13	1	-0.5	0.882	2.4	0.17	0.277	0.6	-20	-2	4	0.4	0.806	107
	5577	2.43	-30	0.564	0.4	0.478	-0.5	-2	12	2	-0.5	0.215	2.1	0.70	0.312	2.7	-20	-2	6	0.3	0.278	205
	5578	8.42	220	93.2	2	0.994	5.4	-2	206	2	0.5	0.979	22	0.21	0.337	4	-20	-2	25	2.4	8.6	163
	5579.1	13.9	270	2.09	2.2	0.203	4.7	-2	45	1	0.5	0.223	19	0.18	0.506	4.4	-20	-2	25	2.4	51.9	147
	5579.2	12	250	1.9	1.5	0.279	3.6	-2	51	-1	-0.5	0.215	17	0.15	3.56	4.1	-20	-2	21	1.7	21.4	129
	5580	6.57	190	0.849	1.9	0.217	4	-2	85	-1	-0.5	0.18	16	0.18	0.269	3.7	-20	-2	22	2.1	8.62	117
Trappmans	5110	15087	-30	208	0.5	0.296	-0.5	-2	68	-1	-0.5	0.11	0.9	0.03	-0.662	1.7	-20	-2	10	-0.2	836	-10
	5111	-12.4	120	52.6	8.4	0.119	2.4	-2	71	-1	-0.5	0.115	4.7	0.96	0.798	2.2	233	10	13	1.2	102	95
	5112	5042	-30	306	0.7	0.248	-0.5	-2	34	-1	-0.5	0.072	1.1	0.02	-0.035	2.8	-20	7	8	0.2	1078	12
	5352	7897	-30	4890	2.2	5.92	1	-2	62	-1	-0.5	2.6	-0.5	0.13	-0.343	-0.5	91	5	14	-227	494	37
	5353	10733	-30	342	0.9	4.52	0.5	-2	77	-1	-0.5	0.426	1.6	0.16	-0.127	3.2	45	7	12	0.4	168	14
	5354	15470	-30	2387	2.8	2.03	-0.5	-2	156	-1	-0.5	0.09	-0.5	0.12	-0.096	9.4	22	-2	13	-227	3197	-10
Wagner	4170	15.60	-30	51.70	1	-0.92	1.3	-2	21	-1	-0.5	-0.5	1.8	0.06	-0.46	2.3	-20	2	5	0.6	121.00	62
	4171	161.00	90	133.00	9.5	2.79	7	-2	417	-1	0.7	2.4	9.8	0.53	2.10	20.3	71	19	56	4	574.00	172
	4172	3.38	60	0.43	7.2	-0.95	4.1	-2	23	-1	0.6	-0.5	7.1	0.81	-0.48	2.1	179	7	20	2	428.00	266
	4173	129.00	30	34.90	4.2	25.70	3.6	38	42	-1	0.7	41.0	2.8	0.19	11.10	42.5	22	-200	37	3.2	115.00	52
	4174	41.00	70	24.10	6.4	9.86	4.8	2	85	-1	0.6	49.3	5.8	0.36	11.80	8.5	84	-200	19	1.6	4.50	113
Wellington	5132	127	30	9.92	1.4	0.81	1.6	-2	46	-1	-0.5	0.187	8.2	0.06	0.224	3.6	-20	-2	12	0.8	29.5	59
	5133	33.7	50	1.81	1.4	0.261	2.1	-2	46	-1	-0.5	0.181	10	0.07	0.275	2.5	-20	-2	11	0.9	14.3	62
	5547	28	-30	1.21	0.5	0.093	1	-2	53	-1	-0.5	0.152	3.8	0.06	0.426	1.7	-20	-2	6	0.4	47.5	51
	5548	51.8	-30	17.5	1.9	15	1.1	-2	147	-1	-0.5	5.77	2.3	0.08	1.26	1.5	-20	-2	19	0.7	22.2	93
Wilsons	5108	1008	40	-1.07	0.8	0.827	0.8	5	47	-1	-0.5	332	3	0.05	0.341	1.3	-20	-2	3	0.3	747	38
	5109	442	50	33.3	0.8	0.424	0.9	-2	138	-1	-0.5	42.5	1.6	0.08	0.291	0.9	-20	-2	6	0.2	414	52
	5351	1113	30	7.38	0.8	2.12	2.3	-2	110	-1	-0.5	9.78	3.1	0.02	0.305	3.8	23	-2	9	0.5	384	-10
	5355	123	60	0.502	0.8	0.327	1	-2	66	-1	-0.5	16.4	3.5	0.04	0.421	0.9	-20	-2	6	0.3	125	40
	5356	124	70	0.486	1.3	0.186	0.9	-2	95	-1	-0.5	3.57	2	0.13	0.43	0.8	-20	-2	6	0.3	176	60
	5357	96.4	70	1.23	0.6	0.171	1.1	-2	85	-1	-0.5	3.48	6	0.05	0.536	1.3	-20	-2	7	0.4	55.6	44
	5358	13.4	50	0.554	0.8	0.214	1	-2	88	-1	-0.5	1.27	4.1	0.09	0.383	1.4	-20	-2	7	0.3	60.3	54
	5646	357	-30	1.01	0.4	0.388	-0.5	-2	18	-1	-0.5	19.9	-0.5	-0.01	0.183	0.5	-20	2	4	-0.2	257	-10
	5647	743	-30	1.28	0.3	0.425	-0.5	-2	34	-1	-0.5	15.4	0.6	0.01	0.409	0.7	-20	-2	5	-0.2	330	11
	5648	280	30	0.7	0.3	0.407	-0.5	-2	101	-1	-0.5	20.9	1.2	0.02	0.288	-0.5	-20	-2	4	-0.2	268	18
	5649	103	80	0.355	0.3	0.226	-0.5	-2	60	-1	-0.5	37.4	1.5	0.01	0.254	-0.5	-20	-2	3	-0.2	17.3	17
	5741	159	60	0.449	0.8	0.605	1.3	-2	82	-1	-0.5	6.93	4.2	0.05	0.381	1.3	-20	-2	7	0.4	94.3	41
	5742	112	110	1.27	1.4	0.511	1.2	-2	142	-1	-0.5	9	2.1	0.13	0.125	0.7	-20	-2	6	0.3	60	58
Yucca Mt.	5815	31.7	-30	1	0.6	-0.039	1	2	20	-1	-0.5	0.135	4.9	0.04	1.37	10.2	-20	-2	7	0.6	24.5	21

(**) interference
(-) less than indicated value

Mine Site Sample Analyses
(U.S. Geological Survey Laboratory Data)

Mining	Sample	Au	Ag	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	Y	Zn	Zr
District	Number	AA	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
Cactus Flat	3209	N0.05	N	170.0	20.	2000.	3.	N	2.	N	L	L	L	1.	0.0	70.	.2	500.	5.	N	L	100.	22.0	5.	N	3000.	.1	100.	20.	30.0	70.
	3210	N0.05	N	60.0	20.	700.	10.	N	.5	N	N	20.	5.	1.5	0.0	70.	.2	150.	10.	N	L	100.	4.0	7.	N	5000.	.2	50.	30.	15.0	150.
	3211	0.05	L	40.0	15.	1500.	15.	N	1.5	N	N	20.	7.	1.	4.0	50.	.5	150.	10.	N	L	30.	4.0	7.	N	5000.	.15	30.	15.	10.0	100.
	3212	0.05	L	20.0	20.	1000.	1.5	N	2.	N	N	L	L	.3	0.0	L	.05	300.	L	N	L	100.		5.	N	1500.	.1	10.	10.	20.0	50.
	3213	N0.05	L		100.	1000.	1.	N	1.5	N	L	15.	10.	.2	0.0	100.	.5	300.	L	N	L	70.		5.	N	1000.	.2	20.	15.	20.0	70.
	3214	N0.05	N	140.0	20.	1500.	3.	N	1.5	N	L	15.	20.	1.	0.1	50.	.1	300.	5.	N	5.	20.	8.0	7.	N	(+)5000.	.2	50.	15.	15.0	150.
Clarkdale	1901	.5	20.	110.0	20.	1000.	30.	N	20.	N	N	10.	5.	3.		30.	.5	2000.	10.	L	10.	70.	1.0	L	N	200.	.1	30.	50.	45.0	100.
	1902	1.4	10.	1000.0	15.	500.	10.	N	.07	N	N	10.	20.	5.		50.	.03	150.	N	50.	L	100.	4.0	15.	N	150.	.1	150.	70.	10.0	300.
	1903	0.05	N	30.0	20.	2000.	5.	N	.3	N	N	10.	5.	3.		20.	.05	50.	N	N	7.	15.	1.0	5.	N	500.	.07	50.	100.	20.0	30.
	1904	N0.05	N	20.0	70.	300.	5.	N	.07	N	N	L	L	.5		50.	.15	100.	N	30.	7.	30.	1.0	5.	N	N	.1	20.	20.	20.0	150.
	1905.1	.5	20.	55.0	70.	500.	50.	N	.07	N	10.	20.	20.	1.5		50.	.15	500.	N	L	30.	20.	1.0	7.	N	200.	.2	50.	20.	120.0	100.
	1905.2	7.3	70.	30.0	30.	500.	70.	N	.05	N	15.	15.	50.	2.		70.	.15	700.	N	L	30.	50.	2.0	5.	N	200.	.2	30.	50.	140.0	150.
	1906	1.6	30.	40.0	15.	500.	70.	N	1.	N	N	10.	100.	1.5		50.	.1	300.	N	N	7.	100.	1.0	5.	N	300.	.15	30.	15.	60.0	100.
	1907	.4	5.	60.0	15.	300.	50.	N	.7	N	5.	10.	5.	1.5		50.	.1	300.	N	20.	7.	20.	3.0	5.	N	700.	.15	30.	20.	60.0	150.
	1908	.85	.5	10.0	15.	200.	5.	N	.05	N	N	L	5.	.7		70.	.03	100.	N	30.	5.	50.	1.0	L	N	100.	.05	15.	50.	40.0	200.
Don Dale	581	0.5	10.0	N0.05	20.	500.	2.	N10.	0.15	N20.	N5.	N10.	10.	5.	0.0	20.	0.02	10	7.	N20.	N5.	70.	4.0	5	N10.	100	0.05	10	15.	55.0	100.
	1467	N0.05	7.	20.0	50.	1500.	2.	N10.	0.05	N20.	N5.	N10.	15.	20.		70.	0.5	50.	N5.	20.	N5.	100.	6.0	10.	10	100.	0.2	50.	50.	0.0	200.
	1468	0.1	7.	160.0	50.	500.	2.	20.	0.05	N20.	N5.	10.	2000.	10.		50.	0.3	200.	5	20.	30.	7000.	500.0	5.	20.	N100.	0.2	70.	10.	0.0	300.
	1469	0.05	7.	110.0	20.	150.	10.	N10.	0.05	N20.	N5.	N10.	30.	5.		50.	0.05	200.	10.	20.	20.	200.	16.0	N5.	N10.	N100.	0.07	20.	10	0.0	200.
	1470	0.4	5.	65.0	20.	150.	3.	N10.	0.05	N20.	5	N10.	20.	5.		50.	0.05	2000.	N5.	20.	10.	200.	6.0	N5.	N10.	N100.	0.02	20.	10	0.0	50.
	3000	N0.05	N0.5	10.0	10.	700.	1.5	N10.	0.1	N20.	N5.	N10.	7.	5.	5.0	30.	0.02	50.	5.	N20.	N5.	20.	1.0	5	N10.	100.	0.03	10	15.	40.0	50.
	3001	N0.05	N0.5	5.0	50.	1500.	1.	N10.	0.1	N20.	N5.	N10.	5.	0.7	0.1	50.	0.05	50.	N5.	N20.	N5.	20.	1.0	5.	N10.	100.	0.1	10	15.	5.0	100.
	3020	N0.05	7.	110.0	15.	300.	1	N10.	N0.05	N20.	N5.	10.	2000.	5.	0.3	20.	0.03	10.	N5.	N20.	N5.	3000.	140.0	N5.	N10.	N100.	0.05	10.	10	250.0	150.
	3021	N0.05	1.	50.0	10	100.	1	N10.	0.05	N20.	N5.	10	15.	1.	0.0	20.	0.02	50.	5	N20.	5	20.	14.0	N5.	N10.	N100.	0.05	10.	N10.	20.0	50.
	3024	0.05	N		30.	1500.	1.	N	.2	N	L	20.	15.	3.	0.2	50.	.1	70.	N	N	L	30.		10.	N	500.	.5	70.	10.	5.0	100.
	3026	N0.05	L	500.0	30.	70.	3.	N	1.	N	10.	L	7.	10.	0.5	L	.03	5000.	7.	N	10.	10.	50.0	5.	N	N	.02	100.	15.	900.0	20.
	3027	N0.05	N	250.0	30.	150.	1.	N	1.	N	L	20.	20.	15.	4.7	20.	.03	200.	N	N	7.	10.	100.0	N	N	300.	.015	70.	L	120.0	15.
	3038	N0.05	N	40.0	15.	200.	1.	N	.15	N	L	L	L	10.	4.5	30.	.02	5000.	30.	N	L	10.	10.0	5.	N	L	.1	30.	15.	210.0	100.
	3048	0.05	1.5	170.0	20.	100.	1.5	N10.	0.05	N20.	5.	15.	200.	5.	0.7	50	0.03	300.	10.	N20.	20.	200.	12.0	5	N10.	N100.	0.07	10	10	860.0	100.
	3049	0.05	2.	150.0	15.	70.	1	N10.	N0.05	N20.	7.	20.	20.	1.	0.7	50	0.05	300.	N5.	N20.	7.	150.	22.0	5	N10.	N100.	0.07	10.	10	60.0	150.
	3050	0.75	150.	500.0	10.	300.	1	15.	0.05	N20.	N5.	20.	500.	3.	5.0	50.	0.02	20.	150.	N20.	5.	2000.	1000.0	5.	20.	300.	0.5	10	15.	80.0	1000.

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

Mine Site Sample Analyses
(U.S. Geological Survey Laboratory Data)

Mining	Sample	Au	Ag	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	Y	Zn	Zr
District	Number	AA	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
	3051	1.4	100.	700.0	10	5000.	N1.	10.	N0.05	N20.	N5.	10	200.	1.	5.0	50.	N0.02	10.	200.	N20.	5	15000.	380.0	N5.	10	200.	0.07	N10.	10	70.0	150.
	3052	0.05	1.5	800.0	10	1500.	1	N10.	0.05	N20.	N5.	10	5.	1.5	5.0	50	0.02	20.	N5.	N20.	5	20.	46.0	N5.	N10.	100	0.02	10.	N10.	15.0	50.
	3053	0.1	1.5	120.0	15.	150.	1.	N10.	N0.05	N20.	N5.	N10.	10.	0.7	2.6	50	0.02	150.	N5.	N20.	5.	70.	8.0	N5.	N10.	N100.	0.05	10	10	140.0	70.
	3059	0.05	1.	160.0	15.	700.	1.5	N10.	0.05	N20.	5.	10.	10.	2.	2.2	50	0.02	3000.	5.	N20.	15.	50.	16.0	5.	N10.	N100.	0.05	10	10.	390.0	70.
	3060	0.2	200.	300.0	10	50.	1	15.	0.05	20	7.	10	3000.	1.5	1.2	50	0.02	1000.	5.	N20.	5.	10000.	800.0	N5.	30.	N100.	0.03	10	10	2000.0	70.
Eastern	448	5	110		50	(+)5000	1	15	0.5	N	N	10	20	5.0		20	0.03	200	L	L	5	300	47	N	N	1000	0.3	50	N	55	200
Goldfield	450	N	L	B	N	100.	1.	N	1.	N	N	N	L	.07		L	.03	150.	N	N	5.	15.	N	N	N	200.	.01	L	N	5.0	15.
	451	10.	140.0	.15	L	500.	N	N	.15	N	N	L	20.	3.		L	.07	1000.	7.	N	N	100.	20.0	L	N	200.	.3	100.	L	85.0	100.
Eden	2785	1.	150.	130.0	10.	200.	3.	N	.05	N	N	N	30.	1.5		N	.05	150.	15.	N	10.	30.	8.0	N	N	N	.05	15.	N	20.0	30.
	2786	1.7	3.	140.0	15.	150.	5.	N	.05	N	N	L	10.	5.		N	.1	150.	30.	L	5.	30.	4.0	N	N	N	.07	10.	15.	15.0	100.
	2787	N0.05	70.	150.0	15.	50.	2.	N	0.05	N	N	N	10.	1.		L	.03	100.	200.	N	5.	30.	200.0	N	N	N	.05	70.	N	5.0	30.
	2788	0.05	2.	140.0	20.	150.	3.	N	.07	N	N	15.	L	1.5		L	.1	70.	50.	N	5.	50.	2.0	N	N	N	.07	30.	10.	55.0	100.
	2789	.05	7.	130.0	L	150.	3.	N	0.05	N	N	N	5.	.7		N	.03	100.	N	N	5.	15.	6.0	N	N	N	.03	L	N	25.0	20.
Groom	2397.1	0.05	700.	90.0	50.	50.	L	N	2.	N	15.	L	3000.	1.		L	.7	1000.	N	N	7.	(+)20000.	2100.0	5.	N	100.	.05	10.	15.	25.0	100.
	3002	N0.05	1.5	1000.0	70.	70.	N	N	.3	N	N	15.	10.	15.	5.0	N	.1	70.	20.	N	15.	L	70.0	L	N	N	.07	15.	L	110.0	50.
	3003	N0.05	N	20.0	15.	100.	N	N	.3	N	N	L	10.	.7	0.1	30.	.02	200.	N	N	5.	L		N	N	N	.05	15.	20.	5.0	70.
	3004	N0.05	N		N	20.	N	N	.05	N	L	N	L	.3	0.0	20.	0.02	15.	N	N	5.	N		N	N	N	.005	20.	N	25.0	15.
	3005	N0.05	N	20.0	N	L	N	N	(+)20.	N	N	N	5.	.5	0.0	N	1.5	200.	N	N	7.	L	18.0	N	N	150.	.01	10.	10.	5.0	15.
	3006	N0.05	300.	100.0	15.	700.	L	N	5.	(+)500.	L	N	2000.	2.	5.0	20.	1.	200.	N	N	L	(+)20000.	200.0	N	N	N	.015	L	N	2000.0	N
	3007	N0.05	2.	1000.0	100.	(+)5000.	1.	N	1.	N	5.	15.	15000.	3.	2.3	30.	.07	500.	N	N	10.	500.	90.0	7.	N	2000.	.15	20.	20.	310.0	150.
	3008	N0.05	200.	700.0	150.	1000.	L	N	1.5	N	100.	N	(+)20000.	3.	5.0	20.	.3	500.	30.	N	200.	(+)20000.	200.0	5.	N	700.	.05	L	15.	35.0	50.
	3009	N0.05	50.	500.0	50.	100.	N	N	10.	N	50.	N	1000.	5.	2.6	L	1.	5000.	10.	N	50.	(+)20000.	96.0	5.	N	200.	.05	L	20.		20.
	3010	.8	N	80.0	20.	100.	N	N	0.05	N	N	N	7.	.3	0.4	L	0.02	15.	N	N	N	70.	20.0	N	N	N	.015	L	N	10.0	50.
	3011	2.7	N	140.0	30.	300.	L	N	.07	N	N	10.	7.	2.	0.6	30.	.05	15.	N	N	5.	15.	60.0	L	N	L	.07	30.	10.	35.0	150.
	3012	.05	N	60.0	30.	500.	L	N	0.05	N	N	L	N	1.	0.7	30.	.05	10.	N	N	L	15.	2.0	L	N	100.	.05	20.	L		100.
	3013	.4	1.5	200.0	70.	300.	1.	N	0.05	N	5.	30.	30.	2.	1.5	30.	.15	15.	L	N	10.	100.	42.0	5.	N	150.	.2	50.	30.		200.
	3014	2.	20.	190.0	50.	150.	2.	L	0.05	N	7.	10.	300.	.7	5.0	30.	.03	5000.	10.	N	L	10000.	170.0	N	N	N	.05	50.	L	25.0	70.
	3015	.15	700.	350.0	50.	500.	L	N	.05	30.	N	15.	500.	1.	5.0	20.	.05	15.	10.	N	N	20000.	500.0	N	N	N	.02	70.	N	110.0	100.
	3016	.25	70.	500.0	L	200.	N	15.	N	L	N	N	3000.	.3	5.0	20.	0.02	20.	10.	N	N	15000.	1000.0	N	N	N	.01	L	N	90.0	20.
	3017	2.9	150.	750.0	10.	300.	L	30.	0.05	20.	N	N	700.	2.	5.0	30.	0.02	30.	50.	N	7.	(+)20000.	200.0	N	N	N	.02	L	N	50.0	70.
	3018	N0.05	N		N	50.	N	N	0.05	N	N	L	L	.2	0.0	30.	.02	20.	N	N	N	50.	8.0	N	N	N	.015	L	N		30.

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

Mine Site Sample Analyses
(U.S. Geological Survey Laboratory Data)

Mining	Sample	Au	Ag	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	Y	Zn	Zr
District	Number	AA	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
	3019	N0.05	N	20.0	15.	1500.	L	N	.1	N	7.	20.	20.	3.	0.1	30.	.03	70.	L	N	7.	50.		7.	N	1000.	.5	100.	10.	20.0	150.
	3022	N0.05	N	500.0	15.	200.	1.	N	1.5	N	L	10.	7.	3.	4.4	20.	.05	300.	15.	N	L	10.	54.0	5.	N	150.	.05	70.	10.	20.0	70.
	3023	N0.05	N	50.0	15.	1000.	L	N	.1	N	5.	30.	15.	3.	0.5	50.	.03	100.	L	N	5.	30.		5.	N	1000.	.5	70.	L	20.0	100.
	3025	N0.05	N		50.	1500.	1.	N	.2	N	L	20.	20.	5.	0.4	50.	.07	50.	N	N	L	30.		10.	N	500.	.5	70.	10.	5.0	100.
	3028	N0.05	100.		20.	100.	N	N	0.05	N	5.	L	100.	.5	5.0	30.	.02	500.	10.	N	N	2000.	450.0	N	N	N	.05	10.	N	25.0	70.
	3029	.05	70.	40.0	15.	200.	L	N	0.05	N	N	L	200.	.5	5.0	30.	.02	500.	L	N	L	3000.	180.0	N	N	N	.03	30.	L	35.0	100.
	3030	4.7	70.	200.0	20.	100.	1.	N	N	N	L	L	500.	1.5	5.0	20.	.03	700.	7.	N	5.	1000.	150.0	L	N	N	.05	20.	L	50.0	50.
	3031	.1	.5	50.0	70.	200.	1.	N	N	N	7.	10.	10.	3.	1.1	30.	.03	2000.	10.	N	20.	50.	16.0	L	N	N	.07	10.	15.	190.0	200.
	3032	.05	2.	450.0	50.	200.	L	N	0.05	N	L	10.	100.	5.	5.0	30.	.03	300.	15.	N	7.	500.	220.0	L	N	L	.07	10.	L	50.0	50.
	3033	.5	N	70.0	30.	150.	N	N	N	N	N	N	5.	.5	0.4	50.	.03	L	N	N	L	20.	30.0	N	N	N	.05	20.	10.		70.
	3034	1.7	7.	250.0	50.	200.	L	10.	N	N	N	L	150.	.7	3.8	50.	.05	15.	N	N	L	300.	250.0	L	N	N	.07	20.	15.	10.0	300.
	3035	.3	N	10.0	L	70.	N	N	N	N	N	N	N	.3	0.0	30.	.02	10.	N	N	N	L		N	N	N	.03	10.	N		50.
	3036	N0.05	N	50.0	10.	50.	5.	N	.05	N	N	N	N	7.	0.0	30.	.02	100.	N	N	5.	L	10.0	N	N	100.	.02	10.	L	35.0	70.
	3037	N0.05	N	120.0	20.	200.	2.	N	.05	N	5.	30.	20.	(+)20.	5.0	30.	.03	70.	N	N	20.	L	2.0	L	N	N	.05	50.	15.	100.0	200.
	3039	.05	50.	560.0	N	30.	N	N	7.	N	100.	L	2000.	10.	5.0	N	5.	1000.	N	N	50.	2000.	200.0	L	N	L	.015	L	15.	2000.0	10.
	3040	.05	500.	400.0	10.	20.	N	N	3.	L	7.	N	3000.	1.	5.0	20.	1.5	700.	N	N	10.	+)20000.	200.0	L	N	100.	.015	N	10.	2000.0	30.
	3041	N0.05	.7	45.0	N	200.	N	N	(+)20.	N	5.	L	15.	5.	0.5	L	2.	2000.	N	N	15.	200.	10.0	N	N	200.	.015	N	15.	160.0	L
	3042	.15	100.	60.0	70.	300.	1.	N	2.	500.	L	10.	700.	2.	5.0	30.	1.	300.	N	N	20.	+)20000.	230.0	5.	N	150.	.05	10.	L	2000.0	15.
	3043	N0.05	100.	1000.0	30.	70.	N	N	2.	N	20.	10.	1000.	15.	5.0	N	1.	300.	5.	N	30.	+)20000.	200.0	L	N	200.	.02	L	L	2000.0	L
	3044	N0.05	200.	1000.0	100.	200.	L	N	1.	N	150.	N	+)20000.	3.	5.0	L	.1	700.	50.	N	150.	+)20000.	200.0	5.	N	200.	.03	N	20.	130.0	70.
	3045	0.05	L	40.0	70.	500.	1.	N	.3	N	7.	20.	200.	3.	0.6	50.	.05	500.	N	N	10.	200.	8.0	10.	N	100.	.2	30.	50.	90.0	200.
	3046	0.05	N	60.0	30.	3000.	1.	N	.15	N	L	L	50.	1.5	0.9	20.	.02	500.	N	N	10.	30.	22.0	5.	N	L	.07	10.	L	65.0	50.
	3047	.2	N	150.0	15.	1000.	L	N	.05	N	7.	10.	7.	1.	0.6	L	0.02	30.	N	N	7.	15.	4.0	N	N	150.	.02	L	L	20.0	70.
	3054	.05	20.	320.0	15.	100.	L	N	0.05	N	5.	10.	300.	.3	2.7	20.	0.02	200.	10.	N	15.	700.	270.0	N	N	N	.02	L	N	310.0	70.
	3055	.05	10.	30.0	20.	200.	L	20.	0.05	N	5.	10.	200.	.3	0.7	L	.02	300.	N	N	5.	7000.	82.0	N	N	N	.05	10.	L	5.0	70.
	3056	2.3	15.	350.0	15.	300.	2.	50.	0.05	N	N	L	300.	2.	1.0	20.	0.02	30.	5.	N	10.	3000.	300.0	L	N	N	.02	10.	10.	75.0	70.
	3057	.2	3.	210.0	70.	150.	1.	N	0.05	N	N	15.	700.	.5	6.2	20.	0.02	10.	N	N	7.	1500.	430.0	L	N	500.	.07	10.	10.	70.0	150.
	3058	1.5	1.	100.0	20.	2000.	L	N	N	N	L	L	20.	.7	0.2	20.	0.02	20.	N	N	5.	70.	6.0	N	N	200.	.02	10.	L		50.
Rainstorm	1900	B	1.5	600.0	50.	200.	L	L	.2	N	7.	30.	300.	5.		L	.07	100.	N	L	15.	100.	22.0	5.	N	1000.	.3	100.	20.	60.0	300.
	1918	.3	N	15.0	20.	150.	N	N	0.05	N	N	20.	10.	.2		50.	.03	20.	N	N	5.	15.	2.0	L	N	N	.05	20.	10.	5.0	100.
	1939	B	1000.	10.0	N	200.	N	500.	0.05	N	N	L	1500.	.07		N	0.02	100.	N	N	5.	+)20000.	42.0	N	15.	N	.02	10.	N		20.

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

Mine Site Sample Analyses
(U.S. Geological Survey Laboratory Data)

Mining	Sample	Au	Ag	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	La	Mg	Mn	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	Ti	V	Y	Zn	Zr
District	Number	AA	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.	E.S.	E.S.	E.S.	E.S.	E.S.	AA	E.S.
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
	1940	B	2000.		N	1000.	L	50.	0.05	N	N	L	7000.	.1		L	0.02	15.	N	N	5.	+)20000.	270.0	N	20.	L	.002	10.	N		N
	1941	B	1000.		N	700.	N	10.	0.05	N	N	N	2000.	.05		L	0.02	15.	N	N	L	+)20000.	210.0	N	15.	N	0.002	15.	N		N
	1942	B	700.	40.0	N	150.	N	200.	0.05	N	N	50.	300.	1.		L	0.02	L	N	N	L	+)20000.	26.0	N	50.	N	.05	50.	N	30.0	50.
	1943	B	50.	90.0	10.	100.	N	N	0.05	N	L	15.	5000.	3.		L	.02	20.	N	N	5.	+)20000.	16.0	L	N	N	.1	50.	N	70.0	70.
	1944	B	10.	170.0	20.	2000.	N	10.	0.05	N	L	20.	700.	3.		L	.05	15.	N	L	5.	1500.	50.0	L	20.	N	.2	50.	30.	180.0	150.
	1945	B	150.	40.0	10.	150.	N	100.	0.05	100.	N	10.	1500.	.7		L	.02	10.	N	N	5.	+)20000.	30.0	N	N	N	.03	15.	N	100.0	70.
	1946	B	70.	85.0	10.	300.	N	50.	0.05	N	N	10.	2000.	.7		L	.03	50.	N	N	5.	10000.	150.0	N	N	N	.05	20.	N	190.0	50.
Silverbow	2774	3.4	150.	690.0	10.	200.	1.5	N	.05	N	N	L	30.	2.		N	.07	30.	200.	N	15.	30.	18.0	L	N	200.	.2	70.	N	40.0	30.
	2775	.05	30.	90.0	10.	L	2.	N	0.05	N	N	N	L	.3		N	0.02	50.	N	N	7.	30.	10.0	N	N	L	.03	L	N	15.0	30.
	2776	.8	70.	150.0	10.	150.	1.5	N	0.05	N	N	L	20.	2.		L	.1	150.	50.	N	5.	150.	42.0	L	N	200.	.05	30.	10.	5.0	50.
	2777	.5	1500.	830.0	L	200.	1.5	N	0.05	N	N	10.	150.	.7		N	0.02	70.	20.	N	5.	100.	450.0	N	N	N	.03	L	N	30.0	15.
	2778	.2	15.	580.0	10.	500.	3.	N	.05	N	N	20.	20.	2.		N	.07	150.	70.	N	30.	20.	8.0	L	N	N	.2	50.	N	5.0	30.
	2779	20.	1000.	200.0	L	100.	3.	N	0.05	N	N	15.	20.	2.		N	.02	100.	15.	N	7.	30.	120.0	N	N	N	.015	15.	N	55.0	N
	2780	3.5	700.	760.0	L	200.	3.	N	.05	N	N	15.	30.	2.		N	.02	150.	50.	N	7.	20.	42.0	N	N	N	.03	15.	N		N
	2781	2.6	700.	450.0	L	100.	2.	N	0.05	N	N	N	70.	2.		L	.1	50.	30.	N	15.	50.	190.0	L	N	N	.07	30.	10.	5.0	30.
	2782	.75	700.	200.0	N	70.	2.	N	0.05	N	N	20.	70.	.7		L	.02	150.	100.	N	10.	150.	130.0	N	N	L	.02	15.	20.	55.0	15.
	2783	7.8	3000.	230.0	L	50.	1.5	N	0.05	N	N	10.	300.	.7		L	.05	100.	150.	N	5.	150.	530.0	N	N	N	.07	20.	10.	240.0	50.
	2784	.2	20.	90.0	L	100.	2.	N	.05	N	N	N	10.	.3		L	.03	50.	20.	N	10.	30.	8.0	N	N	N	.03	10.	L	10.0	50.
Stonewall	1226	.05	30.	10.0	30.	300.	5.	N	10.	N	7.	50.	10.	2.		20.	1.5	3000.	N	N	15.	150.	4.0	7.	N	1000.	.15	30.	15.	85.0	50.
	1227	0.05	1.5	10.0	N	N	L	N	15.	N	N	N	10.	.7		N	(+)10.	1000.	N	N	N	30.	1.0	N	N	100.	.01	L	10.	5.0	15.
Tolicha	1909	3.6	5.	15.0	20.	150.	20.	N	.07	N	N	10.	L	.15		20.	.02	150.	N	N	7.	N	1.0	L	N	N	.01	20.	15.	25.0	50.
	1910	.15	20.	30.0	15.	300.	10.	N	0.05	N	N	L	10.	.7		50.	.02	300.	10.	L	5.	30.	2.0	L	N	N	.05	15.	20.	45.0	100.
	1911	1.5	20.	1000.0	150.	300.	15.	N	.1	N	N	10.	15.	7.		70.	.2	1000.	50.	20.	5.	500.	11.0	15.	10.	L	.2	100.	100.	200.0	200.
	1912	.15	10.	1000.0	70.	300.	10.	N	.3	N	N	L	50.	3.		50.	.15	500.	100.	20.	5.	200.	15.0	15.	N	100.	.07	50.	100.	2000.0	100.
	1913	1.4	20.	25.0	30.	300.	50.	N	0.05	N	N	10.	50.	.5		20.	.02	1000.	200.	N	5.	20.	1.0	N	N	100.	.03	100.	10.	45.0	50.
	1914	.1	10.	25.0	15.	300.	50.	N	.07	N	N	L	L	.5		50.	.07	200.	70.	L	5.	20.	2.0	L	N	L	.07	30.	15.	15.0	100.
	1915	.3	20.	30.0	20.	300.	50.	N	.1	N	N	10.	10.	.5		30.	.02	50.	50.	N	7.	50.	3.0	N	N	L	.02	20.	50.	25.0	50.
	1916	.25	15.	20.0	20.	300.	20.	N	0.05	N	N	10.	5.	.5		70.	.1	70.	50.	20.	5.	70.	3.0	L	N	L	.07	30.	20.	10.0	150.
	1917	.55	3.	10.0	15.	700.	5.	N	.05	N	N	L	15.	1.		70.	.02	150.	N	L	5.	30.	1.0	5.	N	200.	.1	30.	20.	30.0	150.
Transvaal	1065	B	2.	30.0	20.	700.	2.	N	.07	N	N	N	L	.3		30.	.07	150.	30.	L	5.	70.		N	N	N	.07	20.	15.	15.0	150.

(-) less than indicated value
(+) greater than indicated value
L low (near dectection limit)
N not detected at detection limit

MINE SITE SAMPLES
Listed by District or Area
(Data supplied by DRI)

Mining District	Sample	Ag	Ag	Al	As	Au	Ba	Be	Bi	Ca	Cd	Cd	Co	Cr	Cu	Cu	Fe	Ga	Hg	K	La	Mg
	Number	ppm	oz/ton	%	ppm	ppb	ppm	ppm	ppm	%	ppm	%	ppm	ppm	ppm	%	%	ppm	ppm	%	ppm	%
Gold Range																						
	91-24	9.2		0.03	20	10	30	<0.5	24	>15.00	<0.5		<1	11	74		1.3	50	<1	<0.01	10	0.23
	91-25	1.4		1.51	25	15	60	<0.5	<2	12.55	<0.5		6	66	35		4.08	30	<1	0.09	20	0.14
	91-26	0.2		0.89	15	15	160	<0.5	6	0.27	<0.5		1	44	58		1.55	10	<1	0.27	30	0.1
	91-27	<0.2		0.76	10	5	220	<0.5	<2	0.11	<0.5		6	158	49		2.29	<10	<1	<0.01	10	0.01
Papoose																						
	91-04	2		0.24	145	15	40	<0.5	<2	0.06	0.5		1	364	117		1.91	<10	<1	0.33	<10	0.06
	91-05	18.2		0.04	3940	435	40	<0.5	42	0.11	<0.5		2	318	255		5.41	<10	<1	<0.01	<10	<0.01
	91-06	1.2		0.06	215	20	10	<0.5	4	0.14	<0.5		<1	279	68		3.28	<10	<1	<0.01	<10	<0.01
	91-07	>200	13.7	0.05	1205	185	<10	0.5	<2	1.22	>100.0	0.081	<1	114	>10000	11	0.34	20	61	<0.01	<10	0.4
	91-16	<0.2		0.91	95	<5	90	<0.5	<2	0.51	>100.0	0.028	118	56	62		>15.00	10	<1	0.15	10	0.24
	91-17	0.6		1.65	160	10	50	<0.5	<2	0.87	>100.0	0.033	100	50	50		14.2	20	<1	0.29	30	0.78
	91-18	129.5		0.05	875	215	<10	<0.5	2	0.06	6.5		3	208	93		1.3	<10	<1	<0.01	10	0.01
	91-19	38.6		0.15	1085	90	10	<0.5	<2	0.19	<0.5		<1	210	429		>15.00	<10	<1	0.02	10	0.03
	91-20	194		0.03	225	200	620	<0.5	<2	0.3	<0.5		<1	193	>10000	12.3	3.38	<10	10	<0.01	<10	0.02
	91-21	140		<0.01	210	430	30	<0.5	1035	0.01	1.5		<1	88	4210		0.41	<10	38	<0.01	<10	<0.01
	91-23	<0.2		0.13	490	1810	20	<0.5	674 0	0.1	<0.5		3	76	416		>15.00	<10	<1	0.01	<10	0.03
Rainstorm																						
	91-01	0.4		0.39	20	40	60	<0.5	<2	0.04	0.5		<1	245	5		0.53	<10	<1	0.17	10	0.02
	91-02	3.6		0.72	120	30	370	<0.5	2	0.02	4		1	274	699		1.28	<10	<1	0.33	10	0.03
	91-03	12.4		0.37	405	625	240	<0.5	18	0.05	<0.5		1	275	269		3.1	<10	1	0.37	<10	0.01
	91-09	0.4		0.16	480	495	so	<0.5	16	0.36	<0.5		10	322	182		7.2	<10	<1	0.01	<10	0.05
	91-22	158.5		0.22	30	3400	1210	<0.5	114	0.02	8		<1	178	240		0.39	<10	66	0.05	<10	0.01
Southeastern																						
	91-10	0.2		0.54	20	<5	<10	<0.5	<2	6.78	<0.5		4	205	96		3.08	20	<1	<0.01	<10	0.07
	91-11	>200	27.9	0.43	7410	135	<10	<0.5	<2	2.3	>100.0	0.043	1	238	>10000	4.91	0.66	90	61	0.03	<10	1.11
	91-12	>200	7.28	0.03	5910	445	20	<0.5	10	0.87	>100.0	0.029	<1	199	>10000	1.84	0.48	<10	309	<0.01	<10	0.43
	91-14	9.6		0.02	130	40	20	<0.5	14	>15.00	39.5		1	16	1260		0.22	40	12	<0.01	10	1.79
	91-15	0.8		0.09	475	<5	<10	1	<2	>15.00	15.5		1	27	273		1.33	40	<1	0.02	10	5.1

(<) less than indicated value
(>) greater than indicated value

MINE SITE SAMPLES
Listed by District or Area
(Data supplied by DRI)

Mining District	Sample	Mn	MnO	Mo	Na	Ni	P	Pb	Pb	Sb	Sc	Sr	Ti	Tl	U	V	W	Zn	Zn
	Number	ppm	%	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	%	PPM	PPM	PPM	PPM	PPM	%
Gold Range																			
	91-24	1395		<l	0.01	<l	<10	6190		10	1	842	<0.01	<10	<10	8	20	22	
	91-25	1790		<1	0.01	2	170	790		5	4	311	<0.01	<10	<10	26	<10	110	
	91-26	185		1	0.04	<1	50	126		<5	3	20	0.01	<10	<10	9	<10	64	
	91-27	30		1	<0.01	<1	250	80		<5	2	29	<0.01	<10	<10	21	<10	22	
Papoose																			
	91-04	35		1	0.01	3	200	1900		30	<1	36	<0.01	<10	<10	19	30	94	
	91-05	85		5	<0.01	4	950	>10000	3.27	175	<1	9	<0.01	<10	<10	92	80	122	
	91-06	15		1	0.01	2	80	1400		65	<1	8	<0.01	<10	<10	1	80	58	
	91-07	30		92	0.13	<1	1460	>10000	6.55	>10000	2	104	<0.01	<10	10	174	950	>10000	3.69
	91-16	>10000	4.2	4	0.02	137	1140	484		<5	4	54	<0.01	<10	10	23	100	>10000	14.1
	91-17	>10000	1.97	4	0.01	149	3470	1845		<5	5	72	0.01	<10	<10	26	60	>10000	6.32
	91-18	230		85	<0.01	2	620	>10000	12.2	20	<1	18	<0.01	<10	<10	7	20	1240	
	91-19	15		457	0.02	<1	1550	>10000	11.9	55	1	30	<0.01	<10	<10	43	<50	1265	
	91-20	15		11	0.01	2	1840	>10000	15	65	2	120	<0.01	<10	50	2	1300	1475	
	91-21	<5		16	0.01	<l	<10	>10000	50.8	175	<1	102	<0.01	<10	<10	<1	10	312	
	91-23	120		<1	0.03	<1	910	1110		185	2	15	0.02	<10	<10	44	<50	72	
Rainstorm																			
	91-01	15		<1	0.01	1	60	64		<5	<1	15	<0.01	<10	<10	5	<10	18	
	91-02	10		<1	0.02	1	70	716		<5	<1	10	<0.01	<10	<10	8	<10	210	
	91-03	5		<1	0.04	<1	120	2730		40	<1	13	<0.01	<10	<10	7	<10	278	
	91-09	55		1	0.3	7	180	704		40	<1	66	0.02	<10	<10	60	10	84	
	91-22	<5		2	0.01	<1	40	>10000	25.2	85	<1	14	<0.01	<10	<10	4	20	188	
Southeastern																			
	91-10	2520		28	0.01	3	780	216		5	1	25	<0.01	<10	<10	14	1350	142	
	91-11	290		445	0.08	5	1910	>10000	10.2	70	1	46	<0.01	<10	<10	14	350	>10000	3.1
	91-12	140		86	0.01	<l	50	>10000	4.57	7740	<1	11	<0.01	<10	10	590	150	>10000	1.75
	91-14	1155		8	0.02	<1	<10	1265		140	<1	108	<0.01	<10	<10	19	10	1365	
	91-15	250		1	0.06	1	10	908		225	<1	24	<0.01	<10	<10	122	150	1270	

(<) less than indicated value
(>) greater than indicated value

PLAYA SAMPLE ANALYSES

Area	Sample Number	UTM East	UTM North	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Co	Cr	Cs	Cu	Eu	Fe	Ga	Hf	Hg	La	Li	Lu
				ICP	ICP	GFAA	XRF	AA	ICP	INAA	INAA	ICP	INAA	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	ICP	INAA	AA	INAA
				ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Antelope Lake	5819	527977	4171059	0.21	11.4	0.005	561	-5	0.432	1	3	0.352	78	11	30	13	17.6	1.9	3.4	4.81	3	-0.006	45	75	0.34
Antelope Lake	5820	529127	4169990	0.216	10.3	0.004	576	-5	0.483	1	4	0.358	71	8	30	12	20.5	1.8	3.5	5.7	5	0.003	44	83	0.3
Main Lake	5821	524157	4189047	0.145	7.39	0.003	451	-5	0.365	1	3	0.216	75	9	20	12	12.5	1.5	2.7	2.85	4	0.013	43	90	0.31
Main Lake	5822	524199	4188589	0.199	9.6	0.004	430	-5	0.441	1	2	0.343	76	12	40	15	20.7	1.1	3.5	5.97	4	0.026	43	95	0.31
Alkali Lake	5837*	466678	4190060	0.259	14.3	0.021	526	-5	0.734	2	4	0.349	74	14	40	19	27.8	1	3.5	4.58	3	0.015	41	129	0.36
Alkali Lake	5838*	466056	4189873	0.304	18.6	0.024	527	-5	0.987	2	4	0.395	73	14	40	18	28.4	1	3.4	5.03	4	0.026	40	122	0.35
Stonewall playa	5839	486147	4153777	0.19	9.86	0.009	520	-5	0.372	7	6	0.281	76	11	40	9	18.1	1	3.1	4.31	4	0.082	43	72	0.31
Kawich playa	5847	569340	4149788	0.085	8.07	0.002	374	-5	0.423	3	<1	0.435	78	9	30	11	16.7	1.2	3	5.69	4	0	40	85	0.34
Mud Lake	5910*	491911	4190993	0.098	22.3	0.002	507	-5	0.503	2	3	0.222	62	10	20	15	16.7	0.9	3	4.66	3	0	37	120	0.22
Mud Lake	5911*	491887	4192473	0.099	23.8	0.002	545	-5	0.481	1	3	0.238	61	10	20	16	19.4	0.9	3.1	5.62	3	0.004	37	130	0.29

* sample is outside of NAFR, not shown on location maps

PLAYA SAMPLE ANALYSES

Area	Sample	MnO	Mo	Na	Nb	Nd	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb	Te	Th	TiO2	Tl	U	V	W	Y	Yb	Zn	Zr
	Number	XRF	ICP	INAA	XRF	INAA	XRF	ICP	INAA	ICP	INAA	ICP	INAA	XRF	XRF	INAA	INAA	ICP	INAA	XRF	ICP	INAA	XRF	XRF	XRF	INAA	ICP	XRF
		%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Antelope Lake	5819	0.107	1.9	11000	16	30	28	15.6	130	1.37	11.7	0.397	5.1	-2	281	<1	<0.5	0.186	17	0.52	0.391	3.6	96	-2	21	2.2	64.2	130
Antelope Lake	5820	0.114	1.56	11000	18	20	31	17	170	1.51	12.2	0.095	5	-2	228	<2	1.1	0.136	16	0.52	0.63	2.7	89	-2	24	1.9	72.6	148
Main Lake	5821	0.087	0.962	16000	16	30	25	10.2	130	1.1	9.9	0.248	4.7	-2	327	<1	<0.5	0.127	17	0.46	0.441	4.1	75	-2	20	2	38.7	147
Main Lake	5822	0.104	1.4	12000	19	30	30	15.7	150	1.51	12.2	0.374	4.9	-2	252	<1	<0.5	0.178	18	0.51	0.598	3.2	77	-2	23	1.9	69.5	136
Alkali Lake	5837*	0.107	2.17	24000	16	30	35	15.5	170	2.15	11.6	0	5	-2	357	<1	<0.5	0.31	15	0.50	0.619	3.3	124	-2	22	2.2	70.7	138
Alkali Lake	5838*	0.115	7.14	21000	16	30	37	17.1	150	2.44	11.7	0.196	5.1	-2	319	<1	<0.5	0.534	15	0.49	0.582	4.1	93	-2	22	2.2	75.9	142
Stonewall playa	5839	0.090	1.63	9700	19	30	32	11.5	70	1.87	11	0.771	5.3	4	306	<1	<0.5	0.275	14	0.52	0.35	3.2	75	-2	24	1.9	51.2	169
Kawich playa	5847	0.104	1.79	7400	23	30	31	15.2	160	1.33	9.7	0.734	5.1	-2	262	<1	0.6	0.175	17	0.51	0.626	2.9	76	-2	26	2.3	65.1	165
Mud Lake	5910*	0.116	5.44	18000	15	20	25	13.4	160	1.78	9.3	0.35	3.9	6	313	<1	<0.5	0.168	15	0.40	0.633	5.6	131	-2	19	1.6	55.7	120
Mud Lake	5911*	0.122	5.71	19000	16	20	27	14.2	140	1.94	9.7	0.428	3.9	4	320	<1	<0.5	0.155	16	0.40	0.519	5.7	117	-2	21	1.8	62.6	126

* sample is outside of NAFR, not shown on location maps

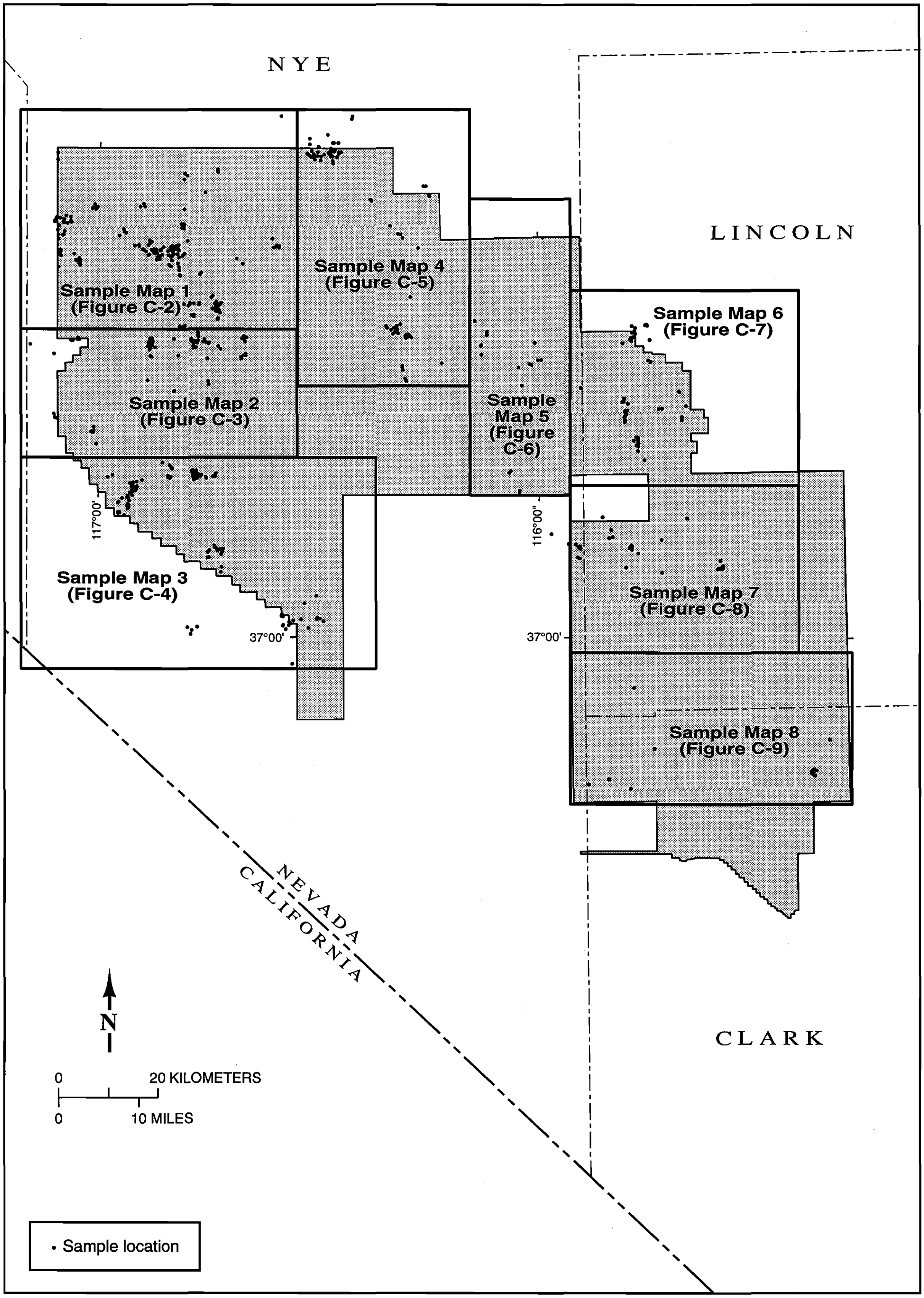


Figure C-1 Index to mine, prospect, and outcrop sample location maps.

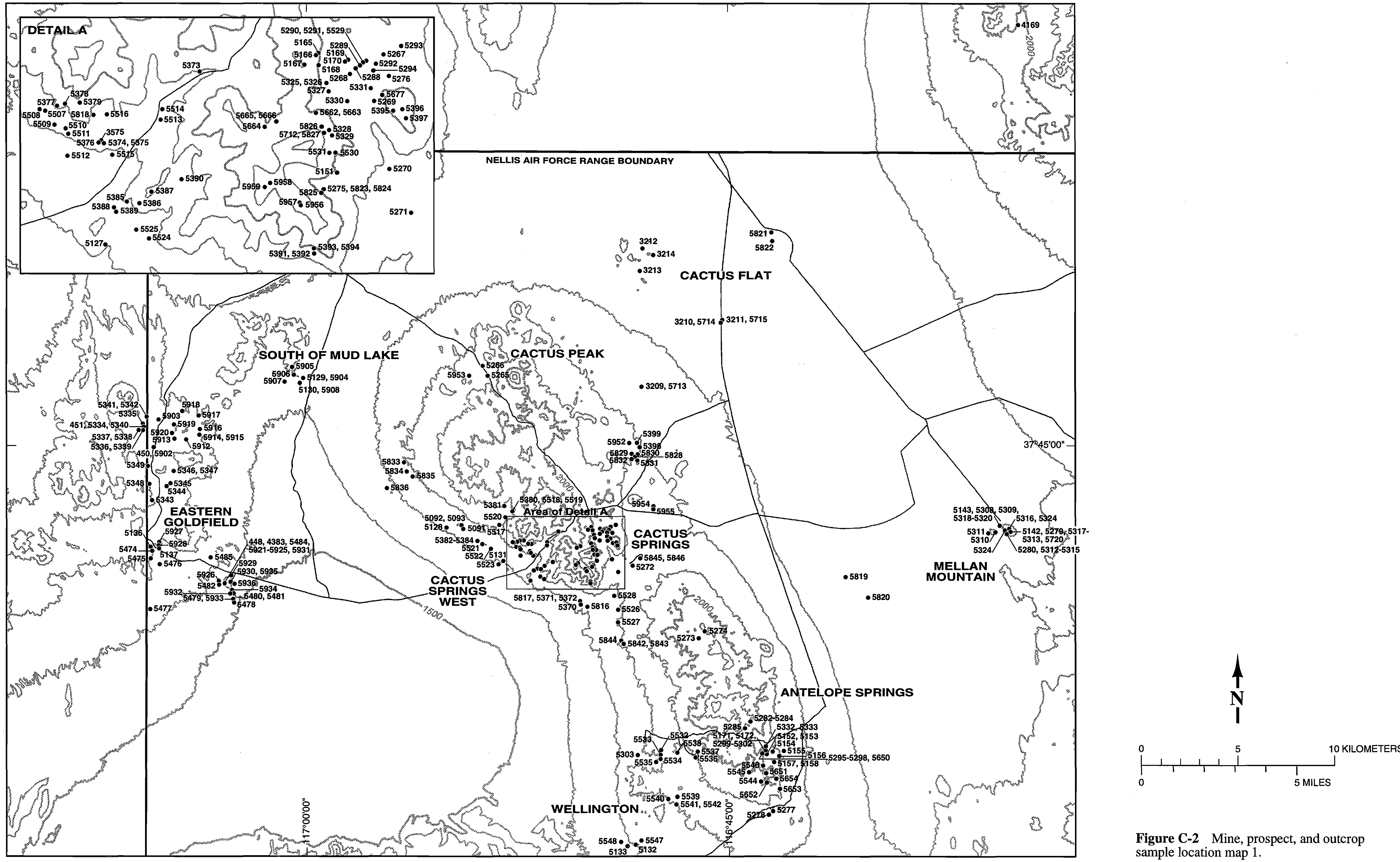


Figure C-2 Mine, prospect, and outcrop sample location map 1.

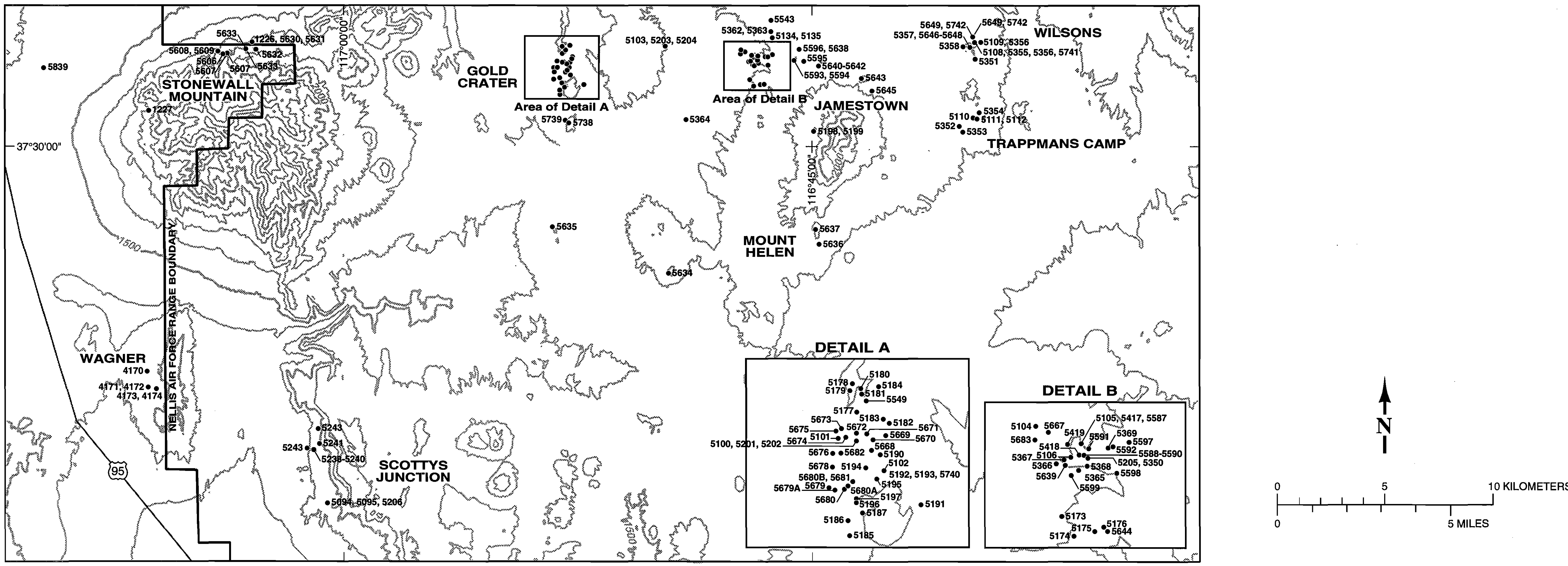


Figure C-3 Mine, prospect, and outcrop sample location map 2.

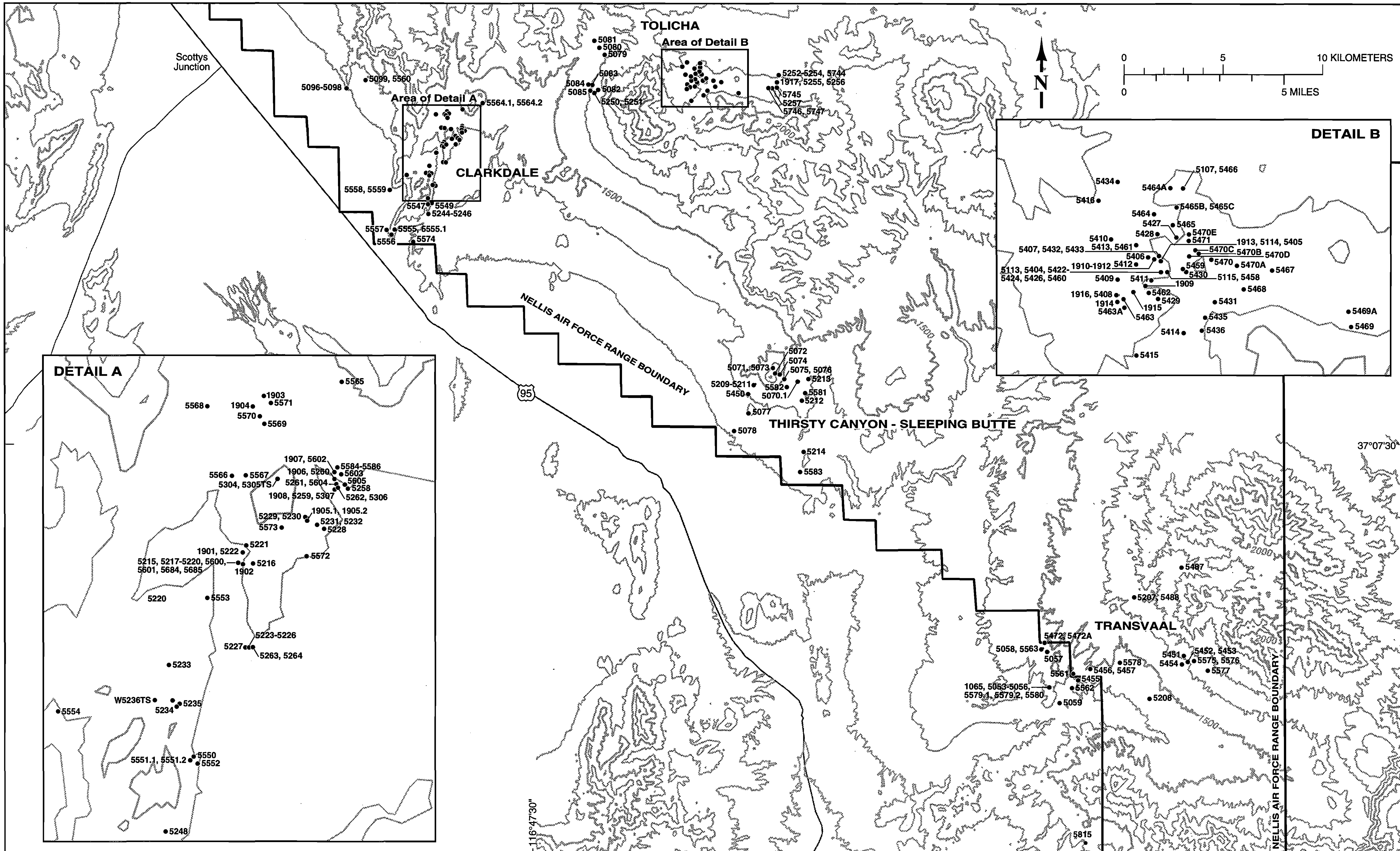


Figure C-4 Mine, prospect, and outcrop sample location map 3.

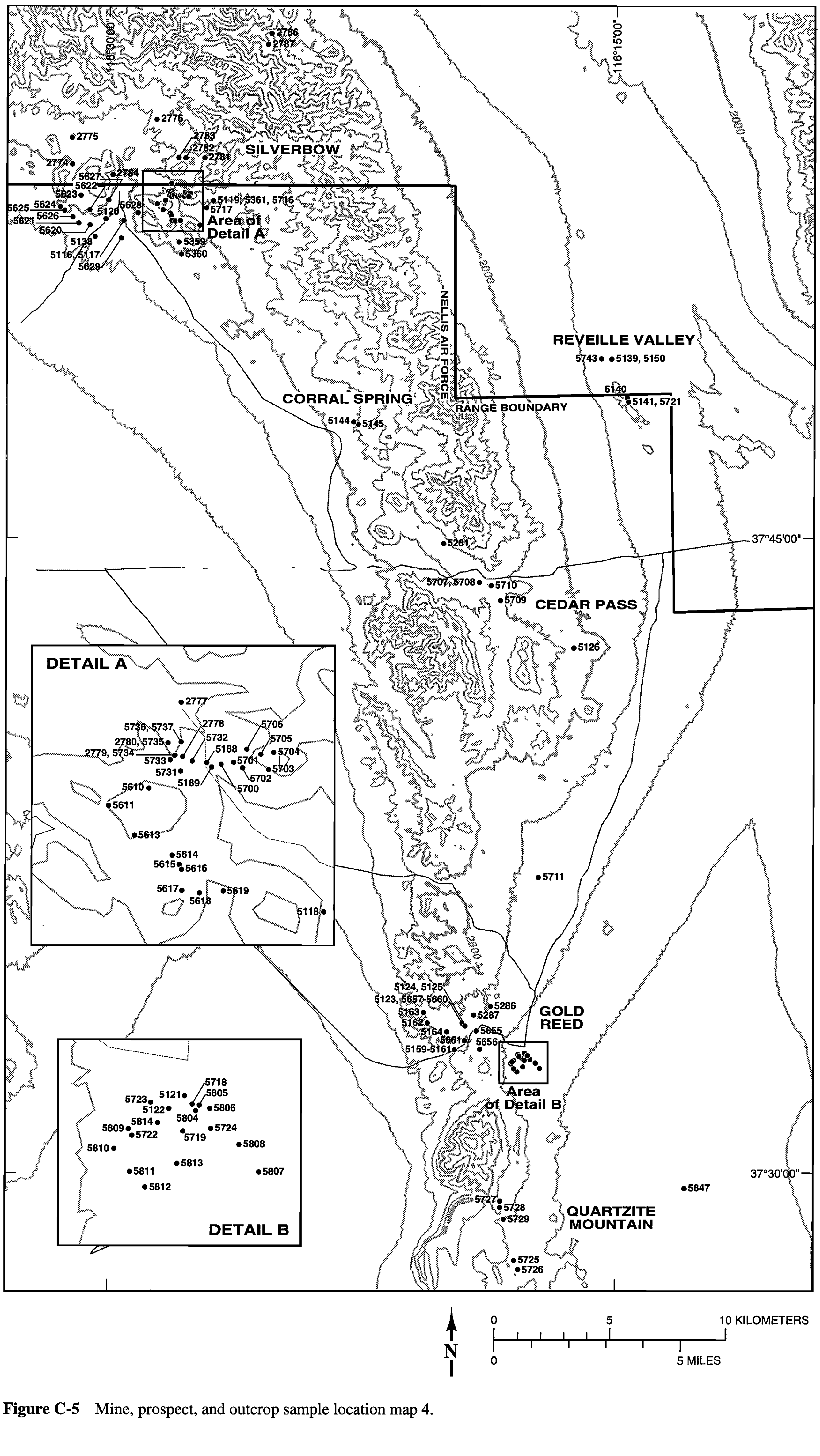


Figure C-5 Mine, prospect, and outcrop sample location map 4.

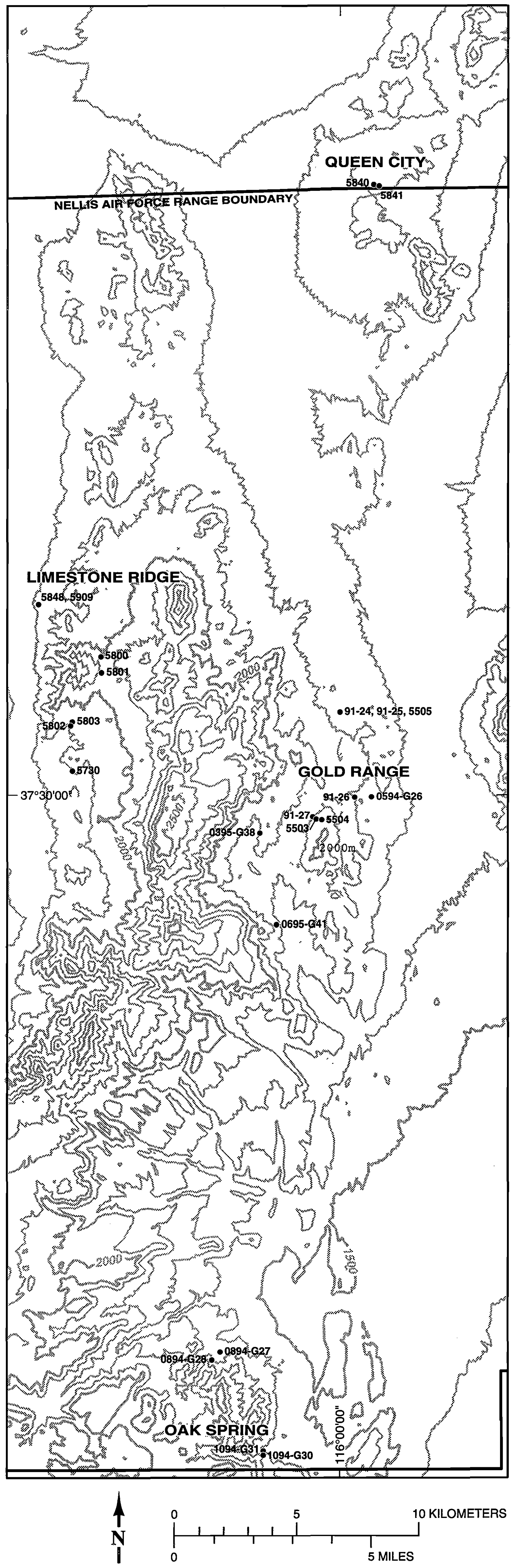


Figure C-6 Mine, prospect, and outcrop sample location map 5.

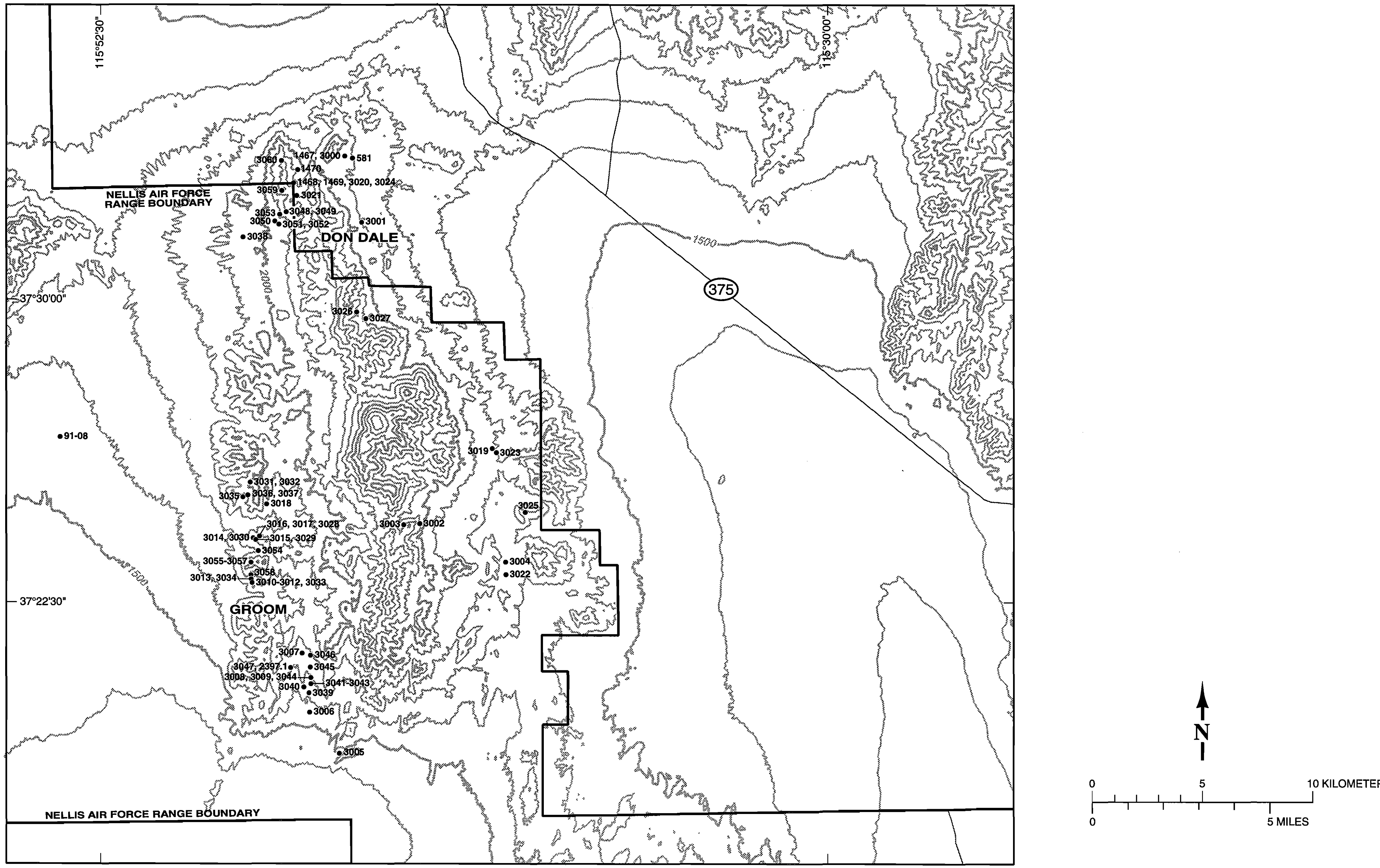


Figure C-7 Mine, prospect, and outcrop sample map 6.

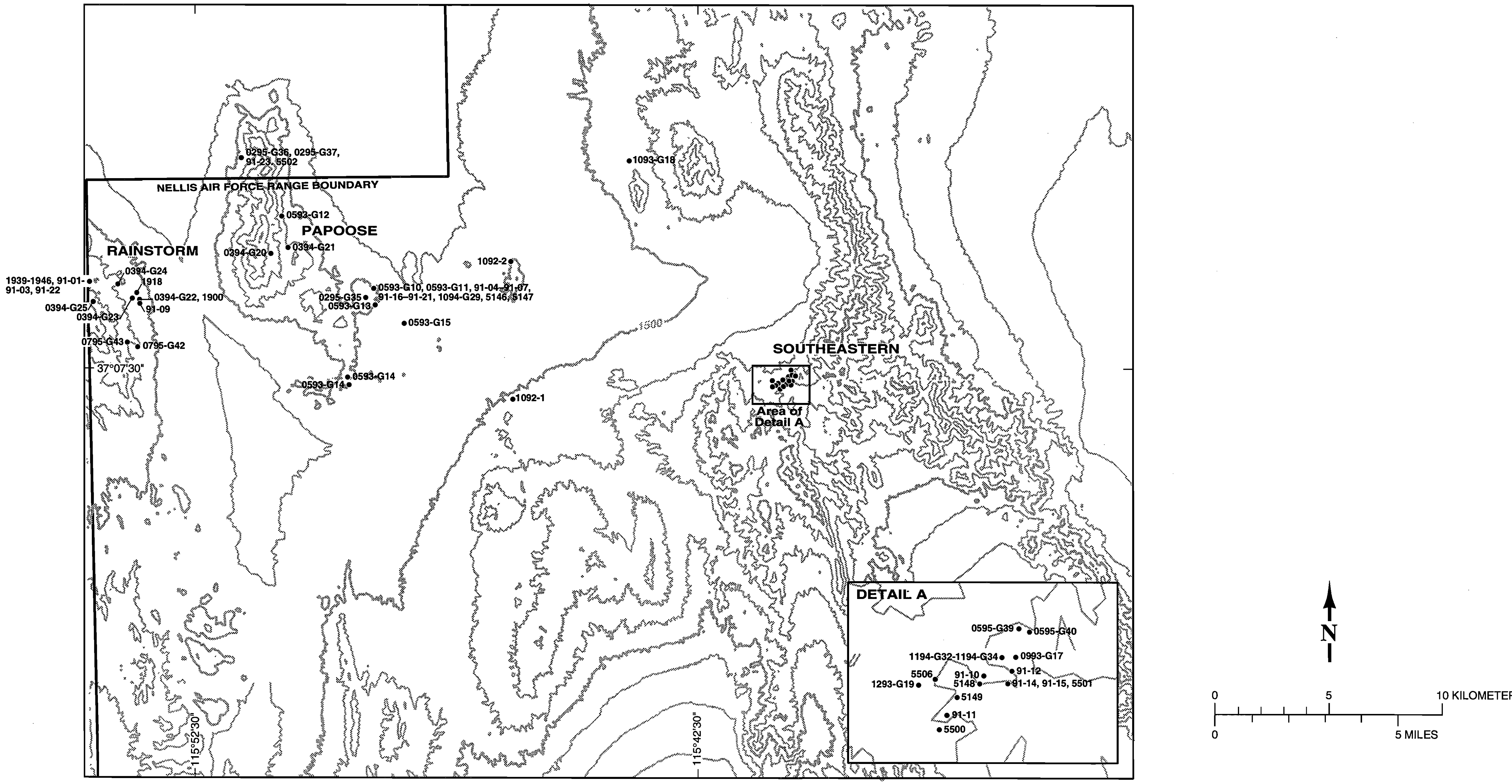


Figure C-8 Mine, prospect, and outcrop sample location map 7.

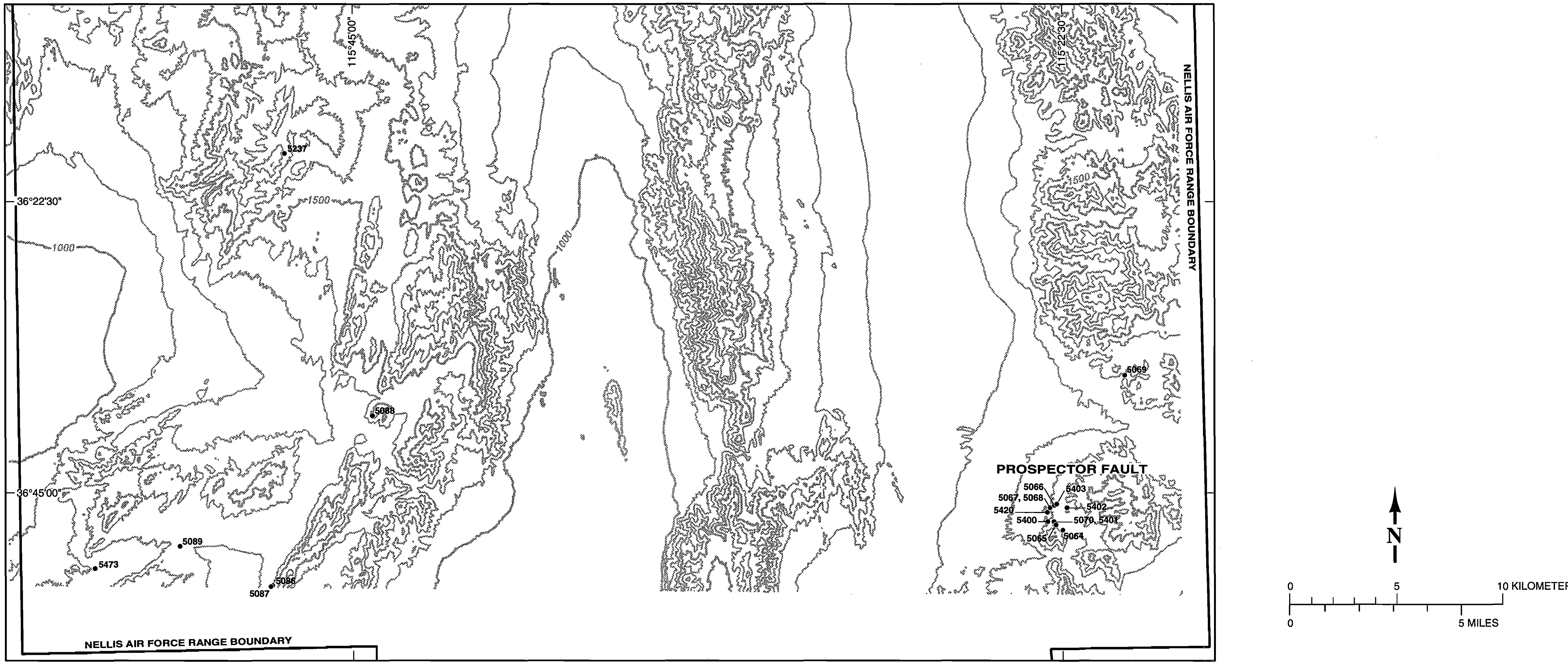


Figure C-9 Mine, prospect, and outcrop sample location map 8.

APPENDIX D

STREAM SEDIMENT ANOMALY MAPS

Notes on Appendix D

Each of the following maps shows the locations silt or float chip samples with anomalous values for a specific element.

On these maps, the threshold value used for each element varies with the geologic setting of the sample site: one threshold value is used for samples collected in areas of Tertiary (mainly volcanic) rocks, another is used for samples collected in areas of pre-Tertiary (mainly sedimentary) rocks, and another is used for samples collected in areas of mixed Tertiary, pre-Tertiary rocks. Element values in volcanic rock outcrop areas are compared against GSC threshold values for volcanic rocks (table 6.5). Element values in sedimentary rock outcrop areas are compared against GSC threshold values for sedimentary rocks (table 6.5). For samples collected in areas of mixed outcrops, the lower of the two threshold values was used. The method of selecting the threshold values is explained in section 6.2.2.2.

Maps have not been prepared for every element listed in the sample data sets. For some of these elements, no sample contained the element in an amount equal or above the threshold value and no map was generated.

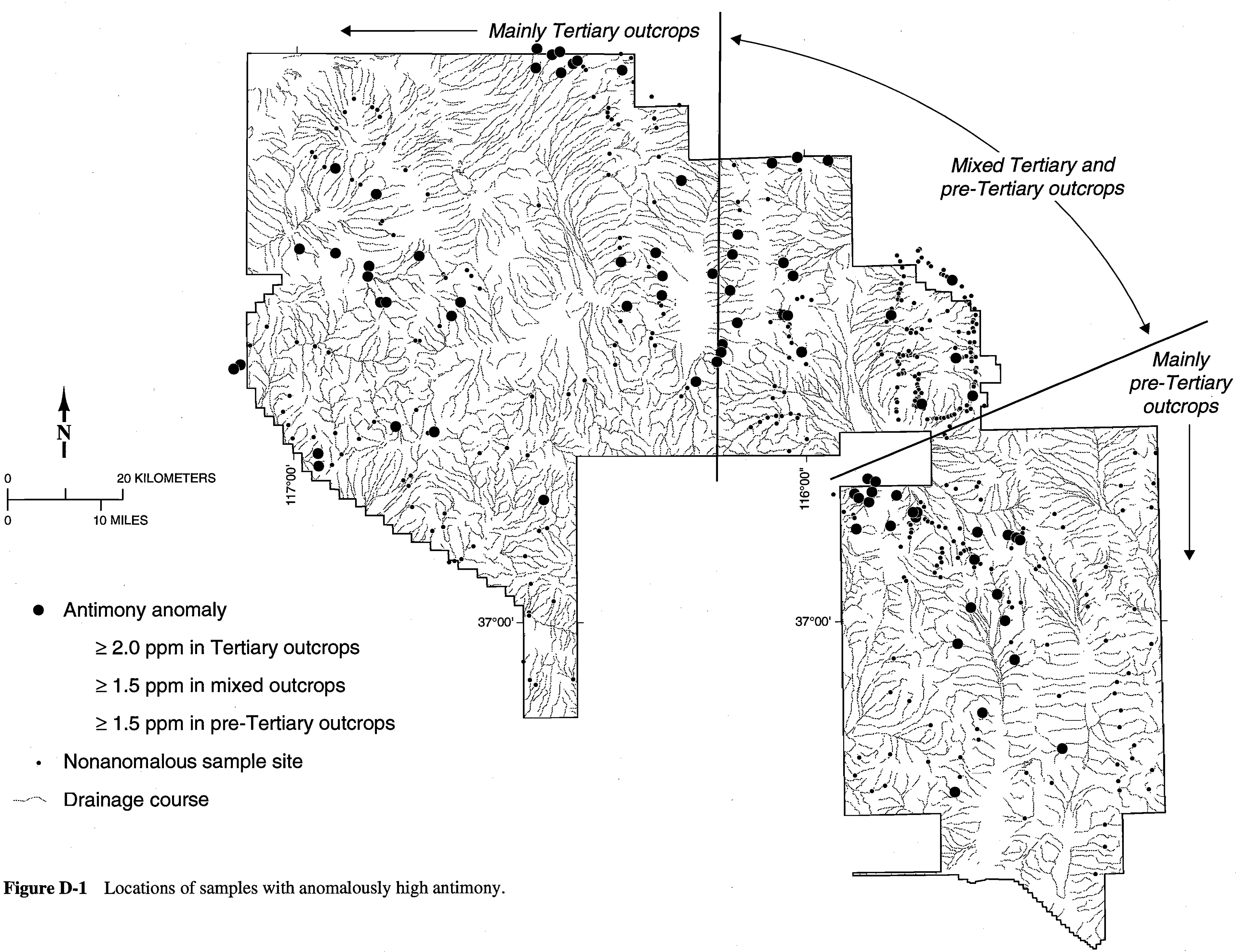


Figure D-1 Locations of samples with anomalously high antimony.

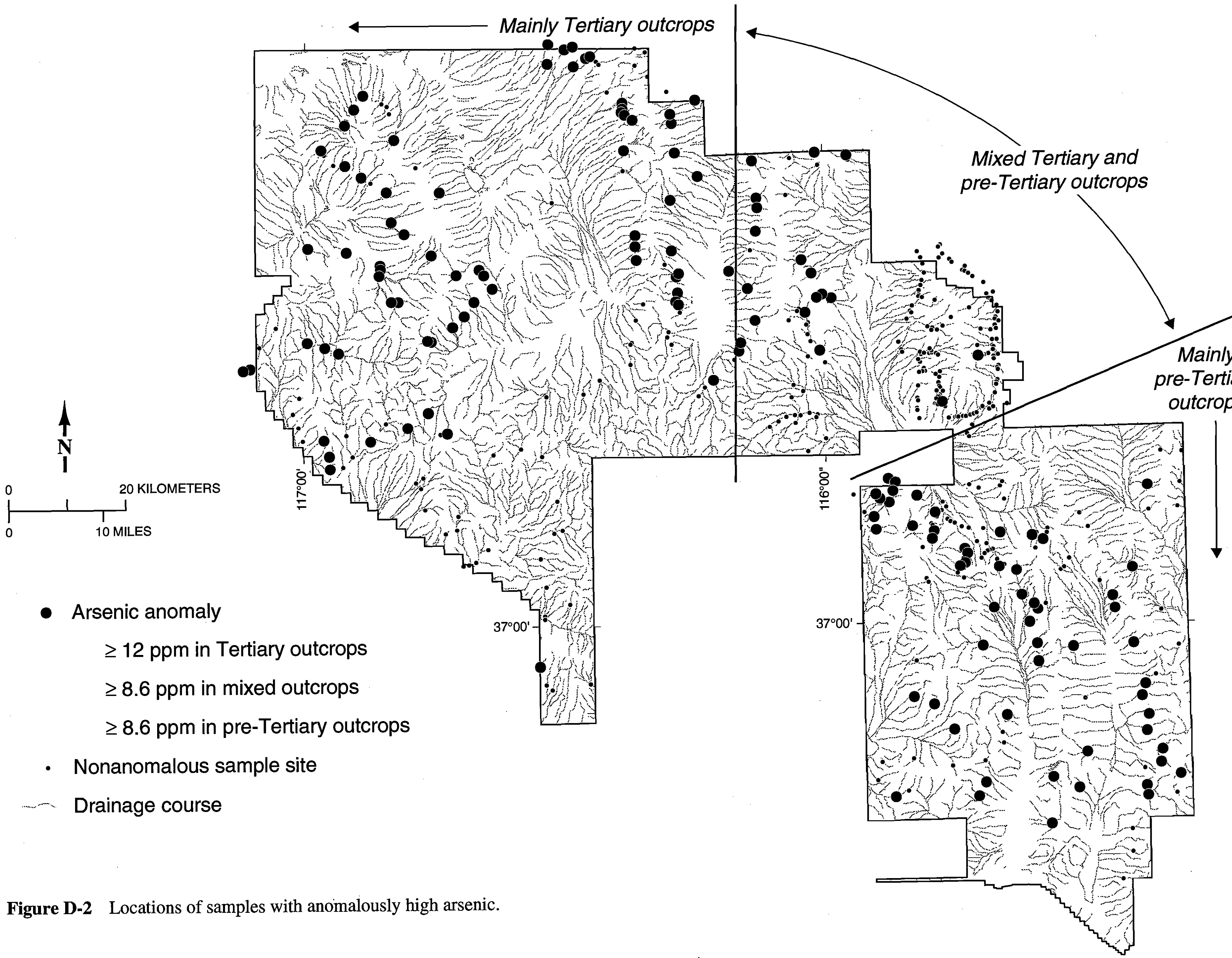


Figure D-2 Locations of samples with anomalously high arsenic.

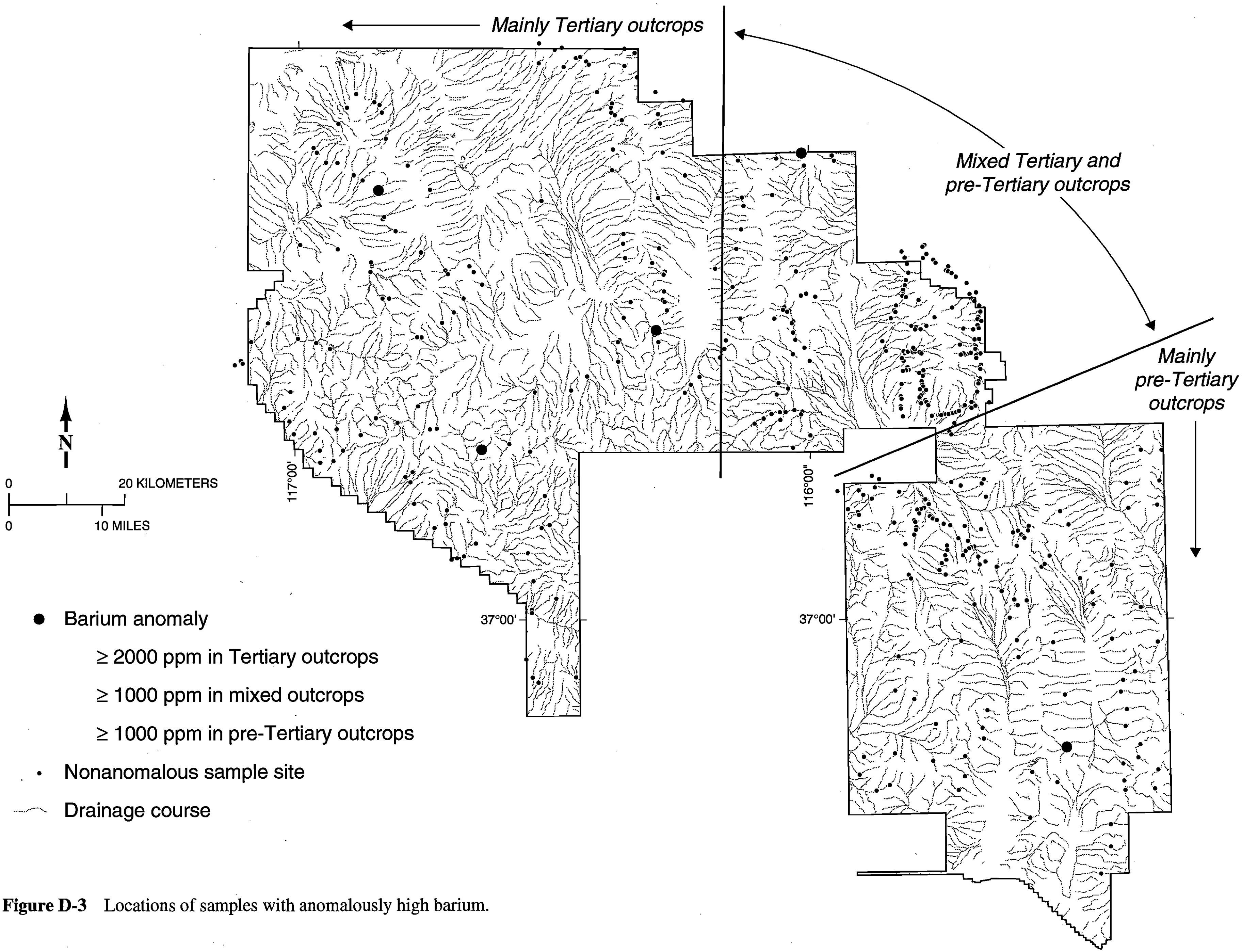


Figure D-3 Locations of samples with anomalously high barium.

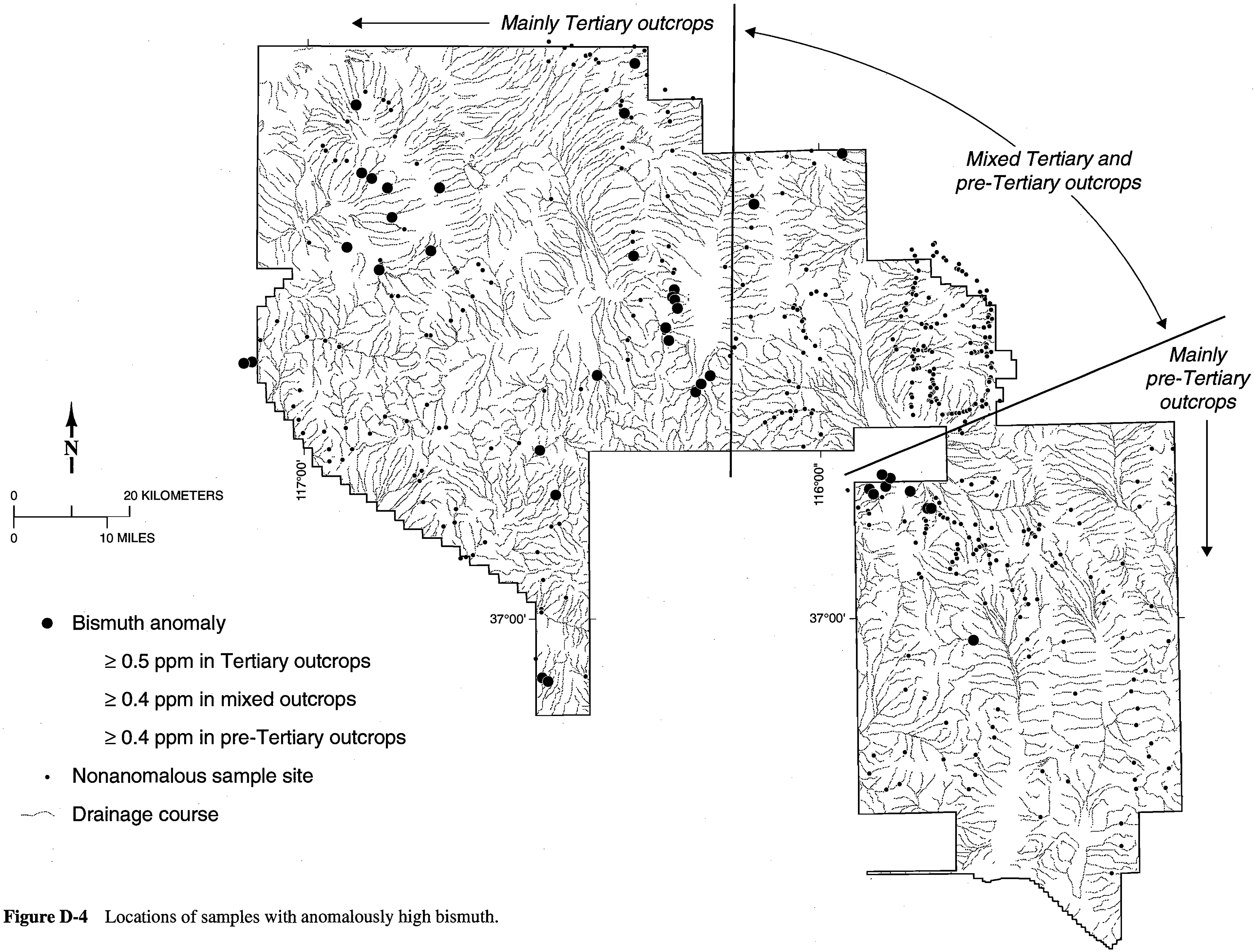


Figure D-4 Locations of samples with anomalously high bismuth.

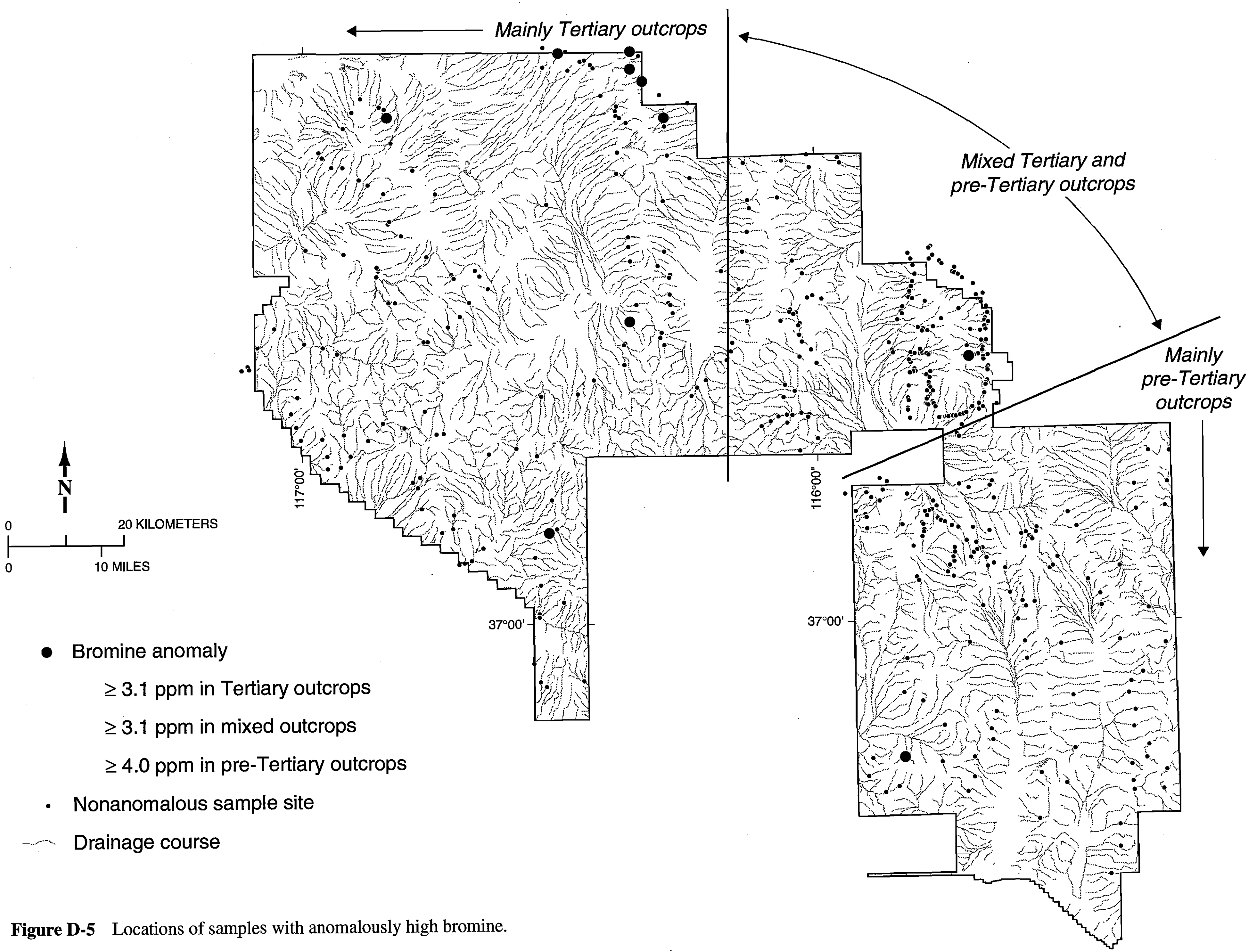


Figure D-5 Locations of samples with anomalously high bromine.

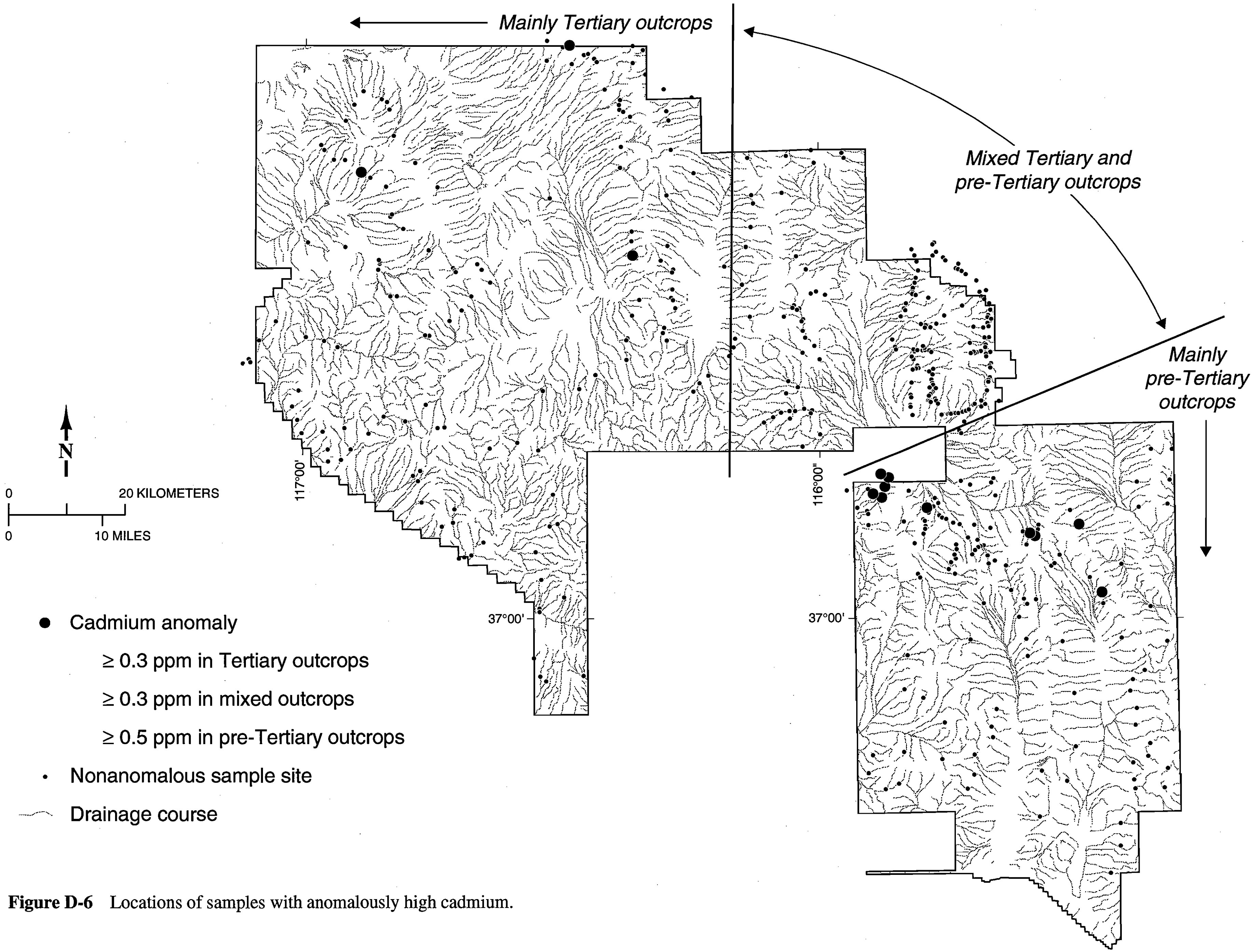


Figure D-6 Locations of samples with anomalously high cadmium.

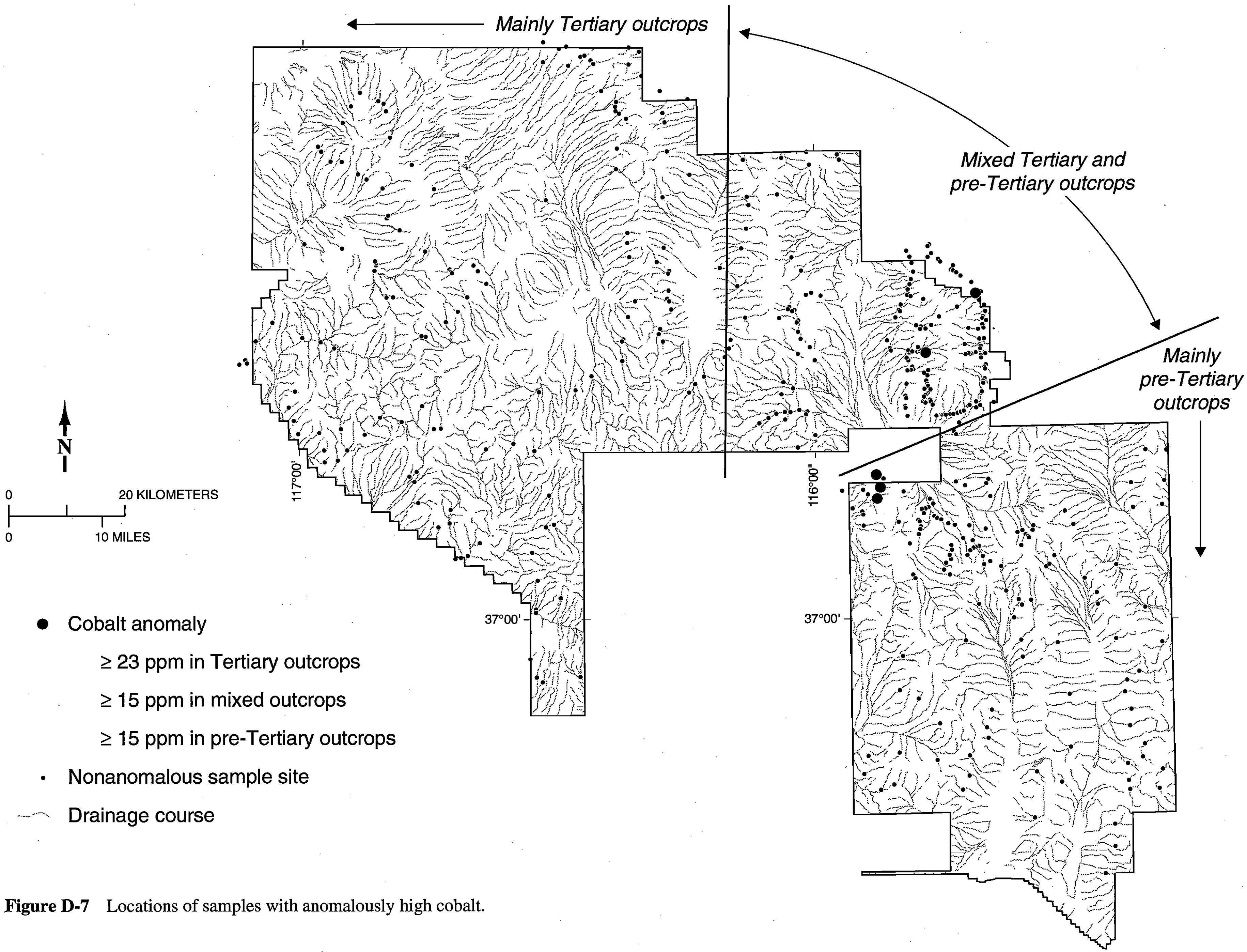


Figure D-7 Locations of samples with anomalously high cobalt.

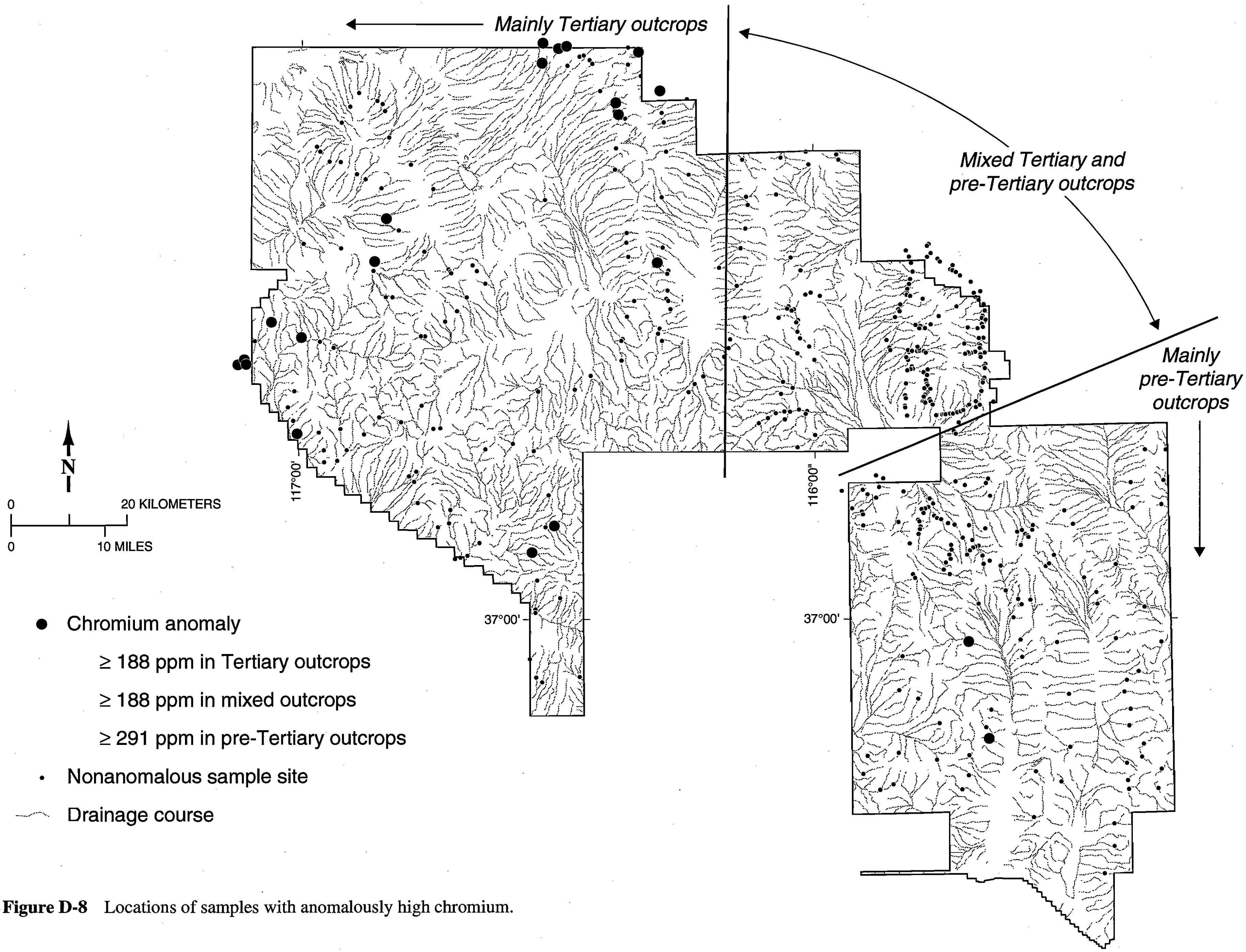


Figure D-8 Locations of samples with anomalously high chromium.

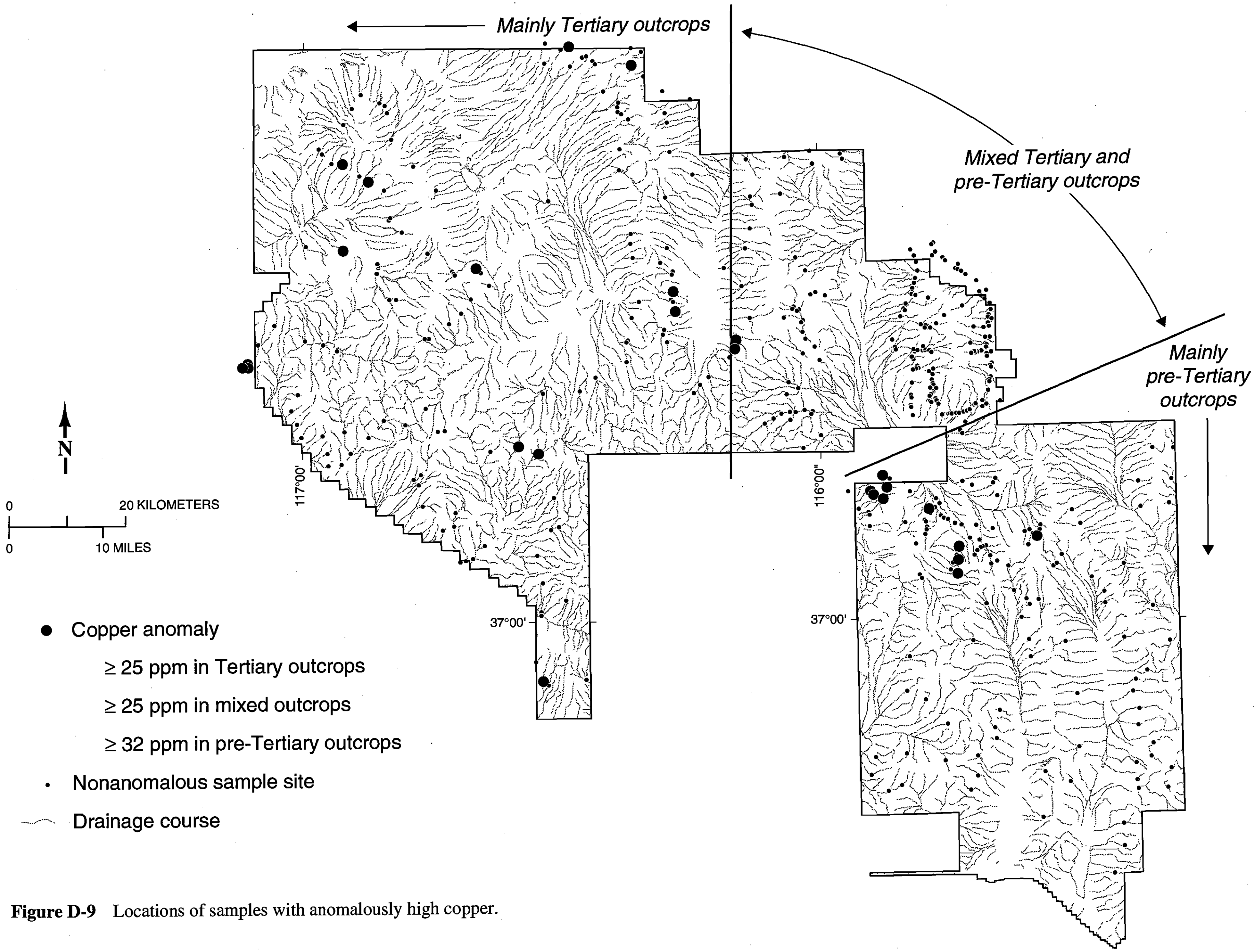


Figure D-9 Locations of samples with anomalously high copper.

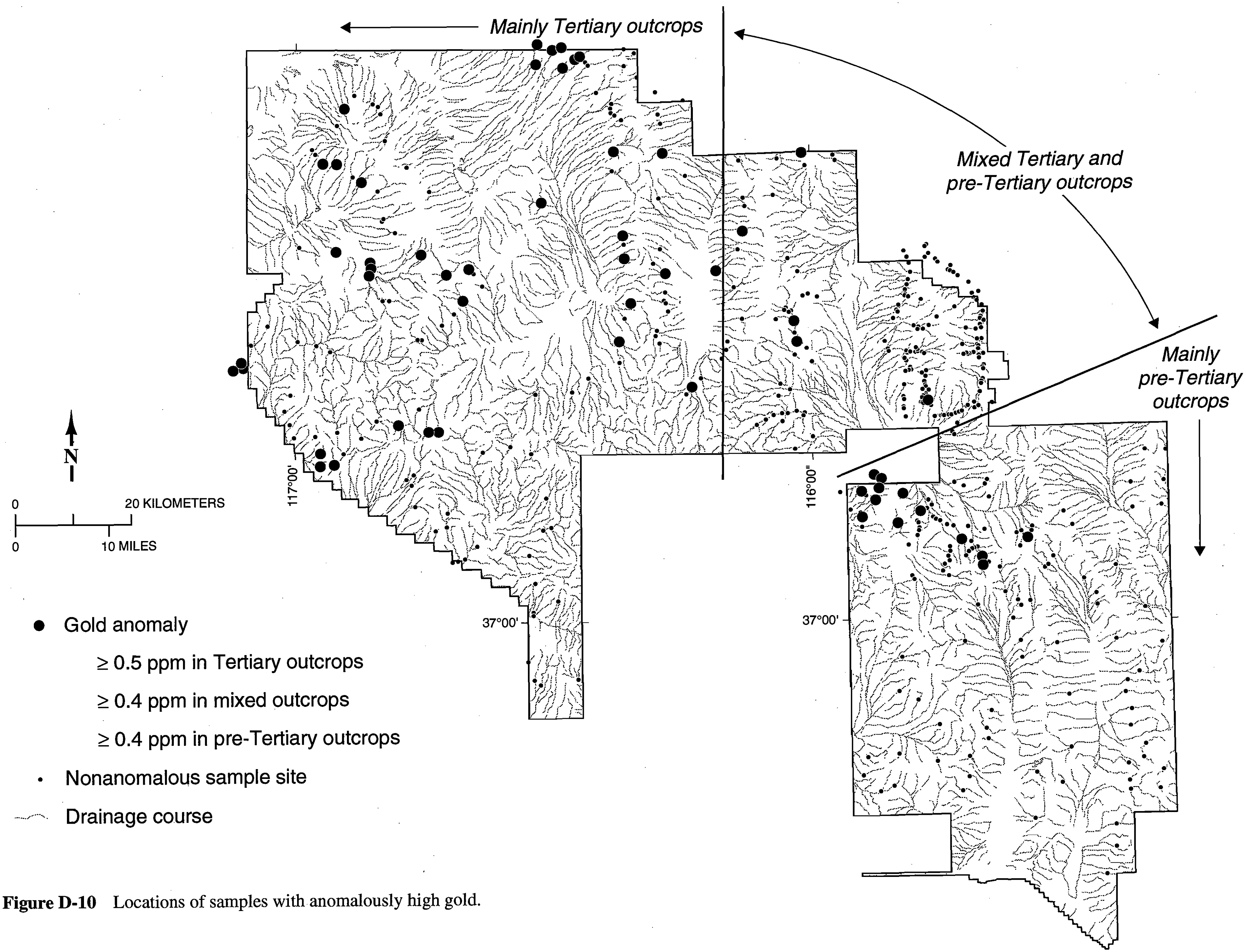


Figure D-10 Locations of samples with anomalously high gold.

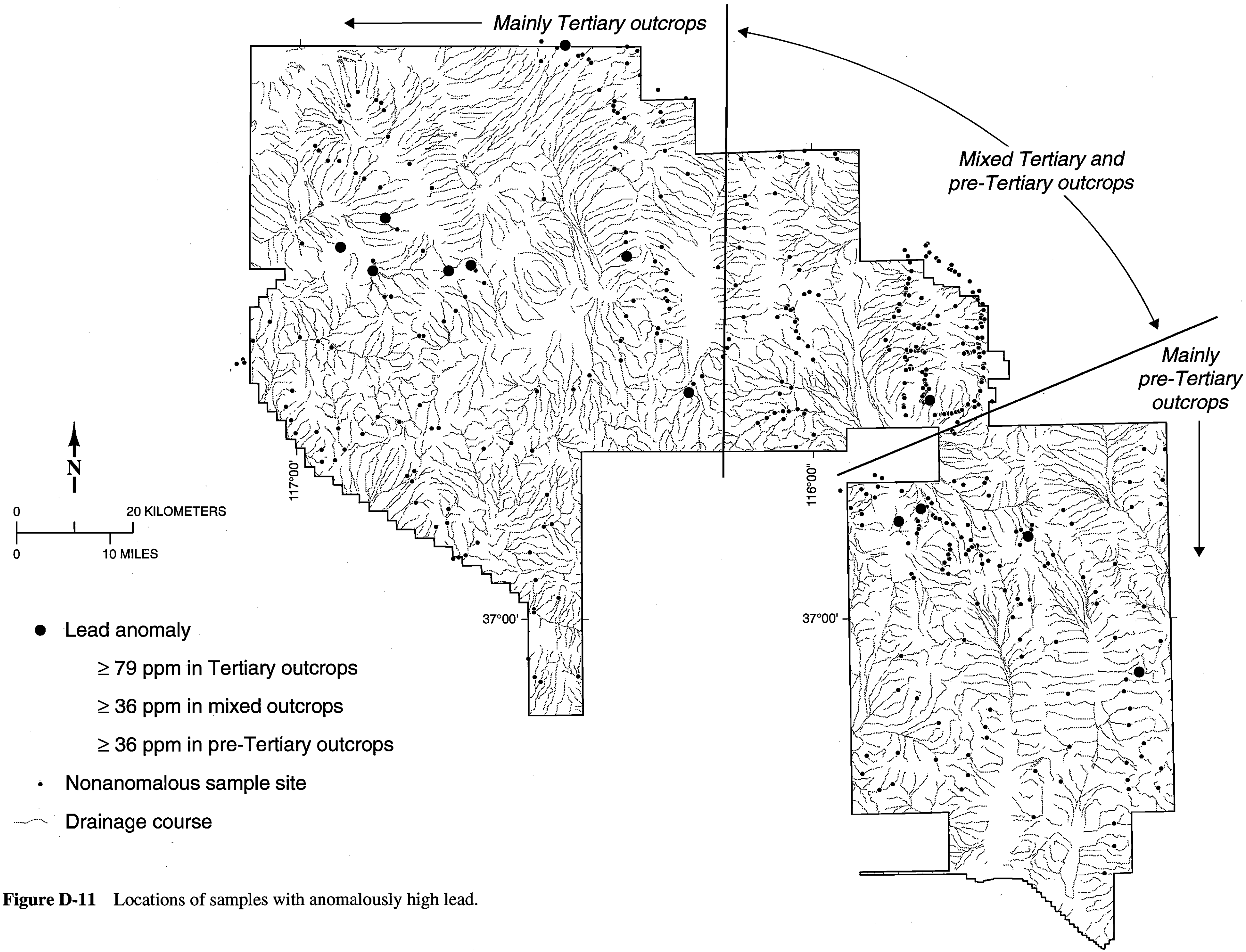


Figure D-11 Locations of samples with anomalously high lead.

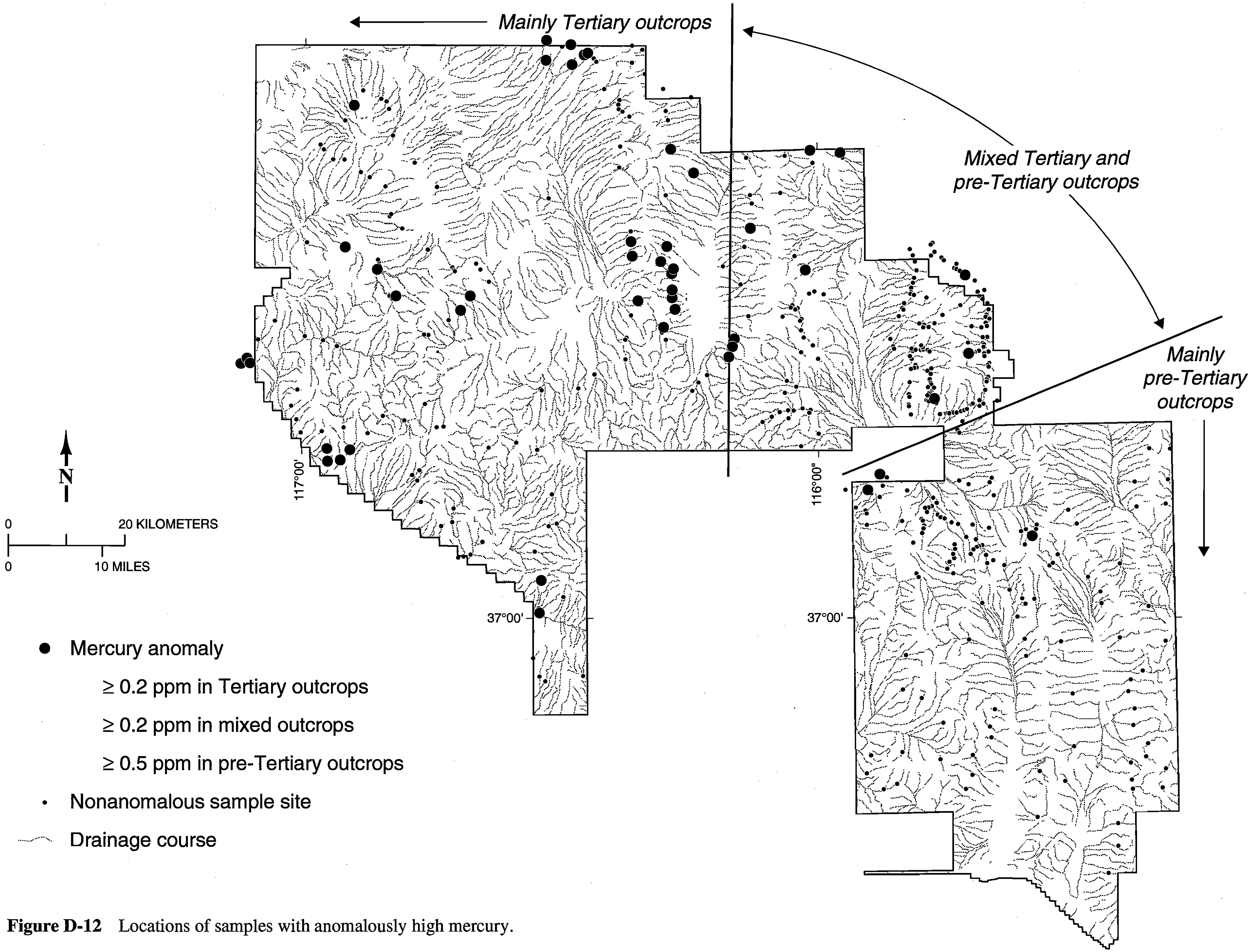


Figure D-12 Locations of samples with anomalously high mercury.

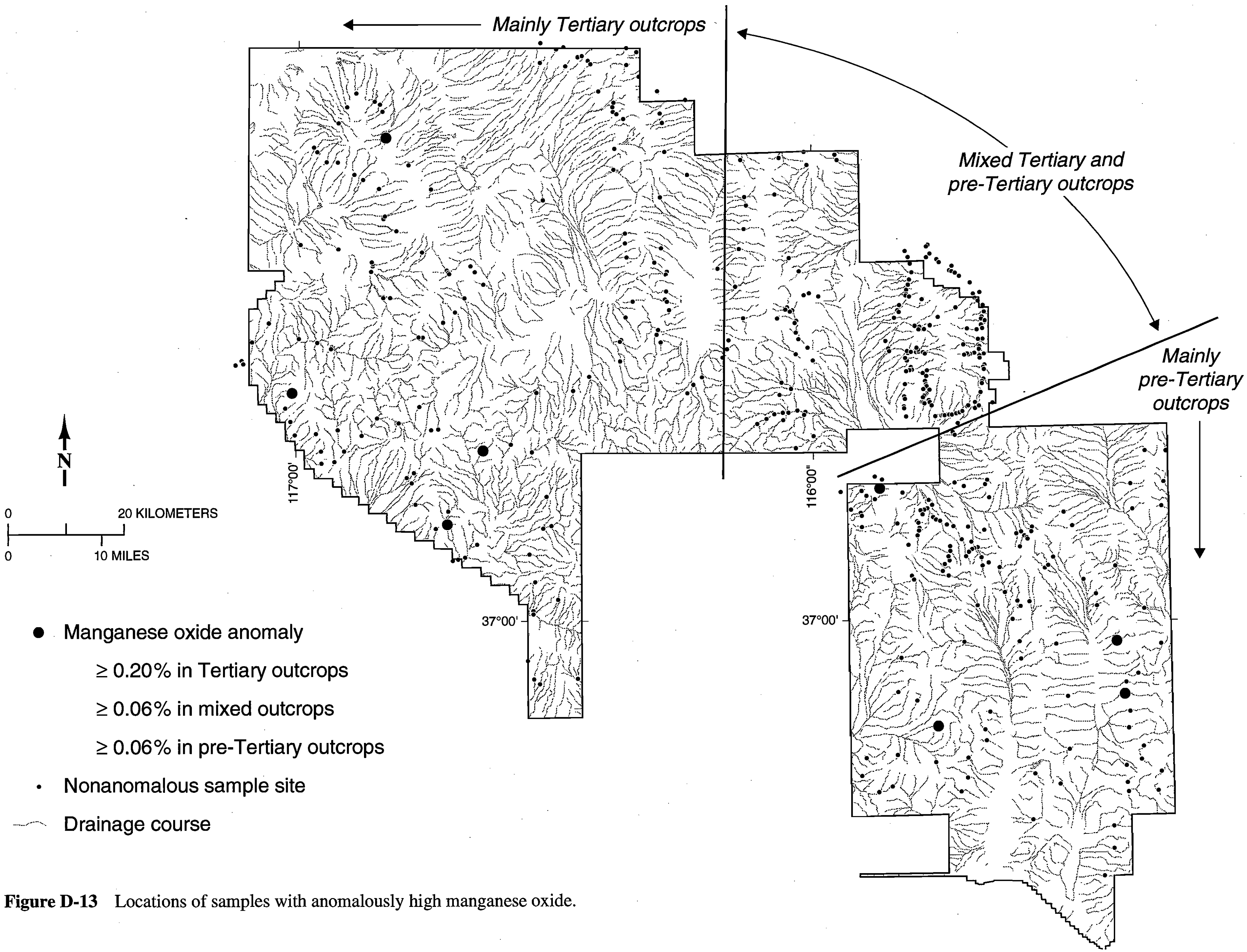


Figure D-13 Locations of samples with anomalously high manganese oxide.

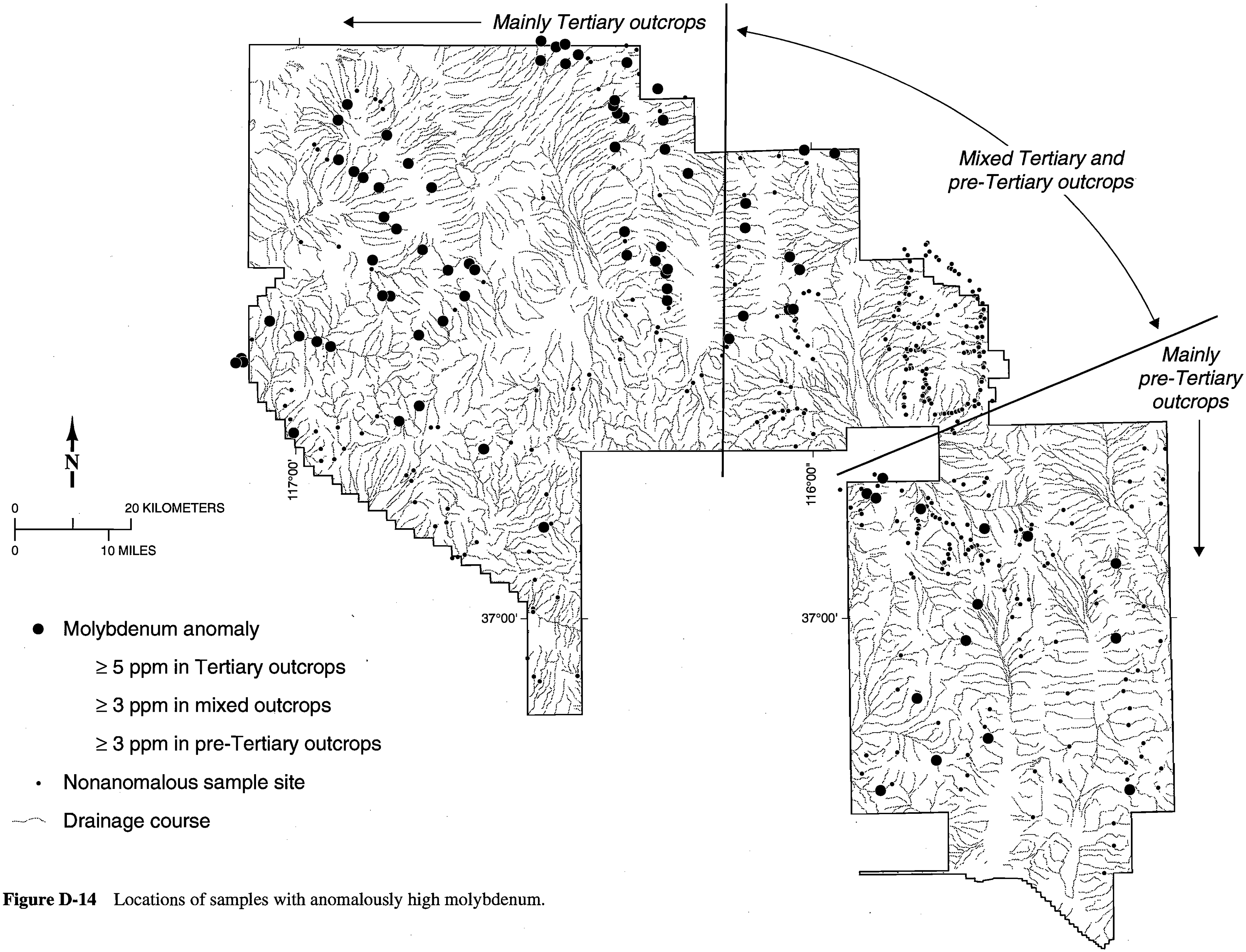


Figure D-14 Locations of samples with anomalously high molybdenum.

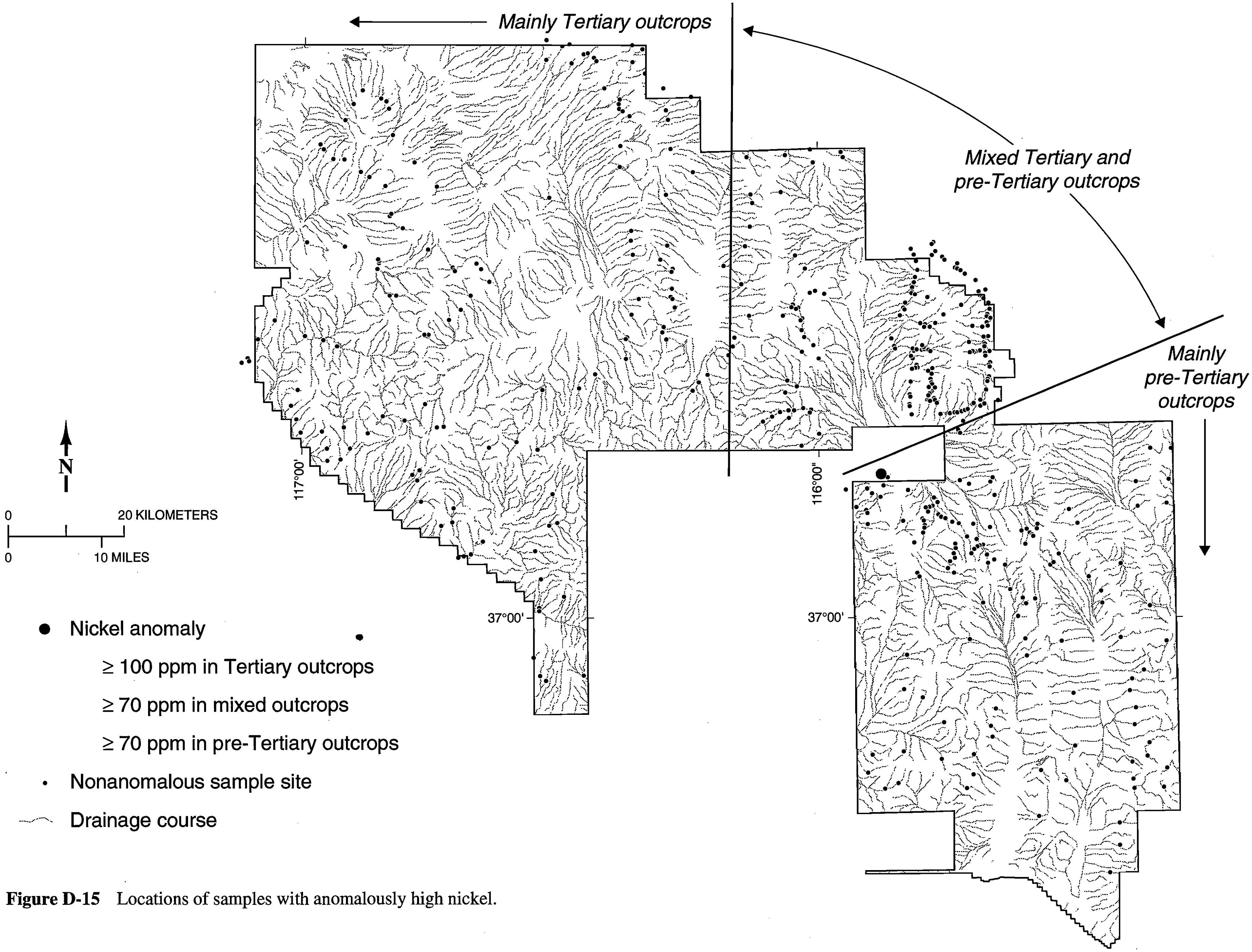


Figure D-15 Locations of samples with anomalously high nickel.

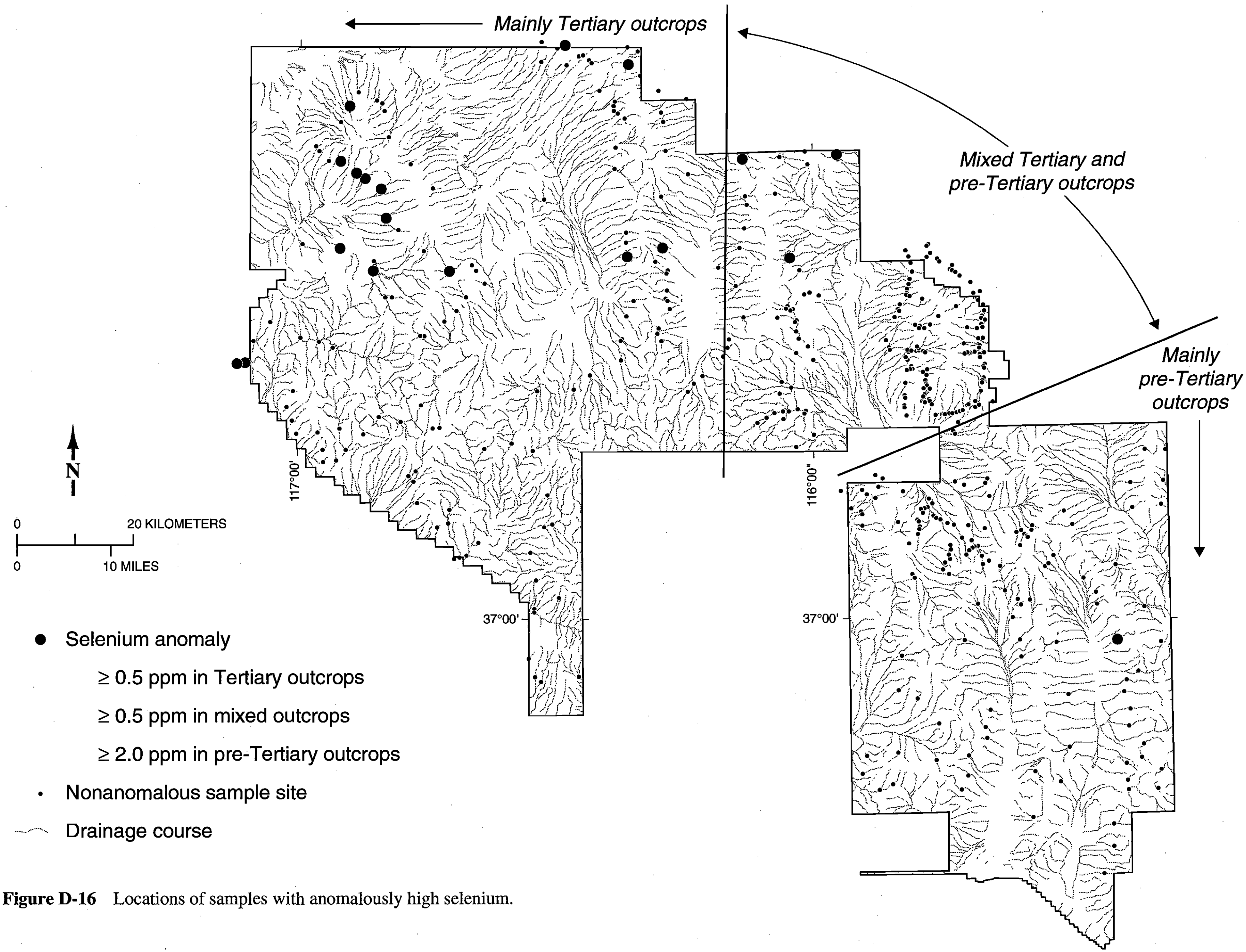


Figure D-16 Locations of samples with anomalously high selenium.

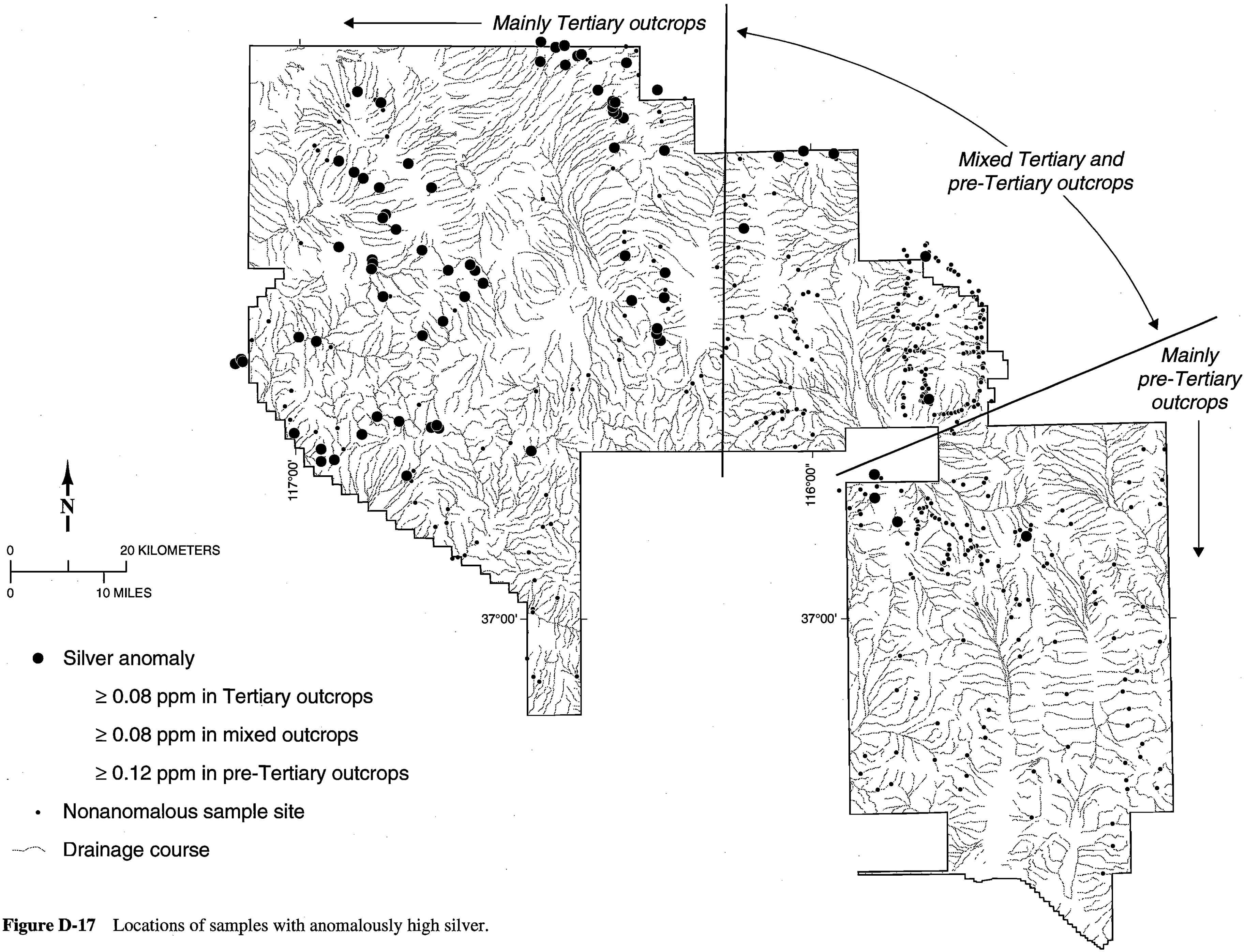


Figure D-17 Locations of samples with anomalously high silver.

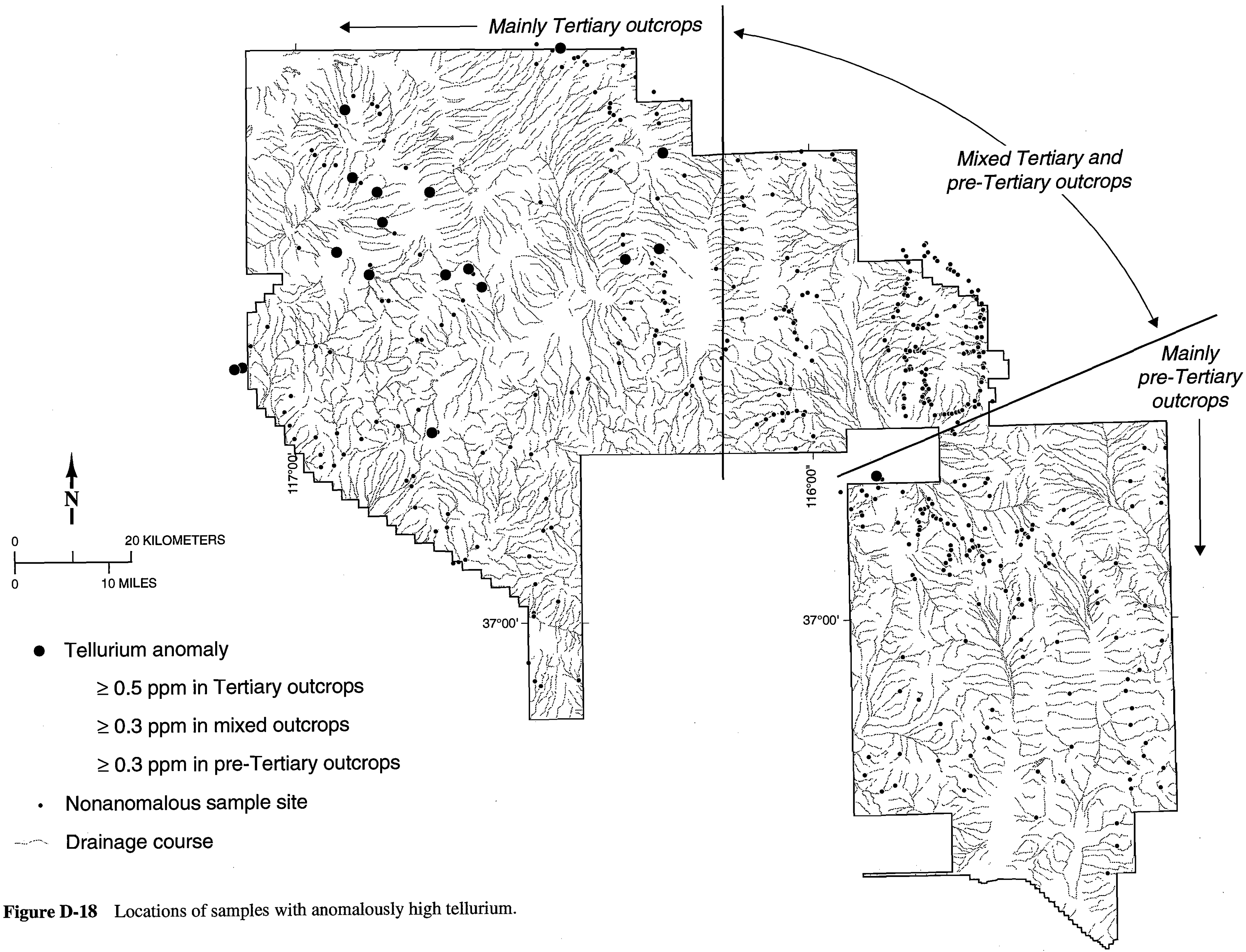


Figure D-18 Locations of samples with anomalously high tellurium.

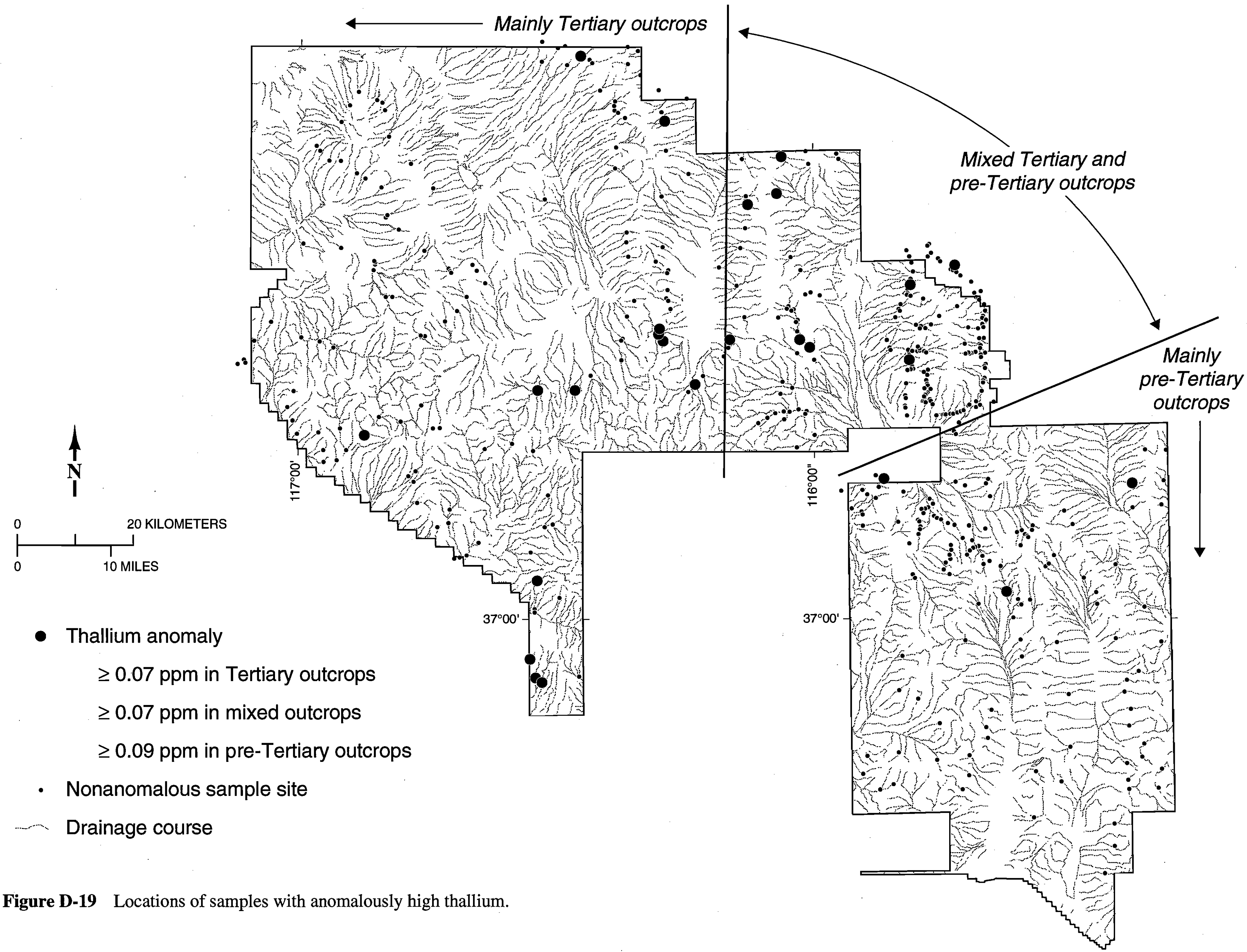


Figure D-19 Locations of samples with anomalously high thallium.

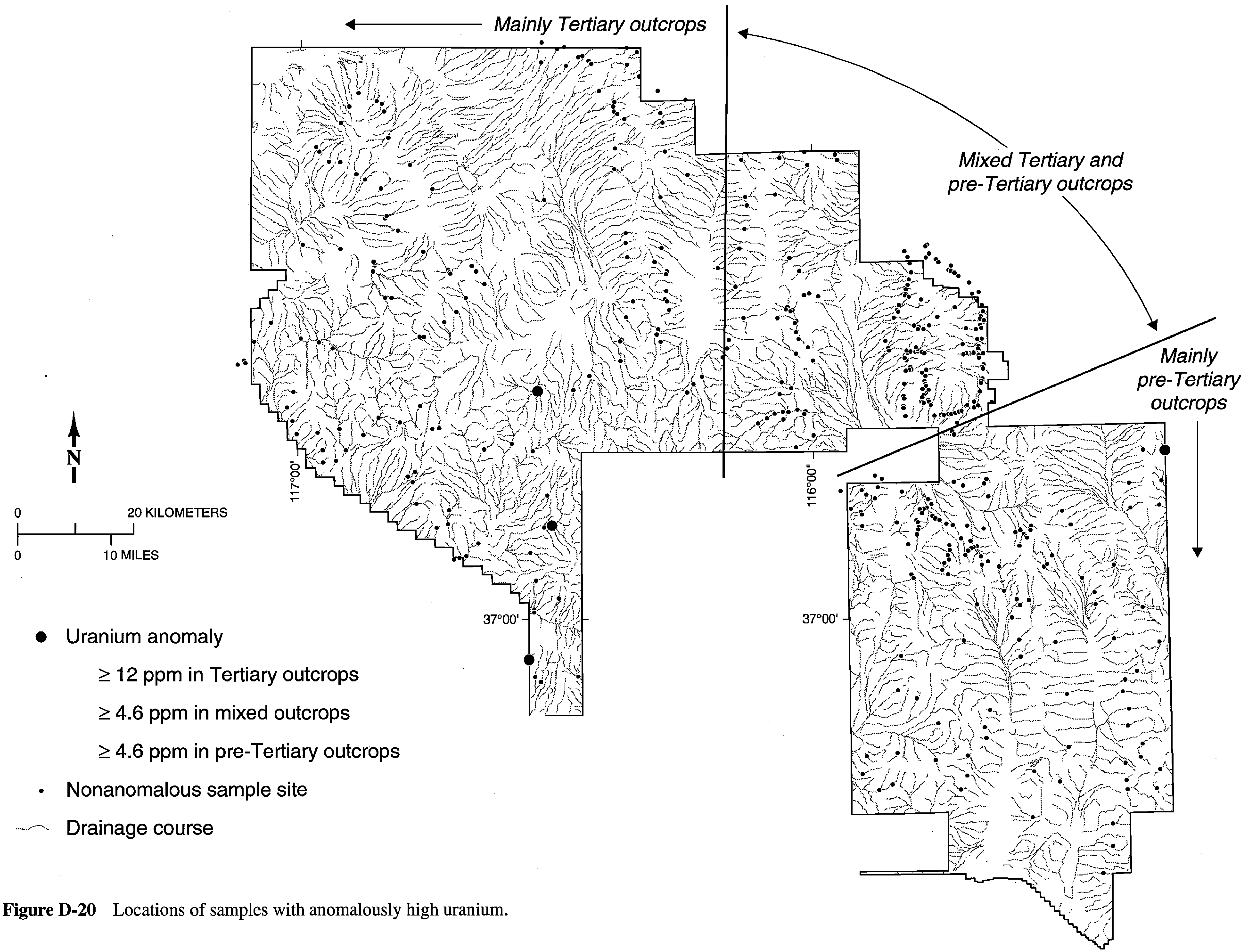


Figure D-20 Locations of samples with anomalously high uranium.

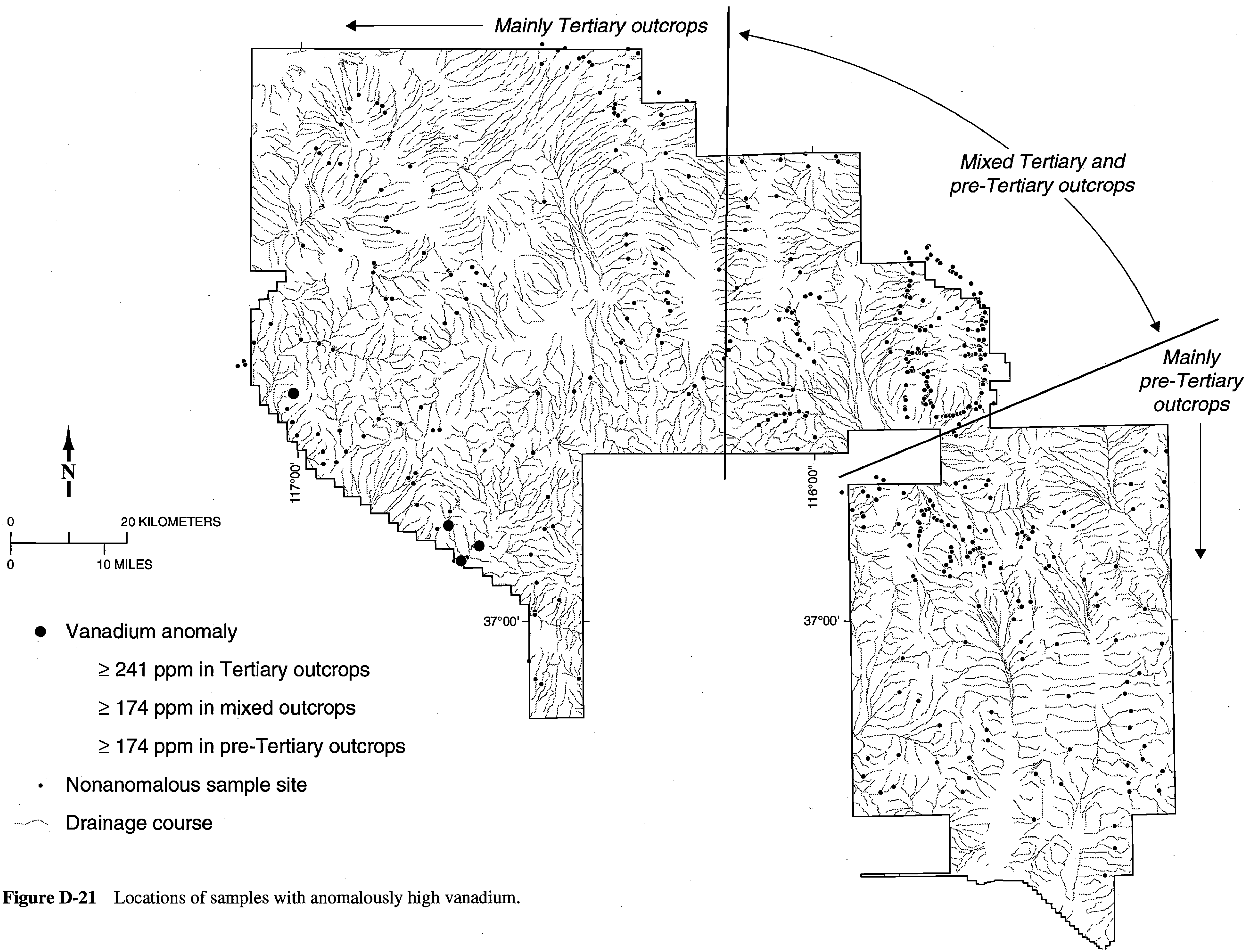


Figure D-21 Locations of samples with anomalously high vanadium.

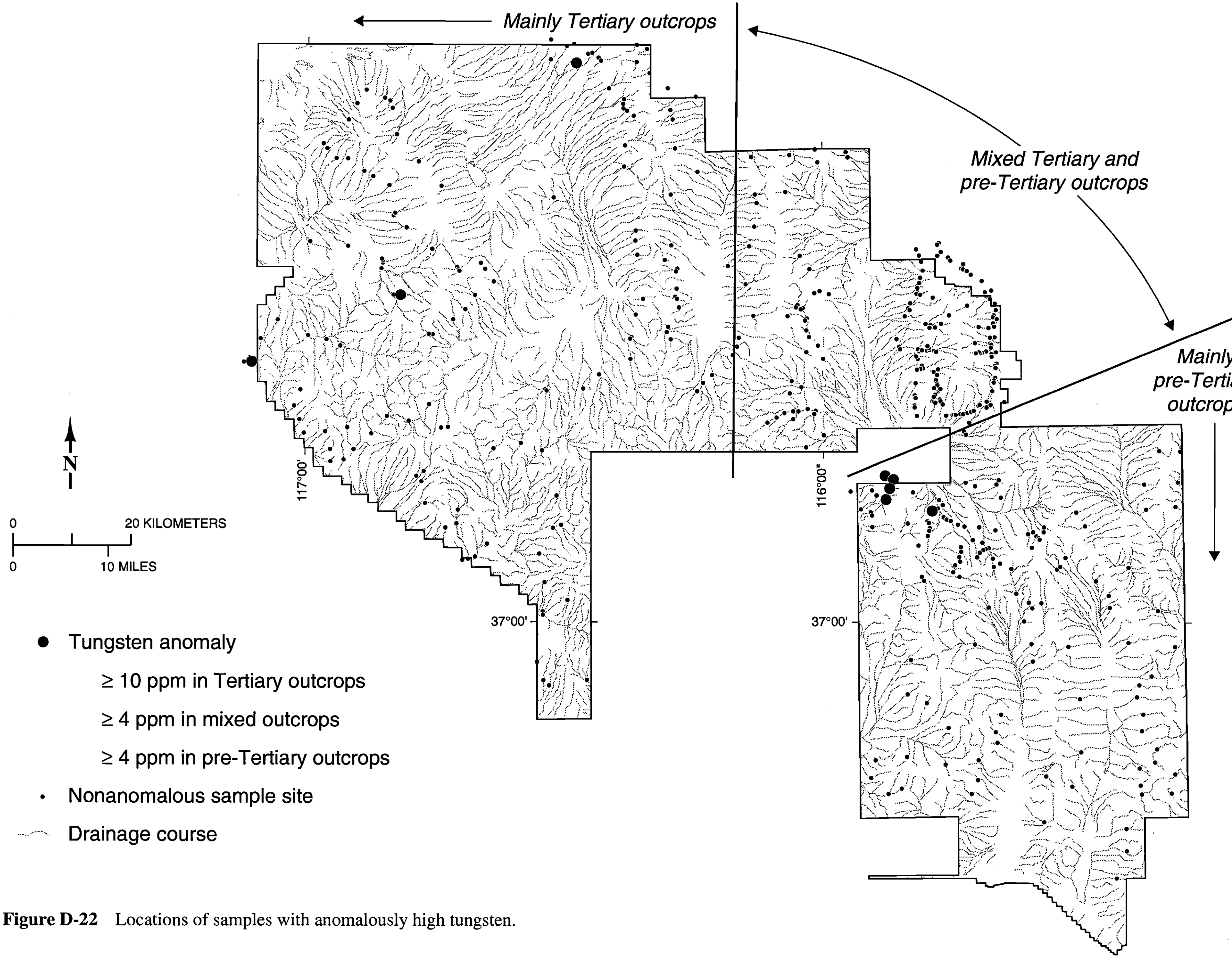


Figure D-22 Locations of samples with anomalously high tungsten.

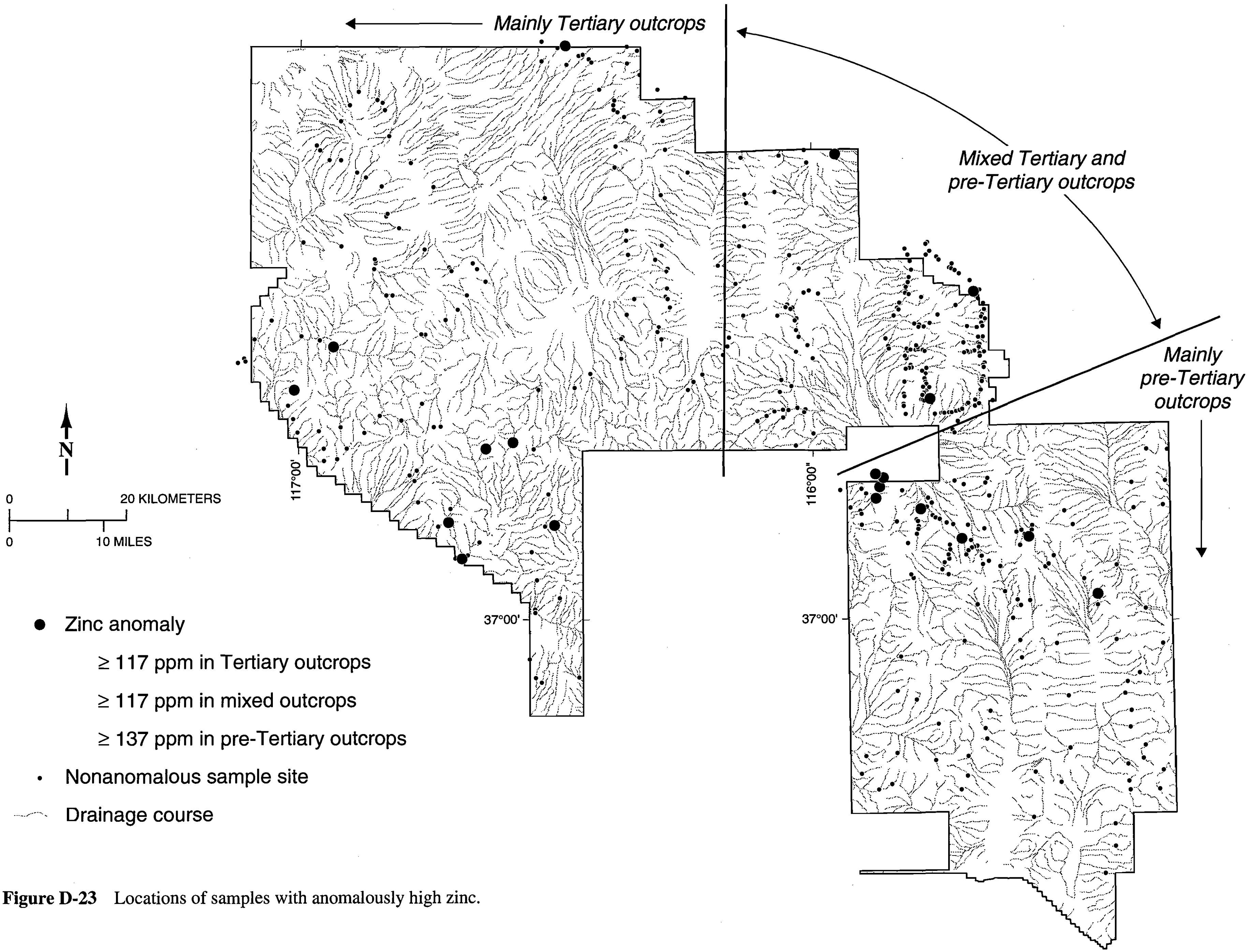


Figure D-23 Locations of samples with anomalously high zinc.

APPENDIX E

QUALITY ASSURANCE PLAN FOR NELLIS MINERAL INVENTORY

QUALITY ASSURANCE PROJECT PLAN FOR NELLIS MINERAL INVENTORY

TABLE OF CONTENTS

1.0 INTRODUCTION

This project plan summarizes the quality assurance (QA) procedures to be followed in the Nevada Bureau of Mines and Geology (NBMG) Nellis Mineral Inventory (NMI). The project has six tasks:

Task 1. Survey Analysis
Task 2. Photo interpretation
Task 3. Geochemical characterization
Task 4. Reconnaissance geochemical survey
Task 5. Examination and sampling of mineralized areas
Task 6. Data analysis and report preparation

The purpose of this plan is to assure consistency and accuracy in the collection of data, sampling, sample custody, analysis, and data reduction for all aspects of the NMI.

Information collected during the NMI, including sample locations and elemental distribution will be maintained using the geographic information system (GIS) ARC-INFO and other databases. NBMG will provide summary statistical analyses and histograms. In addition, archival sample sets, including hand samples, thin sections, and sample pulps will be maintained at NBMG.

2.0 PROJECT DESCRIPTION

The purpose of the NMI is to provide a "B" level mineral and energy survey and assessment of all minable minerals and energy resources located on the Nellis Air Force Range, Nevada. Figure E-1 is the organizational flow chart and the listing of the research staff and their fields of specialization is included in section 3.

Task 1: SURVEY ANALYSIS

Task summary: Compile and review all data currently available on metals and industrial minerals, salines and brines, geothermal, and oil and gas resources within the Nellis Ranges, as well as data on geology, geophysics, geochemistry, and mining and production history as they relate to the assessment of mineral resources.

Research staff: Bonham, Castor, Connors, Garside, Goldstrand, Henry, Hsu, LaPointe, Lugaski, Tingley, Weiss

Procedure: Data collection and research is planned at the discretion of the individual researcher, and each scientist is responsible for assembling data within his or her field of specialization. Oversight review is provided by the project Research Associate who has responsibility for overall data collection and organization. As documents are determined to contain information pertinent to the project by individual researchers, bibliographic information is recorded and supplied to the Research Associate who then enters it into a computer database. If a document is acquired specifically for the project, or if portions are copied for general use, these documents or copies are placed in a central project file. The data set will, of course, continue to grow throughout the life of the project. All collected reference materials are available for use by the Nellis project staff, and a bibliography can be generated from the database at any time.

Product:

1. printed reference materials and maps
2. computer files
3. sites selected for sediment and mine site sampling.

Task 2: PHOTO INTERPRETATION

Task summary: Interpretation of satellite imagery for the Nellis Range, outlining structural lineations and areas of rock alteration as necessary to complete the mineral survey.

Research staff: Lugaski

Procedure: Using a PC-based geographic information system (GIS) and image analysis facility for the integration and interactive display of a variety of digital data sets, Landsat TM images, geophysical and geochemical data, mining districts, and cultural resources will be geometrically corrected and coded to a common cartographic projection and scale. A variety of common image processing techniques will be employed with the Landsat TM digital data sets to highlight geology, subtle structural patterns, hydrothermally altered areas, and potential mineral resource areas. Comparison will be made to several nearby mining districts that contain similar rock types and alteration patterns. Additional analysis will be done if the geochemical data outlines new areas of unique alteration or mineral associations

Product:

1. thematic maps showing areas of anomalous structural complexity, anomalous coloration, and possible hydrothermal alteration.
2. sites selected for sediment and/or mine site sampling.

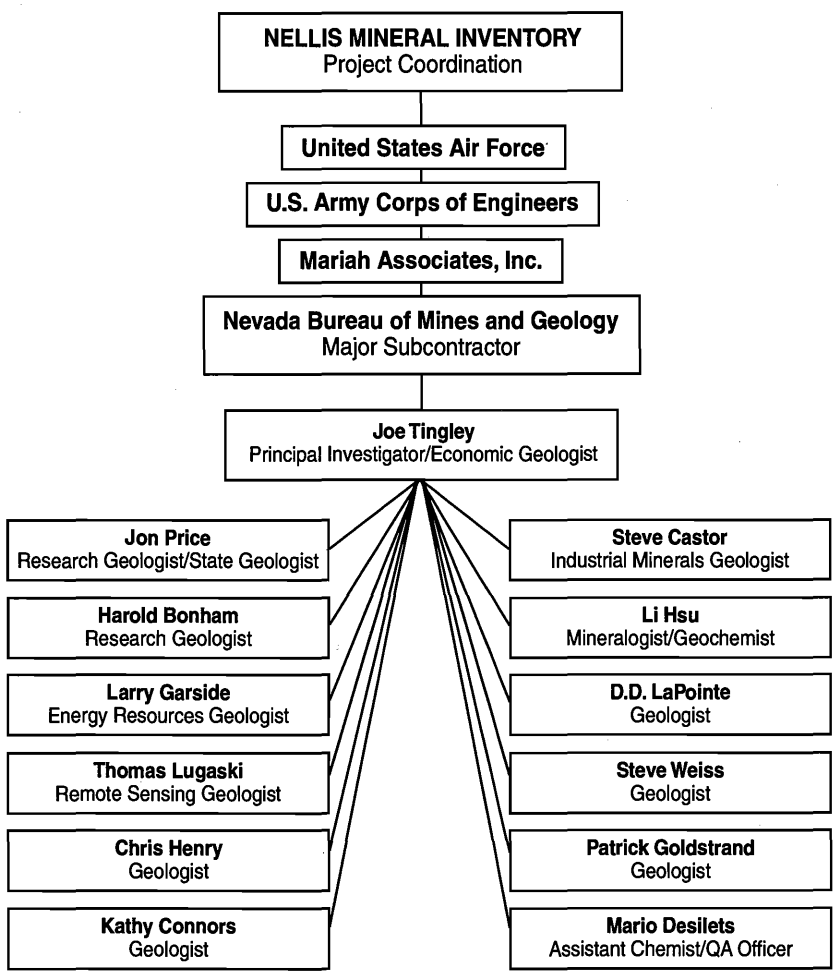


Figure E-1—Nellis mineral inventory organizational chart.

Task 3: GEOCHEMICAL CHARACTERIZATION

Task summary: Complete a geochemical sampling and characterization (GSC) study of major lithologic units to provide evaluation baselines for both the reconnaissance geochemical survey and the mineralized area sampling.

Research staff: Bonham, Castor, Connors, Desilets, Garside, Goldstrand, Henry, Hsu, Price, Tingley, Weiss

Procedure: GSC sample localities are carefully chosen to obtain coverage representative of rocks cropping out within the project area. Sampling is done by field geologists with experience in project area stratigraphy, and in the recognition of altered rocks. At each pre-selected site, a bulk sample of fresh, unweathered rock is collected for petrographic study and geochemical analyses. An archive sample is also selected at each site. A total of five kilograms of material are collected for carbonate rocks; two to five kilograms of material are collected for all other rock types. Each sample is collected into a separate bag, the sample is assigned a unique number with the prefix GSCN followed by a number (e.g., GSCN-25), and the assigned sample number is logged in a field description form (figure E-2). Assigned numbers follow each sample through all aspects of the project. All sample localities are marked in the field with aluminum tags and a 35-mm color slide is taken at some sample sites. Geologic observations at each locality are entered into the field description form. Locations are marked on 7.5-minute topographic maps and are later digitized for entry into computer databases along with chemical data, mineralogical determinations, and petrographic descriptions.

GEOCHEMICAL SAMPLING AND CHARACTERIZATION PROGRAM
Field Description

1. Sample Number: GSC ______________
2. Project: ______________
3. Collector: ______________
4. Field Date (mo/da/yr): ______________
5. Location
   Quadrangle name: ______________
   Quadrangle scale: ______________
   Legal description: sec. ____ , T ____ N, R ____ E
   UTM: north ________ east ________
6. Rock Unit (formation, member, etc): ______________
7. Rock Age: ______________
8. Field Occurrence: ______________
9. Rock Field Description: ______________

SAMPLE

10. Rock Structures: ______________
11. Measured Section (yes, no): ______________
12. Sample Locality Photo Number(s): ______________
13. Remarks: ______________
14. References: ______________

Figure E-2—GSC sample form.

All GSC samples are analyzed for: 1) major oxides (SiO_2, TiO_2, Al_2O_3, total Fe as Fe_2O_3, MnO, MgO, CaO, NaO K_2O P_2O_5, LOI); 2) pathfinder elements for gold (Au, Ag, Sb, As, Hg, Se, Te, Ba, Sn, W, Bi, Tl); 3) base and ferrous metals (Cu, Pb, Zn, Cd, Mo, Cr, Co, Ni, V, W); 4) rare earth elements (La, Ce, Sm, Eu, Tb, Yb, Lu); and 5) elements of petrographic and economic interest (Be, Ga, Nb, Sc, Sr, Rb, Cs, Br, Zr, Ir, Hf, Y, Ta, Th, U).

Thin sections are prepared and examined for each GSC sample. The major mineral constituents are also identified by x-ray diffraction methods. Total C and CO_2 measurements are made on selected samples.

Product:

1. bulk rock sample
2. hand specimen for rock archive (selected from collected sample)
3. rock thin section (prepared from collected sample)
4. site description, lithologic description
5. 35-mm color slide (selected sites)
6. petrographic description (prepared for each thin section)
7. multi-element geochemical analyses for each bulk sample
8. maps showing sample locations
9. tabulation of sample locations and geochemical data in hard-copy and PC-compatible format.

Task 4: RECONNAISSANCE GEOCHEMICAL SURVEY

Task summary: Collect stream sediment samples from pre-selected sites within the study area. Information gained from Tasks 1 and 2 is used to select sample sites, and the extent of sample coverage is designed to investigate anomalous areas outlined by the preliminary studies as well as to provide background geochemical data for regional evaluation.

Research staff: Bonham, Castor, Connors, Desilets, Garside, Goldstrand, Henry, Price, Tingley, Weiss

Procedure: At each pre-selected site, two stream sediment samples are collected. A silt sample is collected from sediment in the most active portion of the stream channel. This material is sieved on site through a 5-mesh (0.157 inch opening) screen and the undersize is saved for analysis. A second sample is collected by chipping small fragments from altered or mineralized float found in the stream channel. Each sample is a composite of material collected over as much as a few hundred feet of channel length. These sample sites are not marked in the field

The silt sample is sieved into a 12- by 18-inch, 8-mil-thick plastic bag and sealed with wire ties and swivel twisters, and the float chip sample is collected into an 7- by 12$^1/_2$-inch Olefin sample bag. Sample size varies somewhat depending on the material present in the stream channel. As a general rule, however, at least half of a bag of sample is collected at a site to insure sufficient material for analysis. The samples are assigned a unique 6-digit number (e.g. 117606) and a preprinted, numbered tag (figure E-3) is placed in each bag. A notation of sample type and topographic map sheet within which the sample is located is entered into the appropriate space on the sample tag. Sample locations are marked on 7.5-minute topographic maps and are later digitized for entry into a computer database along with chemical data.

All sediment samples are analyzed for: 1) pathfinder elements for gold (Au, Ag, Sb, As, Hg, Se, Te, Ba, Sn, W, Bi, Tl); 2) base and ferrous metals (Cu, Pb, Zn, Cd, Mo, Cr, Co, Ni, V, W); 3) rare earth elements (La, Ce, Sm, Eu, Tb, Yb, Lu); and 5) elements of petrographic and economic interest (Li, Be, Ga, Nb, Sc, Sr, Rb, Cs, Br, Zr, Ir, Hf, Y, Ta, Th, U).

Product:

1. silt-fraction sample
2. float chip sample
3. sample form
4. multi-element geochemical analyses for each sample
5. maps showing sample locations
6. tabulation of sample locations and geochemical data in hard-copy and PC-compatible format.

№ 117606

PROSPECT:______

DATE:______ BY:______ STATE:______
COUNTY:______ QUADRANGLE:______
T______ R______ SEC______

SAMPLE TYPE:Rock Chip____ Soil____ Stream Sed____
Outcrop____ Float____ Dump____ Channel____

Drill Hole No.______ From______ To______
Other:______
SAMPLE DESCRIPTION:

SAMPLE

Au Ag As Sb Hg Cu Pb Zn Mo______

CONTRACT GEOLOGICAL SERVICES (702) 358-0923
1395 Greg, Ste. 108, Sparks, NV

Au Ag As Sb Hg Cu Pb Zn Mo **№ 117606**

Figure E-3—Stream sediment sample form.

Task 5: EXAMINATION AND SAMPLING OF MINERALIZED AREAS

Task summary: Examine and sample all accessible mines, prospects, and mineralized areas identified within the project area as necessary to complete an assessment of mineral content and potential of Nellis Range lands. The actual number/location of samples will be determined by the initial investigation of satellite imagery and other information.

Research staff: Bonham, Castor, Connors, Garside, Henry, LaPointe, Price, Tingley, Weiss

Procedure:

Phase One: Information is collected on the geologic setting, rock type structure, rock alteration, ore mineralogy, and condition and extent of mine workings.

at each identified mineral occurrence, prospect, or mine that is examined, If warranted, one or more samples may be collected. The standard sample consists of selected material from dumps, walls of mine workings or ore piles that, in the opinion of the field geologist, contains the most strongly mineralized rock from the site. Samples are purposely "high-graded" to provide information on the type of mineralization present and on trace-element interrelationships. Additional samples may be collected at each site for whole rock analysis, alteration mineral analysis, thin-section preparation, or other specialty analysis as needed. Mineralized sample sizes vary at the discretion of the collecting geologist. These samples are placed in separate Olefin sample bags and identified with a unique four digit series number (e.g. 5282). These samples are separated from all other sample types to avoid cross contamination. Sample sites are not marked in the field but a sample form (figure E-4) is filled out noting general location (topographic map, section, township, range), sample type, minerals present, alteration, and host rock type. In the office, this information is entered into a computer database, Mine site sample locations are marked on 7.5-minute topographic maps and are later digitized for entry into a computer database along with chemical data. At selected sites, a color 35-mm slide is taken. A site description form (figure E-5) is also prepared for each prospect or mine. This form can be completed in the field, but is usually done later in the office. When completed in the field, the data is later entered into a computer database. When done in the office, information from field notes is entered directly into a computer database by the geologist. All Phase One mine site samples are analyzed for: 1) pathfinder elements for gold (Au, Ag, Sb, As, Hg, Se, Te, Ba, Sn, W, Bi, Tl); 2) base and ferrous metals (Cu, Pb, Zn, Cd, Mo, Cr, Co, Ni, V, W); 3) rare earth elements (La, Ce, Sm, Eu, Tb, Yb, Lu); and 5) elements of petrographic and economic interest (Li, Be, Ga, Nb, Sc, Sr, Rb, Cs, Br, Zr, Ir, Hf, Y, Ta, Th, U).

Phase Two: If necessary, sites are revisited to map and sample mine workings, to map and sample areas of extensive surface alteration and mineralization, or to conduct follow-up examinations in areas where the first level of sampling has determined that anomalous or ore-grade mineralization is present. Samples collected during this phase are typically chip or bulk samples used for grade determinations or to determine lateral extent of anomalous mineralization. Phase Two mine site samples are analyzed for specific groups of metals (Au, Ag; Cu, Mo, Au, Ag; Pb, Zn, Ag, Au, or W, Mo) using standard assay techniques.

Product:

Phase One:

1. mine site sample (at most locations)
2. sample description (if sampled)
3. representative hand specimen (selected from mine site sample)
4. 35-mm color slide (selected sites)
5. multi-element geochemical analyses for each mine site sample
6. site description
7. maps showing sample locations
8. tabulation of sample locations and geochemical data in hard-copy and PC-compatible format.

5282

Project: ____________ Date ________

Mining district: ____________

Property name: ____________

Quad: ____________ Scale: ________

Sec: ____________ T: ______ R: ____

UTM: North ________ East ________

Sample type: ____________

Rock type: ____________

____

Alteration: ____________

Mineralization:

SAMPLE

NBMG SAMPLE FORM

Figure E-4—Mineralization sample form.

Phase Two:

1. geology/alteration/mineralization sketch maps (if applicable)
2. maps of mine workings (if applicable)
3. specific element assay results (if applicable)
4. maps showing sample locations
5. tabulation of sample locations and geochemical data in hardcopy and PC-compatible format.

PROPERTY NAME: ____ County: ____
OTHER NAMES: ____ Mining District: ____
MINERAL COMMODITY(IES) ____ AMS Sheet: ____
TYPE OF DEPOSIT: ____ Quad Sheet: ____
ACCESSIBILITY: ____ Sec. ____, T ____, R ____
OWNERSHIP: ____ Coordinate (UTM):
PRODUCTION: ____ North ____ m
East ____ m
HISTORY: ____ Zone ____
DEVELOPMENT: ____
ACTIVITY AT TIME OF EXAMINATION: ____
GEOLOGY: ____
SAMPLE
REMARKS: ____
REFERENCES: ____
EXAMINER: ____ DATE VISITED: ____

Figure E-5—Mine site description form

Task 6: DATA ANALYSIS AND REPORT PREPARATION

Task summary:

1. Previously-collected data will be analyzed. Areas of known mines, mineralized areas and prospects, geological information, etc., for the Nellis Range will be mapped to scale for inclusion in the Mineral Assessment Report.

2. A preliminary draft Mineral Resource Assessment Report shall be prepared in accordance with the BLM Procedural Manual, Section 3060 and submitted for review and comments.

3. A draft Mineral Resource Assessment Report shall be submitted within 45 days of receipt of government comments on the preliminary draft of the report.

4. A final report shall be submitted for distribution to the Corps of Engineers and the Air Force within 45 days of receipt of government comments on the draft of the report.

Research staff: Bonham, Castor, Connors, Desilets, Garside, Henry, Hsu, LaPointe, Lugaski, Price, Tingley, Weiss

Procedure: All data generated in tasks 1 through 5 are summarized in the form of tables, charts, maps and narrative text.

Product: A mineral resource assessment report as outlined in the Bureau of Land Management Procedural Manual, Section 3060.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Researcher	Specialty Fields
H. F. Bonham	Precious metals deposits, base metals deposits, stratigraphy, regional geology, volcanology
S. B. Castor	Industrial mineral deposits, precious metals deposits, base metals deposits, specialty metals deposits, uranium deposits
K. A. Connors	Volcanology, volcanic rock geochemistry, precious metals deposits
M. O. Desilets	Analytical chemistry, geochemistry, quality assurance, mineral resources
L. J. Garside	Geothermal resources, oil and gas resources, uranium deposits, precious metals deposits, base metals deposits, stratigraphy, regional geology
P. Goldstrand	Stratigraphy, regional geology
C. D. Henry	Volcanology, volcanic rock geochemistry
L. Hsu	Petrology, mineralogy
D. D. LaPointe	Mineral resources, mineral land status, general geology
T. Lugaski	Remote sensing, photo interpretation
J. Price	Volcanic rock geochemistry, precious metals deposits, specialty metals deposits, geochemistry
J. V. Tingley	Precious metals deposits, base metals deposits, specialty metals deposits, regional geology, Nevada mineral deposits and mining history, assessment of mineral lands
S. Weiss	Volcanology, precious metals deposits, specialty metals deposits, regional geology

4.0 CALIBRATION PROCEDURES, FREQUENCY AND TRACEABILITY OF STANDARDS USED

ANALYTICAL PROCEDURES AND THEIR STATUS

Control samples are included with each batch of field samples submitted to laboratories for geochemical analysis. Control samples are submitted, in sequence, at a frequency of one per approximately 25 samples and also at the beginning and end of each batch. Field samples and control samples are subjected to the same steps of analysis, from sample preparation to the final report. There are two control samples: 1) CON-1, a phyllite collected west of Pyramid Lake, Nevada at T 24 N, R 24 E, sec. 21, NW 1/4 SE 1/4; and 2) CON-2, an andesite sample collected south of Tracy power plant, Nevada at T 20 N R 22 E, sec. 33 NE 1/4 SW 1/4. For future reference, the sampling location for each control sample has been tagged in the field. The control sample number and the assigned sample number are recorded on the field worksheet (figure E-2). To detect variations in analytical precision, results from the control samples are monitored. At the beginning of the program, a suite of standard reference materials (SDo-1, NBS-1a, G-2, BHVO-1, Good Springs, Lead King, Sampson) was submitted to each laboratory to evaluate accuracy.

5.0 SAMPLE CUSTODY

The number assigned to each sample in the field (e.g., GSCN-23, 117606 or 5282) follows the sample through all aspects of analysis. The sample numbers are recorded on the field work forms (figures E-2, E-3, & E-4). NBMG maintains archival samples of both GSC and mine site samples for future study. Coarse rejects and sample pulps of all samples are maintained at NBMG for the life of the NMI project.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

Laboratory and petrographic data, will be maintained in the NBMG GIS system and a database at NBMG. The databases will be available in PC-compatible formats. NBMG personnel will record and check data. A report will be compiled upon completion of the project.

7.0 INTERNAL QUALITY CONTROL PROCEDURES

Internal quality control includes careful sample tracking and notation during sampling, sample preparation, and geochemical analyses, and the submission and tracking of control samples during the analysis phase. At all phases of sample analysis the NBMG staff conducts random checks. Data collected is added to an NBMG database and checked.

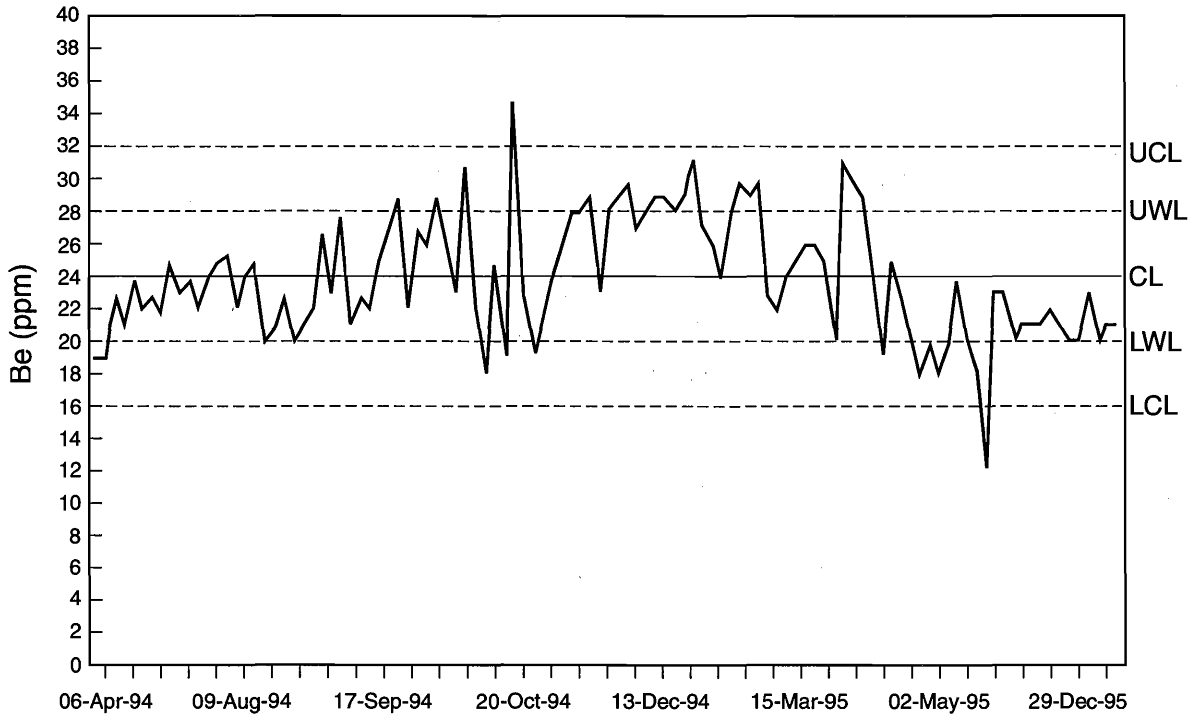


Figure E-6—An example control chart of beryllium data. CL - central line, UWL - upper working limit, UCL - upper control limit, LWL - lower working limit, LCL - lower control limit.

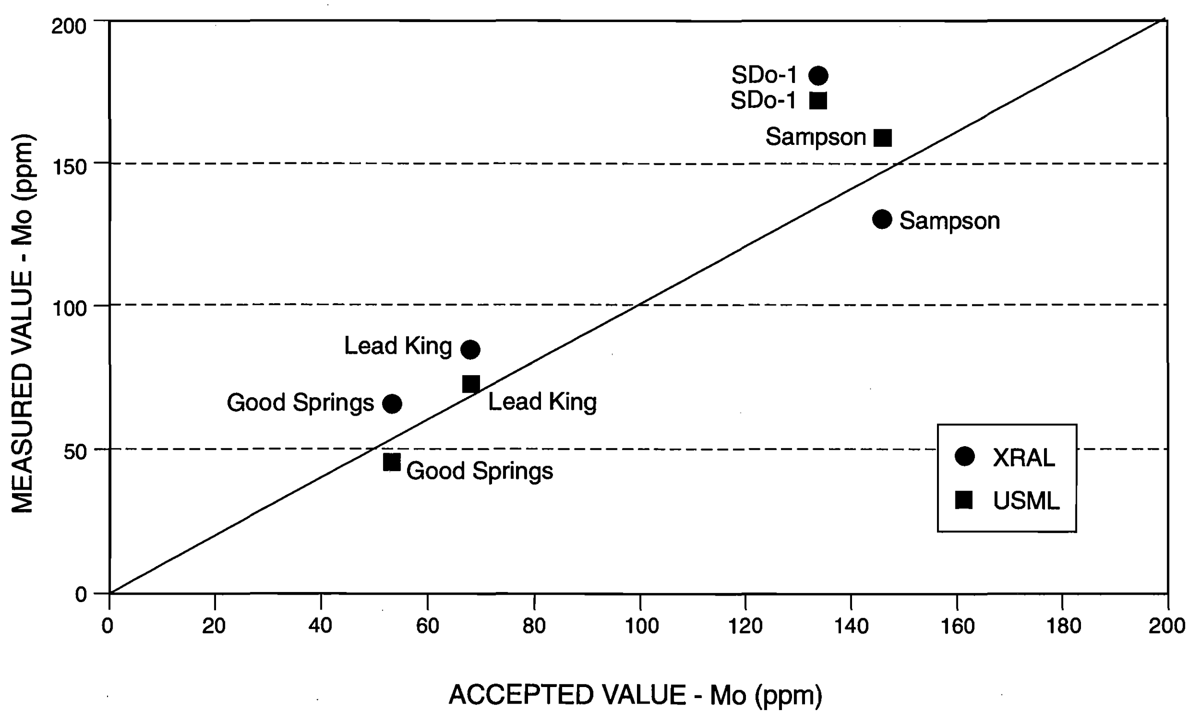


Figure E-7—An example accuracy comparison graph of molybdenum determinations for XRAL and USML laboratories.

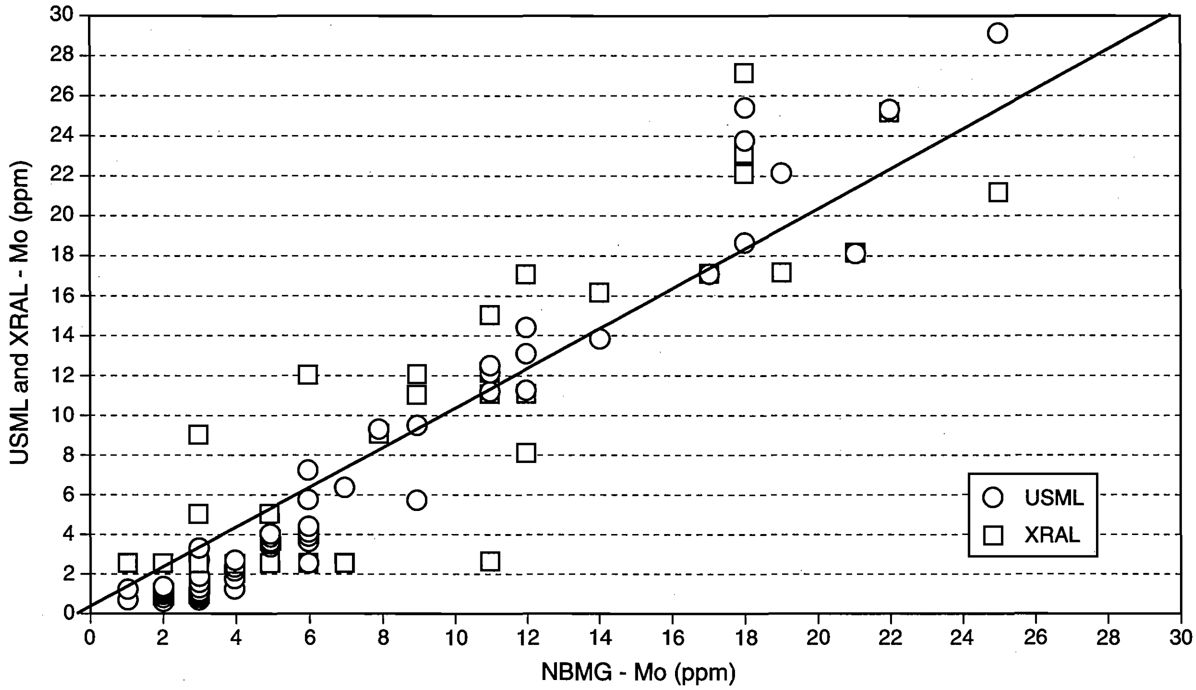


Figure E-8—An example of a inter-laboratory comparison graph of molybdenum determinations from NBMG, USML, and XRAL laboratories.

8.0 PERFORMANCE AND SYSTEM AUDITS

STATISTICAL METHODS USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

CORRECTIVE ACTION REQUIRED FOR OUT-OF-CONTROL SITUATIONS

To evaluate analytical precision, results of control samples are monitored throughout the project. Results for each element are plotted against time as on figure E-6. This type of plot allows monitoring of changes in analytical precision. Standard reference materials are submitted to each laboratory to assess data accuracy. For each element, plots showing the correlation between reported values from the labs and the recommended values for the standard reference materials (figure E-7) allows assessment of analytical accuracy. Inter-laboratory comparison plots are made for analytical results of orientation samples, to determine laboratory accuracy (figure E-8).

If a problem is detected in analytical precision, accuracy, or any other aspect of analysis, the source of the problem is found and remedied. Any sample affected by errors is analyzed again.

9.0 QUALITY ASSURANCE REPORTS

Control sample analyses and charts for the three laboratories used during this project are included in appendix F. Reports on data accuracy, precision, completeness, and the results of performance audits will be prepared as requested.

APPENDIX F

CONTROL SAMPLE ANALYSES AND CHARTS

F1. NBMG control sample analyses and charts

F2. USML control sample analyses and charts

F3. XRAL control sample analyses and charts

F1. NBMG control sample analyses and charts

NBMG Sample#	Control	Batch	Ba(ppm)	Be (ppm)	Cr(ppm)	Hg(ppb)	Li(ppm)	MnO(%)	Nb(ppm)	Ni(ppm)	Sn(ppm)	Sr(ppm)	TiO2(%)	V(ppm)
5064	CON-1	1	1123	<5	77	---	---	0.048	9	42	5	445	0.28	24
SS1193-1	CON-1	3	1135	<5	95	---	---	0.050	10	44	4	448	0.28	49
SS0493-1	CON-1	3	1141	<5	117	---	---	0.052	10	44	3	435	0.29	48
0394-G26	CON-1	3	572	<5	87	---	---	0.050	9	27	4	345	0.19	<20
*0394-G26	CON-1	3	1121		85					40		465	0.29	43
GSCN-57	CON-1	4	1175	<5	106	<10	<10	0.048	10	44	12	446	0.29	38
GSCN-102	CON-1	4	1122	<5	98	<10	<10	0.049	11	41	10	451	0.29	32
GSCN-109	CON-1	4	1154	<5	102	<10	<10	0.049	11	42	5	447	0.29	<20
117567a	CON-1	4	1180	<5	86	<10	<10	0.050	10	42	6	456	0.29	20
117751a	CON-1	4	1134	<5	92	<10	<10	0.051	11	42	15	452	0.29	52
117802a	CON-1	4	1145	<5	97	<10	<10	0.049	10	39	8	453	0.29	60
117809a	CON-1	4	1120	<5	82	<10	<10	0.050	10	42	<2	455	0.29	31
GSCN-111	CON-1	5	1133	<5	83	<10	<10	0.050	9	44	4	461	0.29	48
GSCN-115	CON-1	5	1153	<5	94	<10	<10	0.049	11	41	8	465	0.29	42
GSCN-248	CON-1	5	1134	<5	84	<10	<10	0.049	10	39	10	464	0.29	62
GSCN-250	CON-1	5	1163	<5	75	<10	<10	0.050	9	40	9	459	0.29	19
117820a	CON-1	5	1132	<5	88	<10	<10	0.047	10	40	8	457	0.29	22
117835a	CON-1	5	1129	<5	79	<10	<10	0.048	11	42	11	457	0.29	47
117871a	CON-1	5	1135	<5	81	<10	<10	0.050	10	39	10	461	0.29	28
117898a	CON-1	5	1115	<5	76	<10	<10	0.050	10	43	9	457	0.29	47
118276a	CON-1	5	1174	<5	93	<10	<10	0.048	10	42	11	463	0.29	73
118305a	CON-1	5	1132	<5	78	<10	<10	0.049	11	42	8	454	0.29	31
118324a	CON-1	5	1119	<5	74	<10	<10	0.050	10	45	9	461	0.29	30
118354a	CON-1	5	1127	<5	76	<10	<10	0.049	11	42	6	457	0.29	36
118369a	CON-1	5	1133	<5	75	<10	<10	0.049	10	42	5	457	0.29	34
117778a	CON-1	6	1143	<5	88	<10	<10	0.049	10	41	7	457	0.29	56
5064a	CON-1	6	1143	<5	82	<10	<10	0.049	10	46	13	461	0.29	48
5506a	CON-1	6	1143	<5	92	<10	<10	0.048	10	42	11	461	0.29	37
5507a	CON-1	7	1147	<5	95	<10	<10	0.049	11	41	11	460	0.29	63
5417a	CON-1	8	1131	<5	77	<10	<10	0.049	11	42	6	455	0.29	36
5437a	CON-1	8	1173	<5	83	<10	<10	0.048	11	42	<2	472	0.29	34
1194-078a	CON-1	9	1165	<5	78	<10	<10	0.049	10	44	<2	464	0.29	47
5474a	CON-1	11	1162	<5	87	<10	<10	0.049	11	45	6	460	0.29	44
5065a(R)	CON-1	12	1160	<5	73	<10	<10	0.048	11	41	<2	462	0.29	44
5517a(R)	CON-1	12	1184	<5	86	<10	<10	0.049	11	42	<2	470	0.29	34
5542a(R)	CON-1	12	1152	<5	76	<10	<10	0.050	10	42	<2	467	0.29	48
5151a	CON-1	13	1119	<5	68	<10	<10	0.047	10	38	<2	481	0.30	78
5283a	CON-1	13	1210	<5	72	<10	<10	0.048	10	37	<2	480	0.30	80
5323a	CON-1	13	1145	<5	60	<10	<10	0.047	9	39	<2	485	0.30	77

NBMG Sample#	Control	Batch	Ba(ppm)	Be (ppm)	Cr(ppm)	Hg(ppb)	Li(ppm)	MnO(%)	Nb(ppm)	Ni(ppm)	Sn(ppm)	Sr(ppm)	TiO2(%)	V(ppm)
5656a	CON-1	13	1160	<5	79	<10	<10	0.047	11	39	<2	488	0.30	73
5196a	CON-1	14	1207	<5	63	<10	<10	0.047	10	37	<2	489	0.30	78
5586a	CON-1	14	1181	<5	75	<10	<10	0.047	11	35	<2	491	0.30	76
5605a	CON-1	14	1188	<5	80	<10	<10	0.047	10	41	<2	491	0.30	76
5671a	CON-1	14	1168	<5	72	<10	<10	0.047	11	37	<2	486	0.29	74
5737a	CON-1	14	1197	7	75	<10	<10	0.046	10	37	<2	488	0.30	79
5353a	CON-1	15	1160	<5	98	<10	<10	0.046	11	38	<2	492	0.30	69
5747a	CON-1	16	1144	<5	62	<10	<10	0.048	10	38	<2	486	0.30	75
5717a	CON-1	17	1252	<5	76	<10	<10	0.050	12	48	8	471	0.30	81
117609a	CON-1	18	1157	<5	75	<10	<10	0.049	12	46	<2	467	0.28	86
SS0695-087a	CON-1	18	1132	<5	79	<10	<10	0.050	13	43	9	460	0.29	92
5726a	CON-1	19	1273	<5	85	<10	<10	0.049	12	48	4	467	0.30	76
5908a	CON-1	19	1273	<5	78	<10	<10	0.050	13	46	9	470	0.30	85
117699a	CON-1	20	1238	<5	75	<10	<10	0.050	12	44	<2	456	0.29	83
117724a	CON-1	20	1204	<5	85	<10	<10	0.050	11	48	3	458	0.29	87
117920a	CON-1	20	1271	<5	86	<10	<10	0.049	13	45	6	467	0.31	81
3011(A)a	CON-1	21	1165	<5	76	<10	<10	0.050	12	45	5	459	0.28	80
441SSa	CON-1	21	1207	<5	72	<10	<10	0.051	13	46	3	461	0.29	80
5374a	CON-1	22	1192	<5	72	<10	<10	0.051	12	46	<2	456	0.29	79
5399a	CON-1	22	1158	<5	73	<10	<10	0.049	12	48	6	458	0.29	72
5839a	CON-1	22	1180	<5	83	<10	<10	0.050	12	46	8	463	0.28	80
5924a	CON-1	22	1191	<5	78	<10	<10	0.049	13	48	<2	458	0.28	81
GSCN122a	CON-1	22	1198	<5	78	<10	16	0.051	13	46	4	465	0.28	78
Mean:	CON-1	---	1164	0	82	0	0	0.049	11	42	5	464	0.29	57
StandardDeviation:	CON-1	---	39	1	10	0	0	0.001	1	3	4	13	0.01	22
2 sigma			1241	2	103	0	0	0.052	13	49	13	489	0.30	101
3 sigma			1280	3	113	0	0	0.053	14	52	18	502	0.31	124

NBMG Sample#	Control	Batch	Ba(ppm)	Be (ppm)	Cr(ppm)	Hg(ppb)	Li(ppm)	MnO(%)	Nb(ppm)	Ni(ppm)	Sn(ppm)	Sr(ppm)	TiO2(%)	V(ppm)
5065	CON-2	1	962	<5	187	---	---	0.106	5	61	<2	756	0.69	130
SS1193-2	CON-2	3	966	<5	224	---	---	0.107	5	58	<1	765	0.70	143
SS0493-2	CON-2	3	951	<5	243	---	---	0.103	5	58	<5	758	0.70	142
0394-G27	CON-2	3	934	<5	205	---	---	0.105	4	57	<5	786	0.69	141
*0394-G27	CON-2	3	1013		194					62		794	0.71	127
GSCN-58	CON-2	4	993	<5	230	<10	11	0.106	5	60	6	769	0.72	128
GSCN-103	CON-2	4	982	<5	220	<10	13	0.105	5	59	8	761	0.70	133
GSCN-110	CON-2	4	937	<5	239	<10	14	0.106	5	59	8	758	0.71	147

NBMG Sample#	Control	Batch	Ba(ppm)	Be (ppm)	Cr(ppm)	Hg(ppb)	Li(ppm)	MnO(%)	Nb(ppm)	Ni(ppm)	Sn(ppm)	Sr(ppm)	TiO2(%)	V(ppm)
117567b	CON-2	4	982	<5	180	<10	<10	0.108	5	58	8	772	0.71	129
117751b	CON-2	4	958	<5	201	<10	<10	0.109	5	58	7	771	0.71	126
117802b	CON-2	4	965	<5	182	<10	<10	0.106	5	58	6	768	0.71	143
117809b	CON-2	4	950	<5	205	<10	<10	0.105	4	58	<2	775	0.71	152
GSCN-112	CON-2	5	989	<5	191	<10	13	0.105	6	56	6	783	0.72	144
GSCN-116	CON-2	5	960	<5	193	<10	11	0.108	5	58	5	789	0.71	139
GSCN-249	CON-2	5	978	<5	203	<10	13	0.105	5	61	9	789	0.72	156
GSCN-251	CON-2	5	1001	<5	196	<10	14	0.107	5	59	2	791	0.72	139
117820b	CON-2	5	966	<5	190	<10	<10	0.104	4	58	10	778	0.71	175
117835b	CON-2	5	927	<5	176	<10	<10	0.106	5	58	7	777	0.72	126
117871b	CON-2	5	971	<5	186	<10	<10	0.108	5	57	6	786	0.71	117
117898b	CON-2	5	970	<5	192	<10	<10	0.105	5	60	5	770	0.70	164
118276b	CON-2	5	948	<5	196	<10	<10	0.106	4	58	6	782	0.71	146
118305b	CON-2	5	956	<5	193	<10	<10	0.105	5	59	7	772	0.71	159
118324b	CON-2	5	962	<5	170	<10	<10	0.108	5	56	6	785	0.71	126
118354b	CON-2	5	977	<5	175	<10	<10	0.107	5	59	10	772	0.71	153
118369b	CON-2	5	950	<5	172	<10	<10	0.104	6	54	10	777	0.71	141
117778b	CON-2	6	972	<5	208	<10	<10	0.106	4	60	11	775	0.72	160
5064b	CON-2	6	956	<5	187	<10	<10	0.106	4	60	5	787	0.71	171
5506b	CON-2	6	982	<5	194	<10	<10	0.109	6	59	10	784	0.71	131
5507b	CON-2	7	990	<5	193	<10	<10	0.108	5	61	8	787	0.71	132
5417b	CON-2	8	952	<5	173	<10	<10	0.104	6	57	10	775	0.71	140
5437b	CON-2	8	995	<5	183	<10	<10	0.106	5	60	<2	794	0.71	135
1194-078b	CON-2	9	1010	<5	191	<10	<10	0.108	6	61	<2	785	0.72	145
5474b	CON-2	11	1000	<5	190	<10	<10	0.106	5	60	8	788	0.72	151
5065b(R)	CON-2	12	947	<5	177	<10	<10	0.107	6	58	<2	797	0.71	125
5517b(R)	CON-2	12	999	<5	184	<10	<10	0.106	5	59	<2	795	0.71	137
5542b(R)	CON-2	12	982	<5	196	<10	<10	0.106	5	63	<2	793	0.72	142
5151b	CON-2	13	972	<5	188	<10	<10	0.102	4	52	5	828	0.75	106
5283b	CON-2	13	1008	<5	175	<10	<10	0.101	5	54	<2	826	0.76	96
5323b	CON-2	13	964	<5	167	<10	<10	0.105	4	53	<2	832	0.75	97
5656b	CON-2	13	993	<5	164	<10	<10	0.103	5	54	<2	828	0.77	101
5196b	CON-2	14	1029	<5	174	<10	<10	0.104	5	53	<2	836	0.75	103
5586b	CON-2	14	960	<5	177	<10	<10	0.103	5	55	<2	838	0.76	108
5605b	CON-2	14	992	<5	170	<10	<10	0.104	5	55	<2	835	0.76	102
5671b	CON-2	14	991	<5	189	<10	<10	0.103	4	55	<2	838	0.76	108
5737b	CON-2	14	1011	7	187	<10	<10	0.101	5	56	<2	839	0.75	102
5353b	CON-2	15	1027	<5	189	<10	<10	0.103	4	55	<2	840	0.77	100
5747b	CON-2	16	977	<5	160	<10	<10	0.102	5	54	<2	839	0.76	112

NBMG														
Sample#	Control	Batch	Ba(ppm)	Be (ppm)	Cr(ppm)	Hg(ppb)	Li(ppm)	MnO(%)	Nb(ppm)	Ni(ppm)	Sn(ppm)	Sr(ppm)	TiO2(%)	V(ppm)
5717b	CON-2	17	1084	<5	189	<10	<10	0.105	8	65	<2	804	0.75	116
117609b	CON-2	18	985	6	177	<10	<10	0.101	8	62	9	793	0.70	116
SS0695-087b	CON-2	18	1027	<5	163	<10	<10	0.099	8	64	<2	794	0.70	112
5726b	CON-2	19	1067	<5	186	<10	<10	0.100	8	62	2	797	0.75	118
5908b	CON-2	19	1122	6	189	<10	<10	0.100	8	65	3	798	0.74	118
117699b	CON-2	20	1054	<5	176	<10	<10	0.099	7	61	10	779	0.71	114
117724b	CON-2	20	1048	<5	179	<10	<10	0.101	7	64	9	784	0.72	119
117920b	CON-2	20	1103	<5	183	<10	<10	0.099	7	67	6	808	0.77	114
3011(A)b	CON-2	21	1015	<5	177	<10	<10	0.101	7	62	3	791	0.69	113
441SSb	CON-2	21	1060	<5	172	<10	<10	0.100	8	63	4	788	0.72	117
5374b	CON-2	22	1004	<5	179	<10	<10	0.100	7	63	<2	781	0.71	124
5399b	CON-2	22	1009	<5	180	<10	<10	0.098	8	61	<2	786	0.71	109
5839b	CON-2	22	1024	<5	186	<10	<10	0.102	8	66	14	794	0.71	122
5924b	CON-2	22	990	<5	181	<10	<10	0.098	8	64	2	787	0.69	113
GSCN122b	CON-2	22	973	<5	183	<10	21	0.102	7	63	8	792	0.71	114
Mean:	CON-2	---	991	0	188	0	13	0.104	6	59	4	792	0.72	129
StandardDeviation:	CON-2	---	40	1	17	0	5	0.003	1	3	4	23	0.02	19
2 sigma	CON-2	---	1070	3	221	0	23	0.110	8	66	12	837	0.76	167
3 sigma	CON-2	---	1109	4	238	0	28	0.113	9	69	16	860	0.79	186
21-Nov-94														
***XRF Control rerun from end of batch3 due to out-of-bounds values on 0394-G26**														
SNWNB program and other trace elements not run because these were not out-of-bounds														
SAMPLE	Type	BCH#	Ba	Be	Cr	Hg	Li	MnO	Nb	Ni	Sn	Sr	TiO2	V
			ppm	ppm	ppm	ppb	ppb	%	ppm	ppm	ppm	ppm	%	ppm
0993-G17	DRI	3	<10		292					14		56	0.01	<20
1093-G18	DRI	3	<10		59					9		42	0.03	<20
1293-G19	DRI	3	<10		175					42		102	0.01	<20
0394-G20	DRI	3	520		199					40		1028	0.89	183
0394-G22	DRI	3	355		494					16		122	0.58	98
0394-G24	DRI	3	165		151					81		162	0.42	87
0394-G25	DRI	3	<10		539					23		41	0.17	<20
*0394-G26	CON-1	3	1121		85					40		465	0.29	43
*0394-G27	CON-2	3	1013		194					62		794	0.71	127

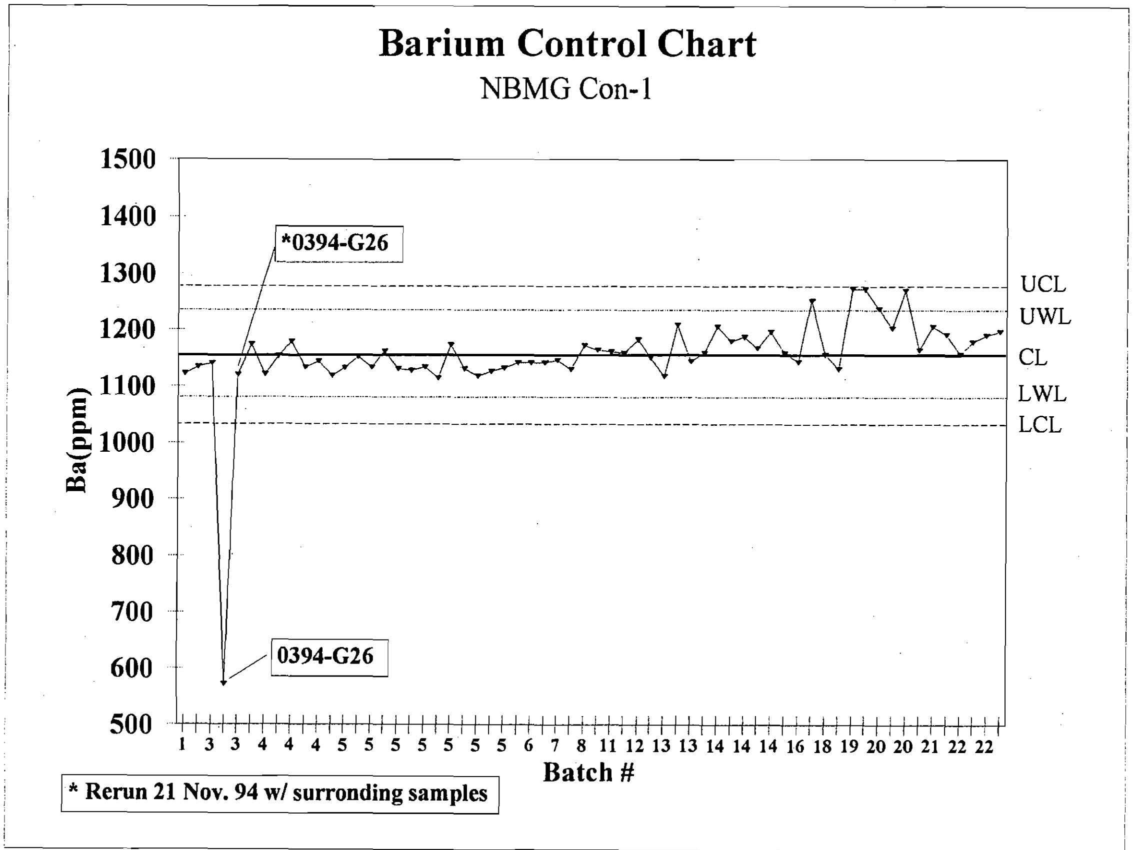
NBMG Sample#	Control	W(ppm)	Y(ppm)	Zr(ppm)
5064	CON-1	<2	37	175
SS1193-1	CON-1	<2	35	174
SS0493-1	CON-1	<2	36	174
0394-G26	CON-1	<2	27	105
*0394-G26	CON-1		36	179
GSCN-57	CON-1	5	37	177
GSCN-102	CON-1	5	35	175
GSCN-109	CON-1	5	33	175
117567a	CON-1	4	35	174
117751a	CON-1	4	34	175
117802a	CON-1	5	35	175
117809a	CON-1	<2	34	175
GSCN-111	CON-1	2	36	178
GSCN-115	CON-1	4	37	178
GSCN-248	CON-1	4	34	180
GSCN-250	CON-1	3	35	180
117820a	CON-1	4	33	177
117835a	CON-1	5	34	177
117871a	CON-1	4	36	176
117898a	CON-1	6	35	179
118276a	CON-1	6	35	177
118305a	CON-1	5	36	178
118324a	CON-1	3	36	176
118354a	CON-1	3	36	178
118369a	CON-1	6	34	179
117778a	CON-1	5	35	178
5064a	CON-1	3	34	178
5506a	CON-1	3	33	179
5507a	CON-1	5	36	177
5417a	CON-1	3	36	178
5437a	CON-1	<2	35	180
1194-078a	CON-1	<2	36	180
5474a	CON-1	6	35	179
5065a(R)	CON-1	<2	36	180
5517a(R)	CON-1	<2	35	180
5542a(R)	CON-1	<2	35	177
5151a	CON-1	<2	38	172
5283a	CON-1	<2	37	169
5323a	CON-1	<2	36	172

NBMG Sample#	Control	W(ppm)	Y(ppm)	Zr(ppm)
5656a	CON-1	<2	37	171
5196a	CON-1	<2	37	172
5586a	CON-1	<2	38	173
5605a	CON-1	<2	36	172
5671a	CON-1	<2	37	173
5737a	CON-1	<2	37	170
5353a	CON-1	<2	38	173
5747a	CON-1	<2	36	171
5717a	CON-1	<2	39	180
117609a	CON-1	<2	39	174
SS0695-087a	CON-1	<2	39	176
5726a	CON-1	<2	40	179
5908a	CON-1	<2	39	179
117699a	CON-1	3	37	179
117724a	CON-1	<2	39	176
117920a	CON-1	<2	39	180
3011(A)a	CON-1	<2	37	176
441SSa	CON-1	<2	38	177
5374a	CON-1	<2	39	174
5399a	CON-1	<2	40	174
5839a	CON-1	<2	37	179
5924a	CON-1	<2	38	177
GSCN122a	CON-1	<2	39	179
Mean:	CON-1	2	36	176
StandardDeviation:	CON-1	2	2	3
2 sigma		6	40	182
3 sigma		9	42	185

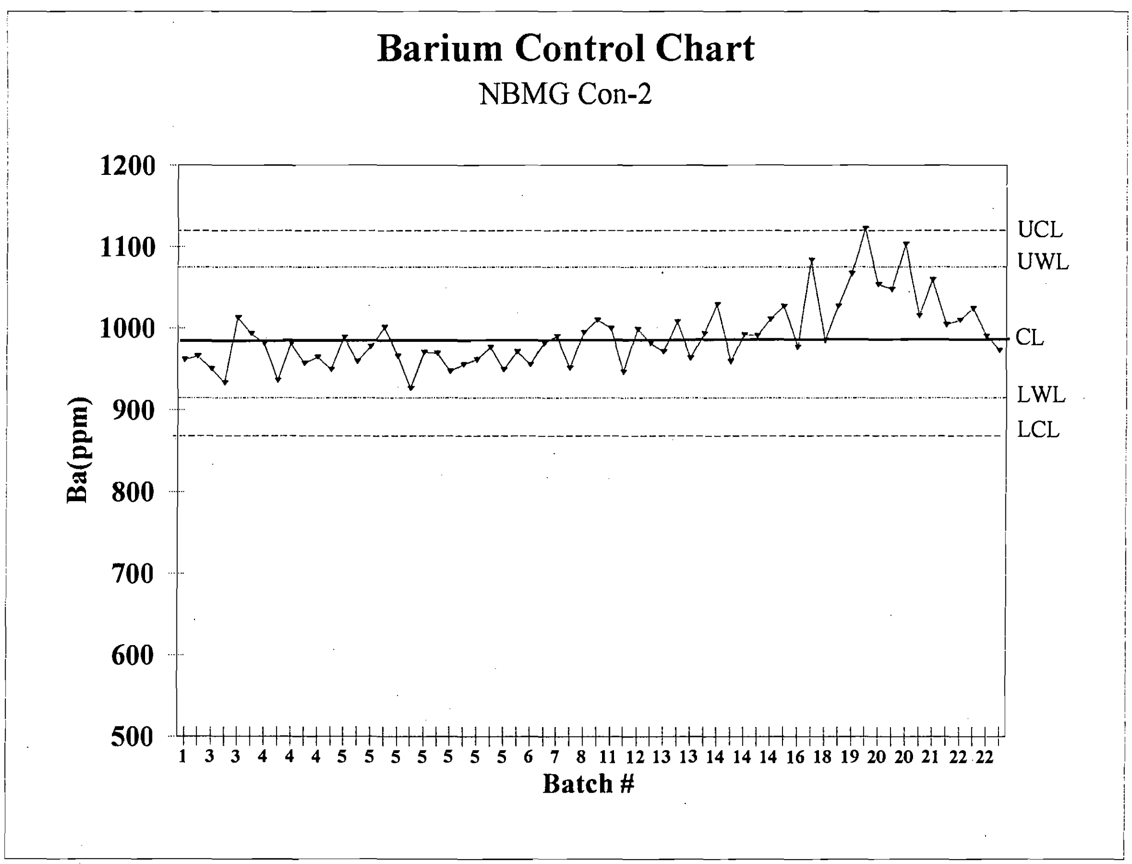
NBMG Sample#	Control	W(ppm)	Y(ppm)	Zr(ppm)
5065	CON-2	<2	12	138
SS1193-2	CON-2	<2	12	140
SS0493-2	CON-2	<2	12	138
0394-G27	CON-2	<2	14	142
*0394-G27	CON-2		13	144
GSCN-58	CON-2	3	12	140
GSCN-103	CON-2	5	13	142
GSCN-110	CON-2	3	13	143

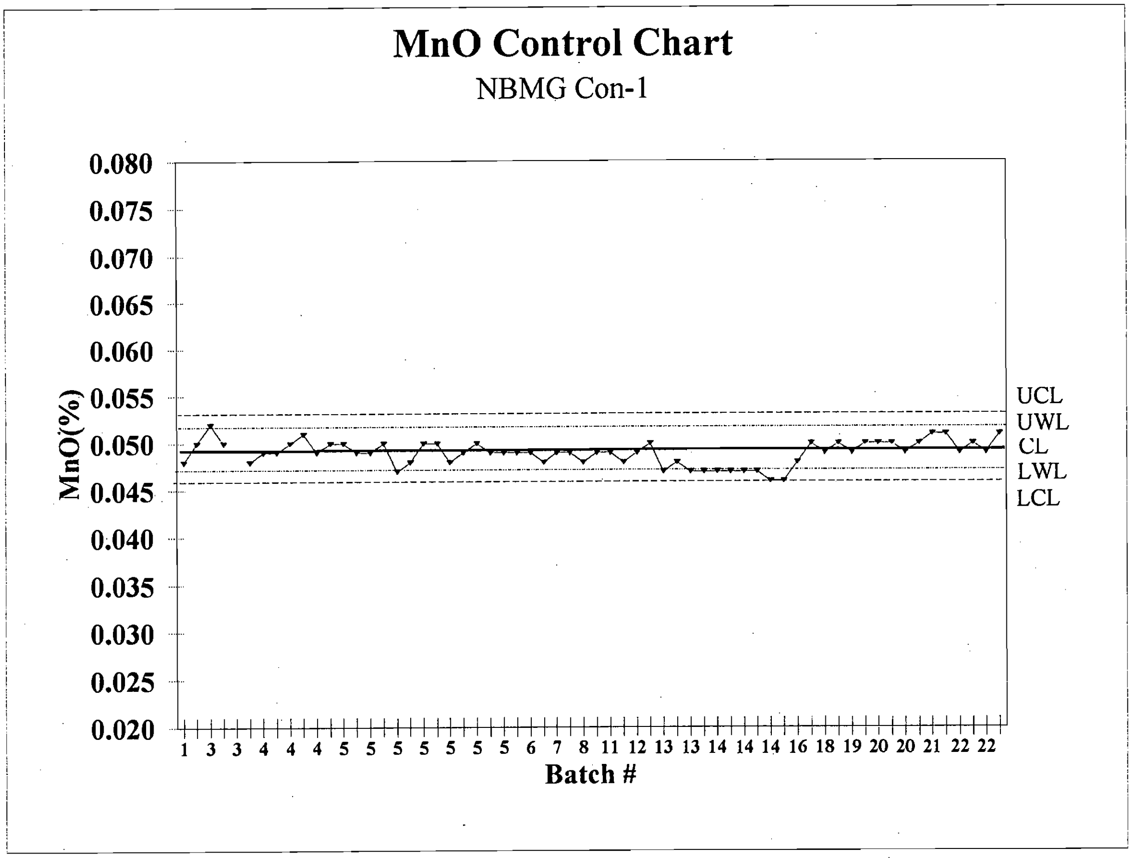
NBMG Sample#	Control	W(ppm)	Y(ppm)	Zr(ppm)
117567b	CON-2	5	11	141
117751b	CON-2	3	11	143
117802b	CON-2	4	13	140
117809b	CON-2	3	12	142
GSCN-112	CON-2	<2	12	144
GSCN-116	CON-2	4	13	141
GSCN-249	CON-2	2	12	145
GSCN-251	CON-2	5	12	145
117820b	CON-2	3	11	142
117835b	CON-2	5	12	142
117871b	CON-2	5	13	141
117898b	CON-2	5	11	143
118276b	CON-2	5	10	143
118305b	CON-2	3	11	143
118324b	CON-2	4	12	144
118354b	CON-2	5	11	143
118369b	CON-2	4	12	143
117778b	CON-2	2	11	143
5064b	CON-2	6	12	143
5506b	CON-2	4	13	143
5507b	CON-2	2	12	141
5417b	CON-2	4	12	143
5437b	CON-2	<2	13	142
1194-078b	CON-2	<2	12	144
5474b	CON-2	3	11	143
5065b(R)	CON-2	<2	13	143
5517b(R)	CON-2	<2	13	142
5542b(R)	CON-2	<2	13	143
5151b	CON-2	<2	14	123
5283b	CON-2	<2	14	123
5323b	CON-2	<2	13	120
5656b	CON-2	<2	13	121
5196b	CON-2	<2	14	122
5586b	CON-2	<2	14	124
5605b	CON-2	<2	14	122
5671b	CON-2	<2	13	124
5737b	CON-2	<2	14	120
5353b	CON-2	<2	13	123
5747b	CON-2	<2	14	121

18-Sep-96

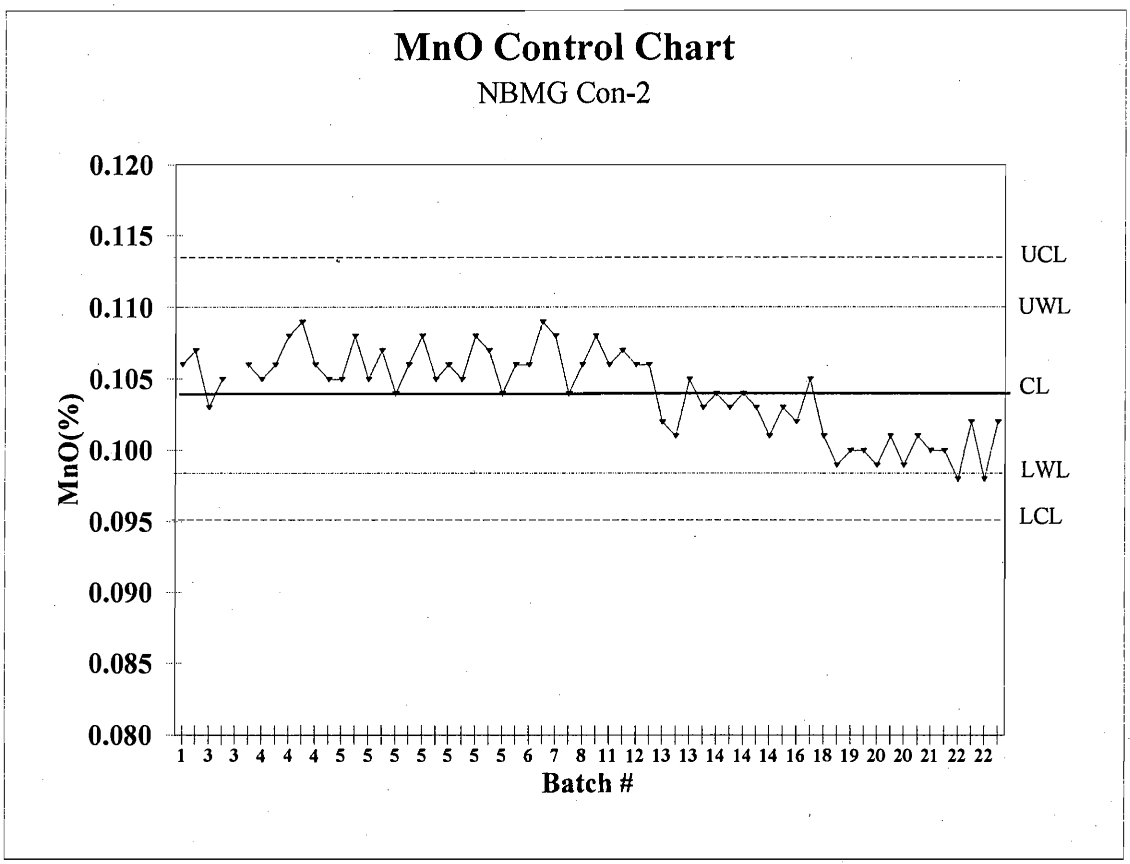


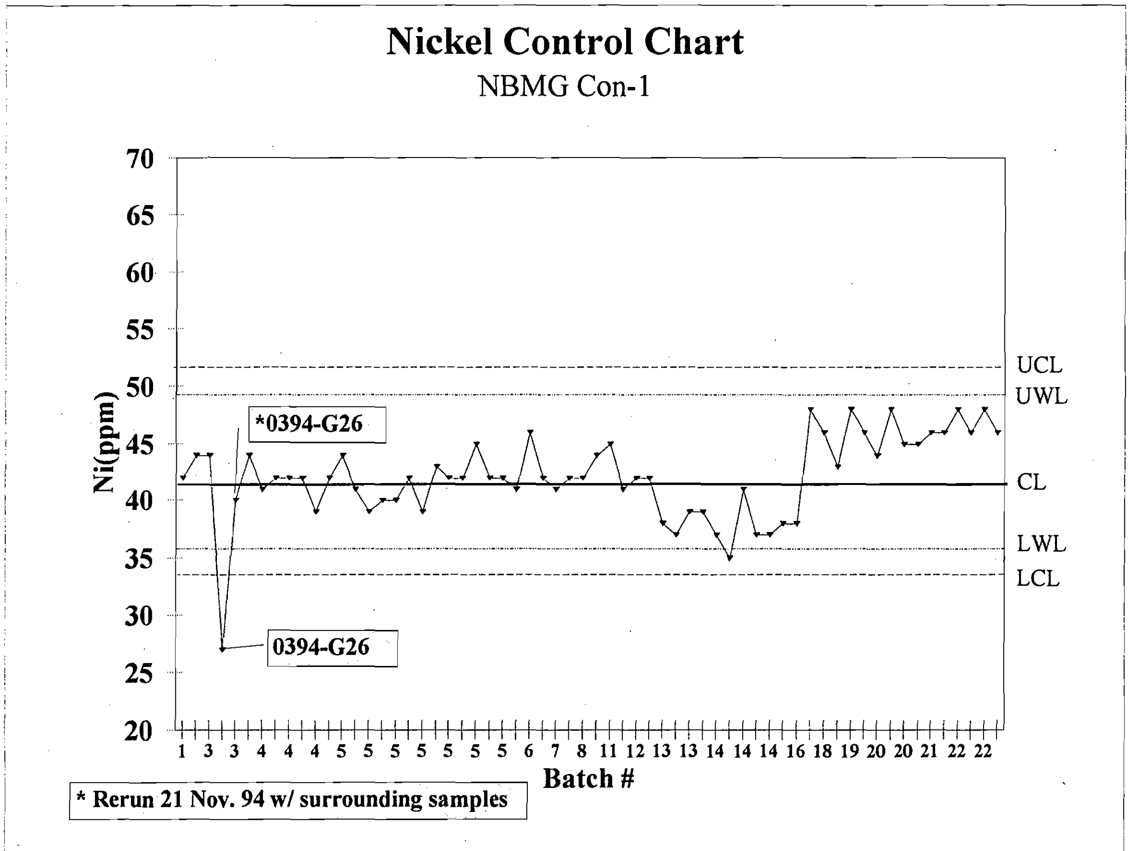
18-Sep-96




MnO Control Chart
NBMG Con-1
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
MnO(%)
UCL
UWL
CL
LWL
LCL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

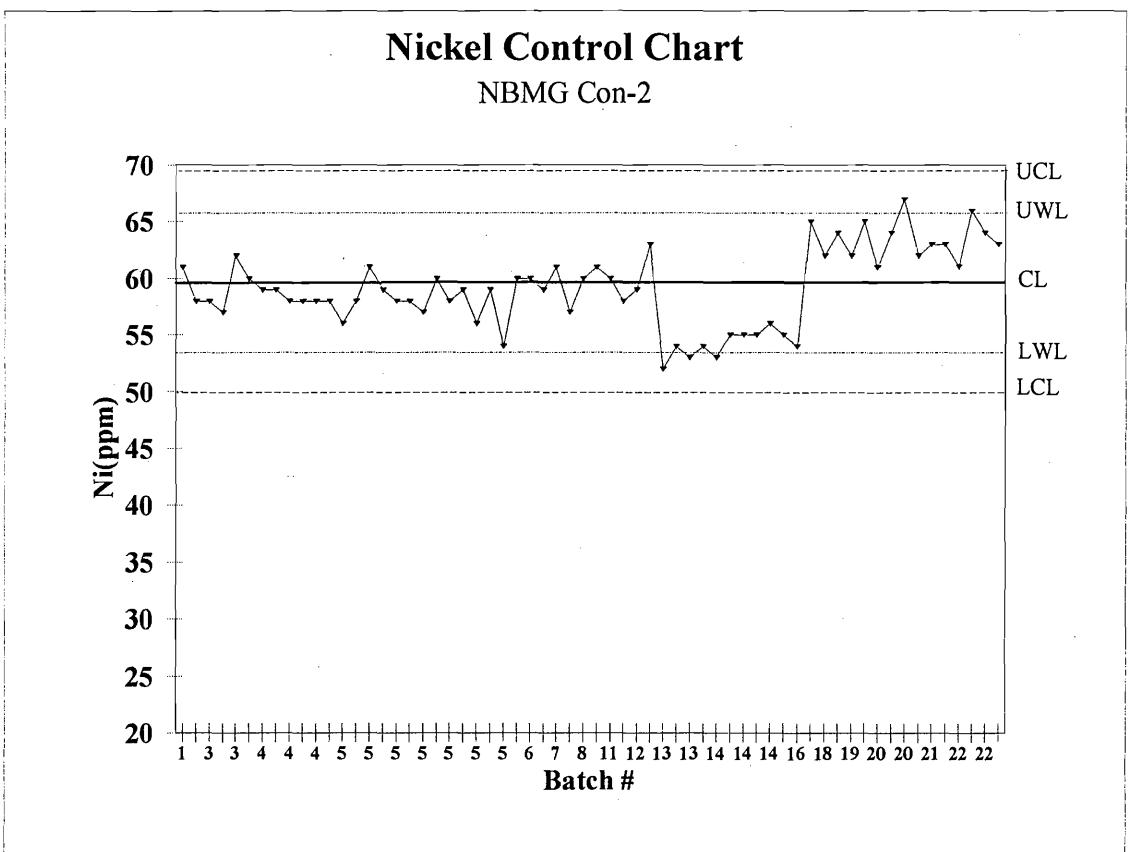
18-Sep-96


MnO Control Chart
NBMG Con-2
0.120
0.115
0.110
0.105
0.100
0.095
0.090
0.085
0.080
MnO(%)
UCL
UWL
CL
LWL
LCL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #



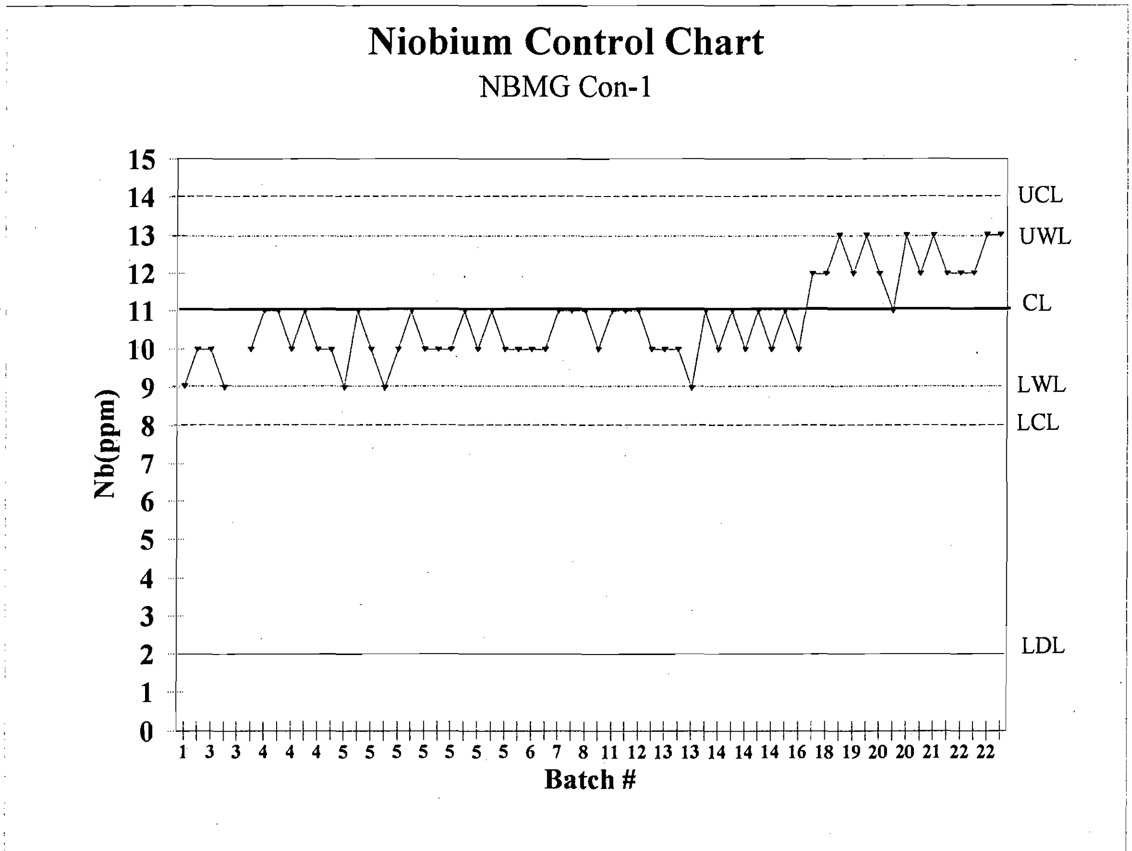
Nickel Control Chart
NBMG Con-1
Ni(ppm)
70
65
60
55
50
45
40
35
30
25
20
UCL
UWL
CL
LWL
LCL
*0394-G26
0394-G26
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #
* Rerun 21 Nov. 94 w/ surrounding samples

18-Sep-96

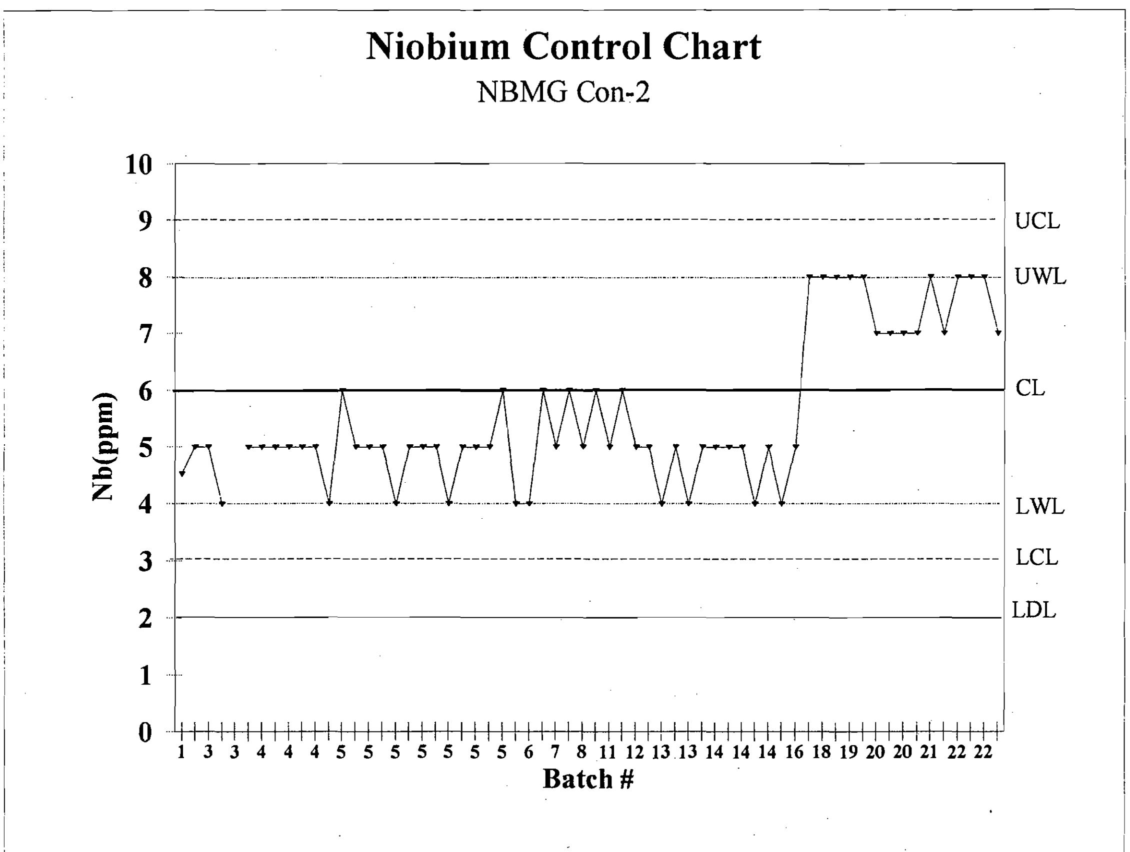


Nickel Control Chart
NBMG Con-2
Ni(ppm)
70
65
60
55
50
45
40
35
30
25
20
UCL
UWL
CL
LWL
LCL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

18-Sep-96



18-Sep-96



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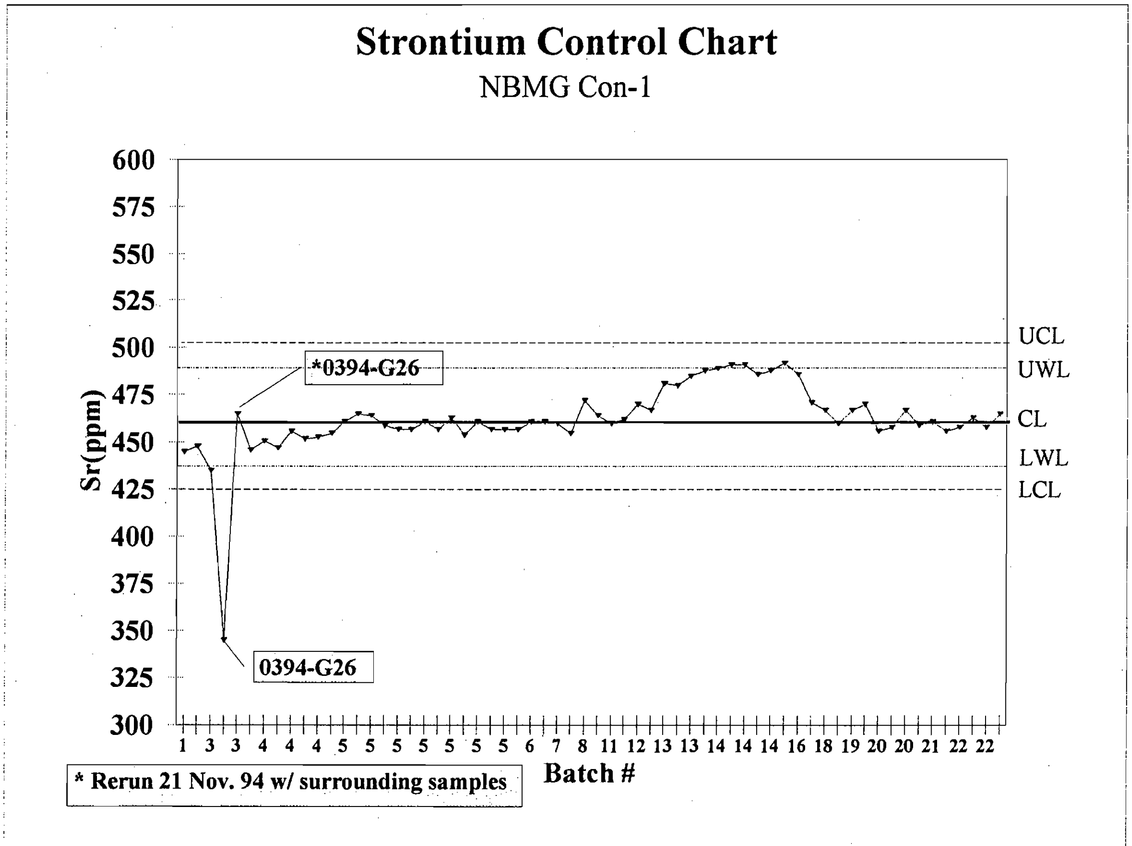

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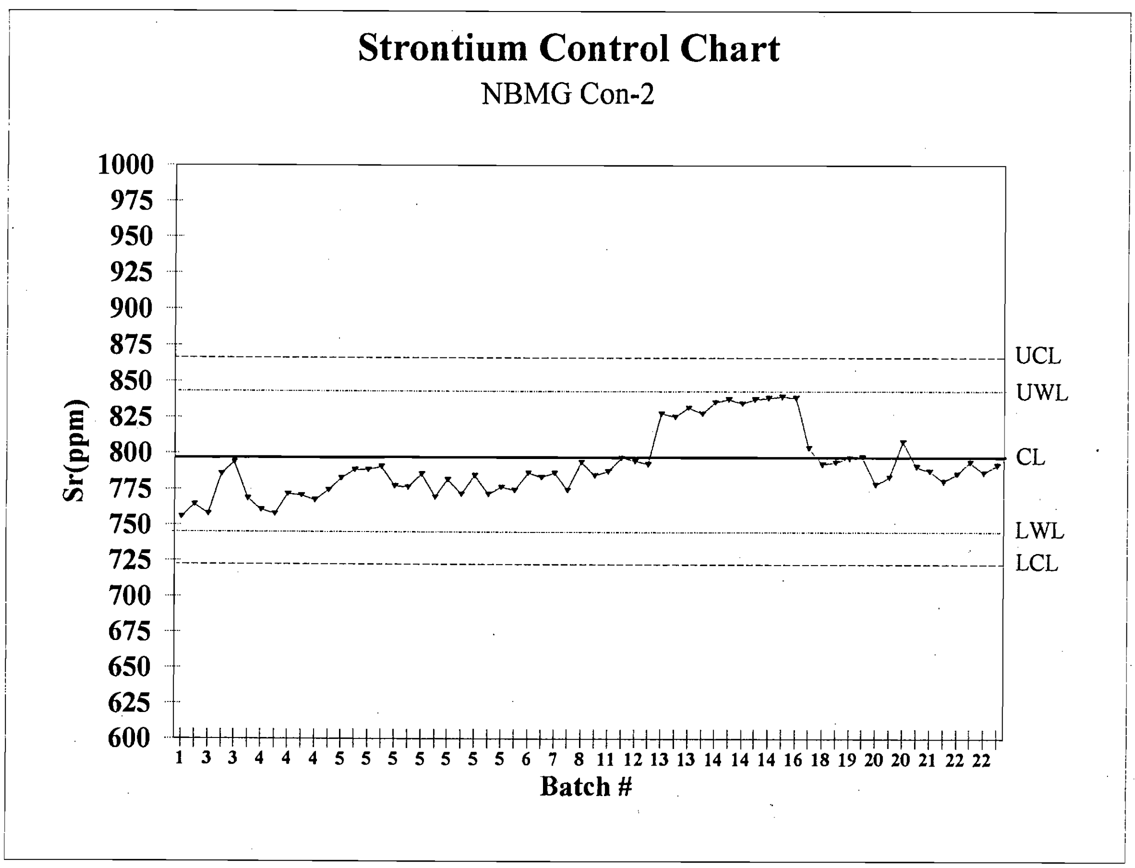

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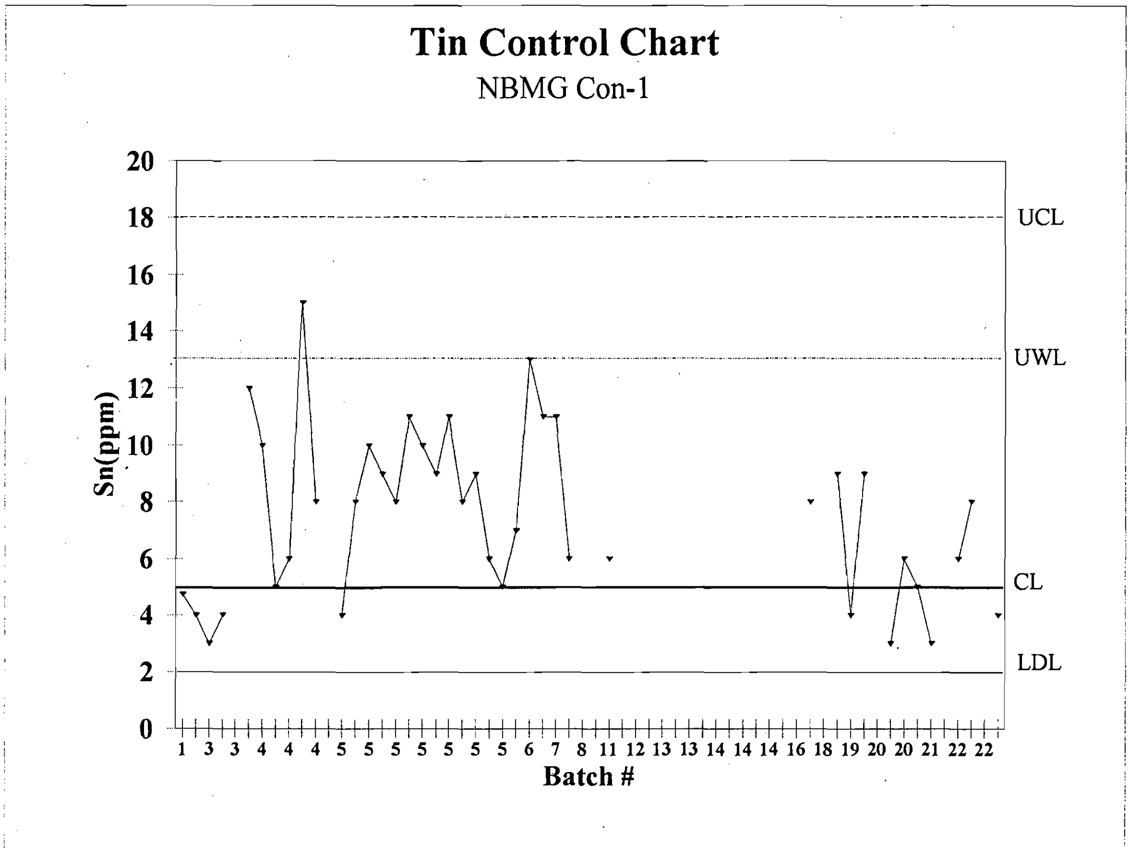

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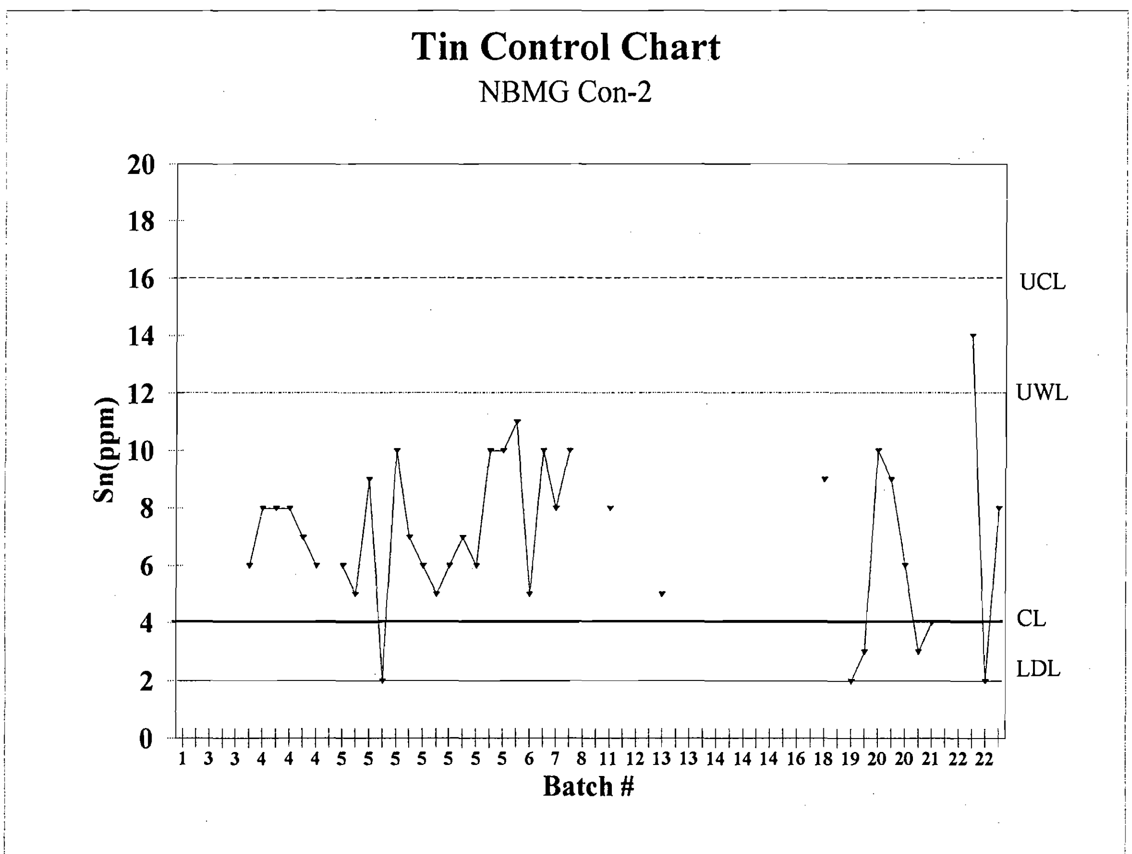

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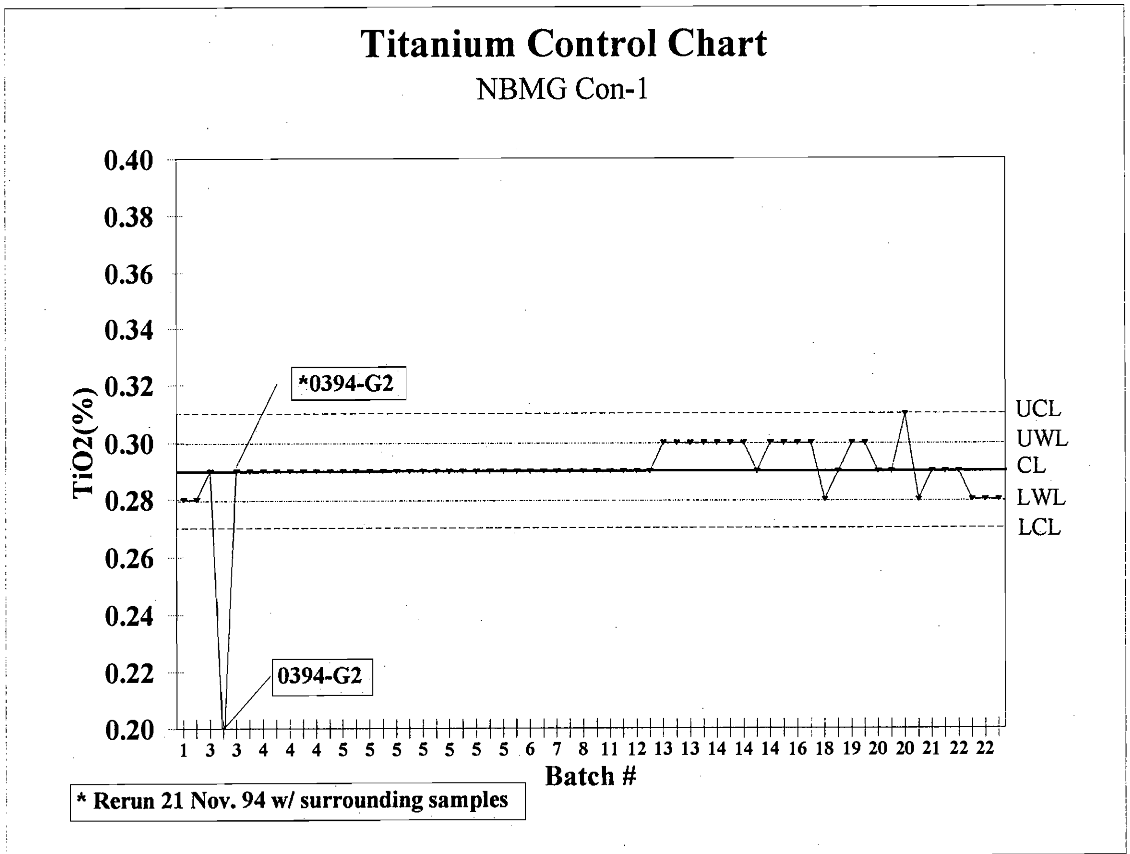

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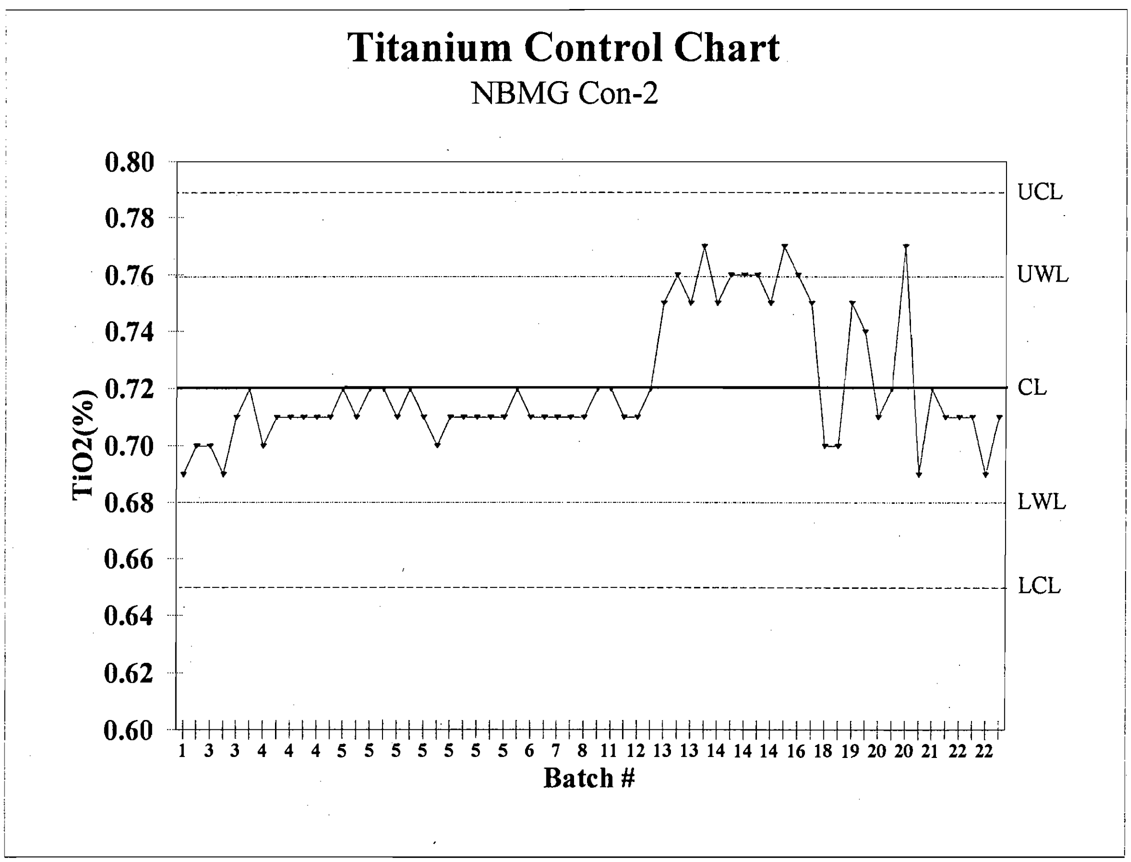

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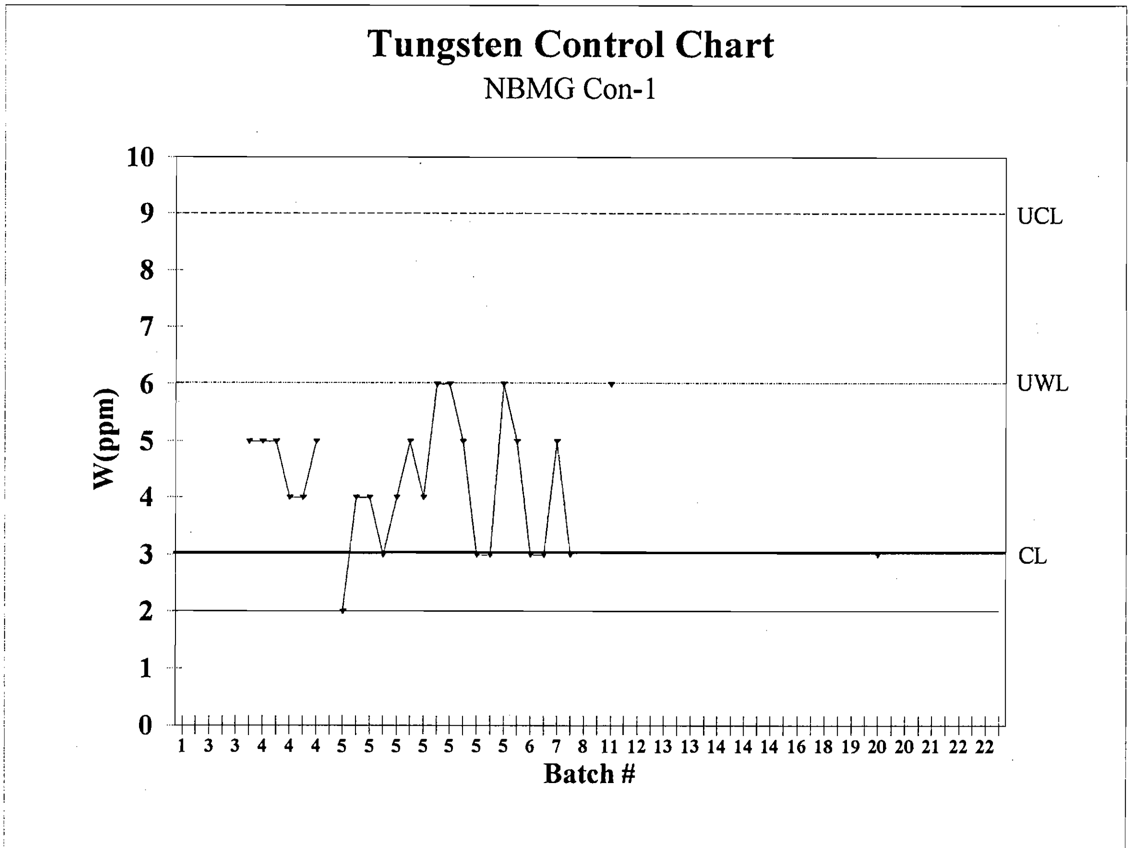

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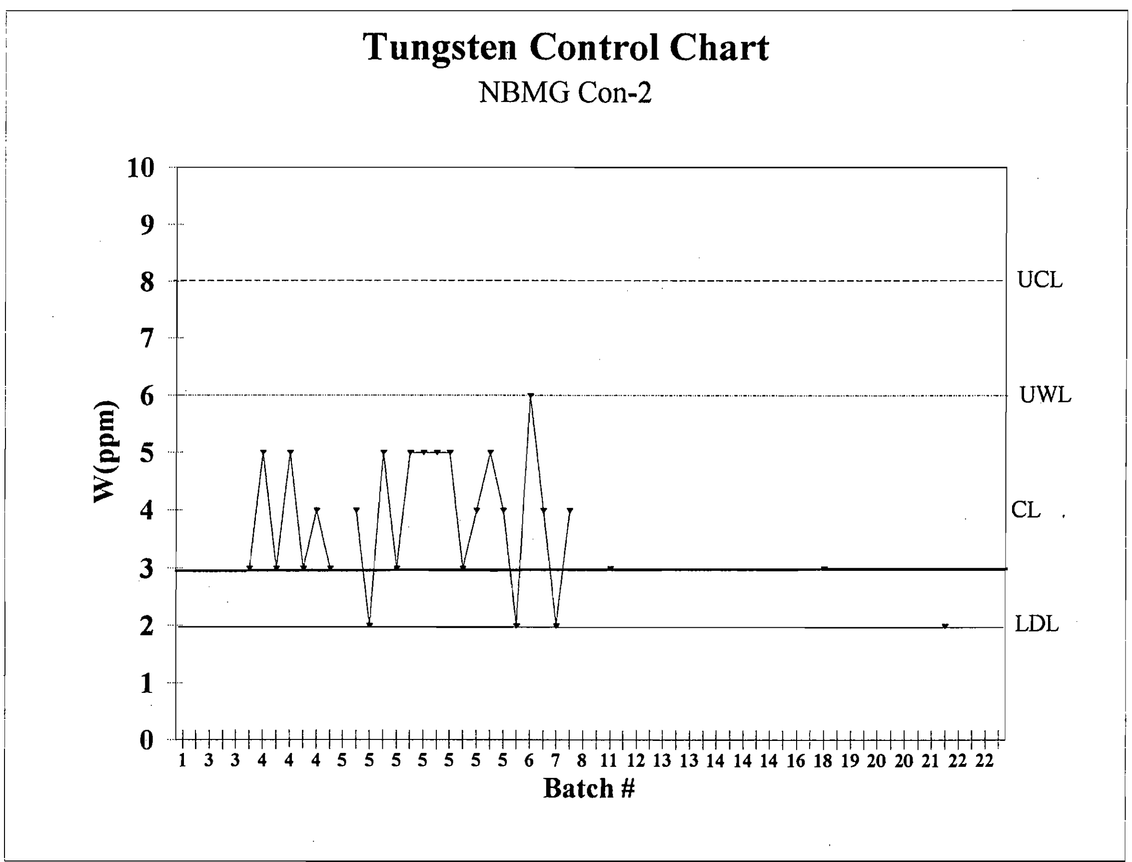
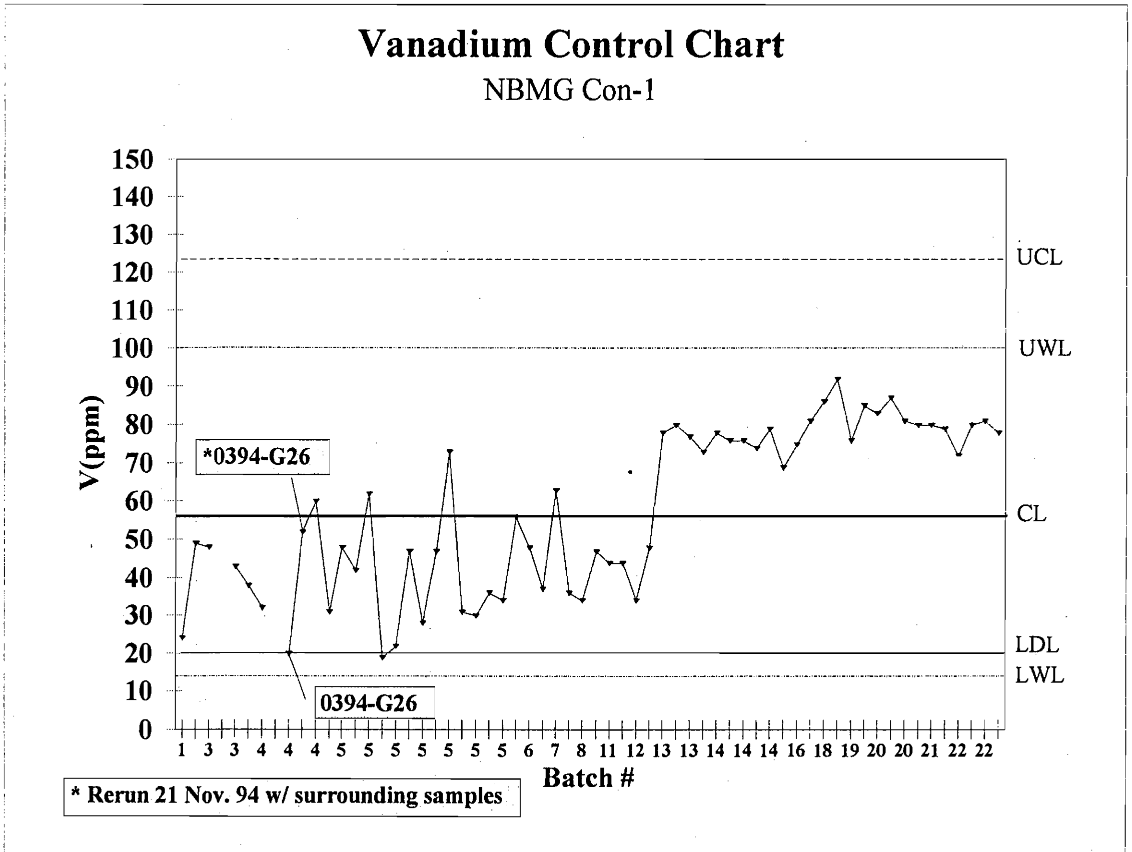
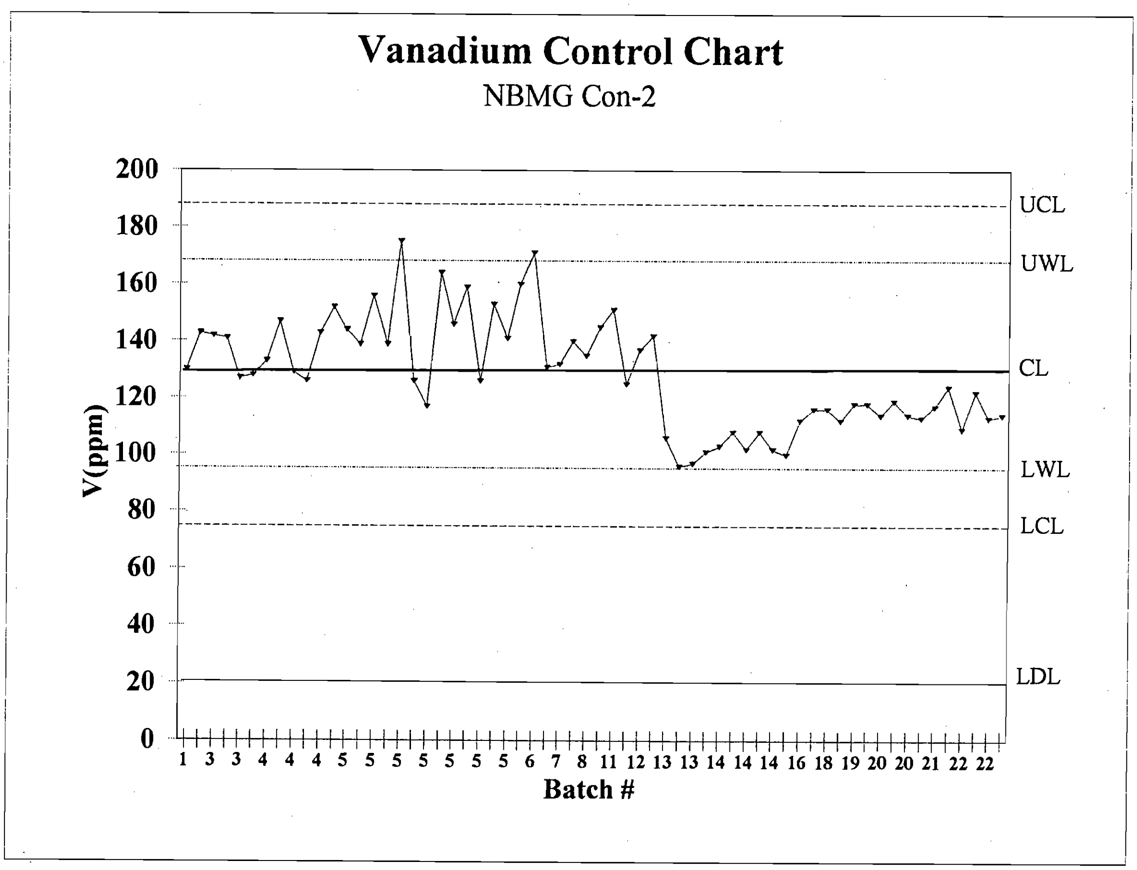


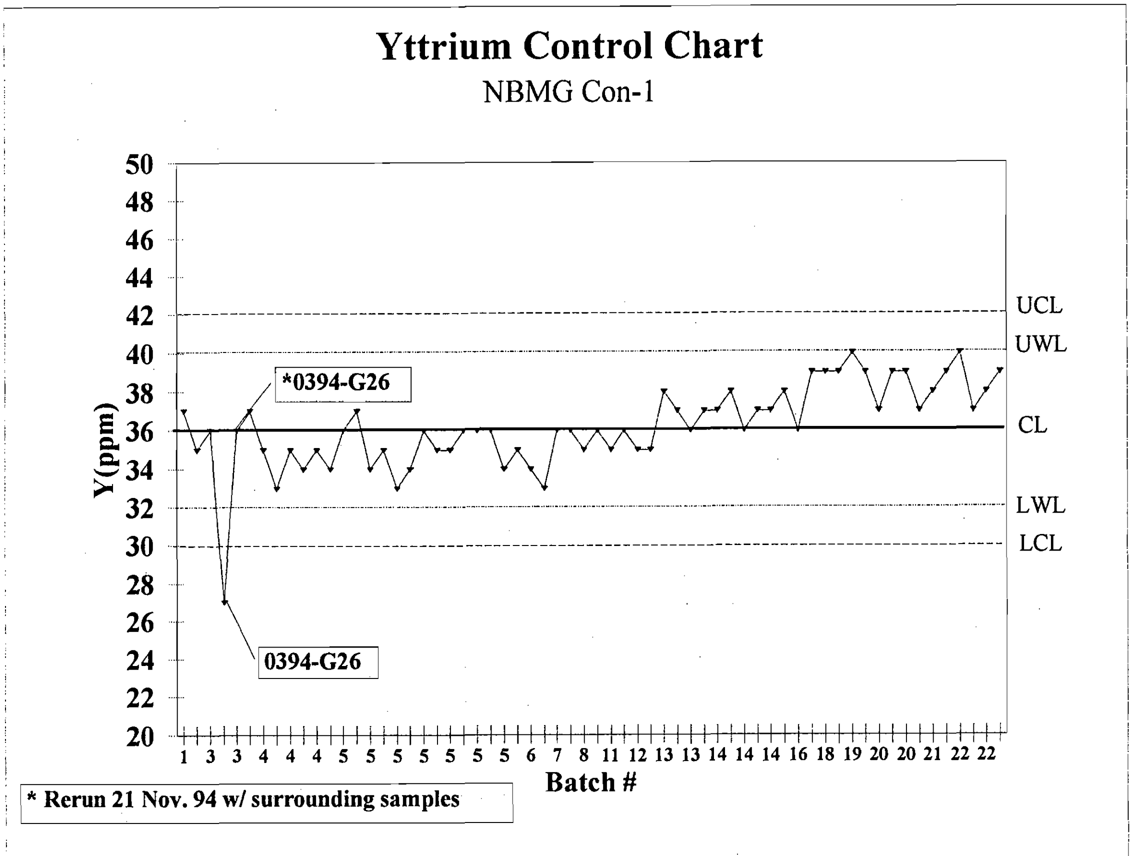
19-Sep-96



19-Sep-96



19-Sep-96



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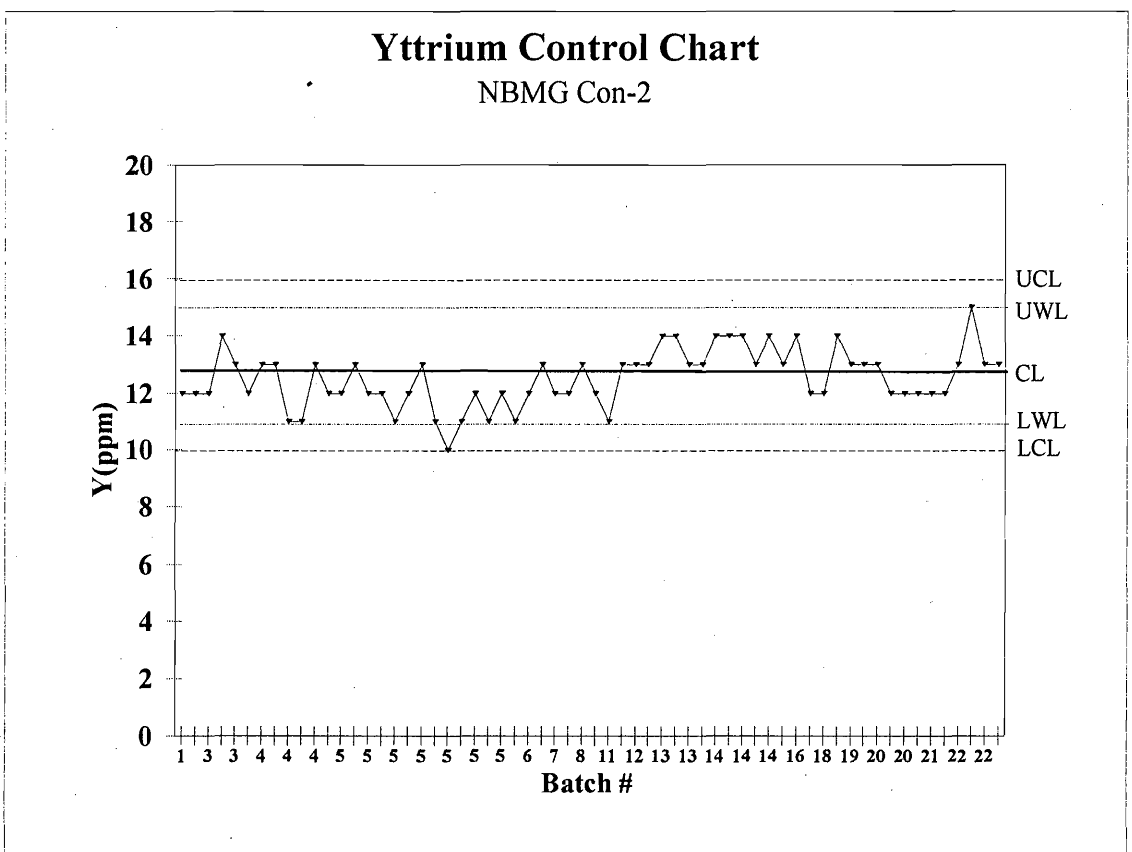

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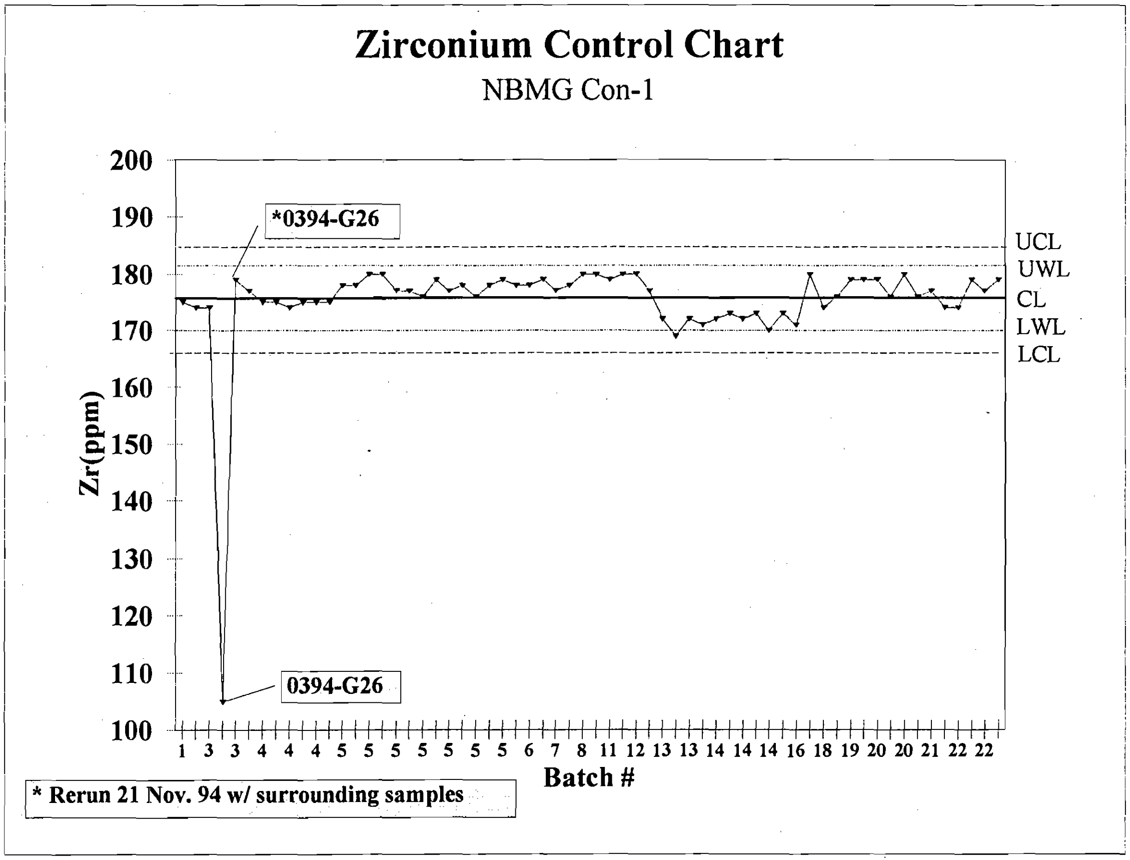

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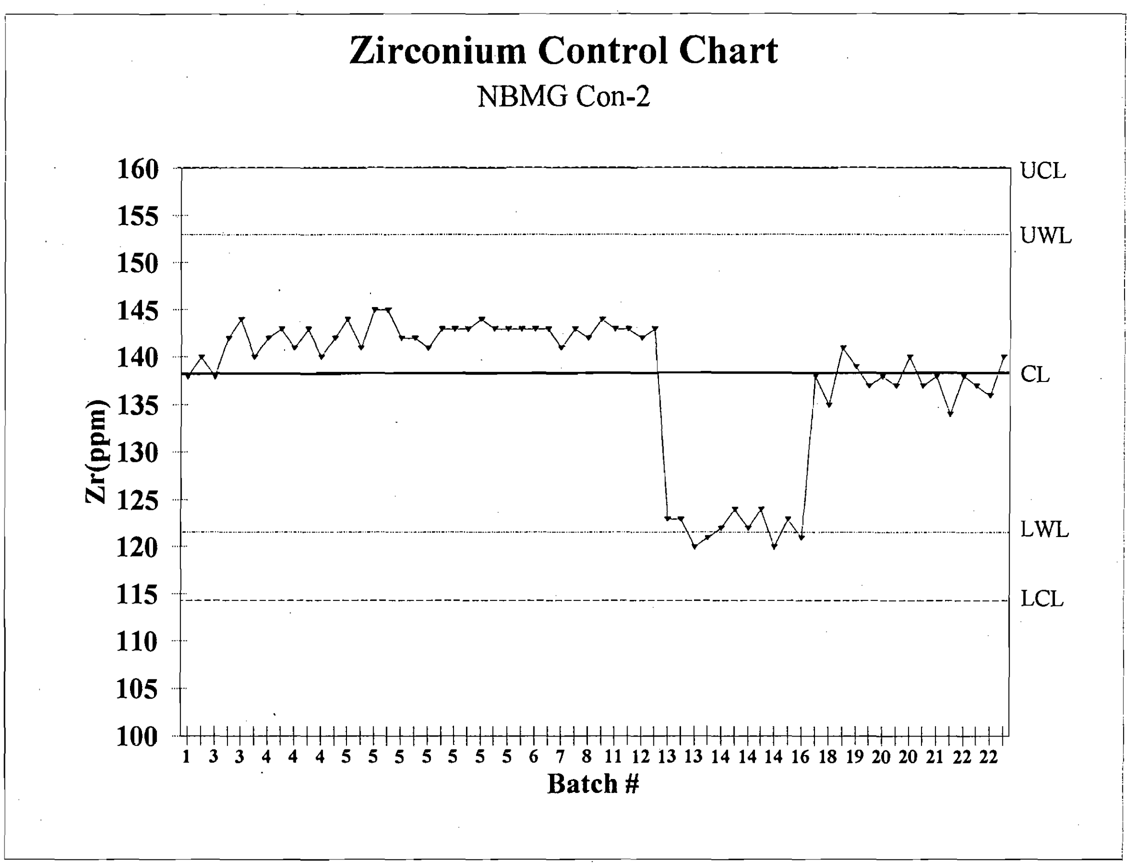


F2. USML control sample analyses and charts

26-Sep-96

USML Sample #	Control	Batch	Ag(ppm)	As(ppm)	Au(ppm)	Bi(ppm)	Cd(ppm)	Cu(ppm)	Ga(ppm)	Mo(ppm)	Pb(ppm)	Sb(ppm)	Se(ppm)
5064	CON-1	1	0.096	5.84	0.0010	0.197	0.600	42.7	2.50	25.20	5.12	0.463	0.219
PC400	CON-1	2	0.079	5.47	0.0000	0.113	0.488	37.8	1.84	21.90	4.02	0.378	0.628
SS 1193-1	CON-1	3	0.112	2.64	0.0003	0.293	0.411	17.6	1.46	4.46	4.76	0.557	0.509
SS 0493-1	CON-1	3	0.118	2.78	0.0003	0.357	0.436	18.2	1.89	4.76	5.00	0.591	0.554
0394-G26	CON-1	3	0.102	8.06	0.0001	0.334	0.613	42.0	2.96	22.40	5.52	1.250	0.845
GSCN-57	CON-1	4	0.128	2.69	0.0007	0.316	0.461	18.8	2.29	4.90	5.08	0.920	0.725
GSCN-102	CON-1	4	0.112	2.41	0.0002	0.281	0.436	18.1	1.71	4.71	4.86	0.811	0.666
GSCN-109	CON-1	4	0.107	2.58	0.0004	0.272	0.429	18.1	1.76	4.65	4.83	0.819	0.647
117567a	CON-1	4	0.112	2.49	0.0000	0.327	0.437	18.2	1.76	4.68	5.22	0.842	0.593
117802a	CON-1	4	0.125	2.15	0.0006	0.281	0.427	18.4	1.65	4.49	4.86	0.823	0.563
117751a	CON-1	4	0.127	2.63	0.0007	0.329	0.433	18.4	1.88	4.70	4.79	0.754	0.508
117809a	CON-1	4	0.113	2.56	0.0009	0.301	0.420	17.8	1.71	4.57	4.63	0.795	0.786
GSCN-111	CON-1	5	0.128	2.71	0.0008	0.336	0.434	18.3	1.79	4.87	5.12	0.842	0.570
GSCN-115	CON-1	5	0.120	2.47	0.0005	0.349	0.437	17.9	1.87	4.82	4.95	0.831	0.702
GSCN-248	CON-1	5	0.114	2.35	0.0007	0.361	0.429	17.2	1.83	4.79	4.64	0.748	0.724
GSCN-250	CON-1	5	0.112	2.60	0.0020	0.365	0.440	18.3	1.98	5.02	5.05	0.808	0.740
117820a	CON-1	5	0.117	2.80	0.0002	0.331	0.448	87.0	1.76	4.92	7.56	0.809	0.441
117835a	CON-1	5	0.125	3.01	0.0009	0.335	0.472	19.3	2.08	5.29	5.25	0.850	0.681
117871a	CON-1	5	0.124	2.60	0.0005	0.352	0.442	17.9	1.72	4.92	4.92	0.815	0.582
117898a	CON-1	5	0.116	2.66	0.0009	0.326	0.456	18.5	1.92	5.09	5.04	0.822	0.626
118276a	CON-1	5	0.130	2.36	0.0020	0.342	0.463	18.9	1.94	5.17	5.16	0.856	0.556
118305a	CON-1	5	0.121	2.67	0.0008	0.322	0.432	17.8	1.89	4.87	4.82	0.839	0.498
118324a	CON-1	5	0.111	2.66	0.0009	0.306	0.452	18.8	1.96	5.07	4.97	0.905	0.643
118354a	CON-1	5	0.124	2.62	0.0000	0.357	0.442	18.2	1.94	4.97	5.00	0.833	0.483
118369a	CON-1	5	0.107	2.30	0.0010	0.330	0.425	17.6	1.81	4.79	4.81	0.812	0.699
117778a	CON-1	6	0.108	3.06	0.0009	0.281	0.420	17.5	1.57	5.00	4.75	0.767	0.565
5064a	CON-1	6	0.119	2.89	0.0008	0.282	0.425	17.7	1.56	5.03	4.67	0.842	0.565
5506a	CON-1	6	0.006	9.88	0.0008	0.312	0.256	5.1	1.74	5.33	2.31	6.160	0.733
5507a	CON-1	7	0.086	3.17	0.0005	0.401	0.481	18.8	1.70	5.19	5.67	0.914	0.889
5417a	CON-1	8	0.012	3.74	0.0004	0.474	-0.338	6.9	1.29	4.65	2.08	1.150	0.719
5437a	CON-1	8	0.018	3.16	0.0010	0.475	-0.256	6.9	1.66	5.18	2.39	1.220	0.631
1194-078a	CON-1	9	0.127	3.30	0.0002	0.489	0.426	17.9	1.75	4.94	5.12	0.807	0.585
5474a	CON-1	11	0.126	2.81	0.0020	0.636	0.419	17.6	1.56	4.63	4.81	0.781	0.417
5065a(R)	CON-1	12	0.118	2.62	0.0004	0.516	0.421	18.0	1.62	4.73	4.93	0.695	0.289
5517a(R)	CON-1	12	0.111	2.66	0.0000	0.398	0.426	16.7	1.48	4.50	4.92	0.715	0.612
5542a(R)	CON-1	12	0.134	2.71	0.0000	0.447	0.410	17.1	1.65	4.48	4.63	0.734	0.584
5151a	CON-1	13	0.123	4.89	0.0010	0.292	0.727	20.2	3.83	5.26	4.92	0.691	0.886
5283a	CON-1	13	0.078	4.80	0.0030	0.416	0.744	20.7	3.93	5.16	5.00	0.726	0.525
5656a	CON-1	13	0.127	4.61	0.0002	0.334	0.701	20.1	3.92	5.12	4.54	0.644	0.893

USML

Sample #	Control	Batch	Ag(ppm)	As(ppm)	Au(ppm)	Bi(ppm)	Cd(ppm)	Cu(ppm)	Ga(ppm)	Mo(ppm)	Pb(ppm)	Sb(ppm)	Se(ppm)
5323a	CON-1	13	0.091	4.04	0.0010	0.406	0.640	19.5	3.86	5.05	4.63	0.681	0.811
5586a	CON-1	14	0.117	4.54	0.0003	0.301	0.585	19.5	3.49	4.57	4.65	0.799	1.430
5196a	CON-1	14	0.126	4.62	0.0010	0.343	0.618	19.9	3.64	4.66	4.68	0.792	1.460
5605a	CON-1	14	0.126	5.08	0.0004	0.309	0.654	20.2	3.92	4.68	4.65	0.852	1.620
5671a	CON-1	14	0.112	3.88	0.0010	0.326	0.525	18.7	3.13	4.32	4.18	0.752	1.340
5737a	CON-1	14	0.105	4.54	0.0007	0.355	0.606	21.3	3.72	4.92	4.97	0.856	1.840
5353a	CON-1	15	<0.015	3.14	0.0010	0.244	0.593	19.9	3.89	4.77	-0.38	-0.033	1.550
5747a	CON-1	16	0.113	4.21	0.0005	0.323	0.551	20.4	4.46	5.08	4.55	0.759	1.100
5717a	CON-1	17	0.089	4.07	0.0002	0.323	0.511	18.8	3.67	4.52	4.12	0.727	1.080
117609a	CON-1	18	0.131	6.03	0.0003	0.348	0.517	19.0	3.30	4.94	4.98	1.110	1.090
SS0695-087a	CON-1	18	0.128	5.51	0.0006	0.332	0.501	17.9	3.29	4.71	4.46	0.797	0.950
5726a	CON-1	19	0.141	4.63	0.0010	0.452	0.589	18.8	3.02	5.11	4.76	0.800	0.997
5908a	CON-1	19	0.130	5.32	0.0009	0.327	0.624	19.5	3.48	5.58	5.03	0.857	1.060
117699a	CON-1	20	0.133	5.23	0.0010	0.315	0.602	19.4	3.61	5.46	4.95	0.762	1.300
117724a	CON-1	20	0.118	5.34	0.0006	0.380	0.608	18.1	3.16	5.32	7.23	0.970	1.090
117920a	CON-1	20	0.128	5.10	0.0004	0.322	0.579	18.3	3.52	5.15	4.30	0.785	1.250
441SSa	CON-1	21	0.129	4.19	0.0000	0.356	0.583	18.5	3.45	5.11	4.51	0.724	0.665
3011(A)a	CON-1	21	0.158	4.93	0.0008	0.322	0.588	18.5	3.54	5.20	4.85	0.784	1.050
5839a	CON-1	22	0.087	2.53	0.0004	0.269	0.388	15.3	1.57	5.44	3.80	0.609	0.680
GSCN-122a	CON-1	22	0.099	2.67	0.0020	0.290	0.430	16.2	2.10	6.25	4.24	0.720	0.754
5374a	CON-1	22	0.095	2.52	0.0020	0.267	0.399	16.0	1.99	5.70	3.94	0.651	0.790
5399a	CON-1	22	0.094	2.75	0.0003	0.267	0.407	16.2	1.99	5.95	3.73	0.678	0.995
5924a	CON-1	22	0.095	2.73	0.0010	0.310	0.420	16.6	2.03	6.17	4.02	0.697	0.706
Mean:	CON-1		0.108	3.68	0.0007	0.340	0.470	20.0	2.44	5.87	4.64	0.867	0.801
Standard Deviation:	CON-1		0.030	1.47	0.0006	0.076	0.169	10.3	0.89	3.93	1.04	0.700	0.327
2 Sigma	CON-1		0.169	6.62	0.0019	0.491	0.809	40.6	4.22	13.73	6.72	2.268	1.455
3 sigma	CON-1		0.199	8.09	0.0025	0.567	0.978	50.9	5.12	17.67	7.75	2.968	1.781

USML

Sample #	Control	Batch	Ag(ppm)	As(ppm)	Au(ppm)	Bi(ppm)	Cd(ppm)	Cu(ppm)	Ga(ppm)	Mo(ppm)	Pb(ppm)	Sb(ppm)	Se(ppm)
5065	CON-2	1	0.050	1.20	0.0005	0.664	0.065	23.0	1.87	1.38	2.58	0.183	0.000
PCL477	CON-2	2	0.051	1.41	0.0003	0.712	0.064	21.7	1.64	1.35	2.50	0.301	0.000
SS 1193-2	CON-2	3	0.057	1.06	0.0000	0.743	0.064	23.8	1.94	1.28	2.56	0.213	0.235
SS 0493-2	CON-2	3	0.056	0.87	0.0000	0.767	0.066	22.7	1.90	1.24	2.30	0.133	0.135
0394-G27	CON-2	3	0.055	2.09	0.0000	0.779	0.075	24.4	2.05	1.36	3.43	0.127	0.185
GSCN-58	CON-2	4	0.006	0.19	0.0008	-0.022	0.024	0.8	0.31	0.47	0.94	0.220	0.242
GSCN-103	CON-2	4	0.054	1.08	0.0000	0.711	0.066	25.2	1.95	1.27	2.58	0.455	0.213
GSCN-110	CON-2	4	0.057	0.97	0.0000	0.673	0.061	25.0	2.09	1.16	2.46	0.390	0.237
117567b	CON-2	4	0.058	1.21	0.0010	0.816	0.067	25.9	2.22	1.40	2.69	0.408	0.228

USML Sample #	Control	Batch	Ag(ppm)	As(ppm)	Au(ppm)	Bi(ppm)	Cd(ppm)	Cu(ppm)	Ga(ppm)	Mo(ppm)	Pb(ppm)	Sb(ppm)	Se(ppm)
117802b	CON-2	4	0.056	1.14	0.0000	0.820	0.070	24.7	2.03	1.36	2.61	0.418	0.115
117751b	CON-2	4	0.057	0.75	0.0000	0.746	0.061	23.8	2.01	1.27	2.48	0.353	-0.029
117809b	CON-2	4	0.054	0.91	0.0000	0.738	0.062	24.9	2.09	1.35	2.54	0.378	0.214
GSCN-112	CON-2	5	0.040	0.77	0.0009	0.010	0.051	23.8	2.57	1.19	1.72	0.320	0.120
GSCN-116	CON-2	5	0.036	0.97	0.0007	0.011	0.055	24.1	2.72	1.13	1.91	0.307	-0.019
GSCN-249	CON-2	5	0.033	0.82	0.0010	0.039	0.054	24.5	2.78	1.05	1.86	0.347	0.182
GSCN-251	CON-2	5	0.037	0.83	0.0010	0.053	0.053	23.9	2.49	1.21	1.84	0.310	0.130
117820b	CON-2	5	0.035	1.32	0.0000	0.056	0.057	24.3	2.70	1.38	1.86	0.379	0.032
117835b	CON-2	5	0.032	0.83	0.0008	0.030	0.054	24.6	2.66	1.21	1.86	0.330	0.212
117871b	CON-2	5	0.034	1.17	0.0006	0.094	0.053	24.8	2.59	1.41	2.02	0.342	0.064
117898b	CON-2	5	0.030	0.99	0.0004	0.032	0.054	24.5	2.74	1.12	1.88	0.303	0.207
118276b	CON-2	5	0.032	0.63	0.0020	0.080	0.052	30.9	2.68	1.41	2.07	0.376	0.126
118305b	CON-2	5	0.035	0.77	0.0005	0.089	0.049	24.4	2.72	1.25	1.86	0.395	0.110
118324b	CON-2	5	0.037	0.74	0.0020	0.054	0.055	25.7	2.82	1.35	1.89	0.389	0.278
118354b	CON-2	5	0.041	0.92	0.0020	0.033	0.055	25.8	2.96	1.32	2.02	0.337	0.146
118369b	CON-2	5	0.031	0.86	0.0020	0.068	0.057	25.6	2.85	1.39	1.97	0.350	0.142
117778b	CON-2	6	0.025	0.77	0.0004	0.035	0.054	24.8	2.55	1.43	1.87	0.338	0.325
5064b	CON-2	6	0.031	0.92	0.0090	0.035	0.051	23.8	2.46	1.40	1.71	0.351	0.131
5506b	CON-2	6	0.004	1.50	0.0005	0.051	0.000	21.4	2.59	1.45	1.56	-0.048	0.127
5507b	CON-2	7	0.020	1.30	0.0000	0.081	0.171	24.3	2.45	1.38	2.26	0.363	0.040
5417b	CON-2	8	0.015	1.65	0.0000	0.198	-0.149	21.6	2.34	1.36	2.32	0.377	0.230
5437b	CON-2	8	0.017	1.66	0.0009	0.203	-0.173	21.8	2.41	1.36	1.76	0.391	0.126
1194-078b	CON-2	9	0.036	1.48	0.0020	0.203	0.053	23.5	2.48	1.36	1.79	0.368	0.208
5474b	CON-2	11	0.054	1.20	0.0009	0.439	0.051	23.7	2.45	1.32	1.94	0.354	-0.009
5065b(R)	CON-2	12	0.041	0.96	0.0004	0.221	0.042	23.6	2.55	1.44	1.82	0.302	-0.196
5517b(R)	CON-2	12	0.034	1.01	0.0000	0.137	0.048	21.7	2.00	1.18	1.65	0.240	0.037
5542b(R)	CON-2	12	0.022	0.86	0.0000	0.166	0.044	23.7	2.60	1.34	1.81	0.219	0.049
5151b	CON-2	13	0.046	1.28	0.0005	0.143	0.052	25.3	2.70	1.31	1.93	0.334	0.091
5283b	CON-2	13	0.035	0.84	0.0030	0.265	0.058	25.3	2.74	1.28	2.00	0.233	-0.328
5656b	CON-2	13	0.050	0.98	0.0007	0.210	0.055	25.3	3.01	1.22	1.84	0.291	0.005
5323b	CON-2	13	0.033	1.02	0.0008	0.256	0.060	27.0	3.25	1.32	2.16	0.280	-0.088
5586b	CON-2	14	0.039	1.26	0.0006	0.193	0.051	23.3	2.60	1.15	1.90	0.373	0.311
5196b	CON-2	14	0.044	1.54	0.0005	0.210	0.060	24.3	2.73	1.19	2.00	0.400	0.397
5605b	CON-2	14	0.041	1.55	0.0000	0.199	0.056	23.8	2.56	1.20	1.65	0.410	0.295
5671b	CON-2	14	0.043	1.50	0.0010	0.195	0.056	24.0	2.63	1.14	1.64	0.397	0.264
5737b	CON-2	14	0.029	1.61	0.0007	0.153	0.048	25.2	2.87	0.95	1.86	0.316	0.550
5353b	CON-2	15	<0.015	1.41	0.0010	0.140	0.055	25.2	2.97	0.93	1.24	-0.082	0.281
5747b	CON-2	16	0.040	1.07	0.0006	0.217	0.059	25.2	3.27	1.19	1.99	0.362	0.207
5717b	CON-2	17	0.034	1.54	0.0005	0.225	0.057	22.9	2.74	0.86	1.48	0.231	0.052

USML													
Sample #	Control	Batch	Ag(ppm)	As(ppm)	Au(ppm)	Bi(ppm)	Cd(ppm)	Cu(ppm)	Ga(ppm)	Mo(ppm)	Pb(ppm)	Sb(ppm)	Se(ppm)
117609b	CON-2	18	0.048	1.47	0.0002	0.224	0.050	21.2	2.00	1.43	2.58	0.806	0.006
SS0695-087b	CON-2	18	0.043	1.87	0.0003	0.216	0.044	21.0	2.06	1.78	2.28	0.353	0.019
5726b	CON-2	19	0.057	0.42	0.0009	0.409	0.055	20.0	2.11	1.12	2.45	0.416	-0.391
5908b	CON-2	19	0.047	1.09	0.0006	0.237	0.053	23.1	2.26	1.18	2.92	0.385	0.032
117699b	CON-2	20	0.043	1.47	0.0010	0.175	0.052	23.2	2.28	1.31	2.87	0.373	0.359
117724b	CON-2	20	0.049	1.17	0.0004	0.315	0.057	18.8	1.82	1.15	4.17	0.424	0.077
117920b	CON-2	20	0.050	0.30	0.0000	0.285	0.049	19.2	1.96	1.13	2.00	0.382	-0.420
441SSb	CON-2	21	0.039	1.13	0.0007	0.253	0.039	20.7	2.05	1.23	2.63	0.319	0.175
3011(A)b	CON-2	21	0.032	1.91	0.0006	0.192	0.045	20.2	1.99	1.12	2.53	0.268	0.809
5839b	CON-2	22	0.030	1.04	0.0006	0.206	0.046	21.5	2.08	1.20	1.93	0.374	-0.054
GSCN-122b	CON-2	22	0.028	1.22	0.0005	0.173	0.044	21.8	2.37	1.09	1.93	0.347	0.169
5374b	CON-2	22	0.036	1.25	0.0003	0.210	0.045	22.1	2.30	1.12	1.83	0.407	0.131
5399b	CON-2	22	0.033	1.15	0.0000	0.197	0.045	22.8	2.19	1.20	1.67	0.398	0.300
5924b	CON-2	22	0.038	0.91	0.0006	0.201	0.048	23.0	2.33	1.26	1.82	0.380	-0.016
Mean:	CON-2		0.038	1.13	0.0008	0.262	0.048	23.3	2.39	1.25	2.10	0.331	0.126
Standard Deviation:	CON-2		0.013	0.36	0.0012	0.242	0.042	3.5	0.45	0.18	0.50	0.116	0.190
2 Sigma	CON-2		0.064	1.86	0.0032	0.745	0.133	30.2	3.29	1.60	3.10	0.563	0.507
3 sigma	CON-2		0.078	2.22	0.0044	0.987	0.175	33.7	3.74	1.77	3.60	0.679	0.697

USML				
Sample #	Control	Te(ppm)	Tl(ppm)	Zn(ppm)
5064	CON-1	0.106	0.323	146.0
PC400	CON-1	0.148	0.138	122.0
SS 1193-1	CON-1	0.132	0.226	75.4
SS 0493-1	CON-1	0.175	0.167	78.8
0394-G26	CON-1	0.234	0.247	147.0
GSCN-57	CON-1	0.203	0.151	79.1
GSCN-102	CON-1	0.143	0.165	77.5
GSCN-109	CON-1	0.224	0.212	77.5
117567a	CON-1	0.150	0.338	80.4
117802a	CON-1	0.215	0.224	73.7
117751a	CON-1	0.158	0.380	81.1
117809a	CON-1	0.192	0.220	77.5
GSCN-111	CON-1	0.171	0.121	82.8
GSCN-115	CON-1	0.193	0.528	81.8
GSCN-248	CON-1	0.207	0.451	78.6
GSCN-250	CON-1	0.173	0.216	82.6
117820a	CON-1	0.184	0.441	117.0
117835a	CON-1	0.178	0.353	83.3
117871a	CON-1	0.234	0.470	78.4
117898a	CON-1	0.218	0.440	81.2
118276a	CON-1	0.239	0.306	82.7
118305a	CON-1	0.180	0.244	78.7
118324a	CON-1	0.178	0.102	82.8
118354a	CON-1	0.190	0.292	79.7
118369a	CON-1	0.212	0.341	77.9
117778a	CON-1	0.174	0.191	77.1
5064a	CON-1	0.173	0.142	79.3
5506a	CON-1	0.167	0.219	79.1
5507a	CON-1	0.217	0.385	80.5
5417a	CON-1	0.226	0.443	50.1
5437a	CON-1	0.212	0.235	55.1
1194-078a	CON-1	0.210	0.349	76.1
5474a	CON-1	0.245	0.765	75.9
5065a(R)	CON-1	0.073	0.423	76.6
5517a(R)	CON-1	0.155	0.150	76.6
5542a(R)	CON-1	0.110	0.255	74.0
5151a	CON-1	0.038	0.173	159.0
5283a	CON-1	0.011	0.785	157.0
5656a	CON-1	0.161	0.622	156.0

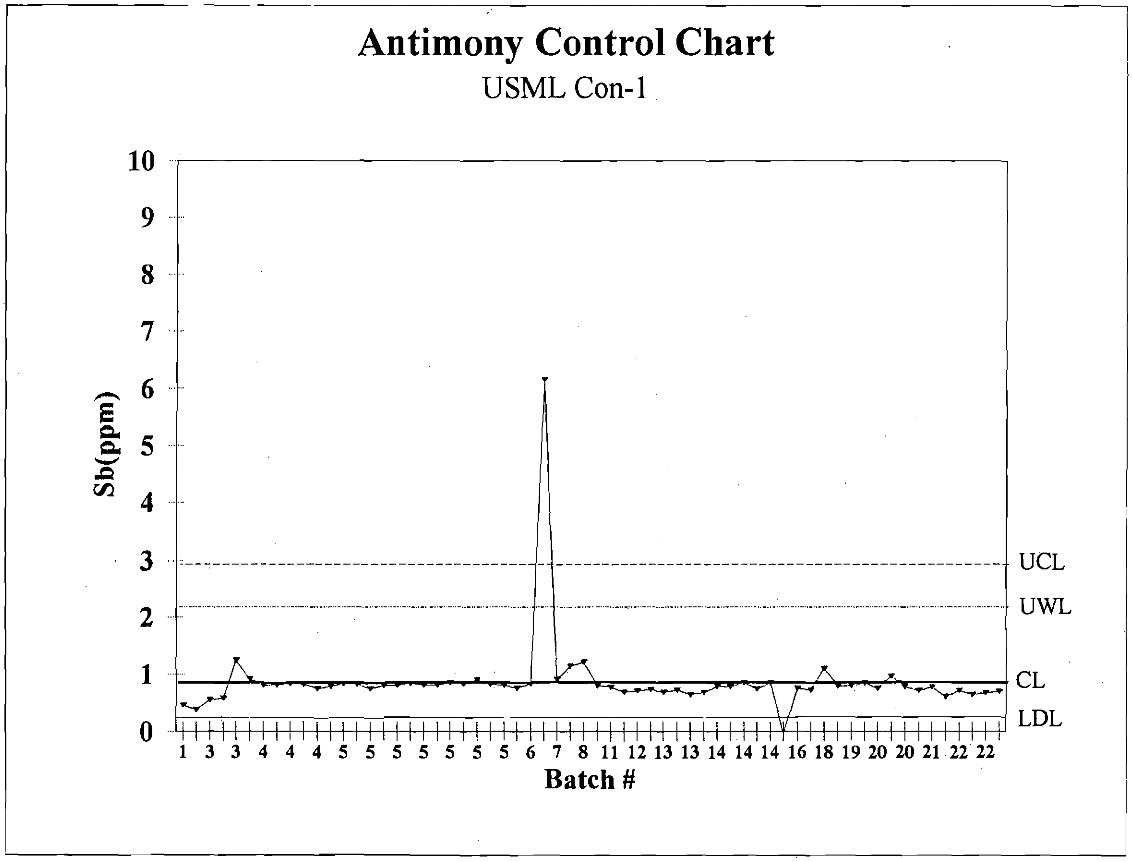
USML				
Sample #	Control	Te(ppm)	Tl(ppm)	Zn(ppm)
5323a	CON-1	0.167	0.808	142.0
5586a	CON-1	0.165	0.344	130.0
5196a	CON-1	0.214	0.458	136.0
5605a	CON-1	0.222	0.320	144.0
5671a	CON-1	0.201	0.368	117.0
5737a	CON-1	0.198	0.341	141.0
5353a	CON-1	0.260	0.258	134.0
5747a	CON-1	0.190	0.383	114.0
5717a	CON-1	0.111	0.493	113.0
117609a	CON-1	0.181	0.355	120.0
SS0695-087a	CON-1	0.146	0.625	116.0
5726a	CON-1	0.175	0.779	126.0
5908a	CON-1	0.168	0.276	136.0
117699a	CON-1	0.130	0.303	130.0
117724a	CON-1	0.244	0.468	128.0
117920a	CON-1	0.179	0.311	124.0
441SSa	CON-1	0.089	0.578	126.0
3011(A)a	CON-1	0.137	0.528	129.0
5839a	CON-1	0.134	0.248	76.6
GSCN-122a	CON-1	0.216	0.152	88.0
5374a	CON-1	0.122	0.209	79.4
5399a	CON-1	0.147	0.222	84.2
5924a	CON-1	0.184	0.355	86.3
Mean:	CON-1	0.174	0.345	99.9
Standard Deviation:	CON-1	0.048	0.170	28.5
2 Sigma	CON-1	0.270	0.685	157.0
3 sigma	CON-1	0.318	0.855	185.5

USML				
Sample #	Control	Te(ppm)	Tl(ppm)	Zn(ppm)
5065	CON-2	0.023	0.421	40.4
PCL477	CON-2	0.107	0.287	36.7
SS 1193-2	CON-2	0.170	0.117	41.3
SS 0493-2	CON-2	0.175	0.163	40.1
0394-G27	CON-2	0.167	0.153	41.7
GSCN-58	CON-2	0.181	0.215	6.0
GSCN-103	CON-2	0.175	0.198	43.3
GSCN-110	CON-2	0.151	0.210	43.2
117567b	CON-2	0.108	0.280	44.7

USML				
Sample #	Control	Te(ppm)	Tl(ppm)	Zn(ppm)
117802b	CON-2	0.175	0.372	43.8
117751b	CON-2	0.150	0.255	43.4
117809b	CON-2	0.137	0.140	44.3
GSCN-112	CON-2	0.136	0.378	47.1
GSCN-116	CON-2	0.174	0.447	48.0
GSCN-249	CON-2	0.192	0.479	48.1
GSCN-251	CON-2	0.139	0.431	46.7
117820b	CON-2	0.182	0.426	45.6
117835b	CON-2	0.148	0.322	46.0
117871b	CON-2	0.112	0.441	46.5
117898b	CON-2	0.113	0.350	46.8
118276b	CON-2	0.203	0.505	49.2
118305b	CON-2	0.123	0.118	46.5
118324b	CON-2	0.184	0.226	48.6
118354b	CON-2	0.159	0.190	47.8
118369b	CON-2	0.144	0.218	48.1
117778b	CON-2	0.148	0.331	46.3
5064b	CON-2	0.114	0.263	45.3
5506b	CON-2	0.192	0.236	46.3
5507b	CON-2	0.105	0.365	45.1
5417b	CON-2	0.195	0.415	34.5
5437b	CON-2	0.170	0.226	34.7
1194-078b	CON-2	0.126	0.399	42.4
5474b	CON-2	0.229	0.707	43.7
5065b(R)	CON-2	0.017	0.434	43.7
5517b(R)	CON-2	0.100	0.225	40.7
5542b(R)	CON-2	0.119	0.308	43.8
5151b	CON-2	0.066	0.385	47.2
5283b	CON-2	0.043	0.797	45.9
5656b	CON-2	0.095	0.694	47.9
5323b	CON-2	0.051	0.637	50.6
5586b	CON-2	0.162	0.325	45.1
5196b	CON-2	0.222	0.261	46.0
5605b	CON-2	0.127	0.357	44.7
5671b	CON-2	0.197	0.254	45.7
5737b	CON-2	0.130	0.382	49.7
5353b	CON-2	0.240	0.351	49.9
5747b	CON-2	0.151	0.203	44.8
5717b	CON-2	0.133	0.586	44.0

USML				
Sample #	Control	Te(ppm)	Tl(ppm)	Zn(ppm)
117609b	CON-2	0.125	0.348	43.2
SS0695-087b	CON-2	0.183	0.473	44.1
5726b	CON-2	0.158	0.844	39.5
5908b	CON-2	0.093	0.432	46.4
117699b	CON-2	0.146	0.226	46.1
117724b	CON-2	0.190	0.580	40.7
117920b	CON-2	0.098	0.424	39.8
441SSb	CON-2	0.096	0.500	42.2
3011(A)b	CON-2	0.184	0.199	41.7
5839b	CON-2	0.159	0.212	37.0
GSCN-122b	CON-2	0.160	0.212	40.8
5374b	CON-2	0.179	0.352	38.1
5399b	CON-2	0.119	0.286	40.6
5924b	CON-2	0.157	0.201	41.4
Mean:	CON-2	0.144	0.351	43.4
Standard Deviation:	CON-2	0.046	0.160	6.0
2 Sigma	CON-2	0.236	0.671	55.4
3 sigma	CON-2	0.282	0.831	61.4

25-Sep-96



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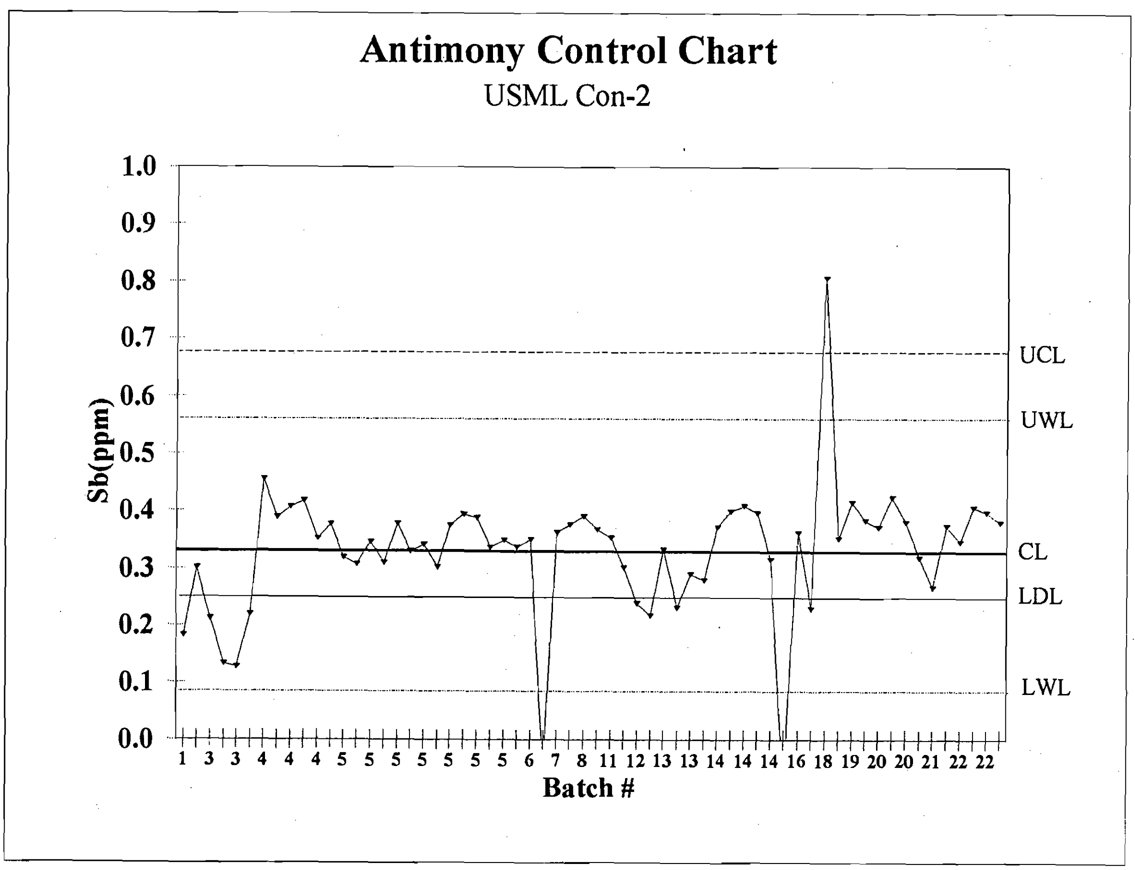

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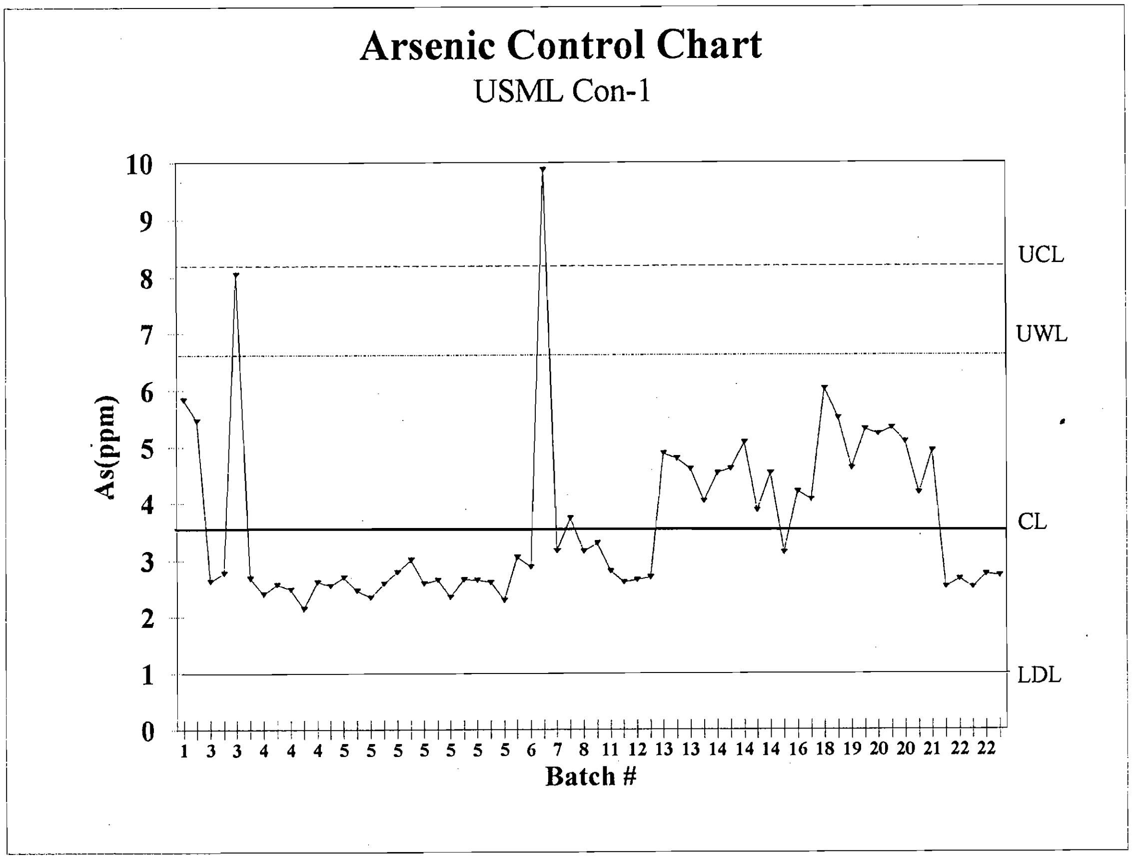

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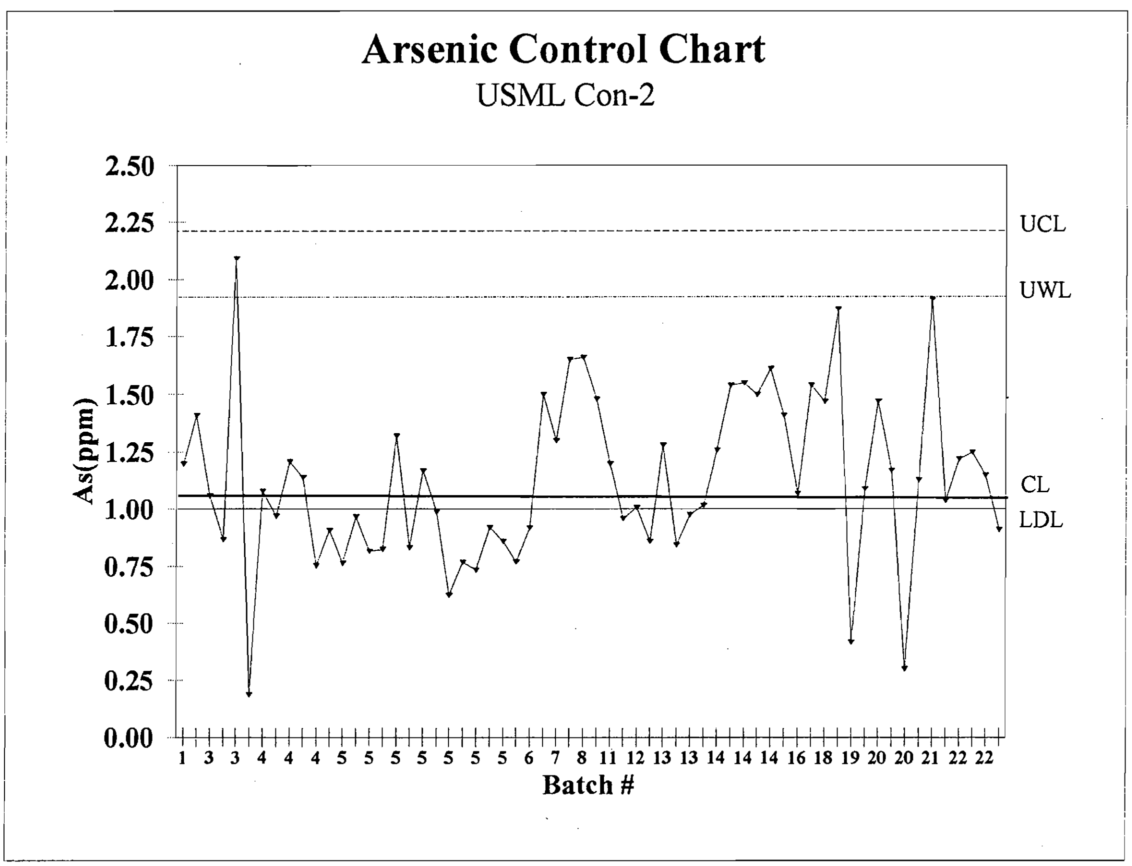

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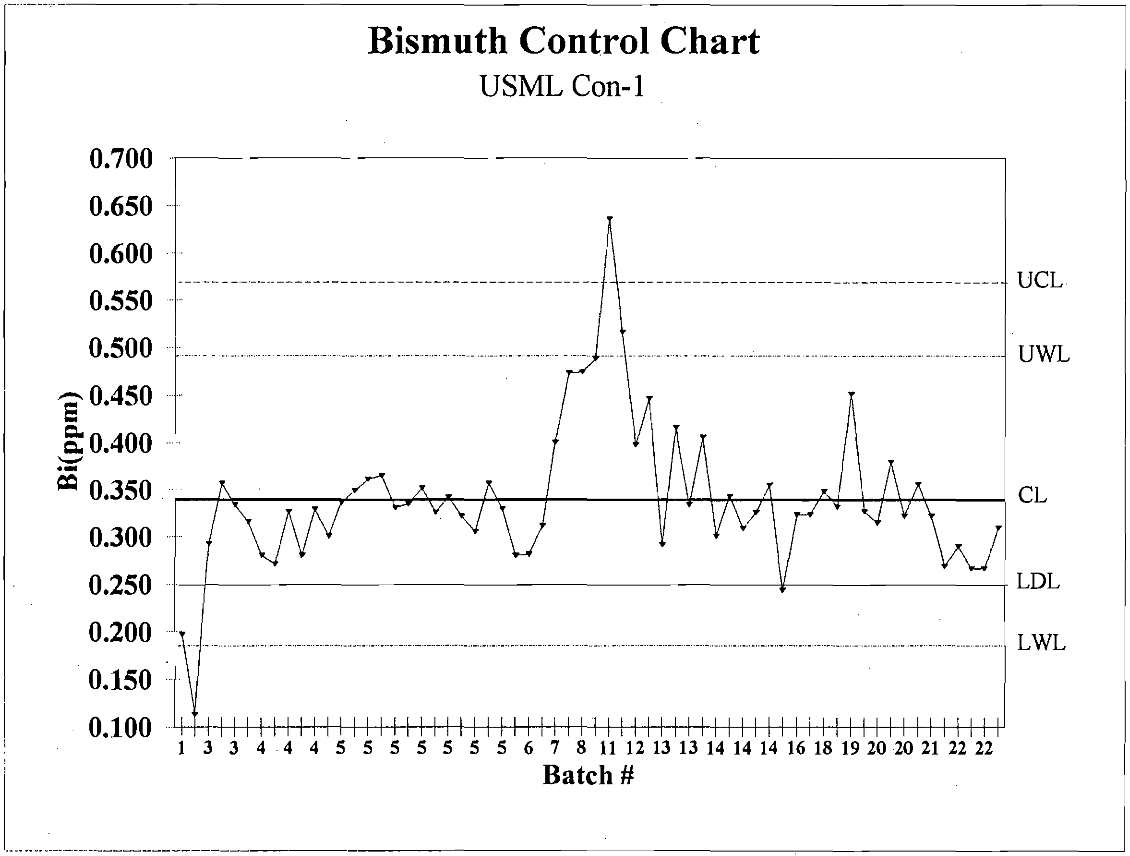

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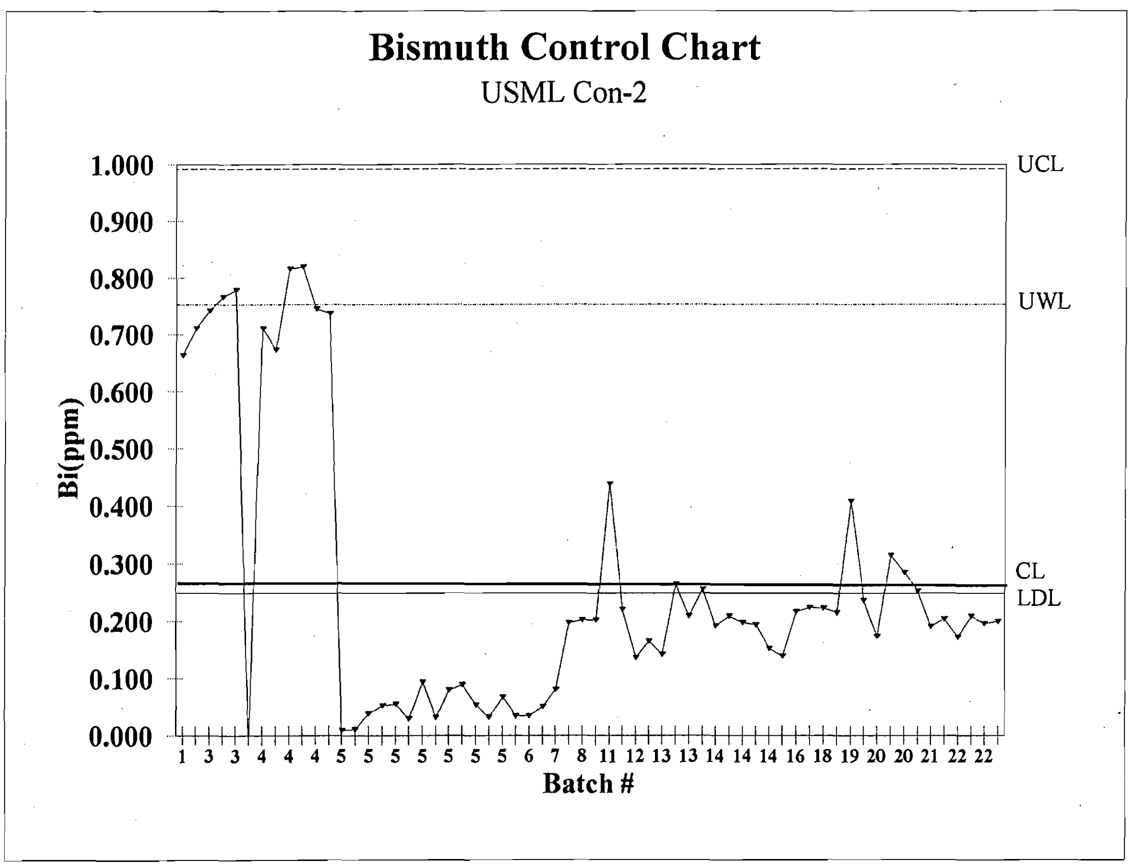
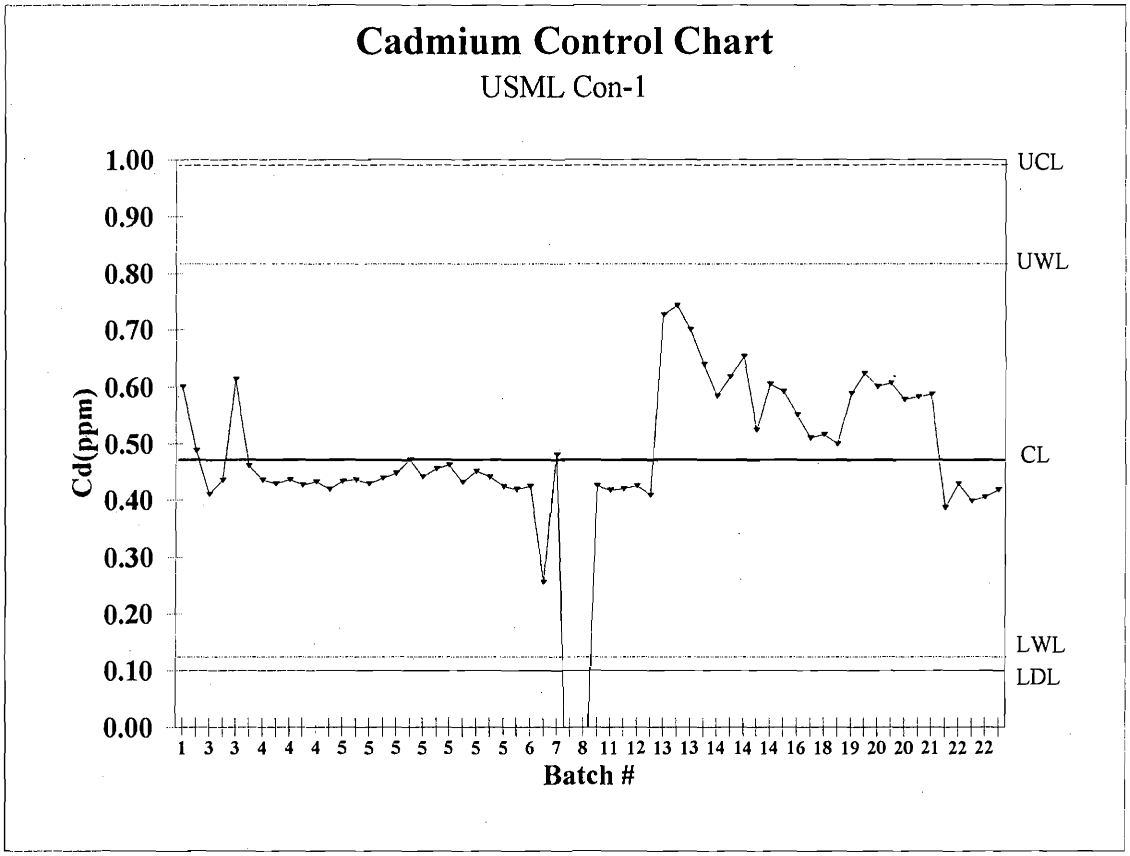
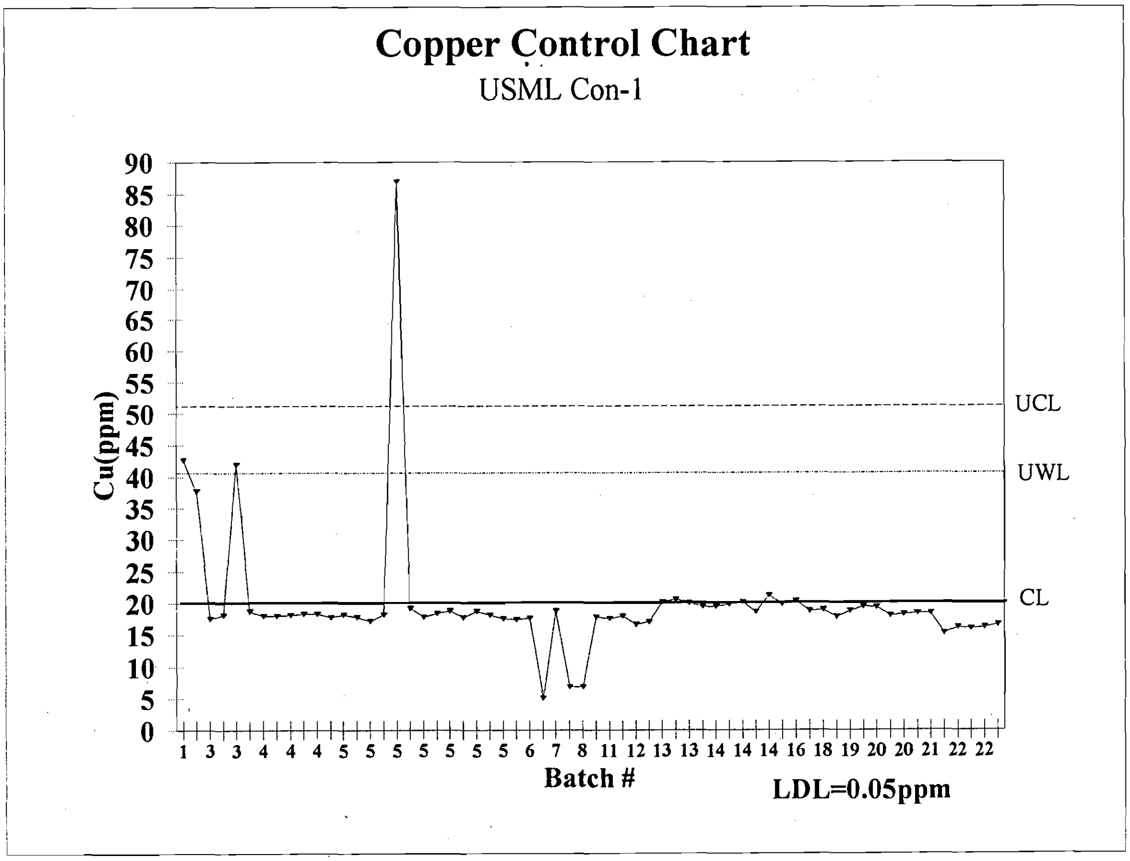




Cadmium Control Chart
USML Con-1
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Cd(ppm)
UCL
UWL
CL
LWL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

25-Sep-96



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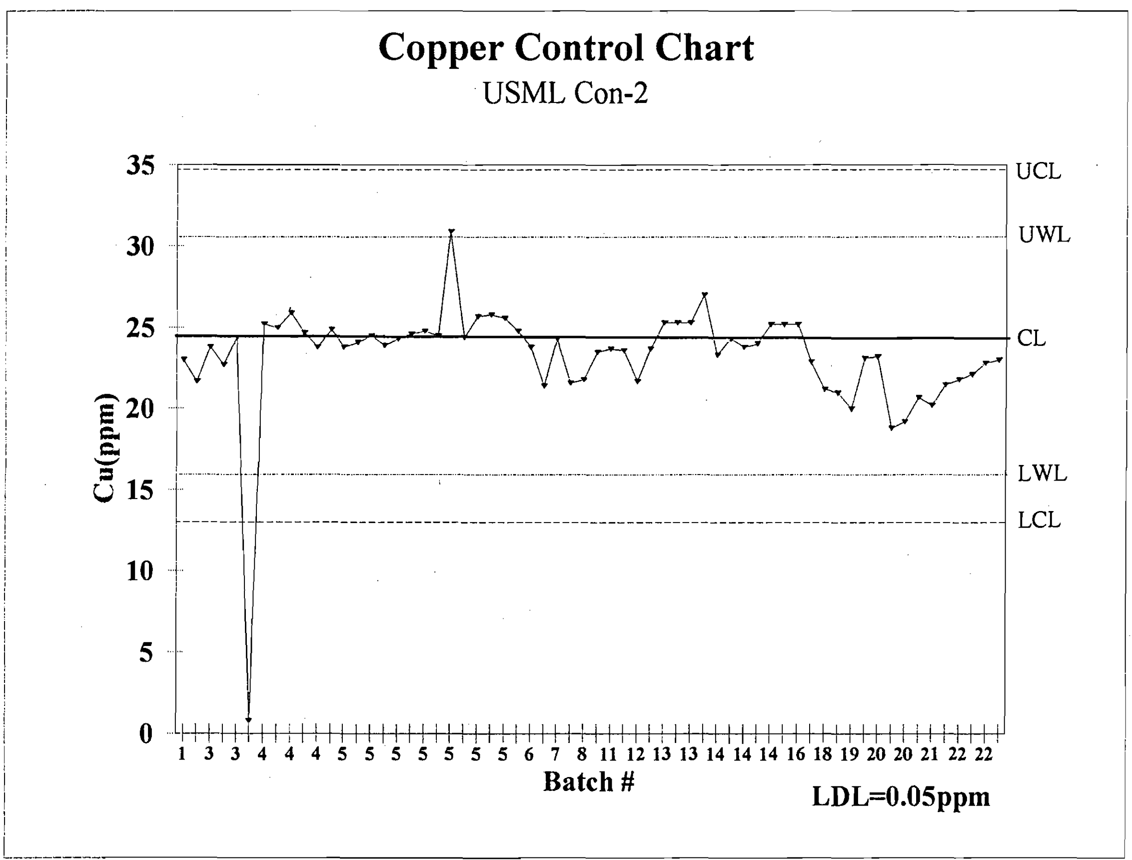

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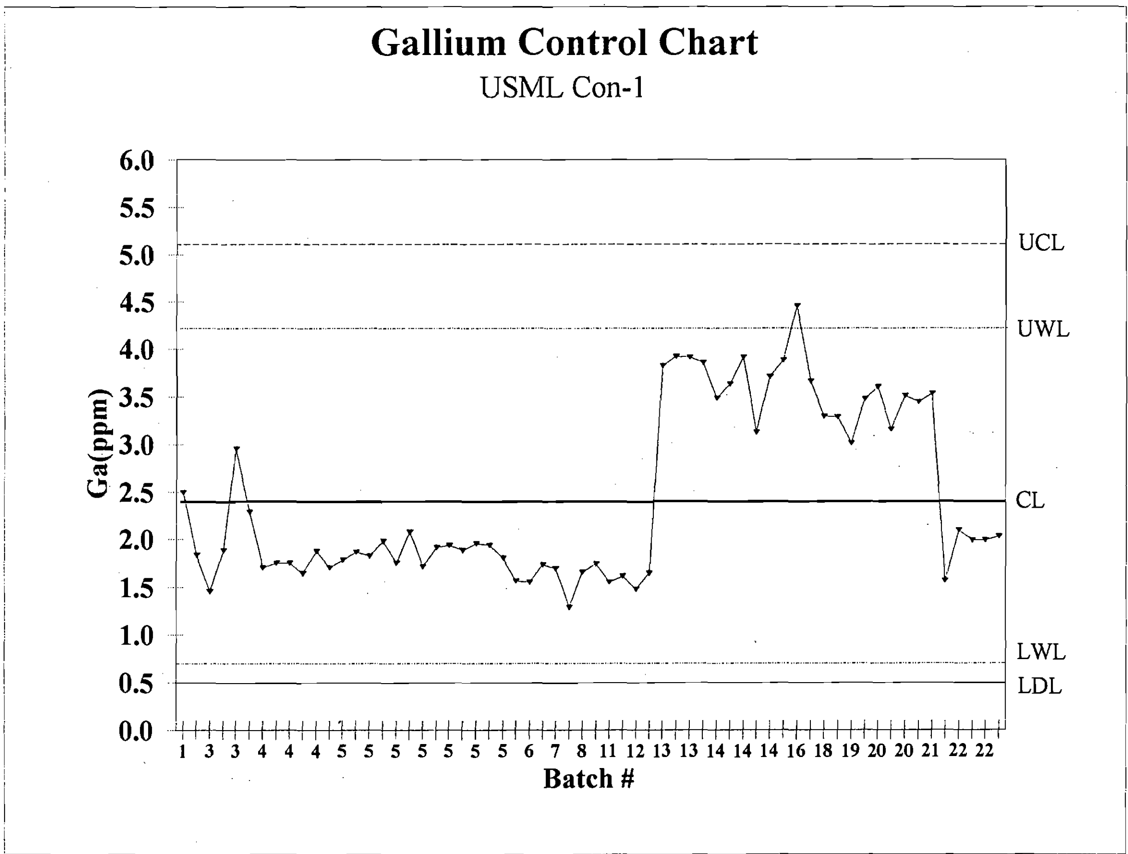
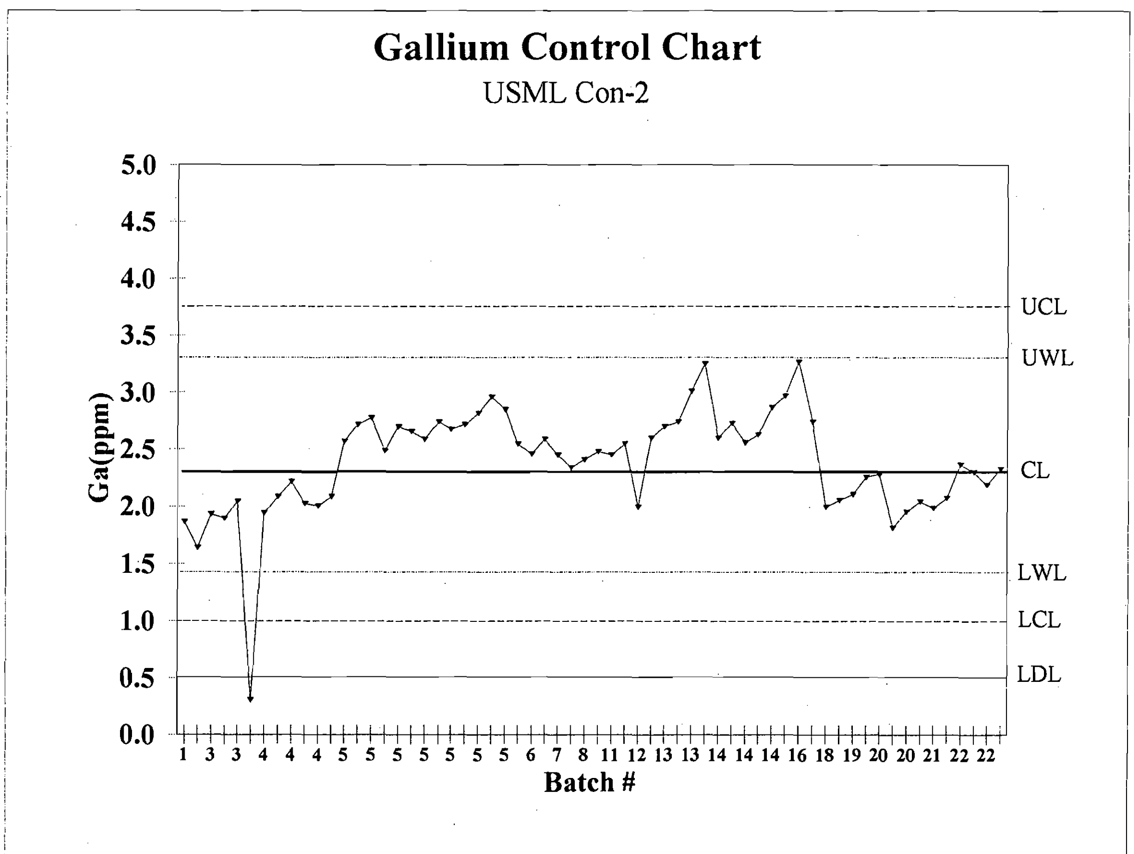
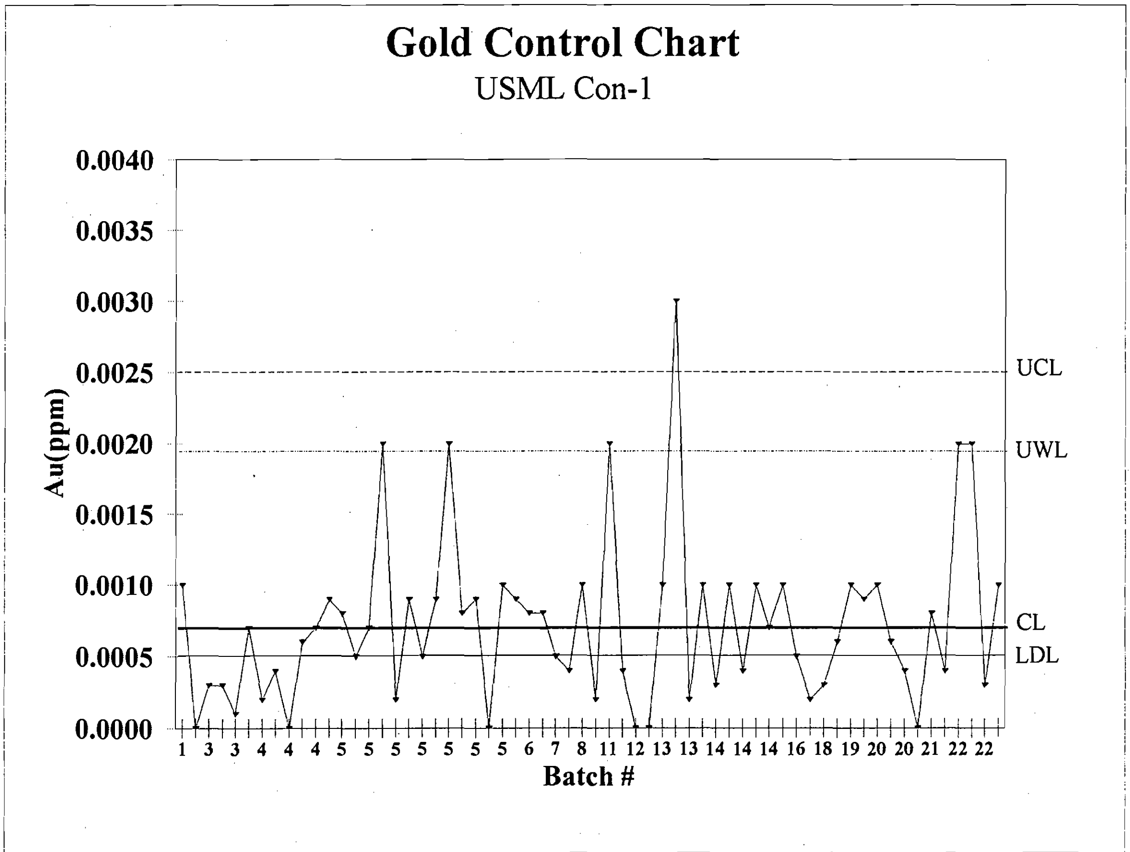
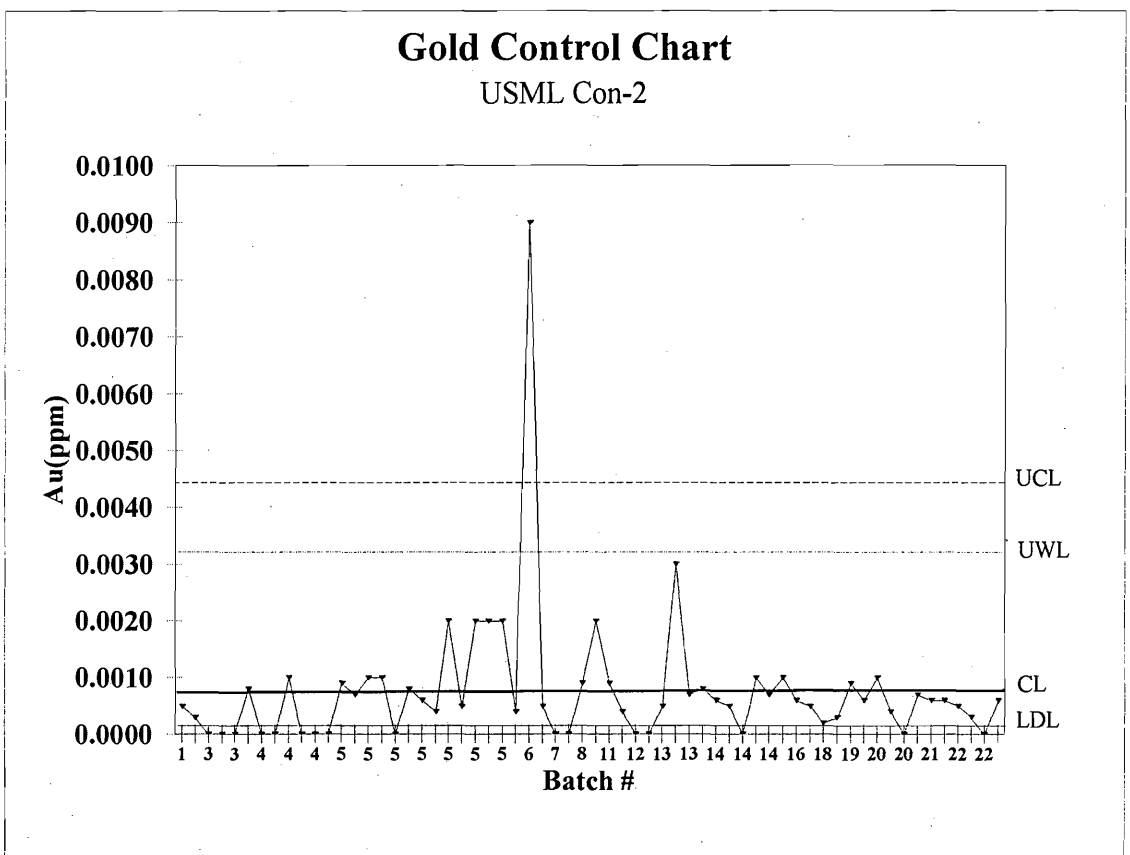


25-Sep-96

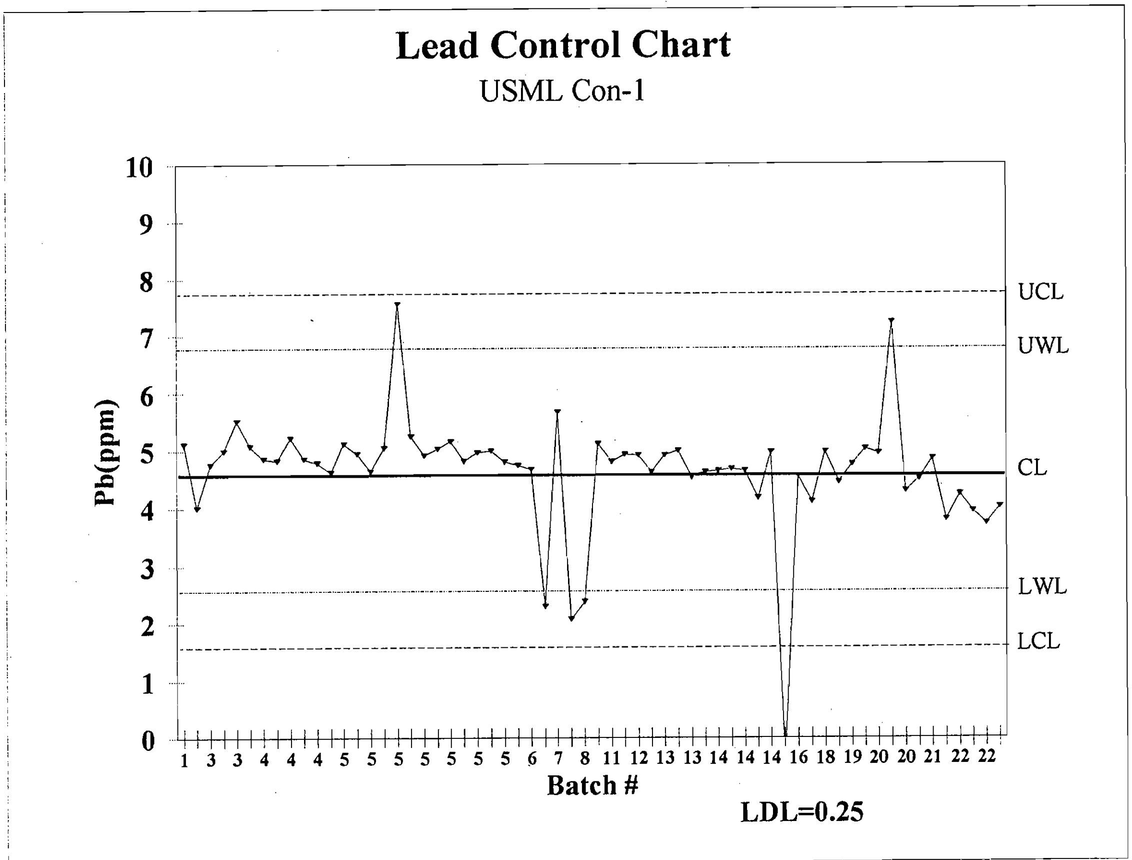



Gold Control Chart
USML Con-1
Au(ppm)
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
UCL
UWL
CL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

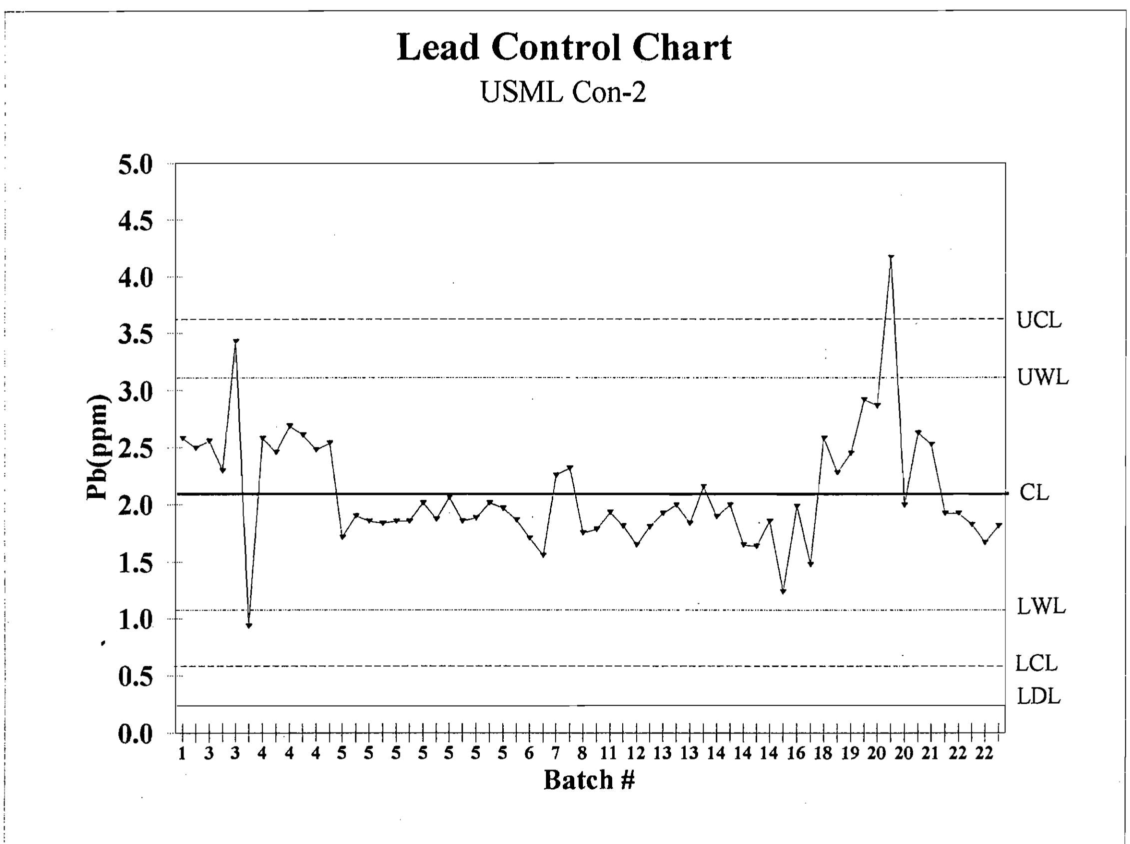
24-Sep-96


Gold Control Chart
USML Con-2
Au(ppm)
0.0100
0.0090
0.0080
0.0070
0.0060
0.0050
0.0040
0.0030
0.0020
0.0010
0.0000
UCL
UWL
CL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

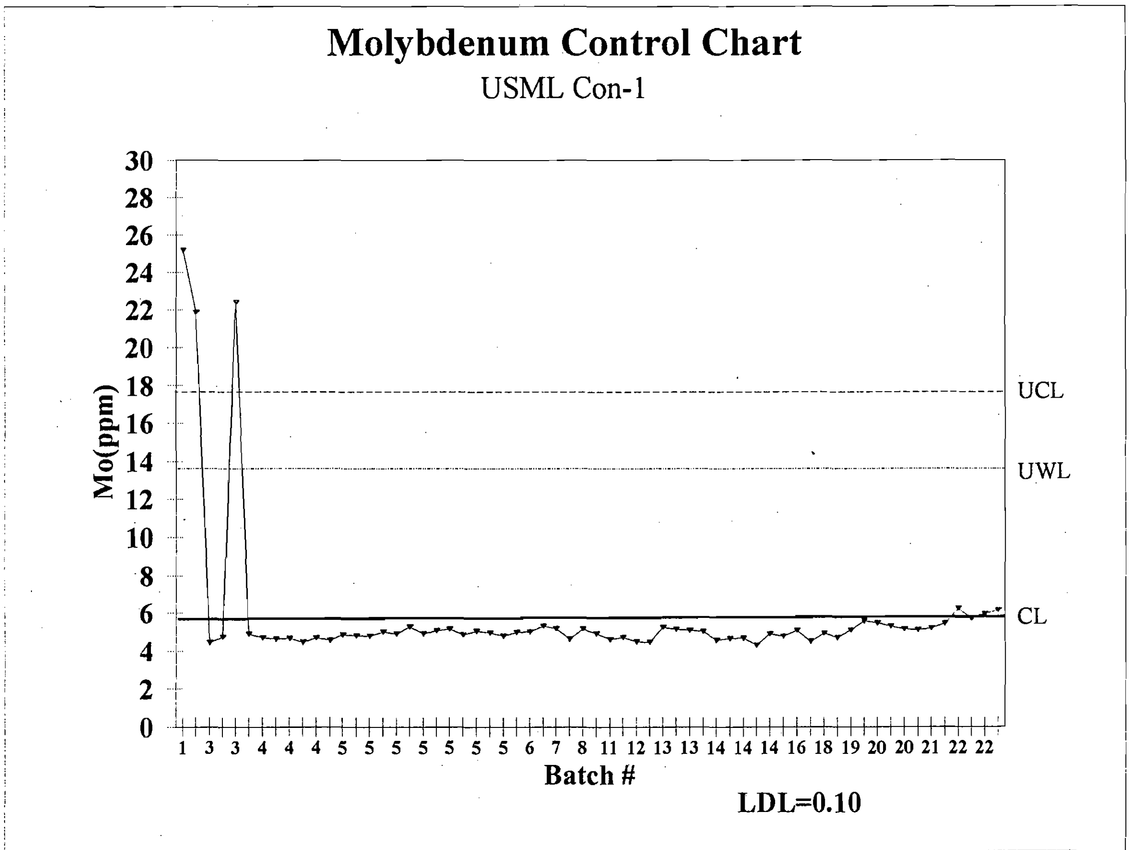
25-Sep-96



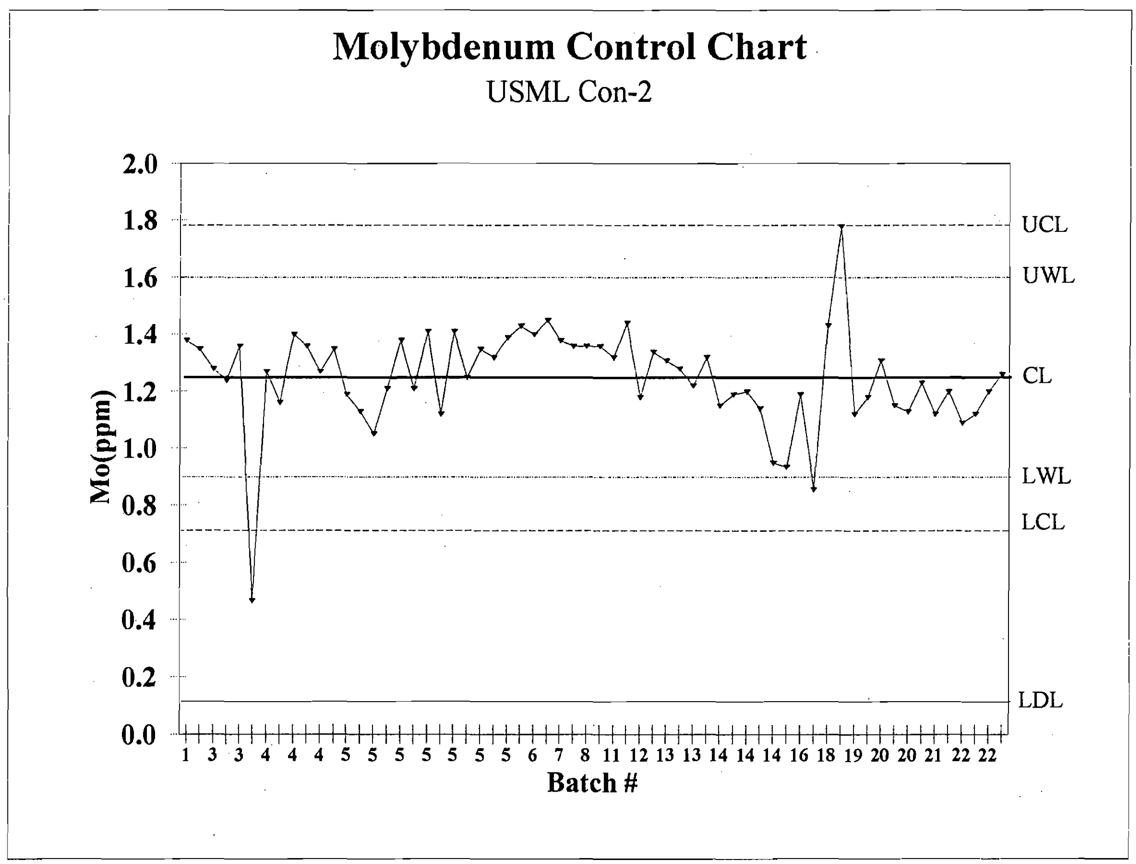
25-Sep-96



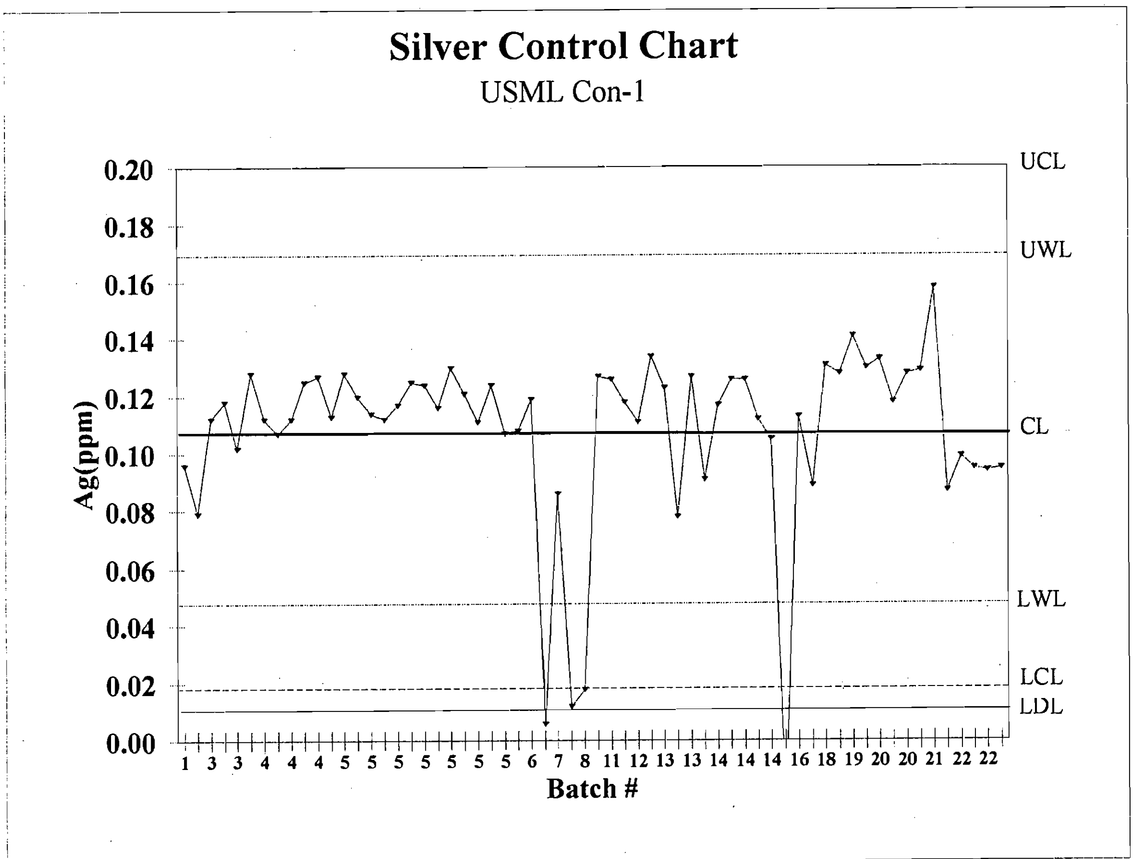
25-Sep-96



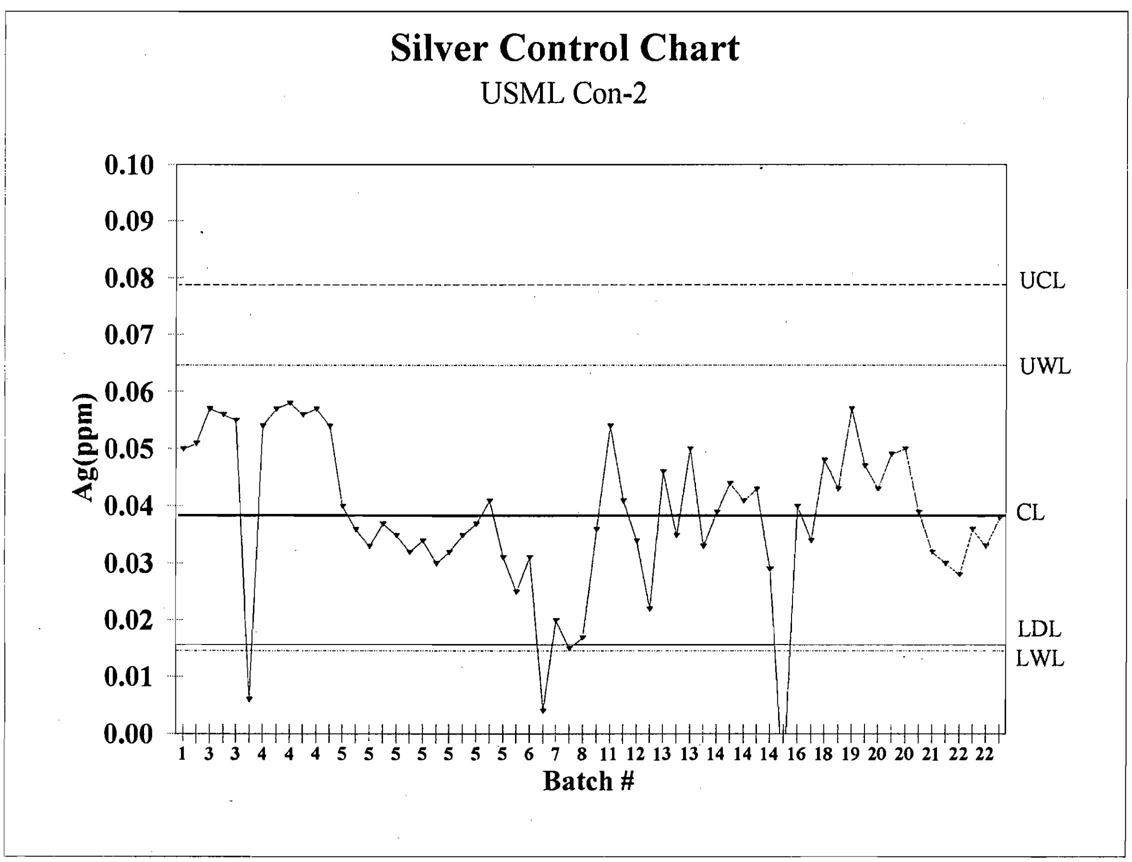
25-Sep-96



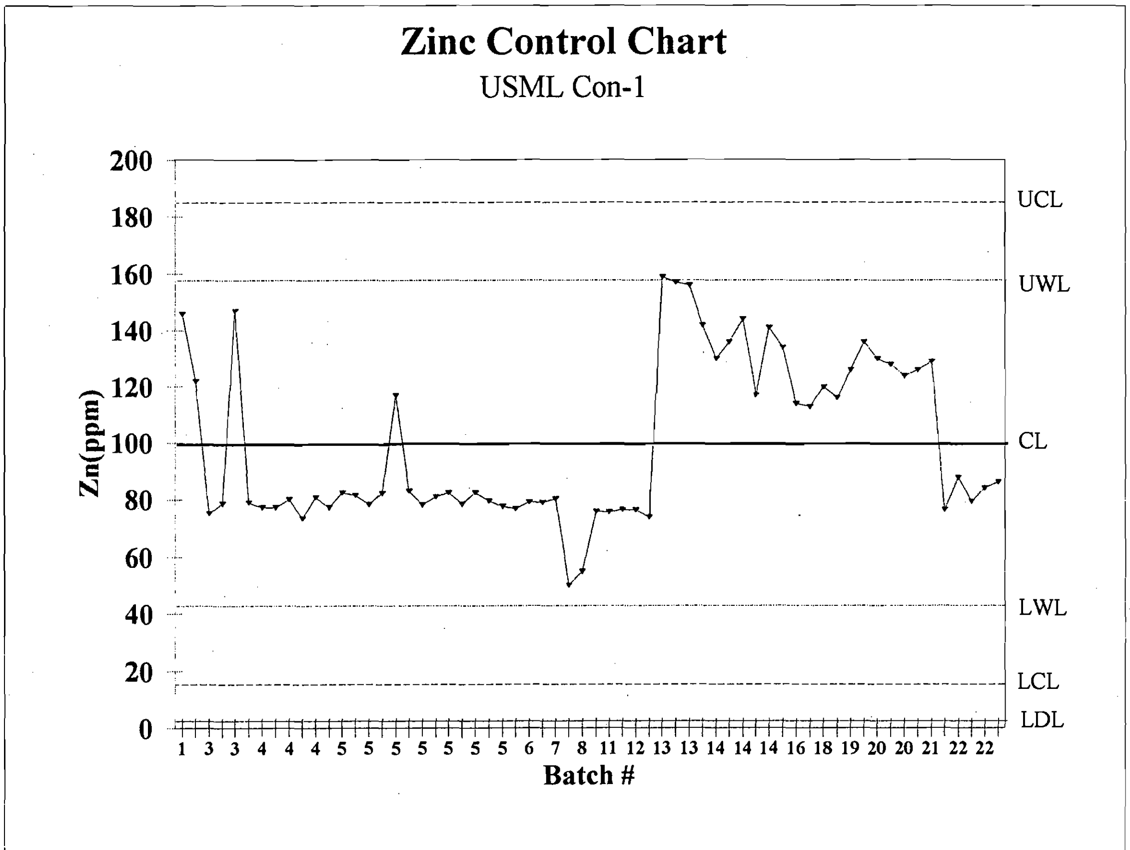
23-Sep-96



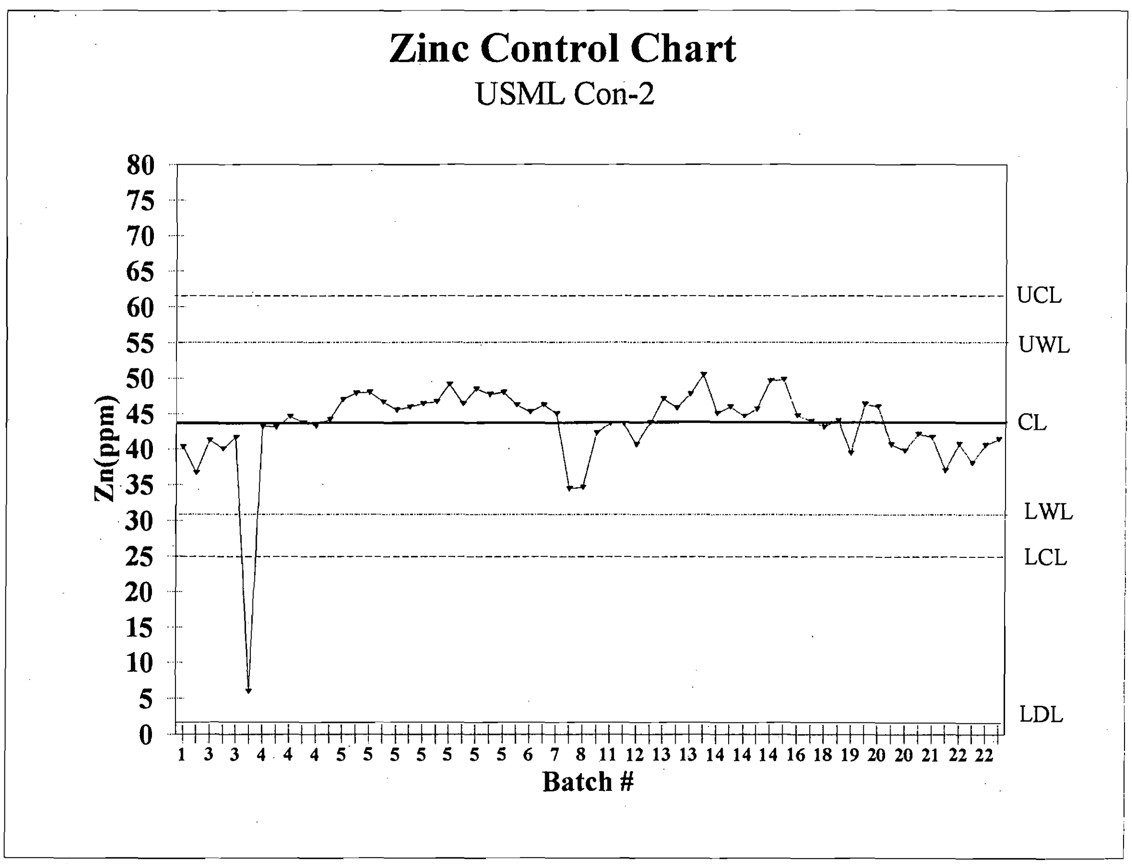
23-Sep-96



25-Sep-96



25-Sep-96



F3. XRAL control sample analyses and charts

XRAL																
Sample #	Control	Batch	Br(ppm)	Ca(%)	Co(ppm)	Cr(ppm)	Cs(ppm)	Fe(%)	Hf(ppm)	Na(ppm)	Rb(ppm)	Sc(ppm)	Ta(ppm)	Th(ppm)	U(ppm)
5064	CON-1	1	1	9	6	40	<3	2.0	5	9300	70	11.3	<1	8.3	4.8
PC400	CON-1	2	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing
SS 1193-1	CON-1	3	1	8	<5	70	<3	0.9	2	5400	80	7.1	<1	3.8	3.2
SS 0493-1	CON-1	3	1	7	<5	50	<3	1.5	4	7800	40	9.4	<1	6.5	4.3
0394-G26	CON-1	3	2	8	<5	70	<3	0.9	2	5600	30	7.2	<1	3.8	3.2
GSCN-57	CON-1	4	2	13	<5	60	<3	0.9	2	5400	50	6.6	<1	3.7	2.6
GSCN-102	CON-1	4	2	13	<5	60	<3	0.8	2	5200	50	6.4	<1	3.2	2.6
GSCN-109	CON-1	4	2	14	<5	60	<3	0.8	2	5600	30	6.7	<1	3.6	2.6
117567a	CON-1	4	2	13	<5	60	<3	0.8	2	5000	40	6.3	<1	3.5	2.5
117802a	CON-1	4	2	13	<5	60	<3	0.8	2	5200	40	6.4	<1	3.8	2.7
117751a	CON-1	4	2	12	<5	50	<3	0.8	2	5100	40	6.1	1	3.2	2.4
117809a	CON-1	4	2	12	<5	60	<3	0.9	2	5400	40	6.4	<1	3.3	2.6
GSCN-111	CON-1	5	2	14	<5	60	<3	0.8	2	5300	40	6.4	<1	3.8	2.6
GSCN-115	CON-1	5	2	15	<5	60	<3	0.8	2	5400	50	6.6	<1	3.6	2.9
GSCN-248	CON-1	5	2	15	<5	50	<3	0.8	2	5300	40	6.5	<1	4.0	2.7
GSCN-250	CON-1	5	2	16	<5	60	<3	0.9	2	5600	30	6.7	<1	3.8	3.1
117820a	CON-1	5	2	14	<5	60	<3	0.8	2	5500	40	6.5	<1	3.4	2.4
117835a	CON-1	5	2	15	<5	60	<3	0.9	2	5300	30	6.5	<1	3.7	2.7
117871a	CON-1	5	2	13	<5	60	<3	0.8	2	5400	40	6.6	<1	3.7	2.5
117898a	CON-1	5	2	17	<5	60	<3	1.0	2	6100	50	7.6	<1	3.8	3.0
118276a	CON-1	5	2	14	<5	60	3	0.8	2	5400	50	6.6	1	3.5	2.8
118305a	CON-1	5	2	12	<5	60	<3	0.8	2	5200	<30	6.4	<1	3.3	2.4
118324a	CON-1	5	2	15	5	60	<3	0.9	2	5700	40	7.1	<1	4.0	2.6
118354a	CON-1	5	2	16	5	70	<3	1.0	3	6200	50	7.7	1	3.8	3.1
118369a	CON-1	5	2	15	<5	50	3	0.9	2	5600	40	6.9	<1	3.6	2.6
117778a	CON-1	6	1	13	5	60	<3	0.9	2	5700	30	6.8	<1	3.8	2.4
5064a	CON-1	6	1	12	5	60	<3	0.8	2	5200	30	6.6	<1	3.6	1.9
5506a	CON-1	6	1	12	5	70	<3	1.0	3	5600	30	7.6	<1	3.9	2.6
5507a	CON-1	7	2	11	5	70	<3	1.0	2	5800	60	7.5	1	4.5	3.2
5417a	CON-1	8	2	14	<5	60	<3	0.9	2	5600	40	6.9	<1	4.0	2.7
5437a	CON-1	8	2	14	<5	60	<3	0.9	2	5600	50	7.1	<1	4.1	2.8
1194-078a	CON-1	9	2	14	<5	60	<3	0.9	2	5400	60	6.5	<1	3.4	2.6
5474a	CON-1	11	3	14	<5	60	<3	0.9	2	5500	40	6.7	<1	3.6	2.9
5065a(R)	CON-1	12	2	13	<5	70	<3	0.9	2	5700	40	6.8	<1	3.8	2.7
5517a(R)	CON-1	12	2	13	<5	60	<3	0.8	2	5500	40	6.6	<1	3.6	2.6
5542a(R)	CON-1	12	1	13	<5	60	<3	0.8	2	5300	40	6.6	<1	3.6	2.6
5151a	CON-1	13	3	11	6	80	<3	1.3	3	8600	70	9.6	<1	6.2	3.8
5283a	CON-1	13	3	10	<5	80	<3	1.2	3	8200	60	9.2	<1	5.9	3.7
5656a	CON-1	13	3	10	<5	80	<3	1.2	4	8300	60	9.2	<1	6.0	3.5

XRAL															
Sample #	Control	Batch	Br(ppm)	Ca(%)	Co(ppm)	Cr(ppm)	Cs(ppm)	Fe(%)	Hf(ppm)	Na(ppm)	Rb(ppm)	Sc(ppm)	Ta(ppm)	Th(ppm)	U(ppm)
5323a	CON-1	13	3	11	<5	80	<3	1.2	3	8200	60	9.1	<1	6.1	3.5
5586a	CON-1	14	2	11	6	80	<3	1.2	4	8300	70	9.4	<1	6.4	3.6
5196a	CON-1	14	2	11	<5	80	<3	1.2	4	8400	50	9.5	1	6.0	3.4
5605a	CON-1	14	1	10	5	70	<3	1.1	4	8100	70	8.4	<1	6.0	3.0
5671a	CON-1	14	2	11	5	90	<3	1.3	4	8600	60	9.8	1	6.1	3.3
5737a	CON-1	14	1	10	5	80	<3	1.2	3	8000	60	9.3	1	6.5	3.9
5353a	CON-1	15	2	12	5	80	<3	1.3	4	8200	80	9.7	<1	6.2	3.5
5747a	CON-1	16	1	13	<5	70	<3	1.0	3	6000	50	7.4	<1	4.6	2.7
5717a	CON-1	17	2	11	6	80	<3	1.3	3	8600	60	10.0	<1	7.0	3.3
117609a	CON-1	18	1	11	5	70	<3	1.3	3	8100	60	9.4	<1	6.2	3.7
SS0695-087a	CON-1	18	2	10	5	70	<3	1.2	3	7700	40	9.8	<1	6.8	3.3
5726a	CON-1	19	2	12	6	80	<3	1.4	3	8200	60	10.0	<1	6.0	3.6
5908a	CON-1	19	2	11	6	70	<3	1.3	4	8300	50	9.8	<1	6.4	3.9
117699a	CON-1	20	2	12	7	70	<3	1.3	3	7900	40	9.9	<1	6.3	3.7
117724a	CON-1	20	2	13	5	80	<3	1.4	3	8500	50	10.3	<1	6.2	4.0
117920a	CON-1	20	2	11	5	80	<3	1.3	4	8200	60	9.6	<1	6.0	3.8
441SSa	CON-1	21	2	12	7	90	<3	1.4	4	8600	70	10.1	<1	6.3	3.7
3011(A)a	CON-1	21	3	12	6	80	<3	1.4	4	8300	70	9.6	<1	6.2	3.5
5839A	CON-1	22	1	14	5	90	<3	1.1	2	6000	50	9.4	<1	3.6	3.0
GSCN-122A	CON-1	22	2	16	5	100	<3	1.2	2	6200	40	7.8	<1	5.3	3.1
5374A	CON-1	22	2	15	5	80	<3	1.2	2	5700	30	7.1	<1	3.6	2.8
5399A	CON-1	22	2	16	5	80	<3	1.1	2	5300	40	6.8	<1	3.5	2.5
5924A	CON-1	22	2	14	<5	80	3	1.0	2	5300	40	6.8	<1	3.4	2.4
AVG	CON-1		2	13	5	68	0	1.1	3	6520	48	7.9	0	4.7	3.1
STD DEV	CON-1		1	2	1	12	0	0.2	1	1365	14	1.4	0	1.3	0.6
2 Sigma	CON-1		3	17	7	92	0	1.5	4	9249	77	10.8	0	7.3	4.2
3 sigma	CON-1		4	19	7	104	0	1.8	5	10613	91	12.2	0	8.7	4.7
XRAL															
5065	CON-2	1	<1	3	21	160	<3	4.5	3	31000	40	13.6	<1	3.6	1.9
PCL477	CON-2	2	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing	missing
SS 1193-2	CON-2	3	<1	2	22	160	<3	4.0	3	29000	<30	12.8	<1	2.5	1.2
SS 0493-2	CON-2	3	1	2	22	170	<3	4.2	3	31000	40	13.4	<1	3.0	1.6
0394-G27	CON-2	3	1	2	21	170	<3	4.1	3	30000	30	13.2	<1	2.8	1.3
GSCN-58	CON-2	4	1	<1	21	140	<3	4.1	3	29000	50	12.3	1	2.8	1.1
GSCN-103	CON-2	4	<1	5	20	140	<3	3.9	3	29000	<30	11.9	<1	2.6	0.9
GSCN-110	CON-2	4	<1	4	22	140	<3	4.1	3	30000	80	12.3	<1	2.1	1.0
117567b	CON-2	4	1	4	20	140	<3	3.9	2	28000	<30	11.8	<1	2.7	1.1
117802b	CON-2	4	<1	5	20	120	<3	3.7	1	28000	<30	11.3	<1	2.1	1.2

XRAL															
Sample #	Control	Batch	Br(ppm)	Ca(%)	Co(ppm)	Cr(ppm)	Cs(ppm)	Fe(%)	Hf(ppm)	Na(ppm)	Rb(ppm)	Sc(ppm)	Ta(ppm)	Th(ppm)	U(ppm)
117751b	CON-2	4	1	2	19	140	<3	3.8	3	27000	50	11.3	<1	2.8	1.2
117809b	CON-2	4	<1	4	18	140	<3	3.7	3	27000	<30	11.4	<1	2.3	1.4
GSCN-112	CON-2	5	1	3	19	140	<3	3.9	3	29000	40	12.3	<1	2.6	1.1
GSCN-116	CON-2	5	1	3	21	140	<3	4.2	3	30000	30	12.8	<1	2.6	1.1
GSCN-249	CON-2	5	<1	4	19	130	<3	3.9	2	29000	<30	12.3	<1	2.5	0.7
GSCN-251	CON-2	5	<1	4	19	130	<3	4.2	2	31000	<30	13.1	<1	2.9	0.6
117820b	CON-2	5	1	5	18	130	<3	3.9	3	29000	<30	12.1	<1	2.3	1.0
117835b	CON-2	5	<1	4	25	130	4	4.1	3	30000	<30	12.9	<1	2.2	1.7
117871b	CON-2	5	1	3	17	120	<3	3.8	2	28000	30	12.0	<1	2.7	1.1
117898b	CON-2	5	1	6	19	140	<3	4.3	3	33000	<30	13.5	<1	2.8	1.2
118276b	CON-2	5	1	5	21	120	<3	4.1	2	29000	50	12.2	<1	2.6	1.3
118305b	CON-2	5	<1	4	23	130	<3	3.9	3	30000	<30	12.6	<1	2.8	1.3
118324b	CON-2	5	<1	5	20	140	<3	4.3	3	31000	<30	13.0	1	2.5	1.7
118369b	CON-2	5	1	4	20	130	<3	4.1	3	31000	<30	13.1	<1	2.5	1.2
117778b	CON-2	6	<1	4	23	160	<3	4.1	4	31000	<30	12.8	<1	2.7	0.6
5064b	CON-2	6	<1	3	20	150	<3	4.2	3	29000	<30	12.6	2	2.9	0.8
5506b	CON-2	6	<1	3	23	170	<3	4.7	3	31000	40	14.6	<1	3.1	0.9
5507b	CON-2	7	<1	3	26	150	<3	4.3	3	29000	<30	13.0	<1	3.4	1.1
5417b	CON-2	8	1	5	20	160	<3	4.1	3	30000	<30	12.8	<1	2.9	1.3
5437b	CON-2	8	1	4	19	150	<3	4.2	3	29000	30	12.7	<1	3.0	1.3
1194-078b	CON-2	9	<1	4	18	150	<3	4.0	2	28000	<30	12.2	<1	2.6	0.9
5474b	CON-2	11	1	4	19	140	<3	3.9	3	28000	30	11.9	<1	2.5	1.1
5065b(R)	CON-2	12	<1	4	20	150	<3	4.1	3	30000	<30	12.9	<1	2.7	0.8
5517b(R)	CON-2	12	<1	4	18	150	<3	4.1	3	28000	30	12.3	<1	2.6	1.1
5542b(R)	CON-2	12	1	3	20	160	<3	4.0	3	29000	<30	12.6	<1	3.0	1.4
5151b	CON-2	13	2	4	16	140	<3	3.9	2	28000	30	12.0	<1	2.6	1.0
5283b	CON-2	13	2	5	17	130	<3	4.0	3	28000	<30	12.1	<1	2.8	1.0
5656b	CON-2	13	2	3	18	140	<3	3.9	3	28000	<30	12.0	<1	2.7	1.1
5323b	CON-2	13	3	4	18	140	<3	4.0	3	29000	<30	12.3	<1	2.5	1.2
5586b	CON-2	14	<1	3	20	140	<3	3.9	4	29000	<30	12.3	<1	2.7	1.5
5196b	CON-2	14	2	4	20	140	<3	3.9	3	29000	30	12.1	<1	2.4	1.5
5605b	CON-2	14	<1	3	17	130	<3	3.7	3	28000	30	11.7	<1	2.6	0.9
5671b	CON-2	14	1	5	21	150	<3	4.1	3	31000	<30	13.1	1	2.8	0.9
5737b	CON-2	14	<1	3	20	150	<3	4.0	3	29000	<30	12.4	<1	2.7	1.2
5353b	CON-2	15	1	4	18	140	<3	4.1	3	29000	30	12.4	<1	2.8	1.1
5747b	CON-2	16	1	4	19	140	<3	4.0	3	28000	30	12.5	<1	2.7	0.9
5717b	CON-2	17	<1	3	20	150	<3	4.1	3	31000	<30	12.7	<1	2.7	0.8
117609b	CON-2	18	<1	4	22	150	<3	4.1	3	30000	<30	12.8	<1	2.4	1.0
SS0695-087b	CON-2	18	<1	4	20	150	<3	4.0	3	29000	30	12.2	<1	2.7	1.1

02-Oct-96

XRAL																
Sample #	Control	Batch	Br(ppm)	Ca(%)	Co(ppm)	Cr(ppm)	Cs(ppm)	Fe(%)	Hf(ppm)	Na(ppm)	Rb(ppm)	Sc(ppm)	Ta(ppm)	Th(ppm)	U(ppm)
5726b	CON-2	19	1	4	21	150	<3	4.3	2	31000	<30	13.3	<1	2.7	1.0
5908b	CON-2	19	2	5	21	160	<3	4.4	4	32000	<30	13.3	<1	2.6	1.1
117699b	CON-2	20	1	5	21	150	<3	4.1	2	30000	<30	12.8	<1	3.1	1.3
117724b	CON-2	20	1	5	25	160	<3	4.5	3	33000	<30	13.5	<1	3.0	1.3
117920b	CON-2	20	<1	3	19	150	<3	4.2	2	31000	<30	13.1	<1	2.3	1.0
441SSb	CON-2	21	1	4	23	160	<3	4.5	3	32000	<30	13.9	<1	3.0	1.5
3011(B)b	CON-2	21	2	5	22	150	<3	4.3	3	31000	<30	13.0	<1	3.0	1.3
5839B	CON-2	22	1	4	23	160	<3	4.5	2	34000	<30	13.2	<1	2.5	0.9
GSCN-122B	CON-2	22	<1	4	23	180	<3	4.5	3	35000	40	14.2	<1	2.8	0.8
5374B	CON-2	22	1	5	22	150	<3	4.0	4	30000	<30	13.2	<1	3.7	1.3
5399B	CON-2	22	2	5	22	160	<3	4.0	3	31000	50	13.3	<1	2.9	1.4
5924B	CON-2	22	1	3	19	160	<3	4.3	3	32000	<30	13.3	<1	2.6	0.9
AVG	CON-2		1	4	20	146	0	4.1	3	29817	37	12.7	0	2.7	1.1
STD DEV	CON-2		1	1	2	13	0	0.2	1	1638	15	0.7	0	0.3	0.3
2 Sigma	CON-2		3	6	24	172	0	4.5	4	33093	66	14.0	0	3.3	1.7
3 sigma	CON-2		4	7	26	185	0	4.7	4	34731	80	14.7	0	3.6	1.9

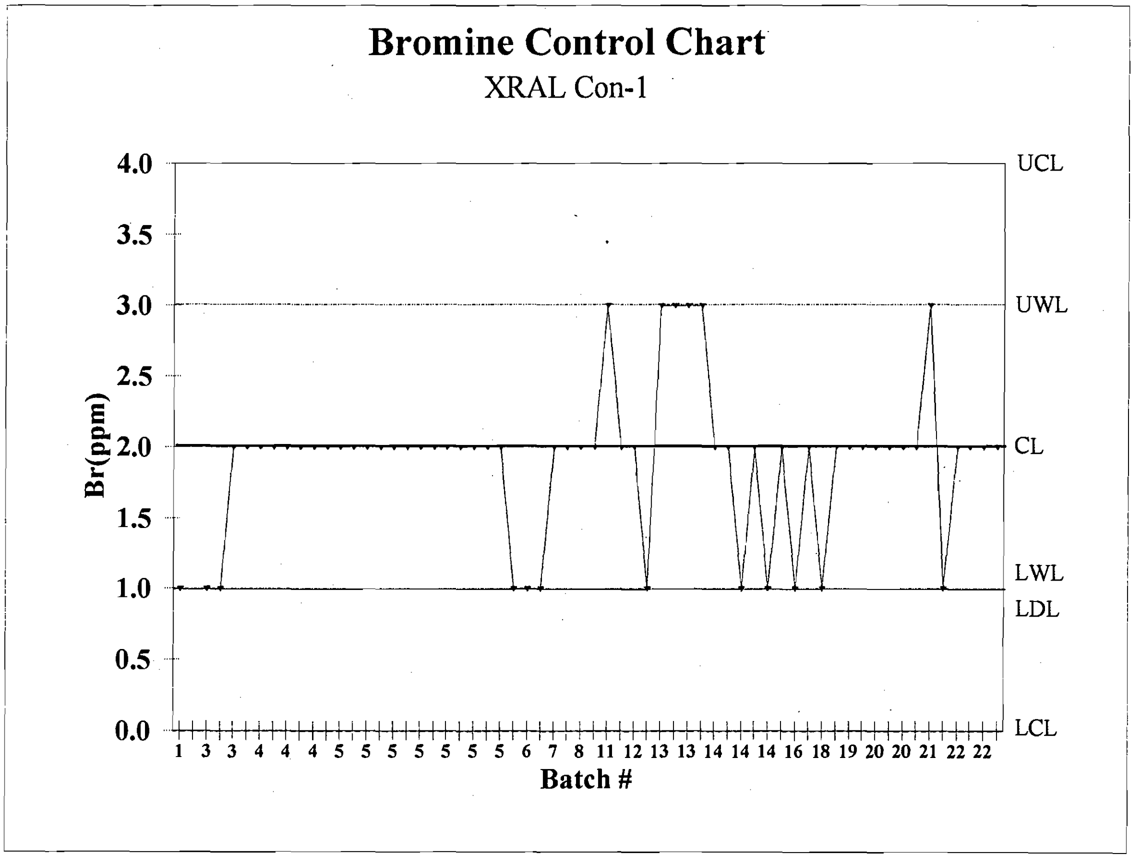
XRAL								
Sample #	La(ppm)	Ce(ppm)	Nd(ppm)	Sm(ppm)	Eu(ppm)	Tb(ppm)	Yb(ppm)	Lu(ppm)
5064	44	83	40	6.9	1.3	0.9	2.6	0.39
PC400	missing	missing	missing	missing	missing	missing	missing	missing
SS 1193-1	17	32	10	3.1	0.8	<0.5	2.0	0.31
SS 0493-1	33	58	20	4.8	0.8	0.5	2.6	0.41
0394-G26	17	31	10	3.1	0.6	<0.5	2.1	0.34
GSCN-57	16	30	10	2.9	0.9	<0.5	1.9	0.29
GSCN-102	16	30	10	2.8	0.6	<0.5	1.8	0.30
GSCN-109	16	30	10	2.9	0.8	<0.5	1.7	0.33
117567a	15	27	10	2.7	0.5	<0.5	1.6	0.25
117802a	15	29	10	2.8	0.8	<0.5	1.8	0.30
117751a	15	28	10	2.6	0.6	<0.5	1.7	0.27
117809a	16	29	10	2.6	0.7	<0.5	1.7	0.27
GSCN-111	16	30	10	2.9	0.3	<0.5	1.9	0.28
GSCN-115	16	30	10	2.9	0.9	<0.5	2.0	0.28
GSCN-248	16	30	10	2.7	0.8	<0.5	1.8	0.28
GSCN-250	16	30	10	2.9	0.7	<0.5	2.0	0.30
117820a	15	23	10	2.8	0.9	<0.5	1.7	0.27
117835a	16	30	10	3.0	0.7	<0.5	1.9	0.28
117871a	15	28	10	2.8	0.7	<0.5	1.7	0.26
117898a	18	34	10	3.2	0.7	<0.5	2.1	0.32
118276a	15	28	10	2.9	0.6	<0.5	1.9	0.28
118305a	17	33	10	3.0	0.4	<0.5	1.8	0.28
118324a	17	32	10	3.1	0.9	<0.5	2.1	0.32
118354a	20	38	20	3.4	1.0	0.5	2.1	0.32
118369a	15	28	10	2.9	0.7	<0.5	1.9	0.33
117778a	16	30	10	3.1	0.5	<0.5	1.8	0.31
5064a	15	28	10	2.6	1.0	<0.5	1.7	0.22
5506a	18	32	10	3.2	1.2	<0.5	2.1	0.33
5507a	19	37	10	3.5	0.6	<0.5	2.1	0.32
5417a	17	31	10	3.2	0.6	0.5	1.9	0.29
5437a	17	30	10	3.3	0.8	0.5	1.9	0.30
1194-078a	15	28	10	3.0	0.5	<0.5	1.9	0.29
5474a	16	28	10	2.9	0.7	<0.5	1.8	0.28
5065a(R)	17	28	10	3.0	0.7	0.5	1.9	0.30
5517a(R)	17	29	10	3.1	0.7	0.5	1.8	0.29
5542a(R)	16	29	10	3.1	0.6	0.5	1.8	0.29
5151a	32	54	30	4.8	0.9	0.6	2.4	0.35
5283a	31	51	20	4.5	0.9	0.5	2.5	0.38
5656a	31	52	20	4.3	0.8	0.5	2.4	0.35

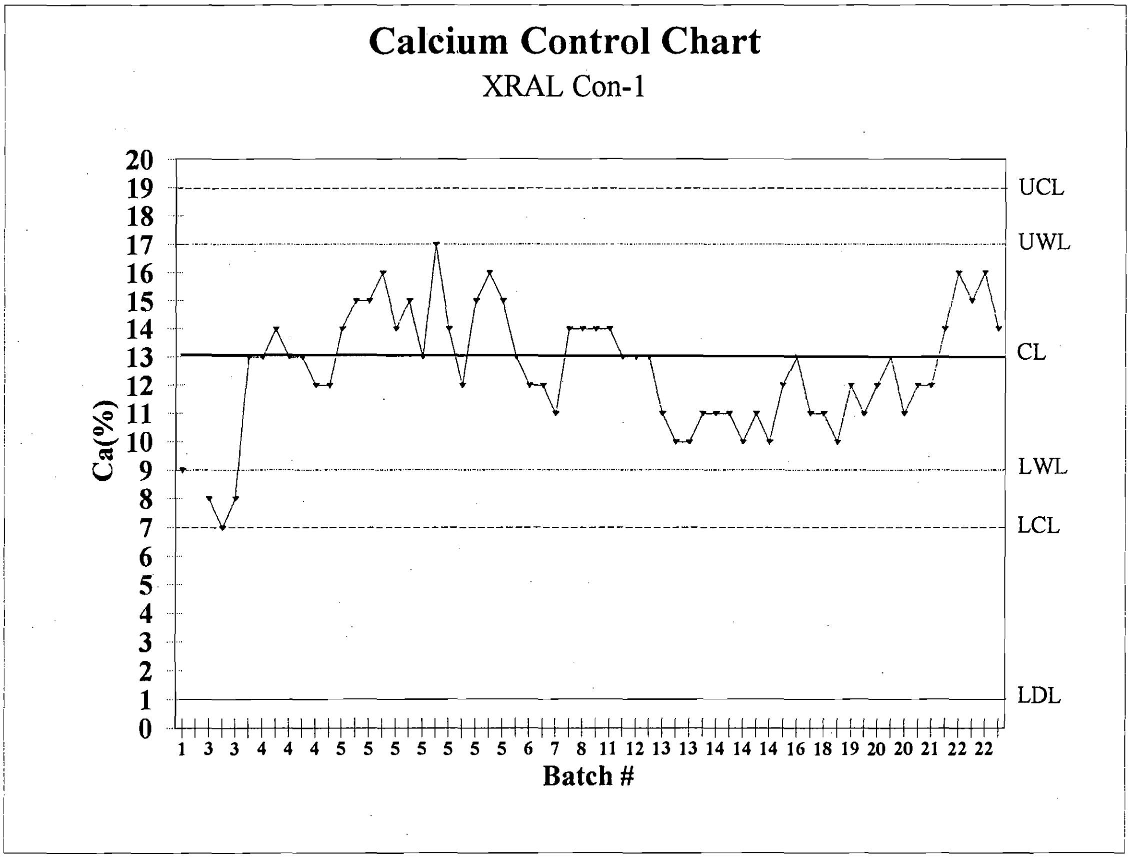
XRAL								
Sample #	La(ppm)	Ce(ppm)	Nd(ppm)	Sm(ppm)	Eu(ppm)	Tb(ppm)	Yb(ppm)	Lu(ppm)
5323a	31	54	20	4.3	1.0	0.6	2.4	0.34
5586a	33	50	20	4.3	0.9	0.5	2.3	0.34
5196a	34	51	20	4.3	0.9	<0.5	2.4	0.36
5605a	30	49	20	4.2	0.9	<0.5	2.2	0.33
5671a	34	53	20	4.1	1.1	0.5	2.5	0.35
5737a	32	51	20	4.4	1.0	0.6	2.3	0.35
5353a	31	55	20	4.5	1.1	0.6	2.4	0.34
5747a	20	33	10	3.5	0.9	<0.5	2.0	0.33
5717a	33	54	20	4.4	1.0	<0.5	2.3	0.35
117609a	31	49	20	4.1	0.8	<0.5	2.3	0.34
SS0695-087a	30	45	20	4.0	0.9	<0.5	2.2	0.33
5726a	33	56	20	4.6	1.3	<0.5	2.5	0.36
5908a	32	56	20	4.3	1.0	<0.5	2.5	0.35
117699a	31	52	20	4.4	1.1	<0.5	2.5	0.36
117724a	33	58	20	4.7	1.0	<0.5	2.6	0.37
117920a	31	55	20	4.5	1.1	<0.5	2.2	0.33
441SSa	33	57	20	4.6	1.0	<0.5	2.4	0.35
3011(A)a	31	54	20	4.6	1.0	<0.5	2.5	0.37
5839A	19	35	10	3.1	0.9	<0.5	2.0	0.33
GSCN-122A	20	38	10	3.4	0.6	<0.5	2.3	0.31
5374A	19	30	10	3.2	1.0	<0.5	1.9	0.30
5399A	18	29	10	3.1	0.6	<0.5	1.9	0.31
5924A	17	30	10	2.9	1.0	<0.5	1.9	0.31
AVG	22	39	14	3.6	0.8	0.6	2.1	0.32
STD DEV	8	12	6	0.8	0.2	0.1	0.3	0.04
2 Sigma	38	64	27	5.2	1.2	0.7	2.6	0.39
3 sigma	46	77	33	6.0	1.5	0.8	2.9	0.43
XRAL								
5065	21	45	20	4.1	0.8	0.5	1.1	0.17
PCL477	missing	missing	missing	missing	missing	missing	missing	missing
SS 1193-2	18	36	10	3.1	1.0	<0.5	1.0	0.13
SS 0493-2	19	40	20	3.4	1.2	<0.5	1.2	0.18
0394-G27	19	37	20	3.4	0.8	<0.5	1.0	0.17
GSCN-58	17	33	10	2.9	0.9	<0.5	0.8	0.14
GSCN-103	17	32	10	3.0	1.2	<0.5	0.9	0.13
GSCN-110	18	35	10	3.1	1.2	<0.5	0.9	0.15
117567b	16	30	10	2.8	1.2	<0.5	0.9	0.14
117802b	16	30	10	2.9	1.4	<0.5	0.8	0.19

XRAL Sample #	La(ppm)	Ce(ppm)	Nd(ppm)	Sm(ppm)	Eu(ppm)	Tb(ppm)	Yb(ppm)	Lu(ppm)
117751b	16	29	10	2.6	1.0	<0.5	0.7	0.13
117809b	17	28	10	2.6	1.1	<0.5	0.9	0.14
GSCN-112	17	36	10	3.1	0.8	<0.5	0.9	0.15
GSCN-116	18	35	10	3.1	1.5	<0.5	1.1	0.17
GSCN-249	17	33	10	2.9	1.5	<0.5	0.7	0.13
GSCN-251	18	36	10	3.1	1.3	<0.5	0.9	0.15
117820b	16	31	10	2.9	0.8	<0.5	0.8	0.14
117835b	19	35	10	2.9	2.0	<0.5	0.8	0.13
117871b	16	31	10	2.8	1.0	<0.5	0.8	0.15
117898b	18	34	10	3.3	1.0	<0.5	1.1	0.14
118276b	17	34	10	3.1	1.3	<0.5	0.9	0.13
118305b	19	34	10	2.7	1.5	<0.5	1.0	0.15
118324b	18	37	10	3.2	1.6	<0.5	1.1	0.14
118369b	18	36	10	3.1	1.6	<0.5	1.0	0.13
117778b	18	31	10	2.9	0.7	<0.5	0.7	0.09
5064b	17	31	10	2.9	1.0	<0.5	1.0	0.12
5506b	21	42	20	3.7	1.5	<0.5	1.0	0.16
5507b	18	35	10	3.1	1.8	<0.5	1.2	0.14
5417b	17	33	10	3.3	1.2	<0.5	0.9	0.14
5437b	17	33	10	3.2	1.2	<0.5	0.9	0.14
I194-078b	16	30	10	3.3	0.4	<0.5	0.8	0.14
5474b	16	31	10	3.2	0.6	<0.5	0.9	0.13
5065b(R)	17	31	10	3.2	1.0	<0.5	0.9	0.14
5517b(R)	17	32	10	3.2	1.2	<0.5	0.8	0.14
5542b(R)	18	31	10	3.3	1.2	<0.5	1.0	0.13
5151b	16	34	10	3.1	1.0	<0.5	0.8	0.13
5283b	16	33	10	2.9	0.9	<0.5	0.9	0.15
5656b	17	35	10	3.0	1.1	<0.5	0.9	0.13
5323b	17	35	10	3.1	1.1	<0.5	0.9	0.14
5586b	18	35	10	2.9	0.9	<0.5	1.0	0.18
5196b	17	33	10	2.7	1.1	<0.5	0.9	0.14
5605b	16	32	10	2.8	1.1	<0.5	0.8	0.14
5671b	19	36	10	3.0	1.2	<0.5	1.1	0.15
5737b	18	34	10	3.1	1.1	<0.5	1.0	0.17
5353b	17	34	10	3.1	0.9	<0.5	0.9	0.15
5747b	17	31	10	3.0	0.8	<0.5	0.9	0.13
5717b	18	28	10	3.1	0.5	<0.5	0.8	0.15
117609b	20	36	10	3.3	0.6	<0.5	0.8	0.15
SS0695-087b	18	33	10	3.2	0.7	<0.5	0.9	0.15

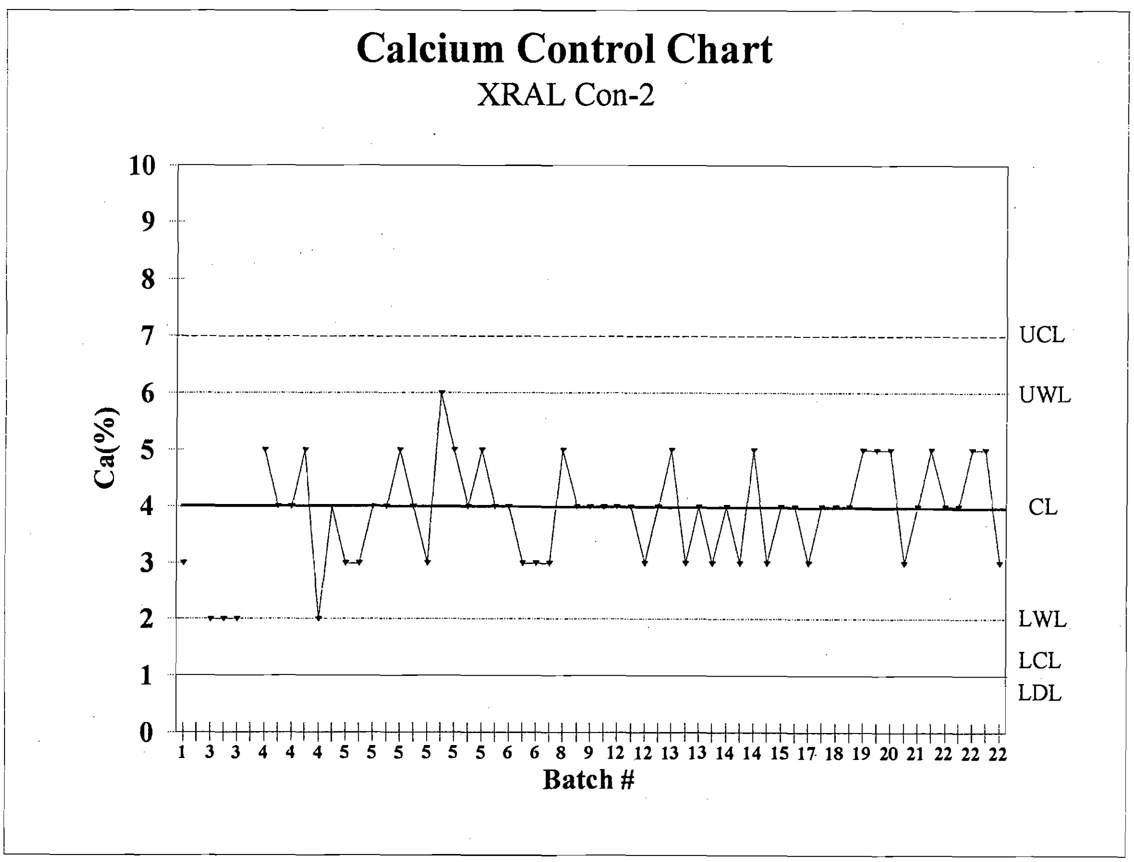
02-Oct-96

XRAL								
Sample #	La(ppm)	Ce(ppm)	Nd(ppm)	Sm(ppm)	Eu(ppm)	Tb(ppm)	Yb(ppm)	Lu(ppm)
5726b	21	38	20	3.6	1.4	<0.5	1.0	0.19
5908b	21	38	20	3.6	1.5	<0.5	1.1	0.20
117699b	20	34	20	3.4	0.9	<0.5	1.0	0.21
117724b	21	40	20	3.7	1.4	<0.5	1.2	0.18
117920b	19	37	20	3.6	1.0	<0.5	1.0	0.18
441SSb	21	40	20	3.6	0.9	<0.5	1.0	0.18
3011(B)b	20	39	20	3.7	1.2	<0.5	1.2	0.18
5839B	20	41	10	3.3	1.2	<0.5	1.0	0.16
GSCN-122B	20	39	10	3.5	1.3	<0.5	0.9	0.16
5374B	20	32	10	3.3	0.7	<0.5	0.9	0.13
5399B	19	35	10	2.9	1.3	<0.5	0.9	0.17
5924B	19	39	10	3.3	1.1	<0.5	0.9	0.15
AVG	18	34	12	3.2	1.1	0.0	0.9	0.15
STD DEV	2	3	4	0.3	0.3	0.0	0.1	0.02
2 Sigma	21	41	20	3.7	1.7	0.0	1.2	0.19
3 sigma	23	45	23	4.0	2.0	0.0	1.3	0.22

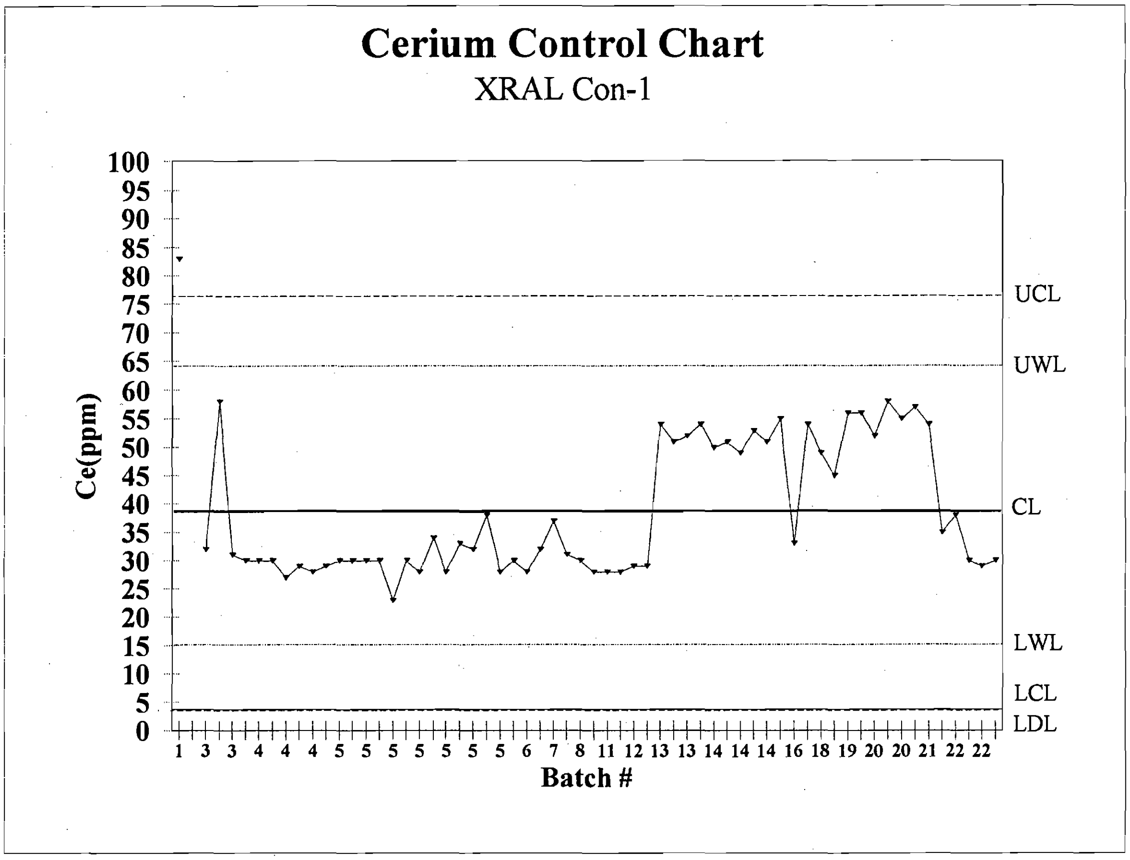

Bromine Control Chart
XRAL Con-1
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Br(ppm)
UCL
UWL
CL
LWL
LDL
LCL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #


Calcium Control Chart
XRAL Con-1
Ca(%)
Batch #
UCL
UWL
CL
LWL
LCL
LDL

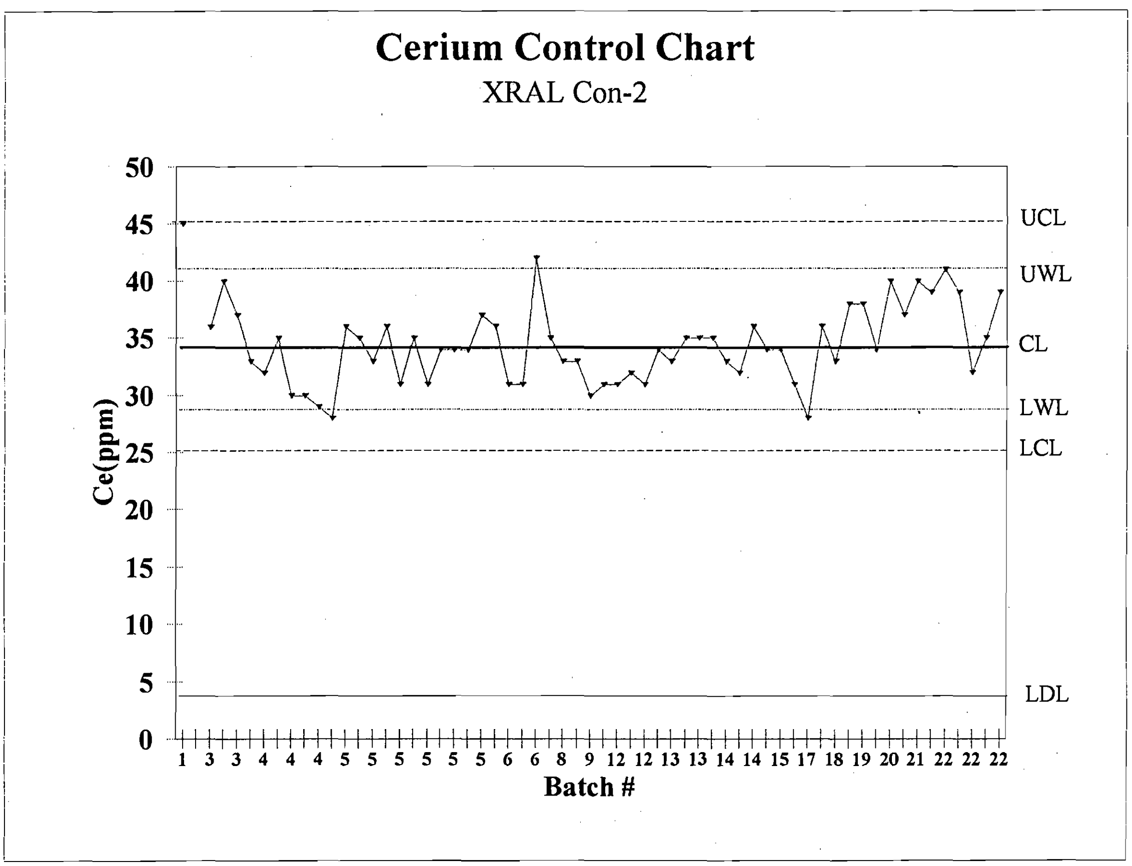
30-Sep-96


Calcium Control Chart
XRAL Con-2
Ca(%)
Batch #
UCL
UWL
CL
LWL
LCL
LDL

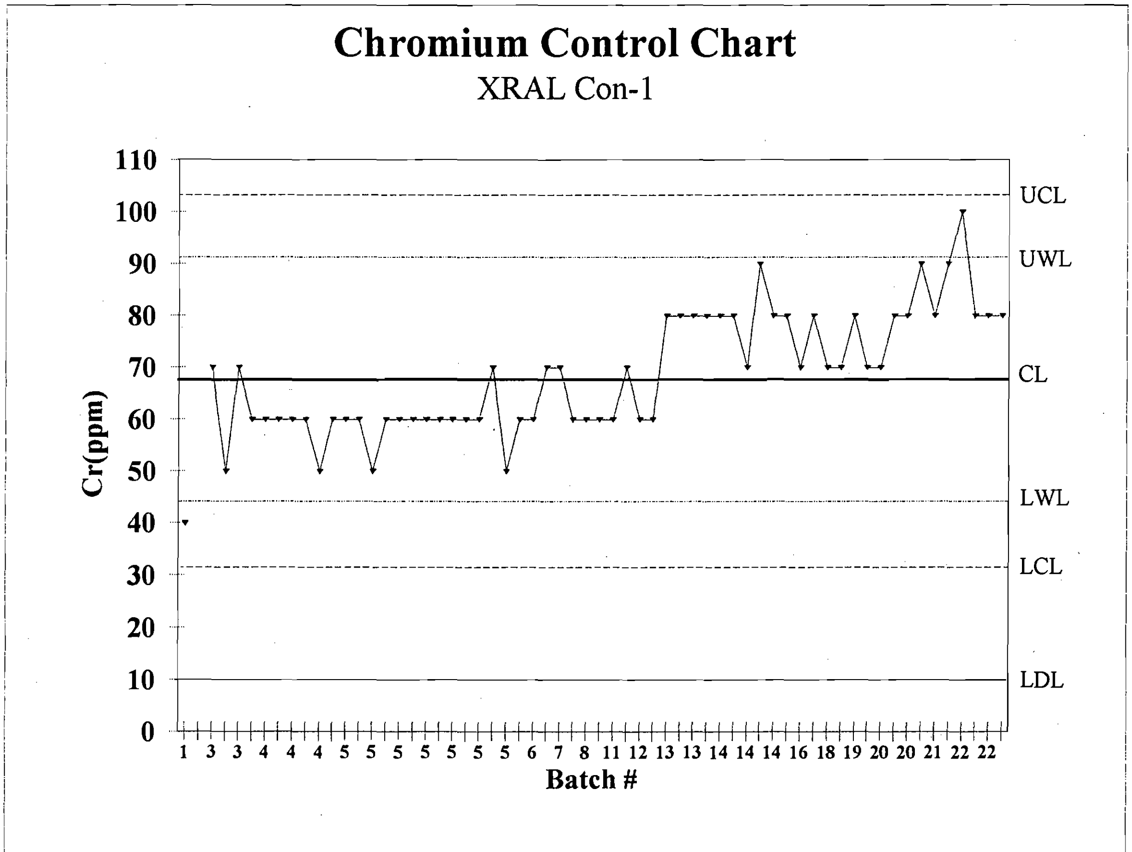
30-Sep-96



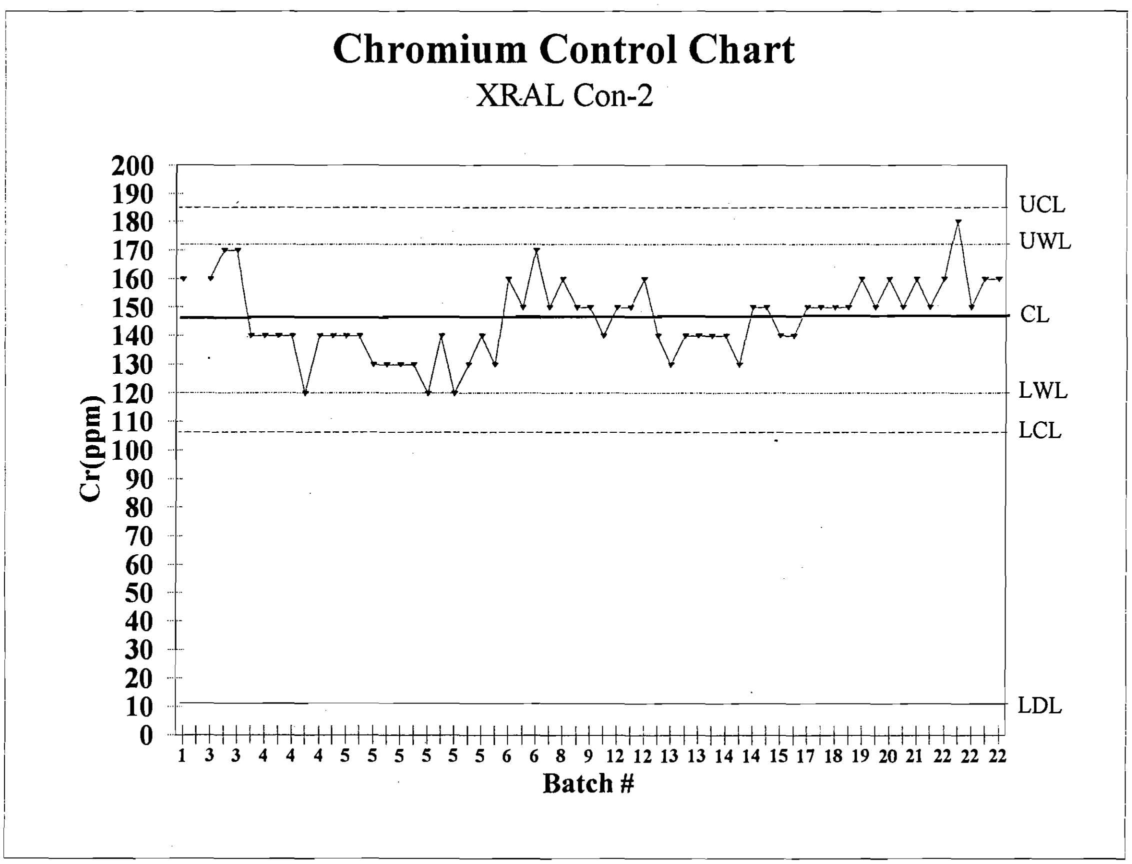
30-Sep-96

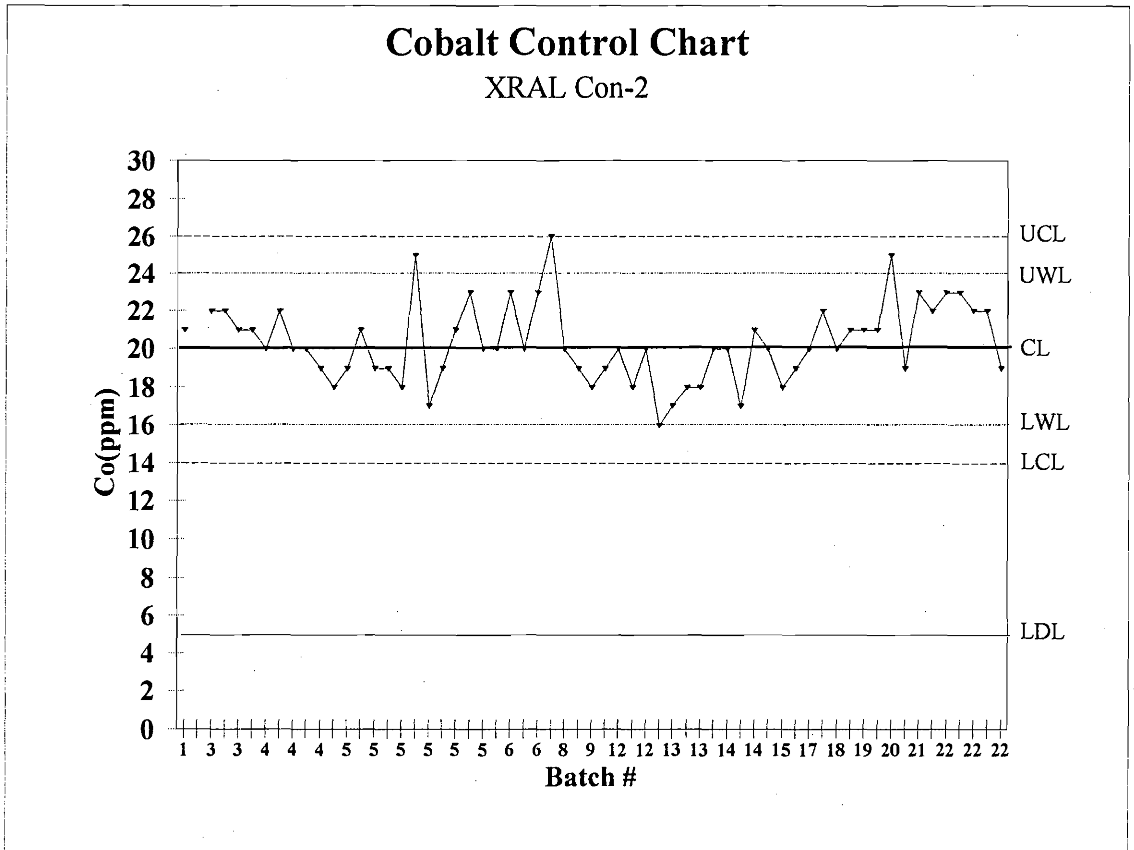


30-Sep-96

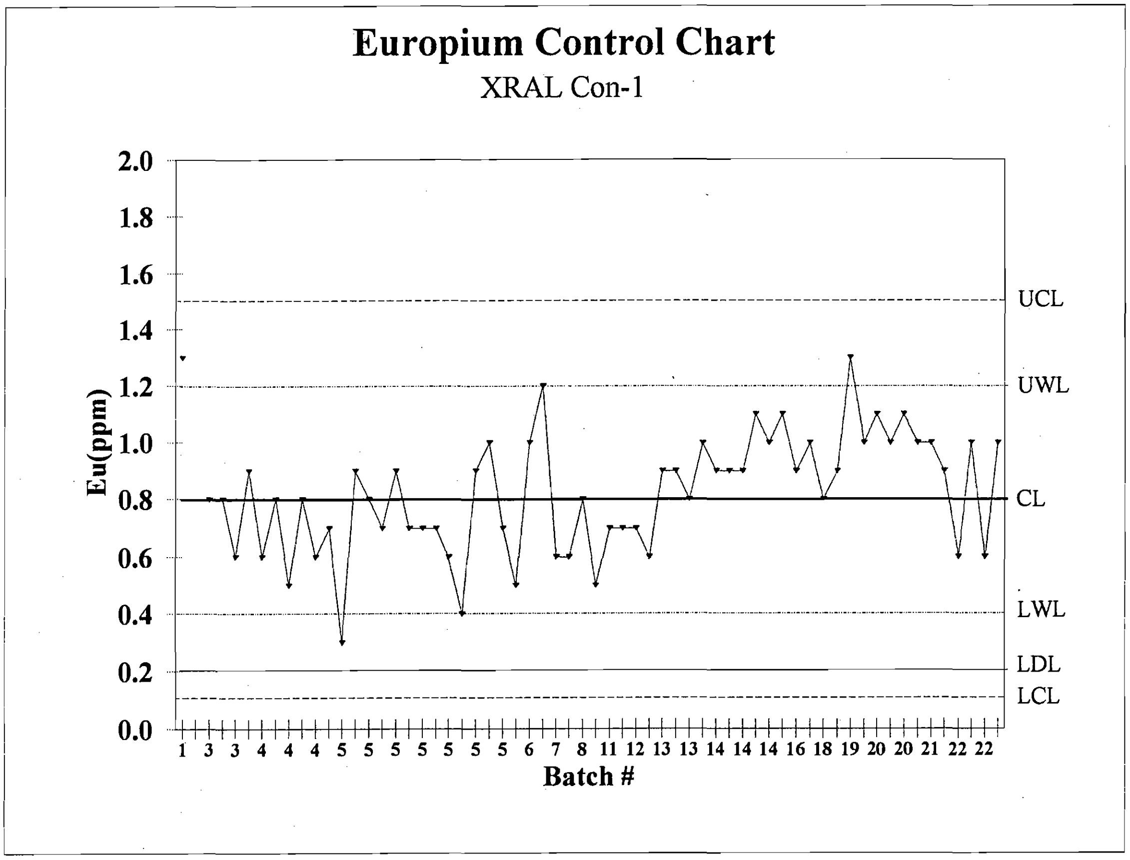


30-Sep-96

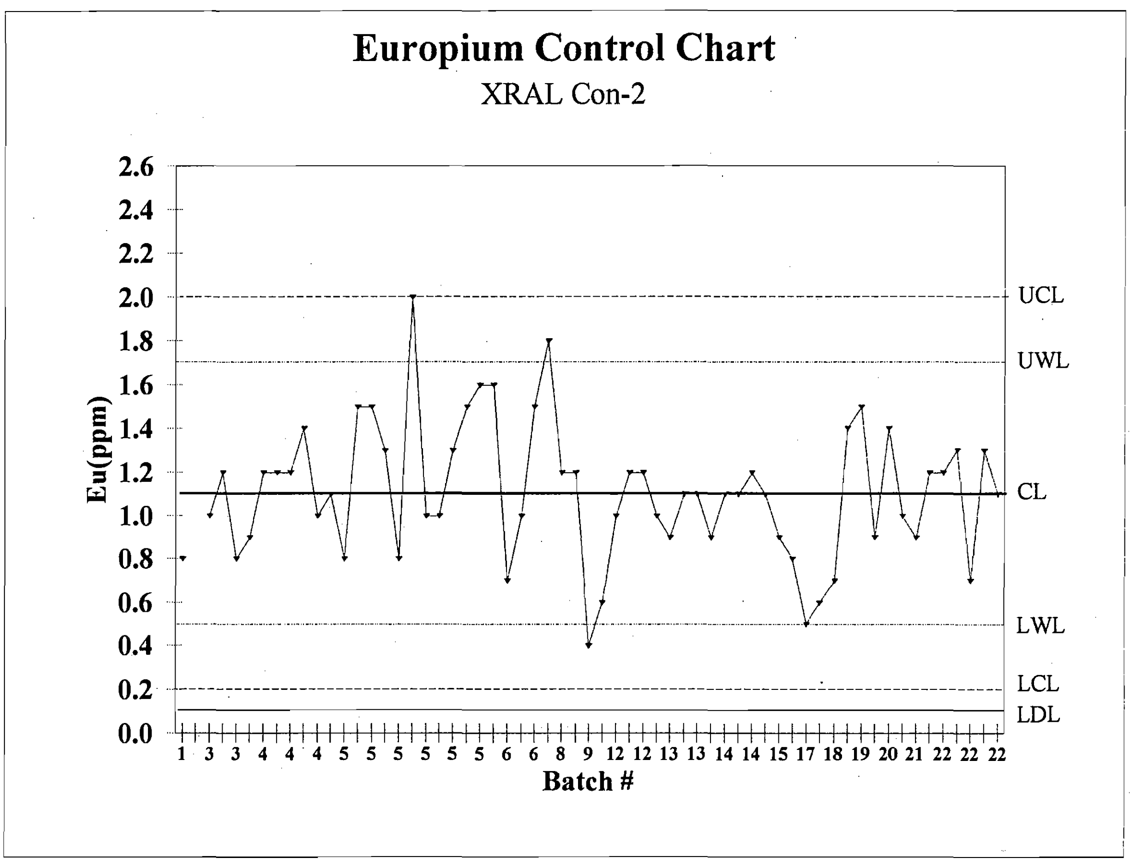



Cobalt Control Chart
XRAL Con-2
Co(ppm)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
UCL
UWL
CL
LWL
LCL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 6 6 8 9 12 12 13 13 14 14 15 17 18 19 20 21 22 22 22
Batch #

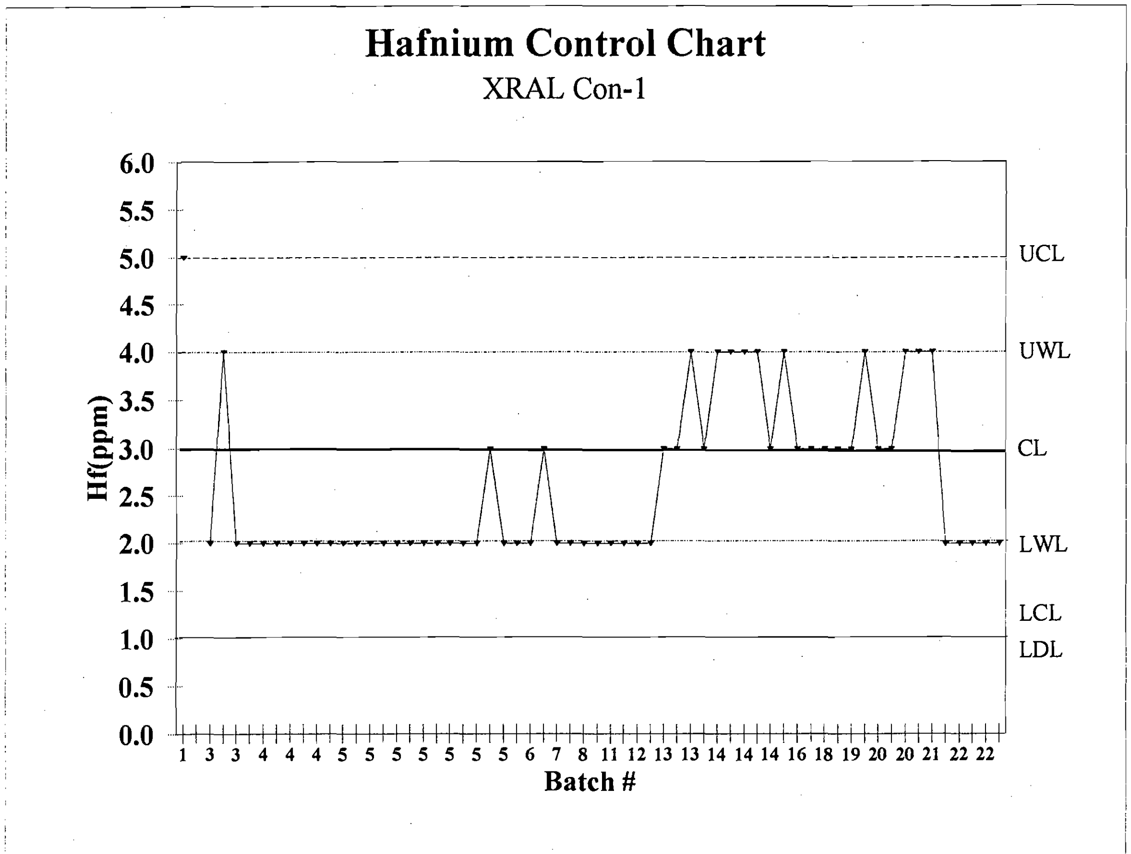
30-Sep-96



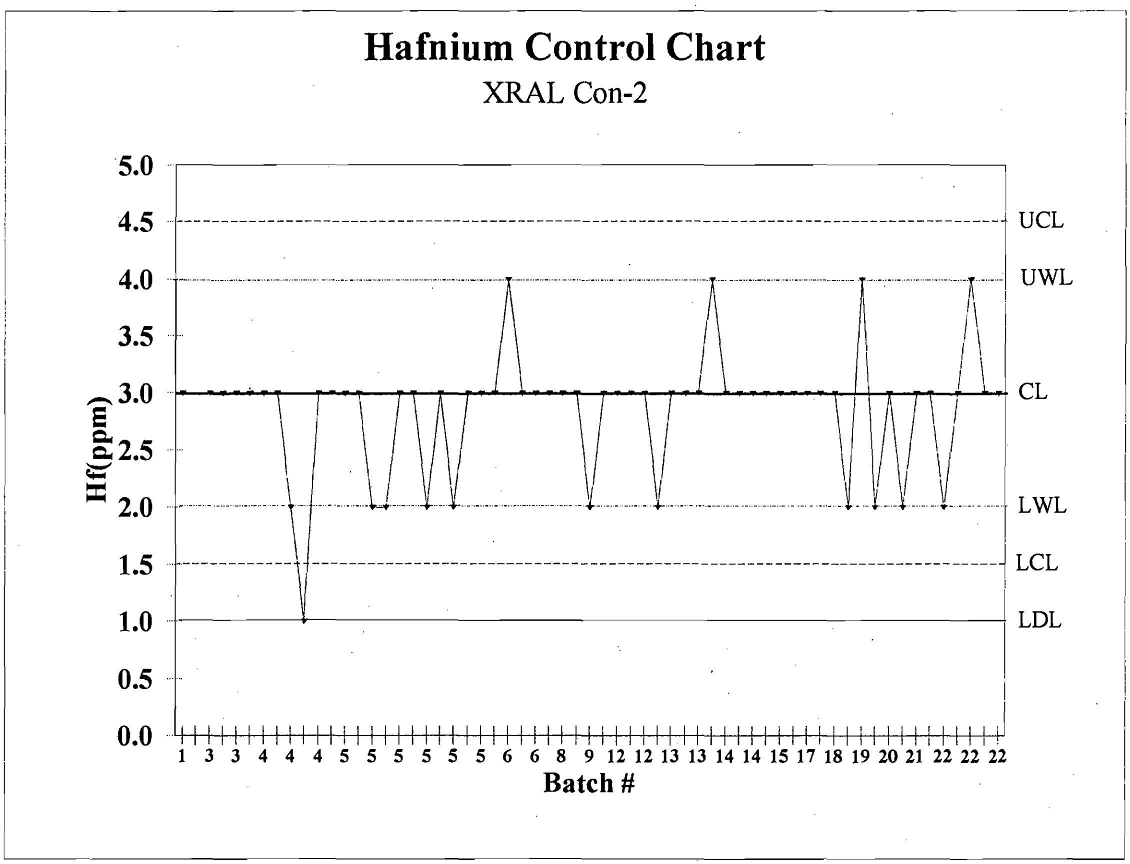
30-Sep-96



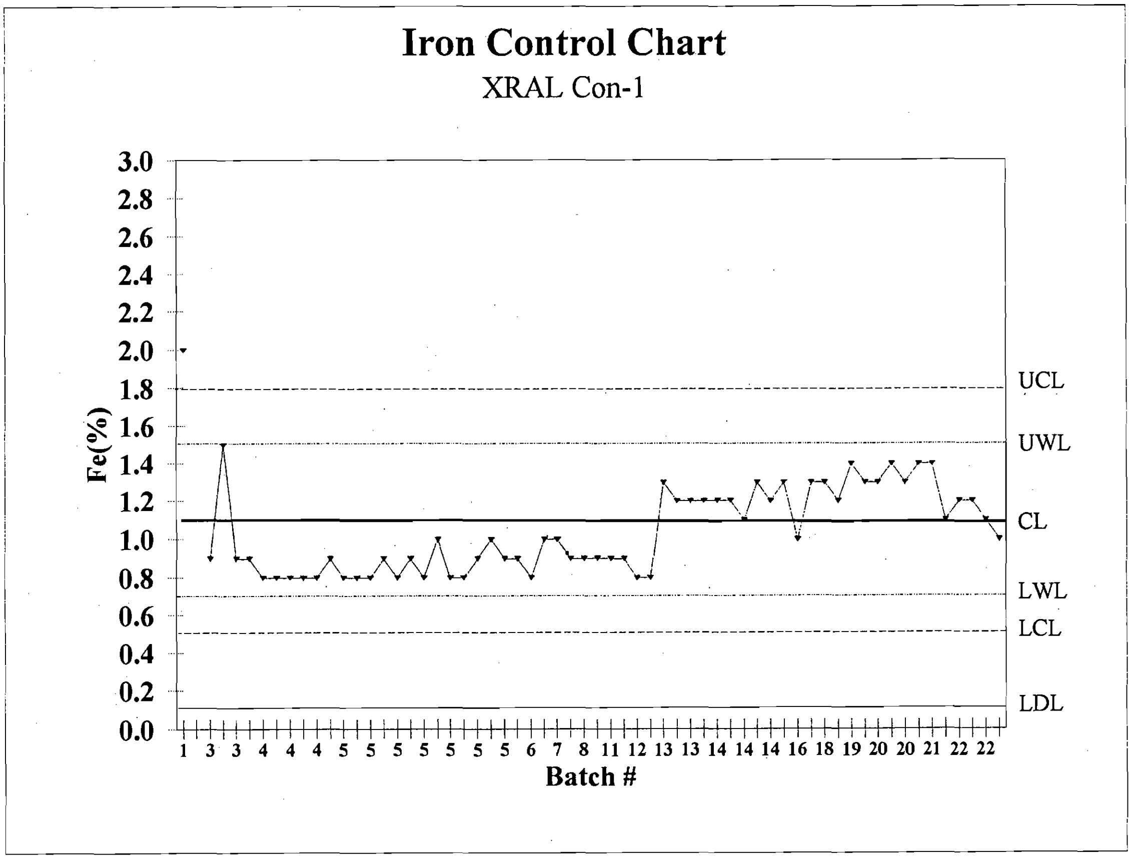
30-Sep-96



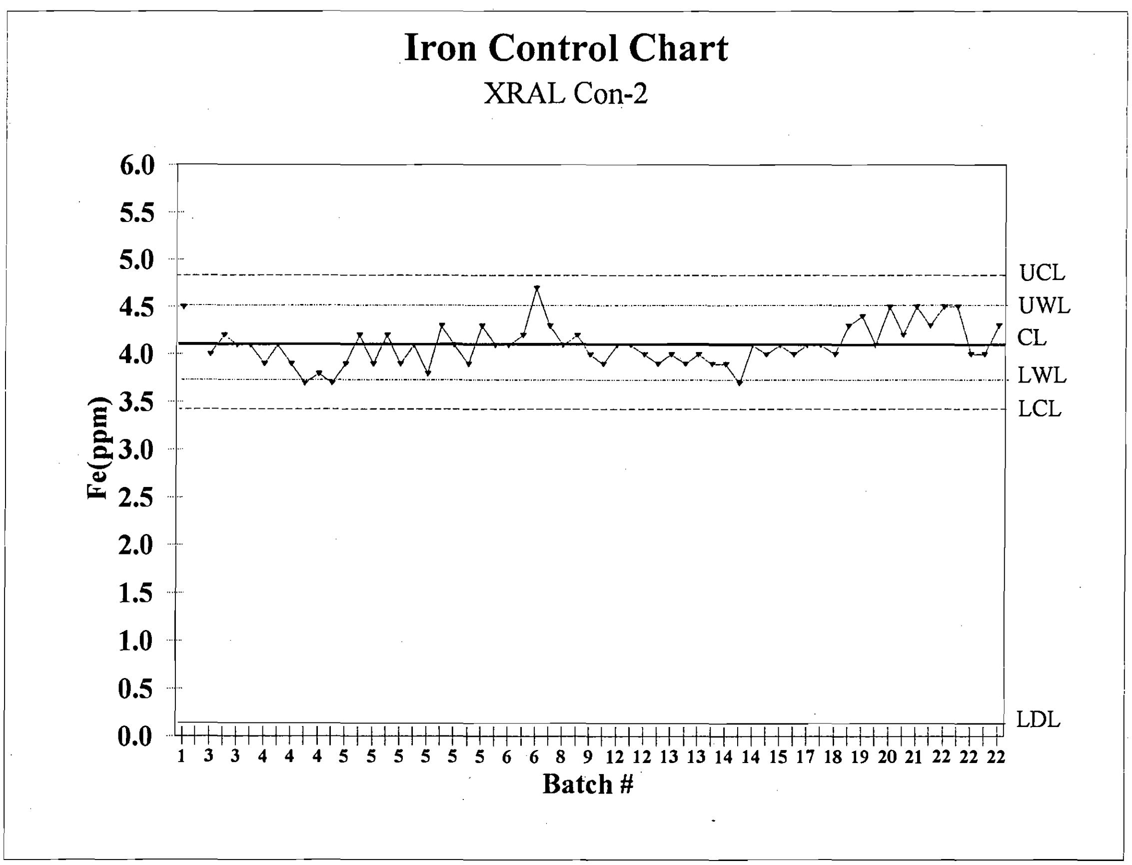
30-Sep-96



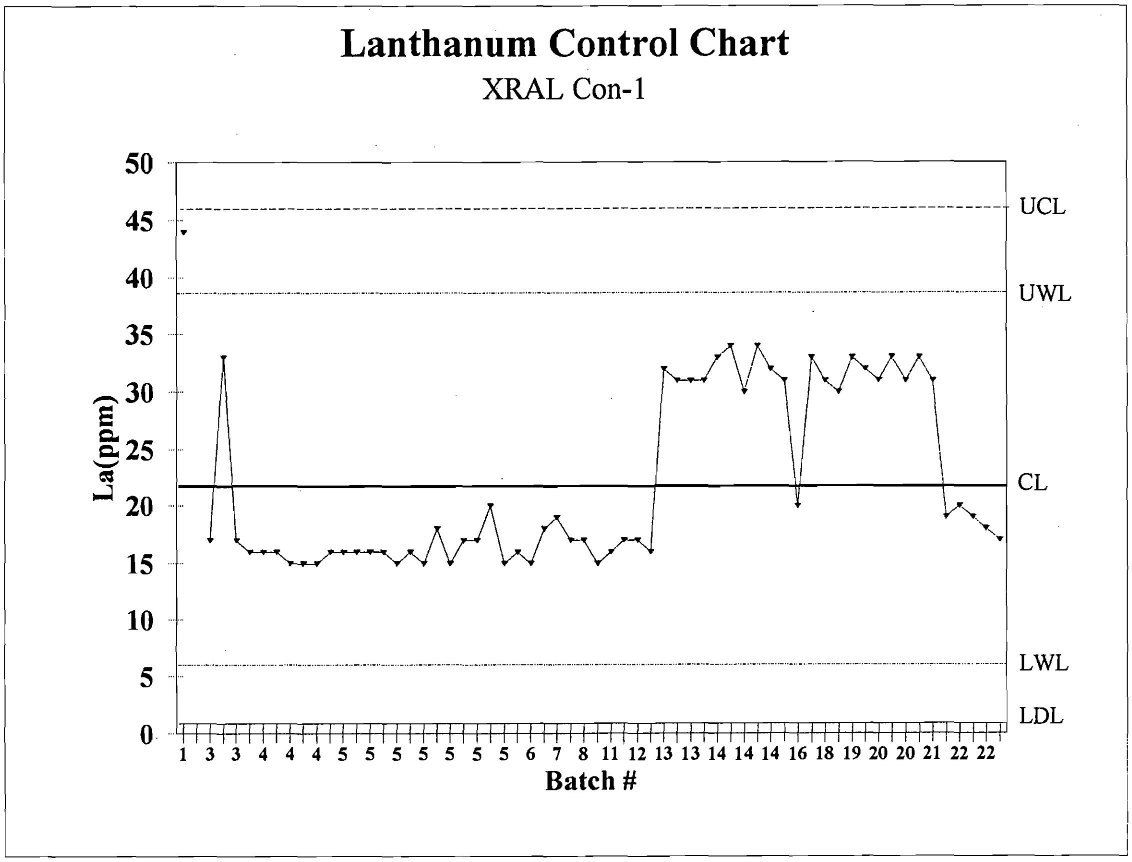
30-Sep-96



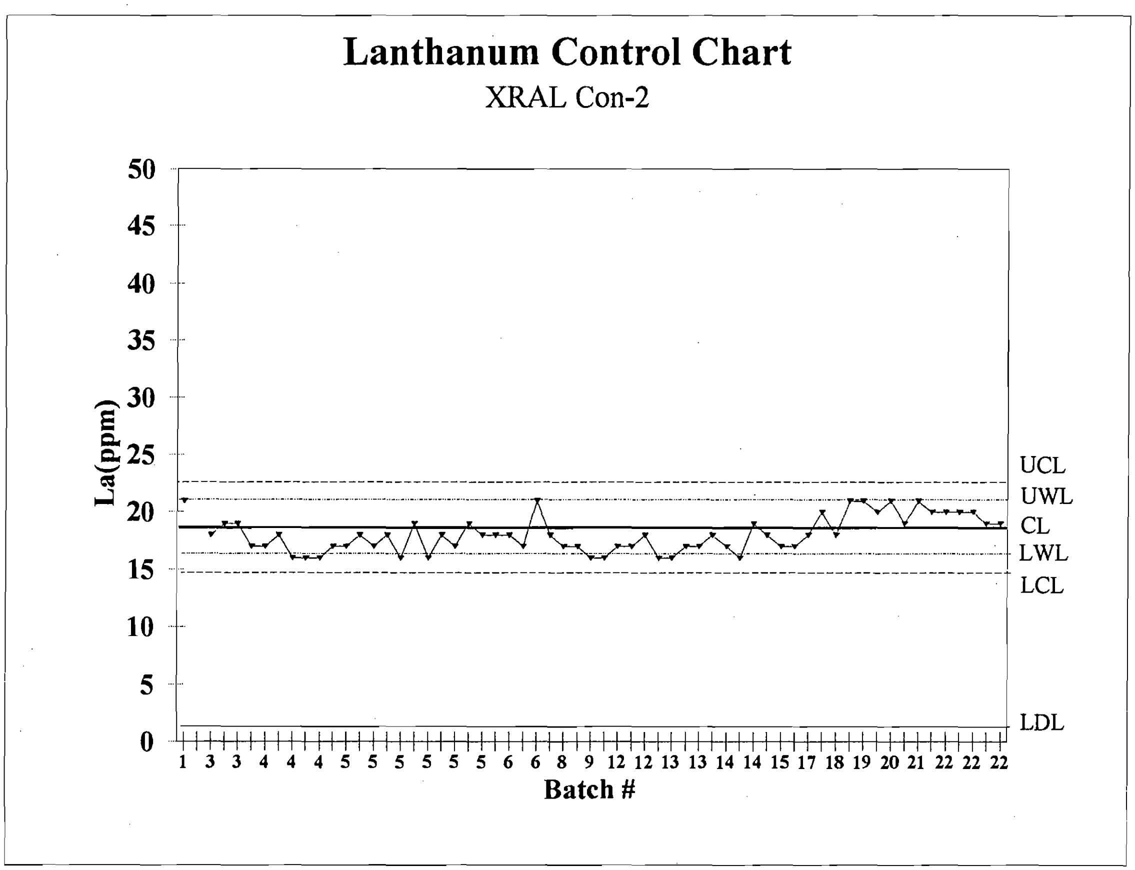
30-Sep-96

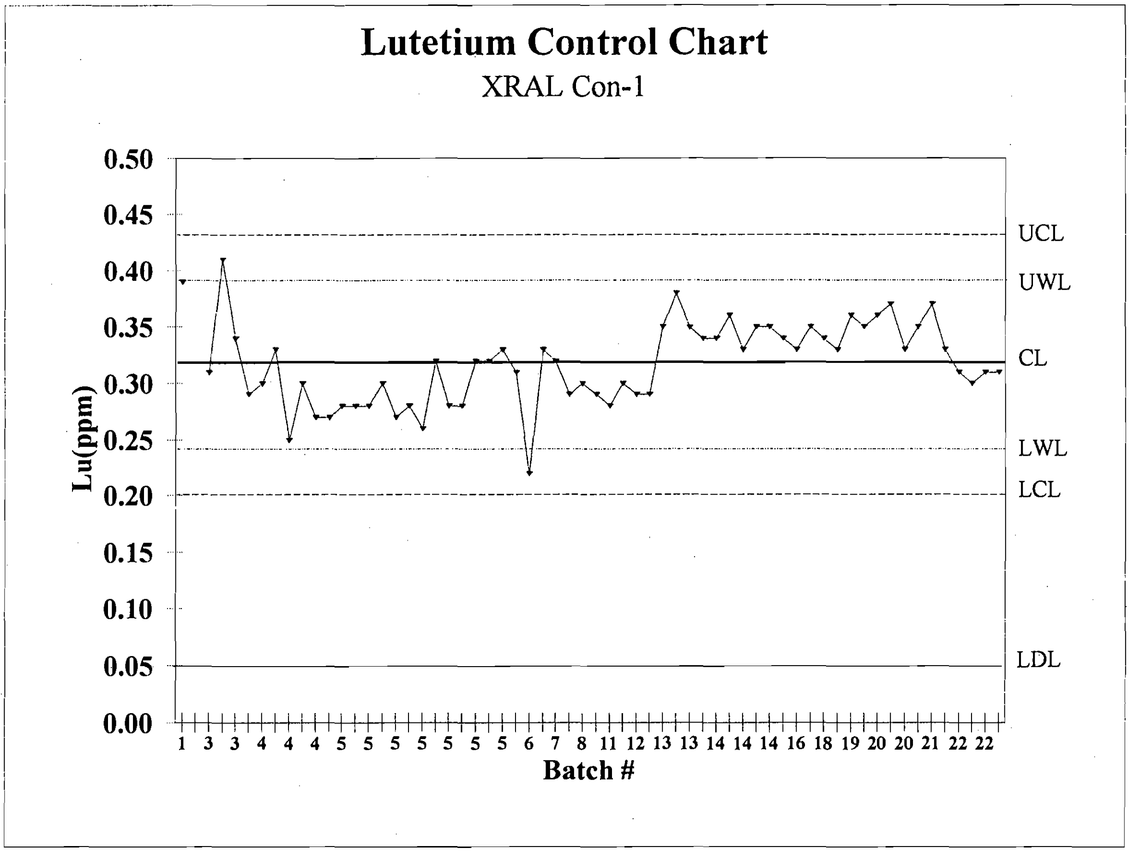


03-Oct-96

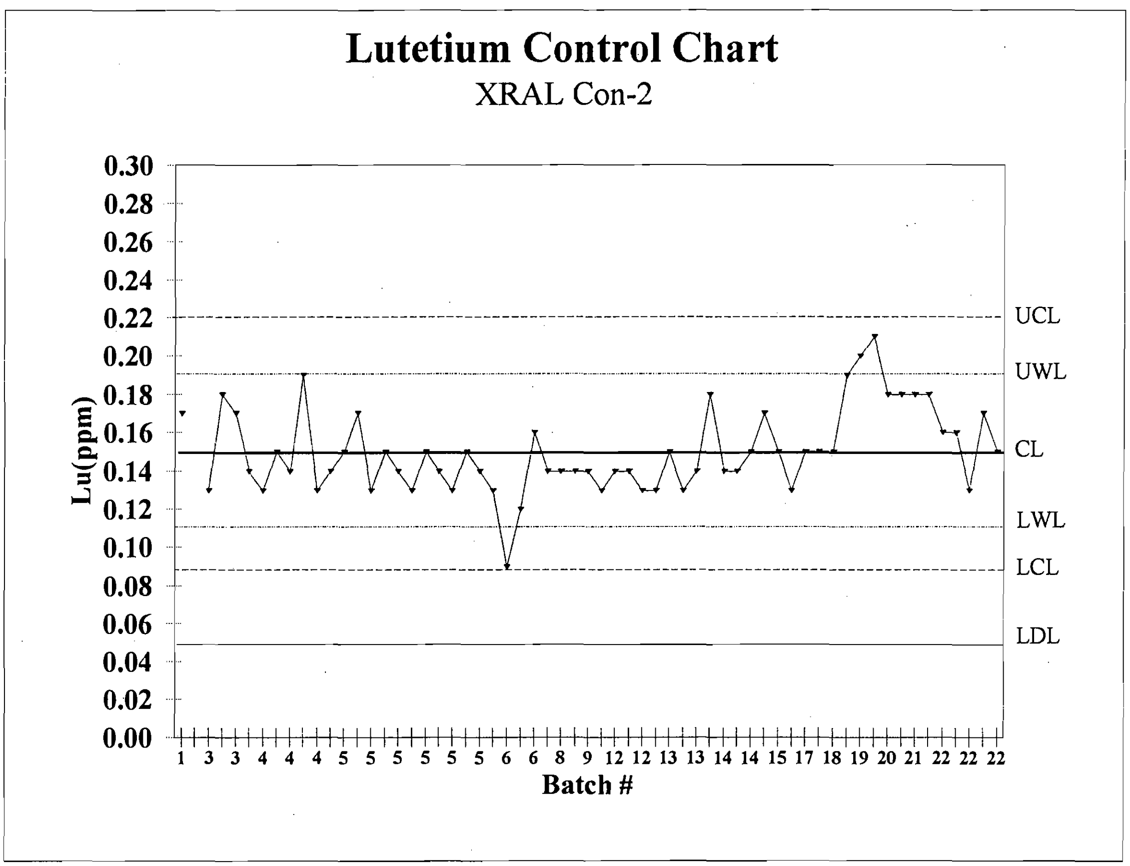


03-Oct-96

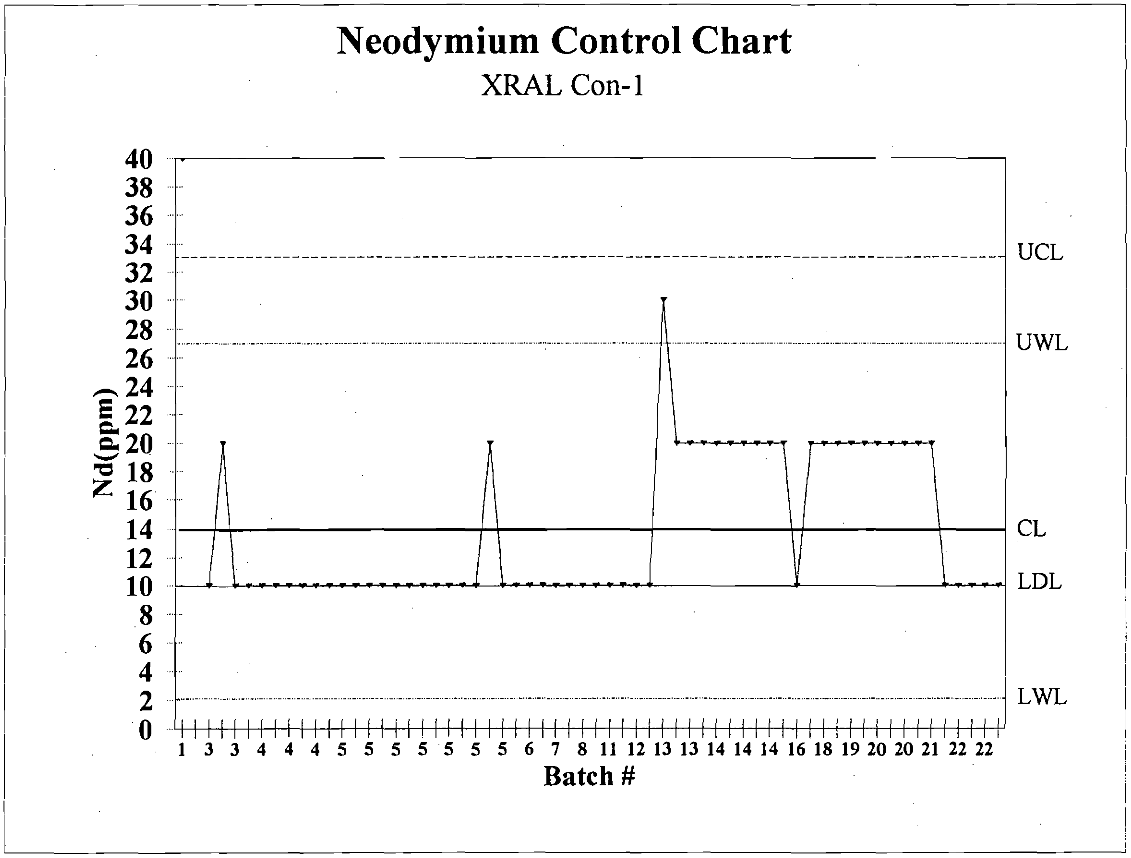



Lutetium Control Chart
XRAL Con-1
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Lu(ppm)
UCL
UWL
CL
LWL
LCL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

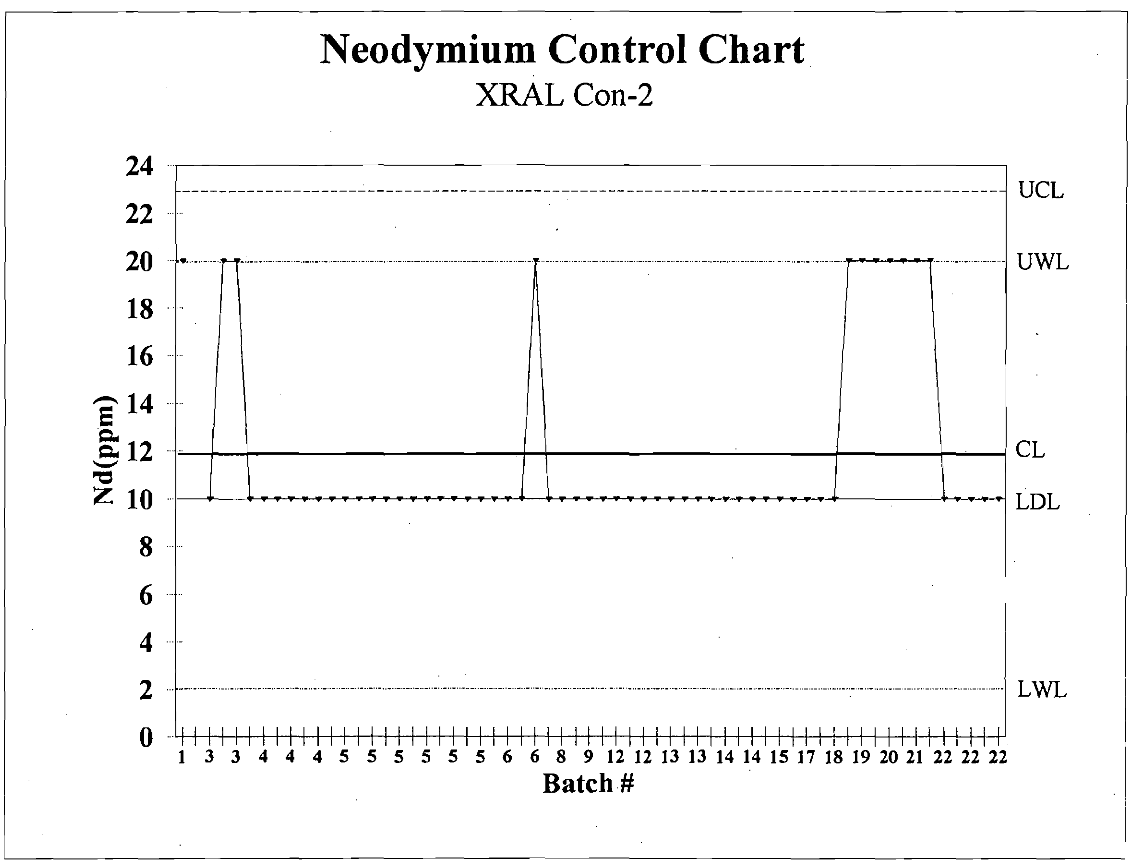
01-Oct-96


Lutetium Control Chart
XRAL Con-2
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Lu(ppm)
UCL
UWL
CL
LWL
LCL
LDL
1 3 3 4 4 4 5 5 5 5 5 5 6 6 8 9 12 12 13 13 14 14 15 17 18 19 20 21 22 22 22
Batch #

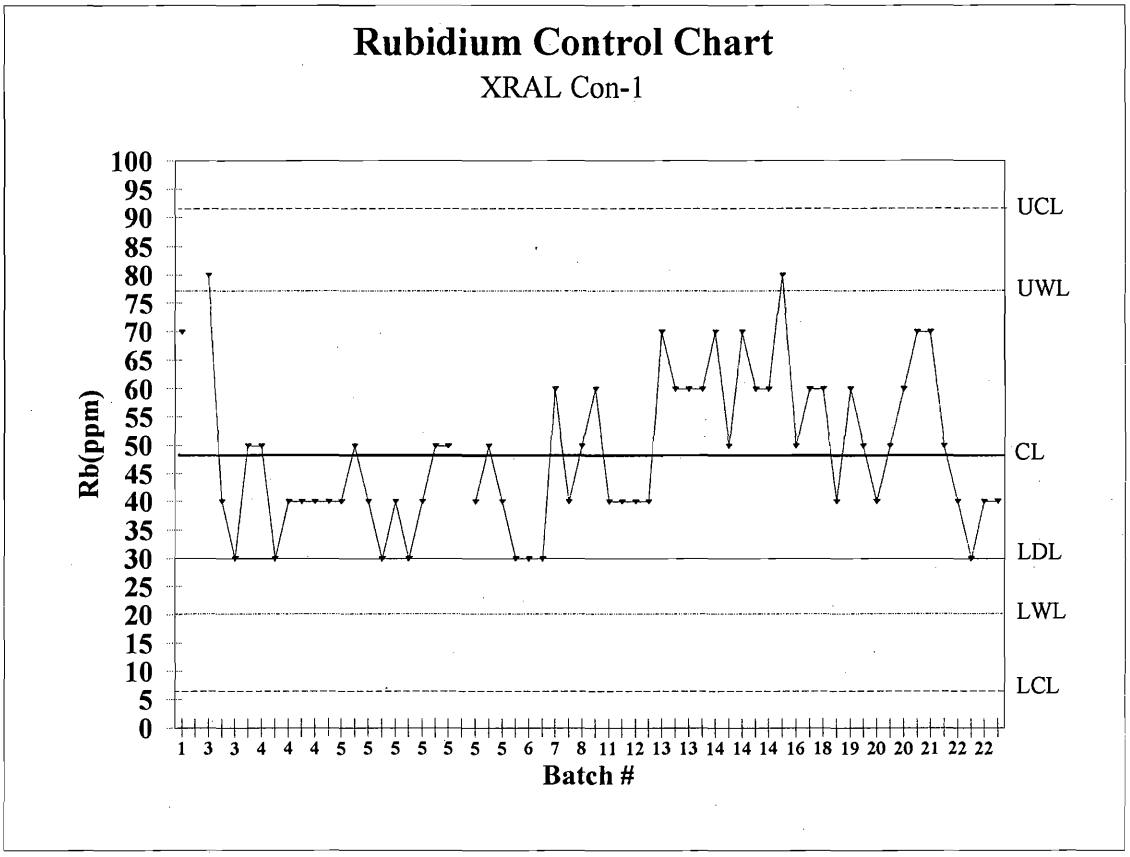
03-Oct-96



01-Oct-96

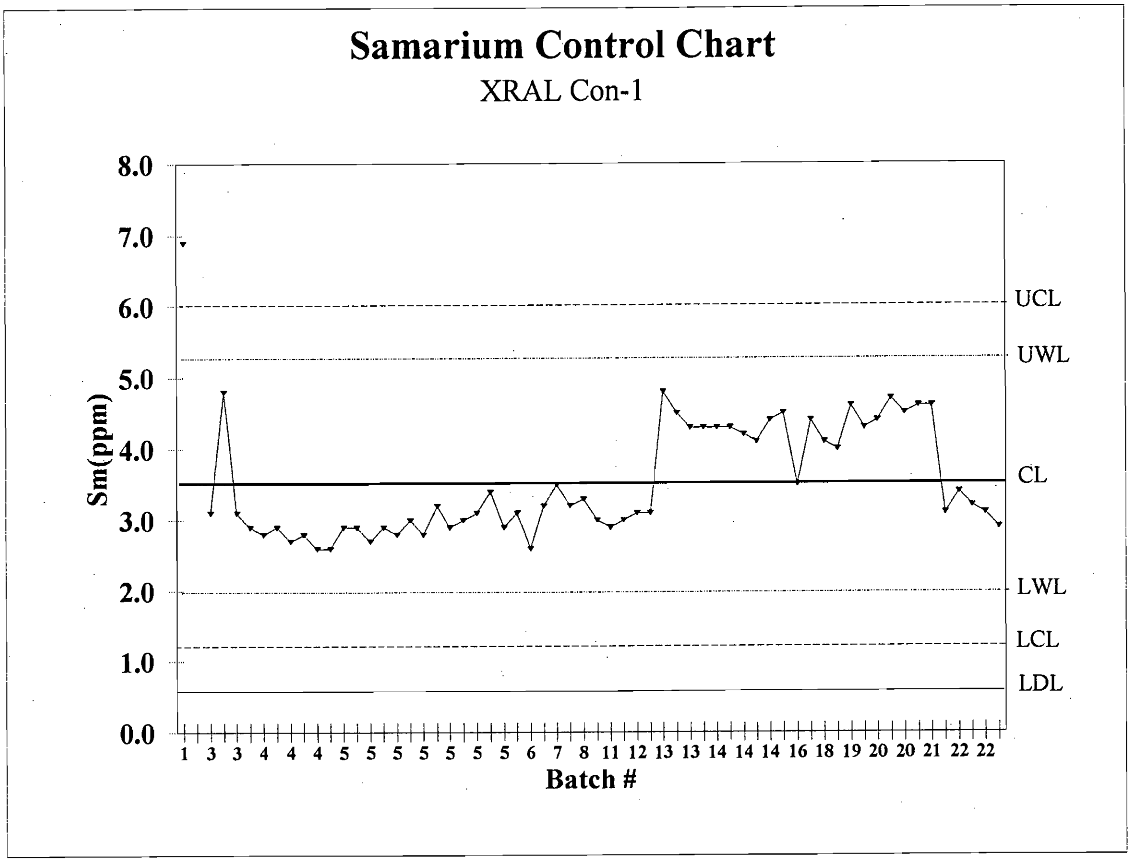


01-Oct-96

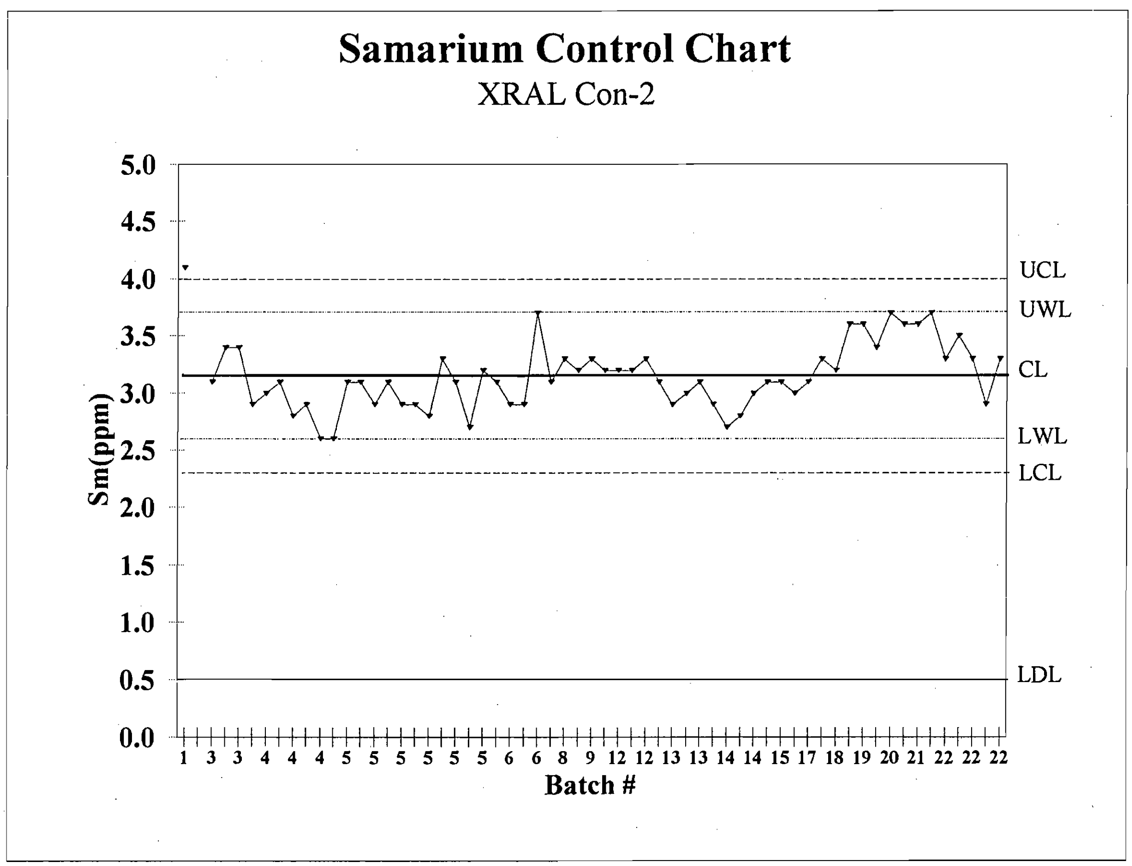


Rubidium Control Chart
XRAL Con-1
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Rb(ppm)
UCL
UWL
CL
LDL
LWL
LCL
1 3 3 4 4 4 5 5 5 5 5 5 5 6 7 8 11 12 13 13 14 14 14 16 18 19 20 20 21 22 22
Batch #

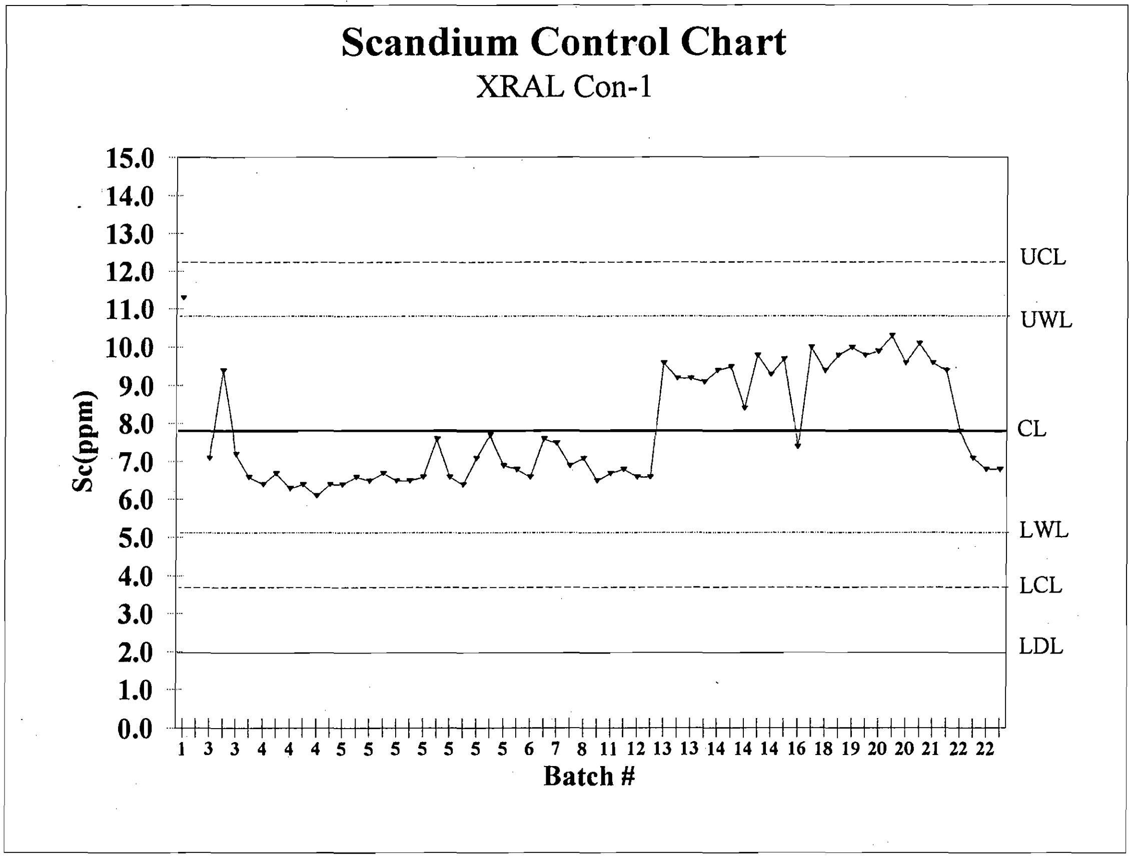
02-Oct-96



02-Oct-96



01-Oct-96



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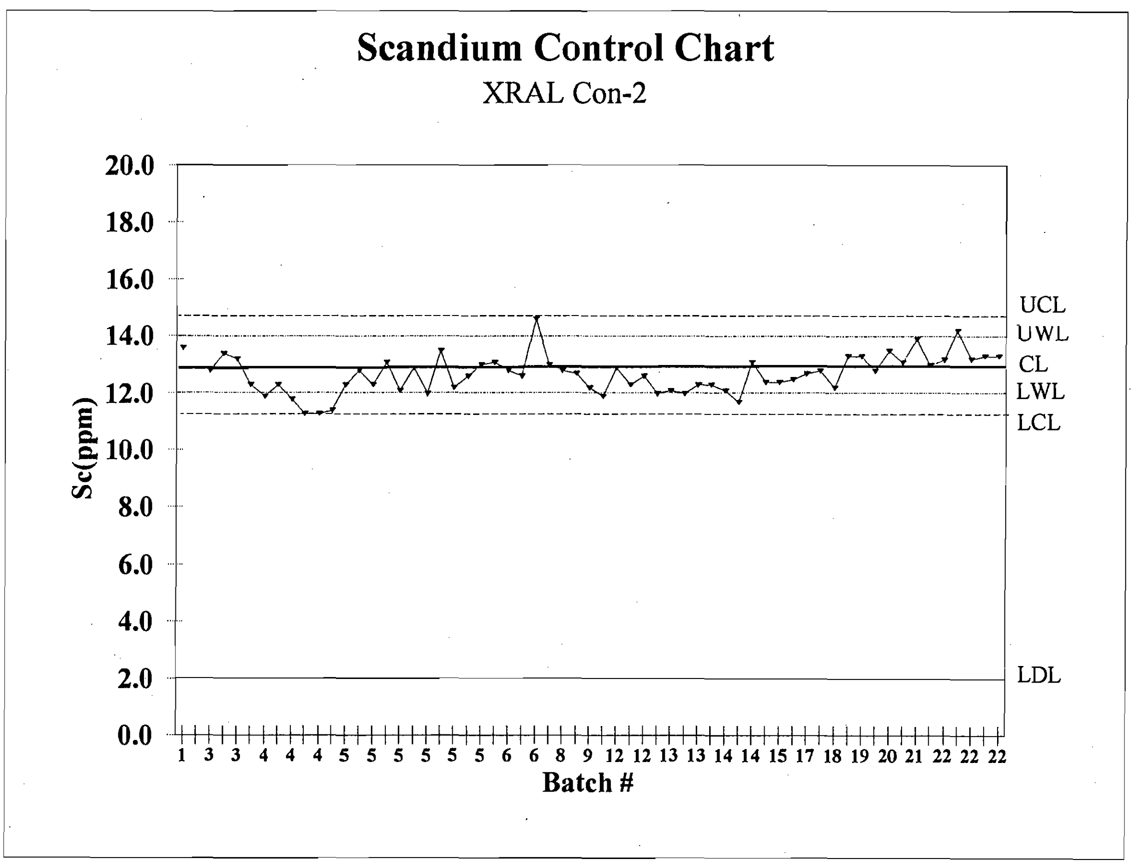

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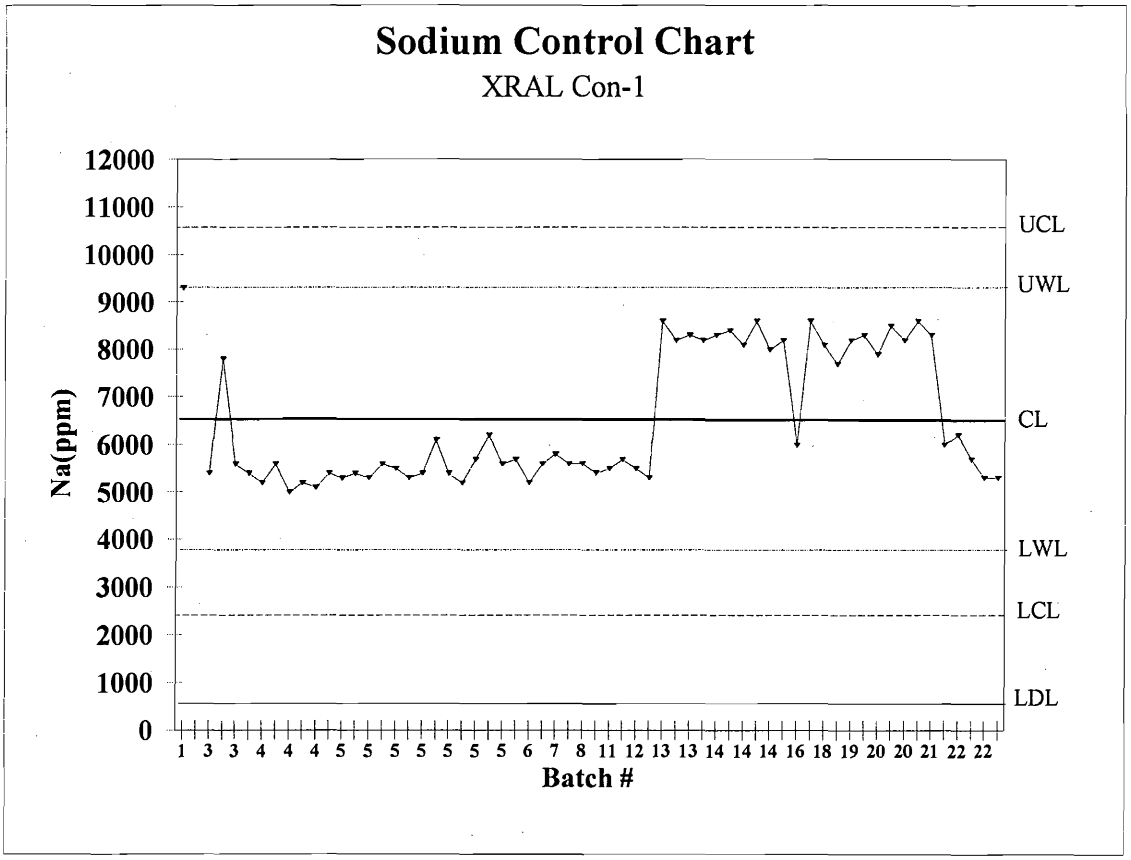

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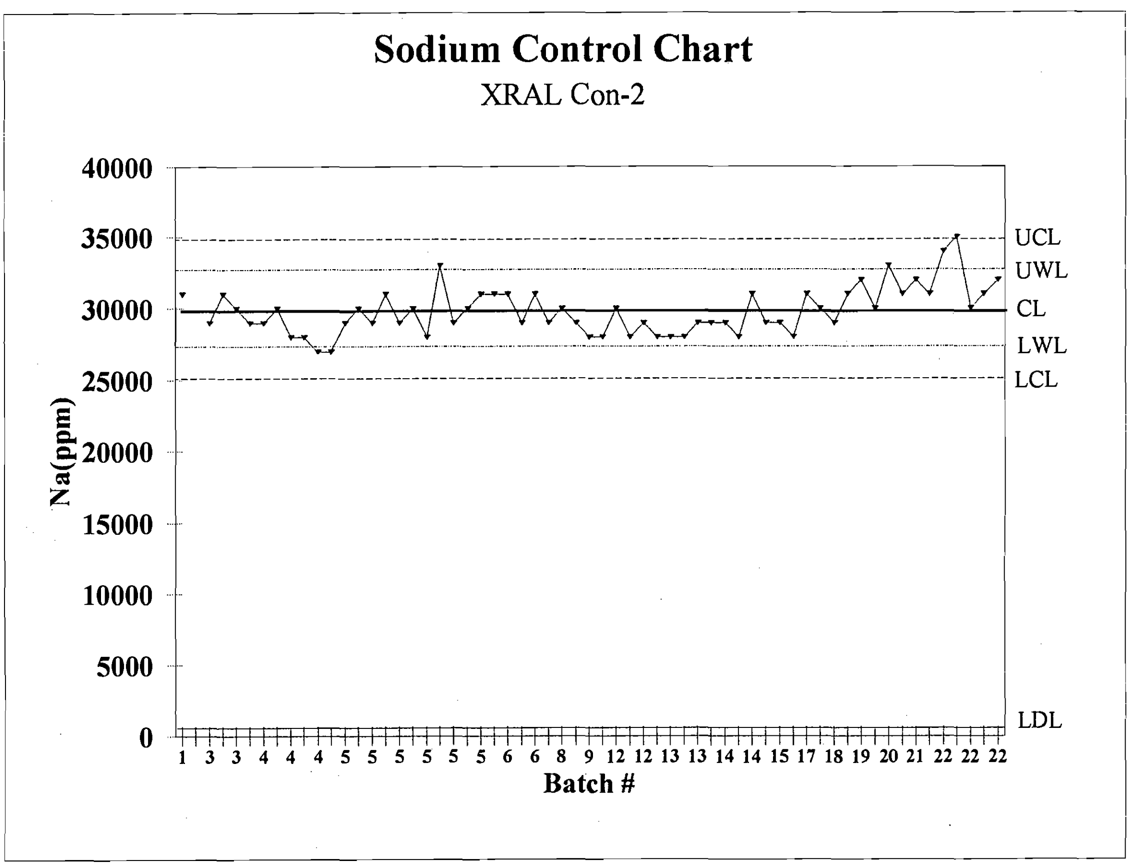

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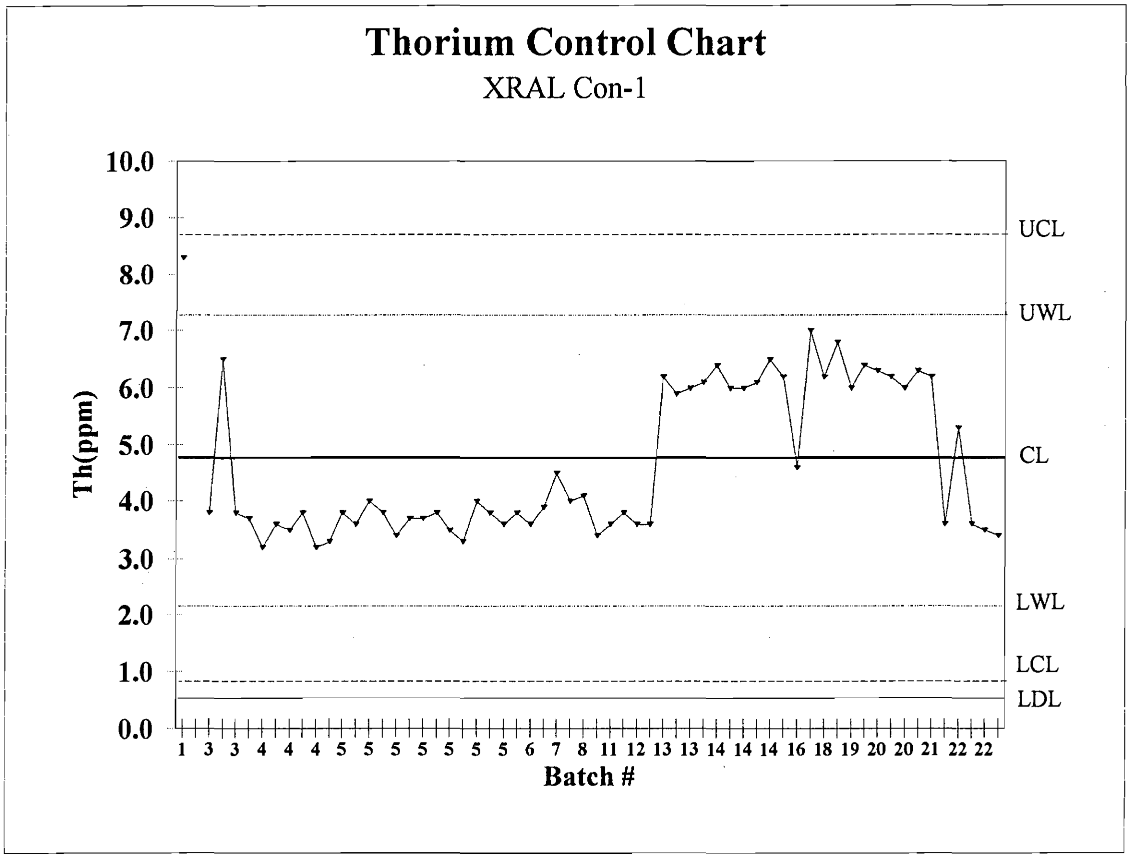

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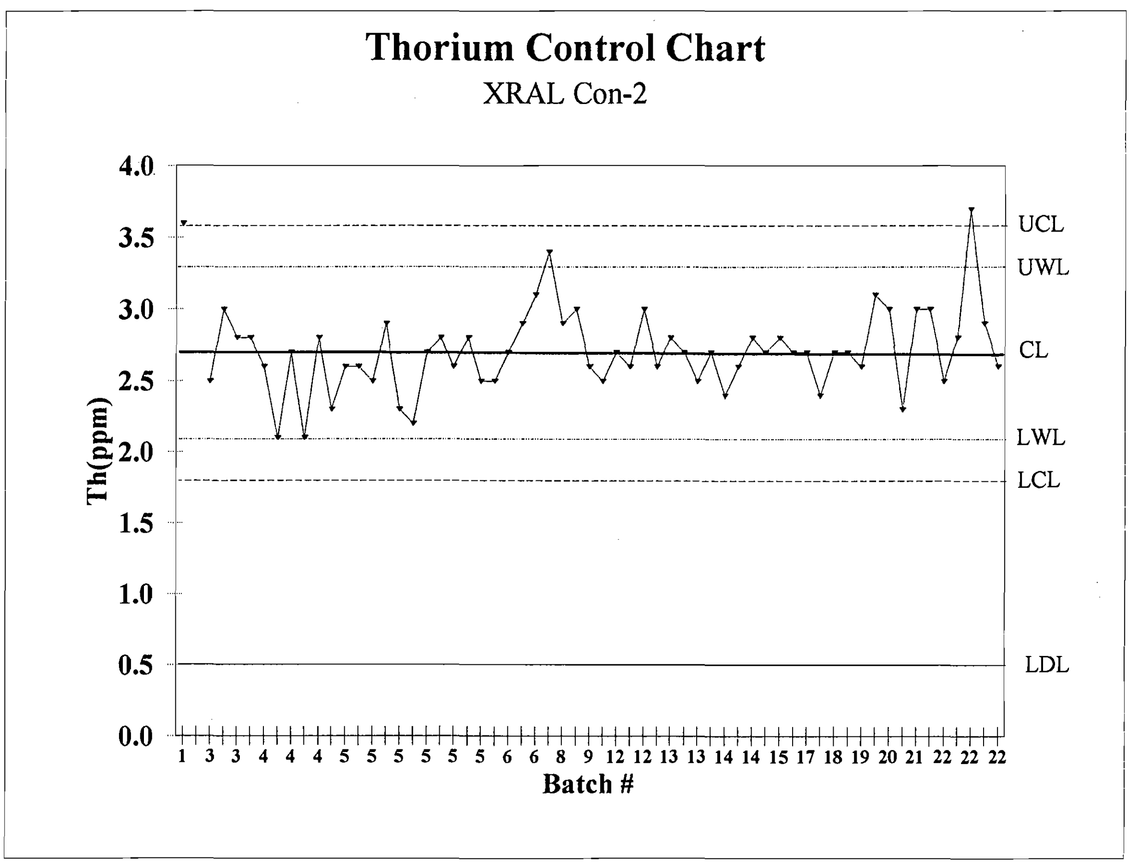

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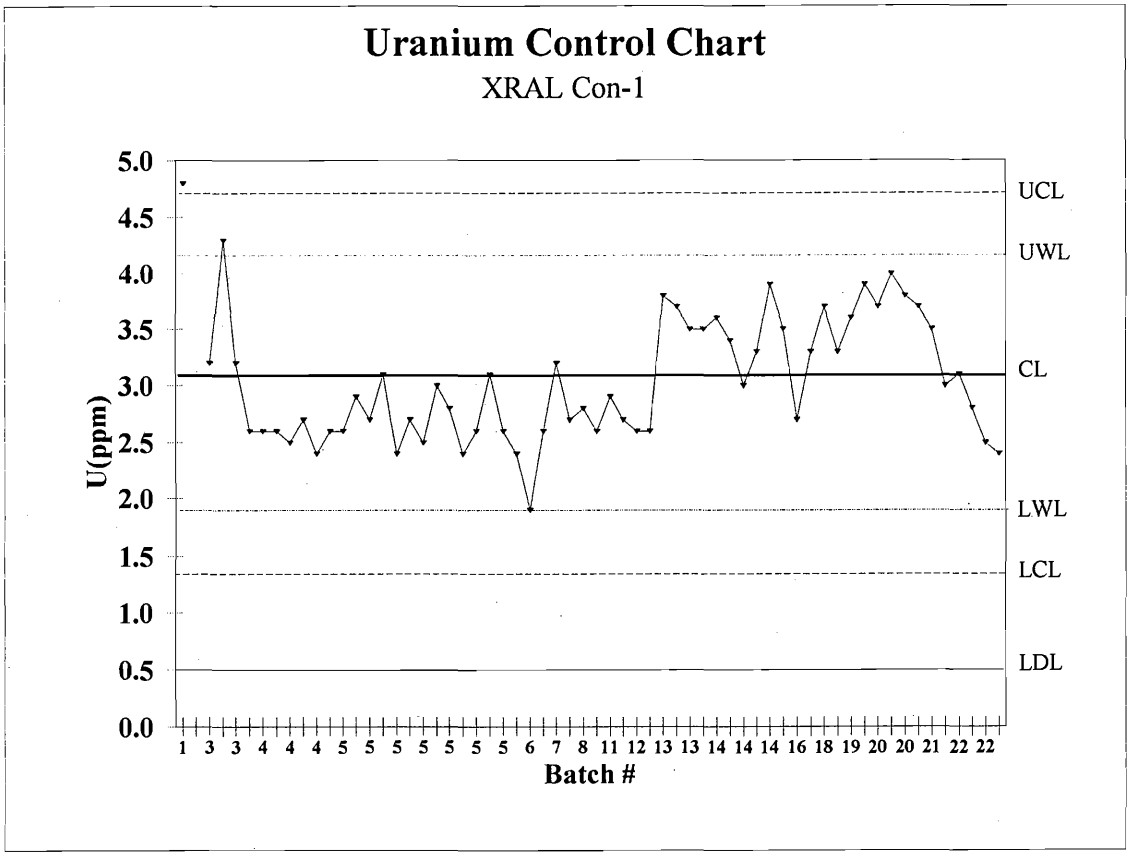

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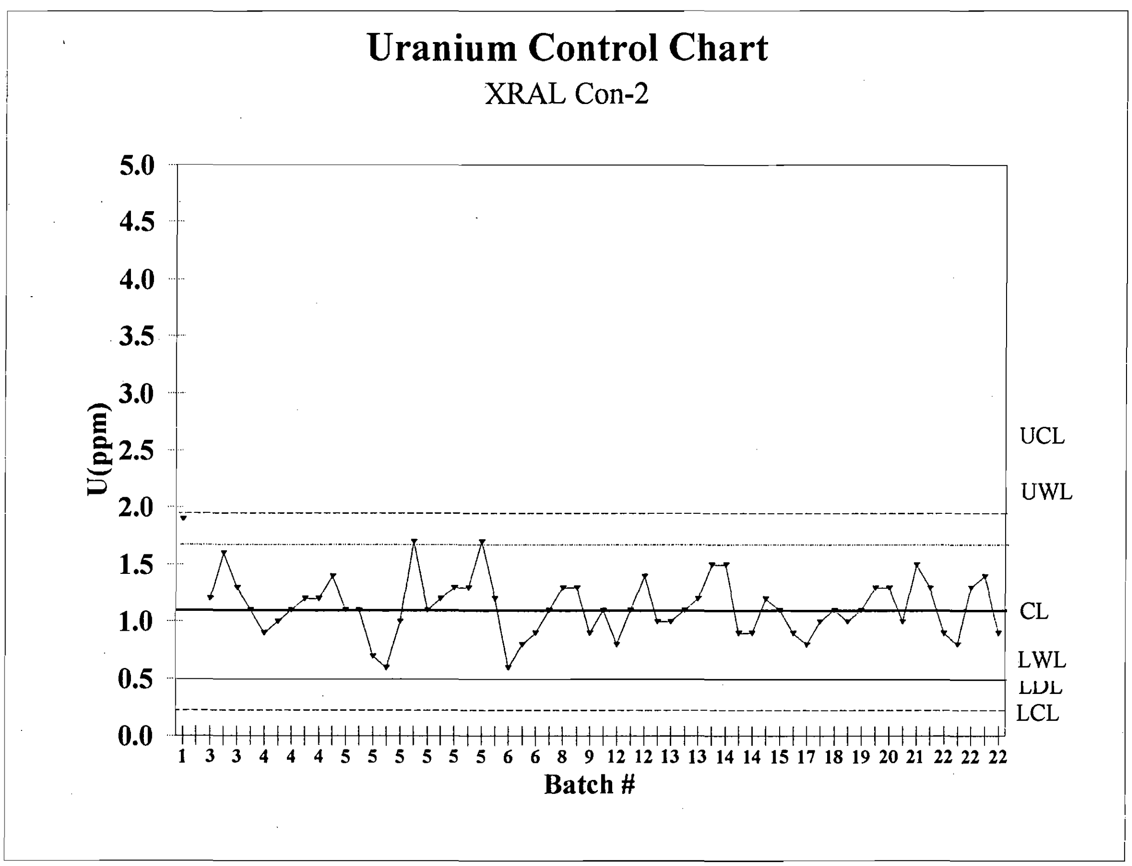

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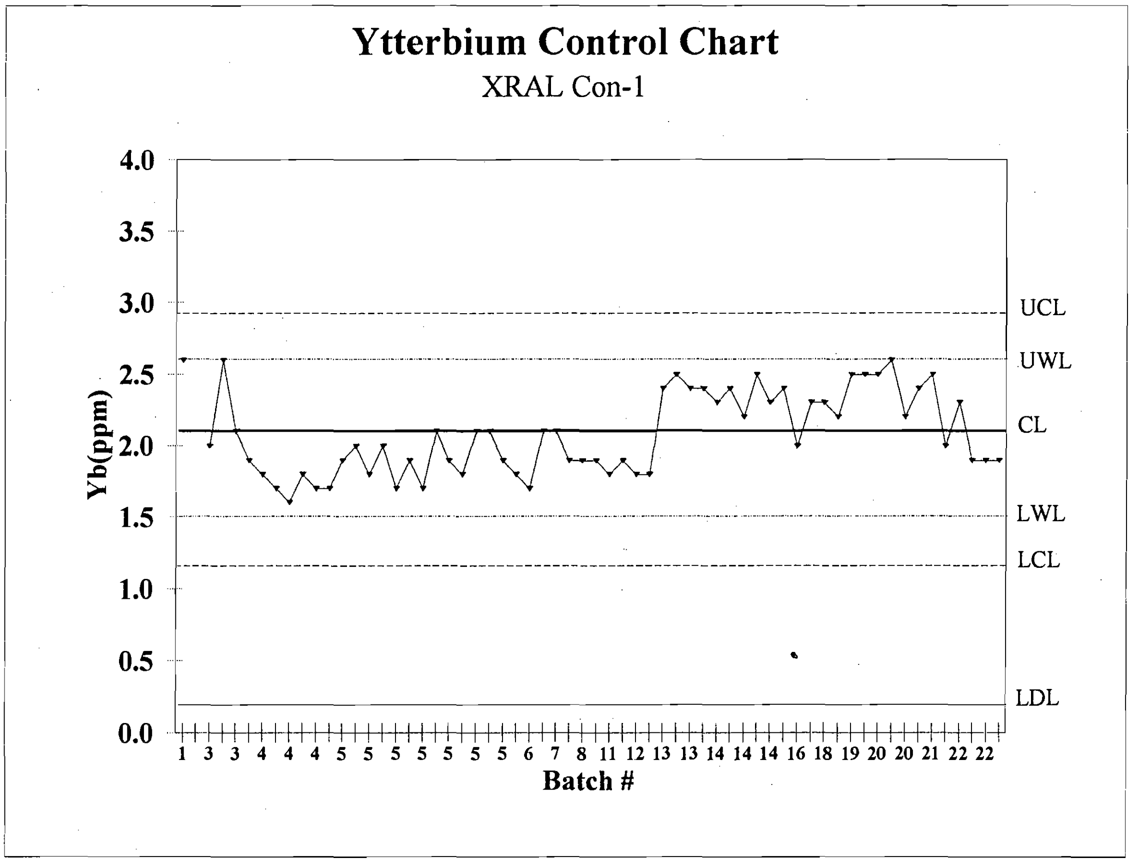

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