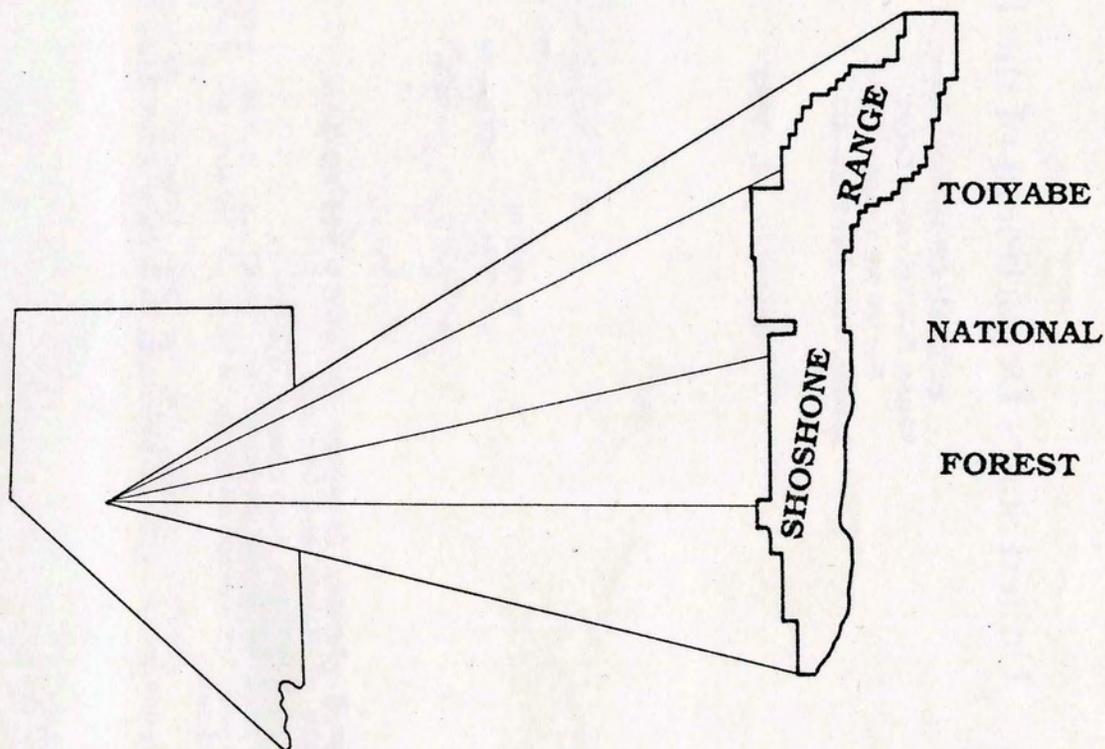


**MLA** 16-93

Mineral Land Assessment  
Open-File Report/1993

**Mines, Prospects, and Mineral Occurrences  
in that part of the Shoshone Range, Nevada,  
Administered as Toiyabe National Forest**



**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF MINES**



# United States Department of the Interior



BUREAU OF MINES  
Western Field Operations Center  
East 360 3rd Avenue  
Spokane, Washington 99202-1413

December 20, 1993

Dr. Jonathan G. Price, Director and State Geologist  
Nevada Bureau of Mines and Geology  
University of Nevada  
Reno, NV 89557-0088

Dear Dr. Price:

Enclosed is one copy of the following MLA Open-File Report:

MLA 16-93 Mines, Prospects, and Mineral Occurrences in That Part of the  
Shoshone Range, Nevada, Administered as Toiyabe National Forest

The U.S. Bureau of Mines will be unable to supply additional copies of this report due to a printing moratorium. However, please feel free to reproduce the report if you need additional copies.

If I may be of further assistance, please let me know.

Sincerely,

Michael M. Hamilton  
Geologist

Enclosure

MINES, PROSPECTS, AND MINERAL OCCURRENCES IN THAT PART  
OF THE SHOSHONE RANGE, NEVADA, ADMINISTERED AS  
TOIYABE NATIONAL FOREST

By  
Michael M. Hamilton

MLA 16-93

1993

Western Field Operations Center  
Spokane, Washington

UNITED STATES DEPARTMENT OF THE INTERIOR  
Bruce Babbitt, Secretary

BUREAU OF MINES  
Hermann Enzer, Acting Director

## PREFACE

A January 1987 Interagency Agreement between the U.S. Bureau of Mines, U.S. Geological Survey, and U.S. Forest Service describes the purpose, authority, and operation for a program of forest-wide studies. The program is intended to assist the Forest Service in incorporating mineral resource data in forest plans as specified by the National Forest Management Act (1976) and Title 36, Chapter 2, Part 219, Code of Federal Regulations and to augment the Bureau's mineral resource data base so that it can analyze and make available minerals information as required by the National Materials and Minerals Policy, Research and Development Act (1980). This report is based upon available published information, field investigations, and mining company data.

This open-file report contains data gathered and interpreted by personnel of the U.S. Bureau of Mines, Western Field Operations Center, Branch of Resource Evaluation, East 3460 Third Avenue, Spokane, WA 99202. This report has been approved by the Branch of Mineral Land Assessment, Washington, D.C.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

lb	avoirdupois pound
cu m	cubic meter
cu yd	cubic yard
fl	flask
ft	foot
g	gram
ha	hectare
in.	inch
kg	kilogram
km	kilometer
lt	long ton
m	meter
mt	metric ton
mt/d	metric ton per day
mtu	metric ton unit
mi	mile
MM	million
ppm	part per million
%	percent
ton	short ton
sq km	square kilometer
sq mi	square mile
oz	troy ounce
¢	U.S. cent
\$	U.S. dollar

CONVERSION FACTORS FOR UNITS OF MEASURE  
USED IN THIS REPORT

1 acre	=	0.4047 ha
1 cu yd	=	0.7646 cu m
1 flask	=	76 lb or 34.47 kg
1 ft	=	0.3048 m
1 g/mt	=	0.02917 oz/ton
1 m	=	3.281 ft
1 mi	=	1.609 km
1 mt	=	1.102 ton
1 mt	=	2,204.6 lb
1 mtu	=	0.01 mt
1 ppm	=	1 g/mt
1 ppm	=	0.029167 oz/ton
1 lb	=	0.4536 kg
1 lb/ton	=	0.5 kg/mt
1 oz	=	0.0311 kg
1 oz/cu yd	=	40.679 g/cu m
1 oz/ton	=	34.286 g/mt
1 ton	=	0.9072 mt
1 ton	=	2000.0 lb

CHEMICAL ABBREVIATIONS USED IN THIS REPORT

Sb	antimony	Mn	manganese
As	arsenic	Hg	mercury
Ba	barium	Mo	molybdenum
BaSO <sub>4</sub>	barite	Rb	rubidium
Be	beryllium	Sc	scandium
Bi	bismuth	Si	silica
B	boron	Ag	silver
Cd	cadmium	Sr	strontium
Ca	calcium	S	sulfur
Co	cobalt	Te	tellurium
Cu	copper	Tl	thallium
F	fluorine	Sn	tin
CaF <sub>2</sub>	fluorite	W	tungsten
Ge	germanium	U	uranium
Au	gold	U <sub>3</sub> O <sub>8</sub>	uranium oxide
Fe	iron	Y	yttrium
Pb	lead	Zr	zirconium
		Zn	zinc

## SUMMARY

In 1989 and 1990 the U.S. Bureau of Mines performed a mineral survey of those parts of the Shoshone Range within and adjacent to the Toiyabe National Forest. This study is part of a mineral resource evaluation of the 1.6 million hectare (4 million acre) Toiyabe National Forest located in central Nevada and eastern California. This report is a compilation of U.S. Bureau of Mines field data with mineral information obtained from literature, unpublished company reports, and files of the U.S. Bureau of Mines, U.S. Forest Service, and the Nevada Bureau of Mines. The main goal of this report is to provide the U.S. Forest Service with mineral resource information for long range land-use planning by defining areas of possible mineral related activity in the future. An additional goal is to add to the Bureau's mineral data base.

The Shoshone Range study area is located in central Nevada, about 64 kilometers (40 mi) northwest of Tonopah and covers about 81,000 hectares (200,000 acres) of mountainous terrain in Nye and Lander counties. The study area is part of the Basin and Range geologic province, and consists of north-trending, block-faulted mountains of sedimentary, metamorphic, and volcanic rocks.

Mining activity started in the early 1860's and continues in the 1990's. Total recorded mineral production for the study area amounts to about 2,998 kilograms (96,400 oz) gold, 771,300 kilograms (24.8 million oz) silver, 1,180,000 kilograms (2.6 million lb) lead, 64,860 kilograms (143,000 lb) copper, 322,240 kilograms (710,400 lb) zinc, 10,900 kilograms (24,000 lb) antimony, 488,500 kilograms (14,168 fl) mercury, 3,570 metric tons (3,940 tons) fluorite, and small amounts of barite. Most of the precious-base metal production came from the Shamrock, Berlin, and Alexander mines; most of the mercury from the Ione Mercury and Nevada Cinnabar mines; and all of the fluorite from the Sea Bee and Chicago mines.

Reported resources from lode deposits with metallic commodities contain 4,350 kilograms (140,000 oz) gold, 40,400 kilograms (1.3 million oz) silver, 1,090,000 kilograms (2.4 million lb) lead, and 124,000 kilograms (3,600 fl) mercury. Most of the gold is in the Grantsville Summit area. Reported precious metal resources should increase when data is released on gold deposits being explored in the Cloverdale and Grantsville mining districts. The remaining ore in the Fury open pit accounts for most of the silver resources, and deposits at the Iron Rail mine account for the lead resources. Deposits with mercury are located at three mines, the Ione Mercury, Nevada Cinnabar, and the San Pedro. Information on mercury resources was, in some cases, derived before cessation of mining operations, making it likely some of these resources were mined. An additional 246 kilograms (7,900 oz) of gold has been reported from placer resources, most of which are in the Ione and Cloverdale Canyon areas.

Reported industrial mineral resources include 91,000 metric tons (100,000 tons) of fluorite and 82,000 metric tons (90,000 tons) of barite. The fluorite is located in defined deposits at the Sea Bee and Chicago mines; the barite is an estimated resource at the Sky mine.

Areas favorable for future mineral-related activity were defined as to the expected mineral deposit types, and rated as to the likelihood of future activity. Areas with high potential for activity involving bulk-tonnage, low grade gold deposits include the Cloverdale district, Grantsville Ridge and Grantsville Summit areas, the Vernal prospect, and the northeast front of the range. Favorable areas for fissure vein and replacement deposits containing precious-base metals are in the central

part of the range from the town of Ione, south to Grantsville Canyon. Several smaller areas include the main part of the Jackson mining district and one property near Mt Ardivey. Additional activity may occur where Tertiary volcanic rocks cover potentially mineralized terrains similar to areas of past precious-base metal production. Future mining activity for fumarole or hot spring type mercury deposits would probably be limited to the Ione district near the big mercury mines. Areas that may attract interest for replacement type deposits of fluorite and hydrothermal vein deposits of antimony exists around known occurrences in the Berlin and Grantsville mining districts. Uranium occurrences near South Shoshone Peak indicate a possible presence of this commodity. Postulated intrusive stocks under central parts of the range suggest the potential for mining activity involving porphyry type deposits. There is a possibility of copper-tungsten porphyry deposits in the Grantsville Canyon area and in the South Shoshone Peak area of molybdenum porphyry deposits.

## INTRODUCTION

This report describes the U.S. Bureau of Mines (USBM) investigation of mineral resources in that part of the Shoshone Range which is administrated by the Toiyabe National Forest.

The study was undertaken at the request of the U.S. Forest Service (USFS) and included an examination of mines, prospects, and mineralized areas. Field work was accomplished in 1989 and 1990 by personnel from USBM's Western Field Operations Center, East 360 Third Avenue, Spokane, Washington 99202.

Results of this investigation are intended to: 1) help the USFS define areas of likely mining and mineral exploration activity in the future; 2) help the USFS to incorporate mineral resource information into forest plans as specified by the National Forest Management Act (1976); and 3) augment the USBM resource data base as required by the National Materials and Mineral Policy. While the USBM's immediate goal is to provide timely, accurate reports to other government agencies involved with land stewardship or mineral related legislation, and to the Public and the scientific community, our long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

### Geographic and Climatic Setting

The Shoshone Range is located in central Nevada about 64 kilometers (40 mi) northwest from Tonopah (fig. 1). The study area covers most of the Shoshone Range south of State Highway 722 and is comprised of about 81,000 hectares (200,000 acres) of National Forest lands, with small inclusions of State Park lands, patented mining claims, and homesteads. This study area is a part of the 1.6 million hectare (4 million acre) Toiyabe National Forest. The closest town with commercial facilities is Gabbs, Nevada, about 26 kilometers (16 mi) west of the central part of the range. Numerous secondary roads, dirt roads, and jeep trails provide fairly good access to most of the areas of mining development (fig.2).

The range trends north-northeast and is bounded by broad valleys on the northeast and west sides. On the southeast side are the narrow valleys of Indian and Cloverdale creeks. Elevations range from about 1,800 meters (5,900 ft) on Cloverdale Creek to 3,143 meters (10,313 ft) at the summit of North Shoshone Peak. Topographic relief is, generally, greater in the northern half of the study area.

The climate is arid and, except after rainstorms and during snowmelt, most creeks are dry. Winters are cold but relatively short with little snowfall. Summers are long, hot, and dry. The high elevations of central Nevada result in a slightly wetter and a more temperate climate than other parts of the state. Most of the range has year around vehicle access except when the ground is very wet. Vegetation is typical of the high desert with grasses on high, wind-swept areas, pinyon pine and juniper forest on slopes, and sage and dryland grasses at the lower elevations.

### Geologic Setting

The Shoshone Range is part of the Basin and Range geologic province, a terrain typified by north-trending fault-block mountains separated by broad, sediment-filled valleys. The geology has been described by Abrams (1979), Bonham (1970), Kleinhampl and Ziony (1985), Silberling

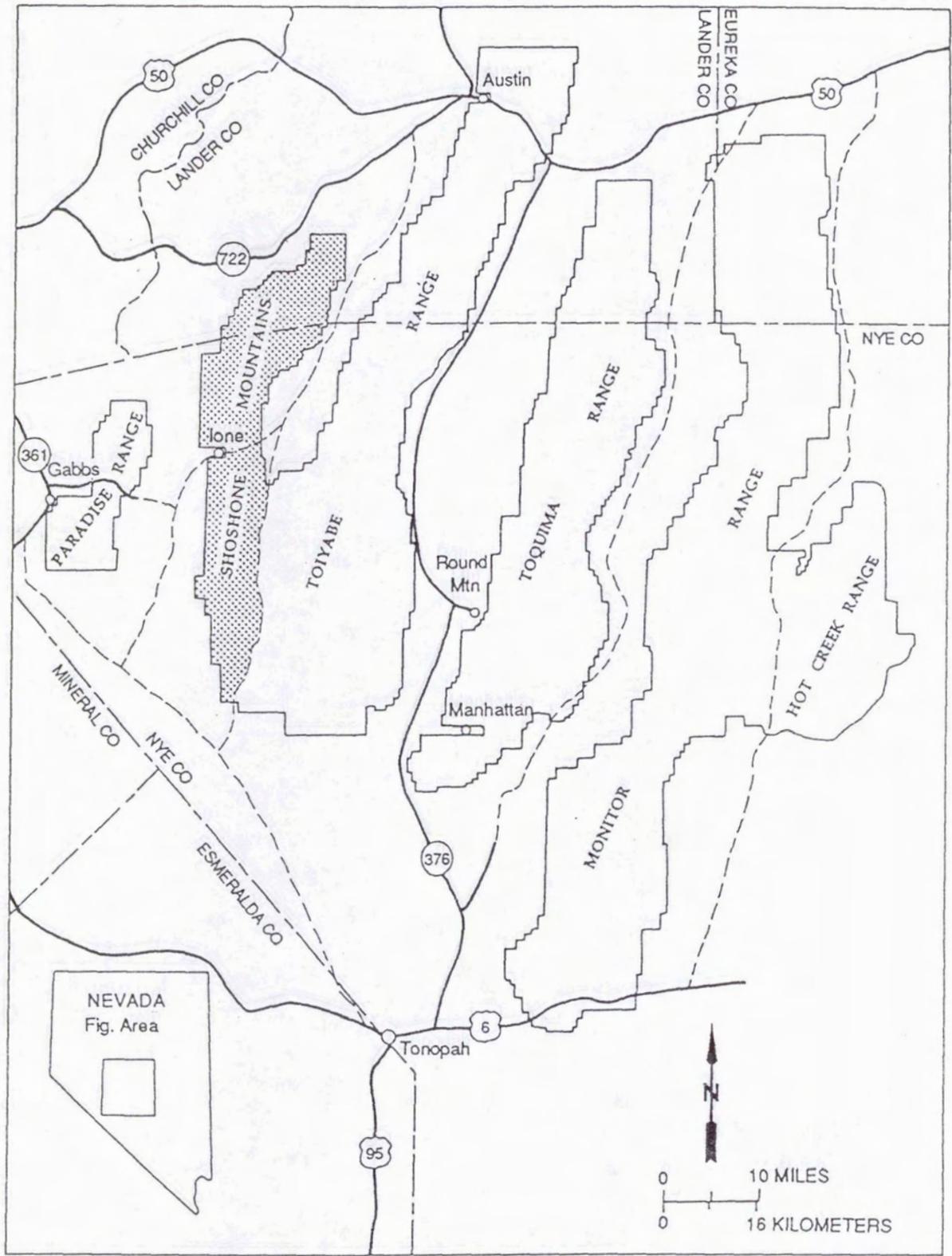


Figure 1.- Map showing the location of the Shoshone Range and five other ranges in west-central Nevada containing land administered as Toiyabe National Forest

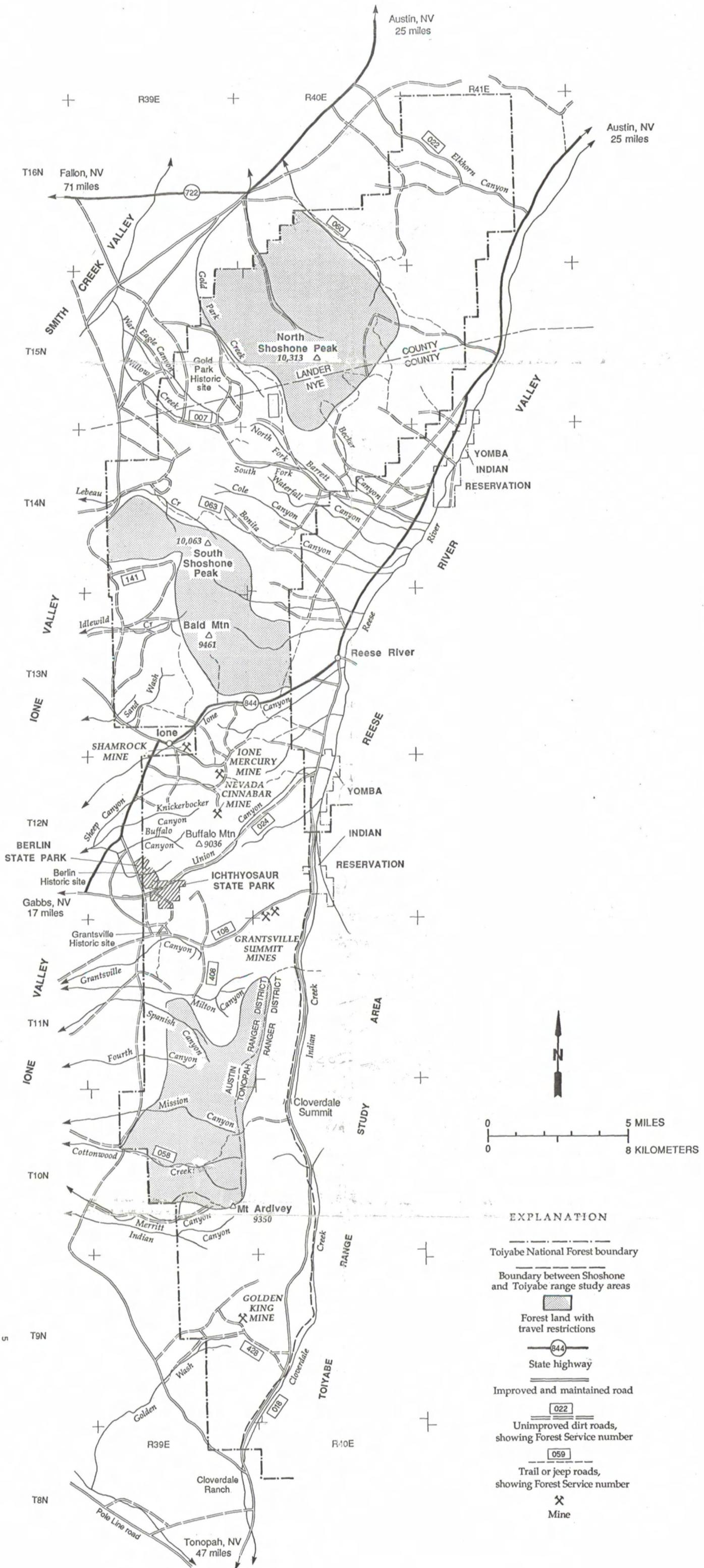


Figure 2.- Map showing geographic and sociographic features of the Shoshone Range study area

(1959), Steward and McKee (1977), and Vitaliano (1963, 1972), and the following brief geologic setting is derived, in part, from these publications.

Bedrock exposed in the range is from Permian to Tertiary in age and has undergone several episodes of tectonism (fig. 3). In the central and western parts of the range there is a nearly complete sequence of stratigraphic units from late Paleozoic to Middle Jurassic in age. The oldest is the Permian Pablo Formation consisting of sedimentary rocks interlayered with andesitic volcanic rocks and greenstones. Overlying the Pablo is a 2,134 meter (7,000 ft) section of marine and alluvial sedimentary rocks of the Grantsville, Luning, Sunrise, Gabbs, and Dunlap formations, which are Triassic to Jurassic in age.

These Pre-Tertiary rocks have been affected by the Mesozoic Nevadan orogeny which obliterated the marine basin in western Nevada. This compressional tectonic event folded, thrust faulted, and normal faulted these rock units. The major fault systems in Union and Grantsville canyons probably belong to this tectonic episode. Several intrusions were emplaced during Mesozoic times; most notable is the diorite intrusion in the Ione area.

The Tertiary was typified by extensional tectonics. Tertiary bedrock consists of thick sections of volcanic rock accumulated from volcanic centers that were, mainly, to the east. These sections consist predominantly of lava flows, pyroclastic rocks, and volcanoclastic sedimentary rocks. There are also dikes and plugs associated with volcanic feeder systems and vents. Several caldera structures have been mapped in the Toiyabe Range immediately to the east of the Shoshone Range (Hardyman, in press). These large structures resulted in regional faulting and alteration of surrounding country rock.

About 17 million years ago, the formation of the Basin and Range Province started with regional doming that stretched and uplifted the earth's surface. This tectonic event is still active and is a main cause of the present topography. Uplifted fault-block mountains are bordered by downfaulted, wide valleys, that are bounded by high-angle normal faults. These youthful mountains have high relief, and the arid climate has resulted in dryland erosion typified by sediment-filled valleys, alluvial fans, and lack of a drainage system.

#### Previous Studies

Most of the literature on geology and mineral resources in the Shoshone range consist of unpublished reports from mining companies or individuals involved in the mineral exploration and production of the range. An attempt to collect this literature for our study resulted in obtaining about 340 documents, including property and exploration reports, maps, notes, letters, memorandum, analyses, and plans of operation. A full listing of this literature is beyond the scope of this report.

The geology of the Shoshone Range has been published by Ferguson and Muller (1949), Kral (1951), Silberling (1959), Vitaliano (1963, 1972), Bonham (1970), Stewart and McKee (1977), Kleinhampl and Ziony (1985) and Hardyman (in press). The U.S. Geological Survey's (USGS) work in central Nevada resulted in published geologic maps by John (1987), McKee and John (1987), Nash and Siems (1988), and Plouff (1990, 1992a, 1992b), and published geochemical and geological reports by Dwyer and Nash (1991), Fairfield and others (1985), John and others (1991), Nash (1988), Orris and Kleinhampl (1986), Siems and others (1986), Whitebread

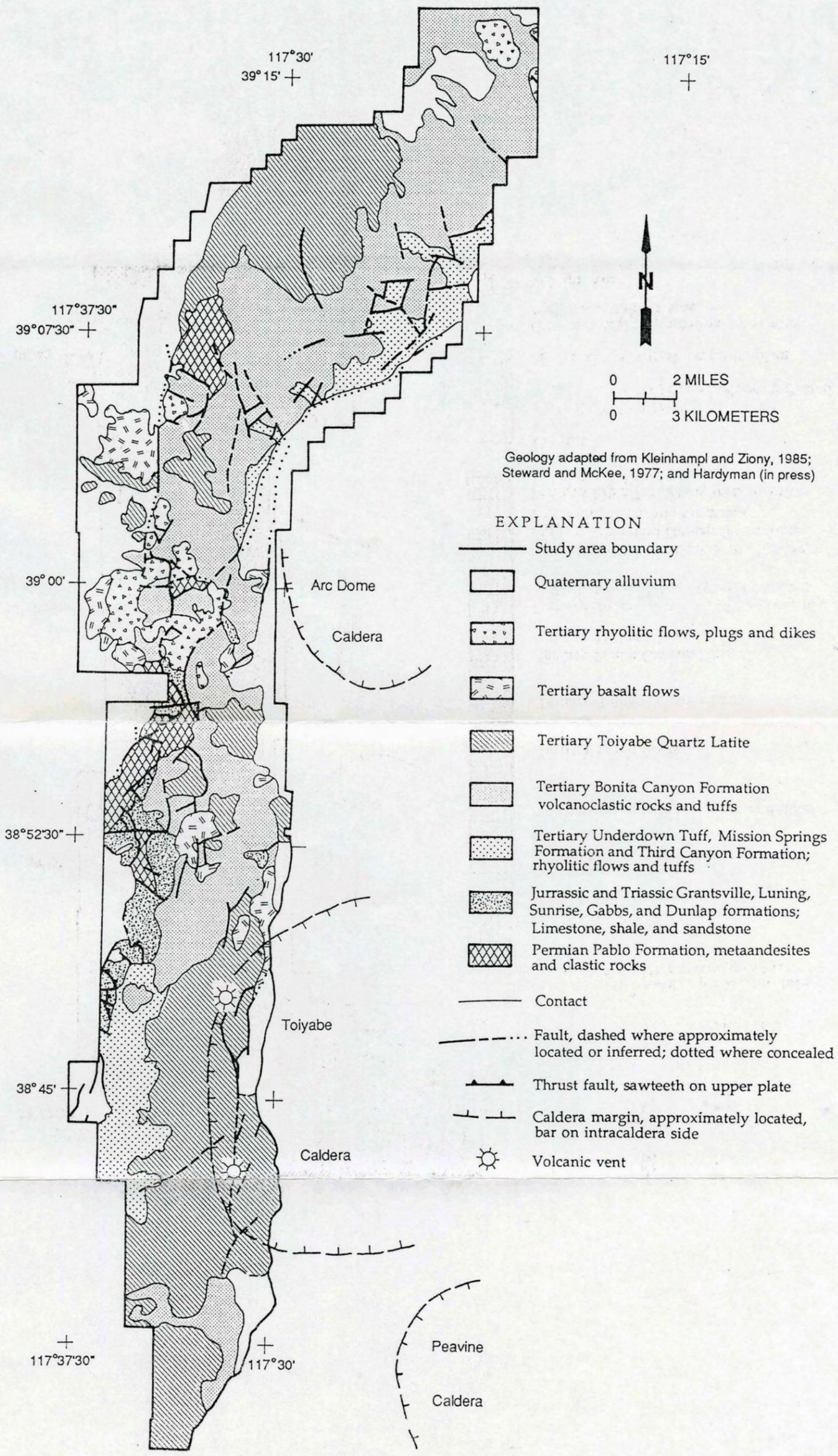


Figure 3.- Generalized geologic map of the Shoshone Range study area

(1986), and Whitebread and John (1992). The geology and mines of the central part of the range are described in detail in theses by Silberling (1957) and by Abrams (1979).

The earliest published mineral report was a study by Daggett (1908) of faulting at the Berlin mine. During and after World War II, the government produced a number of unpublished strategic mineral reports. Reports on mercury deposits included those by Bailey and Phoenix (1942a, 1942b), Smith (1942a, 1942b), U.S. Bureau of Mines (1942, 1943a), Couch and Carpenter (1943), and Holmes (1958a, 1958b). Base metals at the Alexander mine were addressed by the U.S. Bureau of Mines (1943b) and at the Copper King mine by Barnes and Robertson (1953). A report by Sheahan and Reeves (1955) was on the uranium in Bonita Canyon.

Mines, mineral resources, and mining districts are discussed by Stager (1977), McNary and Hose (1979), Voss (1981), Tingley and Smith (1983), and Kleinhampl and Ziony (1984). Mineral resources are described briefly in statewide commodity reports on placer gold by Vanderburg (1936) and Johnson (1973), on mercury by Bailey and Phoenix (1944), on fluorspar by Horton (1961) and Papke (1979), on antimony by Lawrence (1963), on radioactive minerals by Garside (1973), and on strategic and critical minerals by Lowe and Raney (1985).

#### Present Studies

Prior to field examination, pertinent literature, county mining records, and files of the USBM, Nevada Bureau of Mines, and USFS were researched. Claimants, mine owners, and mining companies were contacted to obtain information on claim location, history, and economic geology.

Field work was conducted during the spring and summers of 1989 and 1990, and consisted of examining all mines, prospects, and mineralized areas within and adjacent to the study area. Most sites were mapped using 1:6,000 scale topographic base maps on which were located workings, sample localities, and prominent geology. Existing mine and deposit maps were used when available. The study area was reconnoitered by foot, jeep, and helicopter traverses to locate mineral sites not disclosed by prefield studies.

A total of 541 samples were taken for this study (fig. 4). Each mineral site was sampled to determine the commodities present. When possible, high grade samples were taken to indicate possible maximum grades. Sampling the placer resources of the range was not within the scope of the study. Lode samples consisted of four types: 1) chip - a continuous series of rock chips across a mineralized structure in bedrock; 2) random chip - an unsystematic series of rock chips from bedrock; 3) grab - rock samples collected unsystematically from a stockpile, dump, or float (loose rock lying on the ground); 4) select - rock samples collected with a bias for unique or unusual characteristics.

All rock samples were crushed, pulverized, homogenized, split, and checked for radioactivity and fluorescence. One split was sent to a commercial laboratory for analysis and the other was retained at the Western Field Operations Center for future reference. Assay laboratories used for this study were Geochemical Services Inc., Bondar-Clegg Inc., IGAL Inc., and Root & Norton Assayers<sup>1</sup>. Each sample was analyzed for 15 elements by inductively coupled plasma emission

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<sup>1</sup>Use of trade and company names in this report are for descriptive purposes only and does not imply endorsement by the USBM.

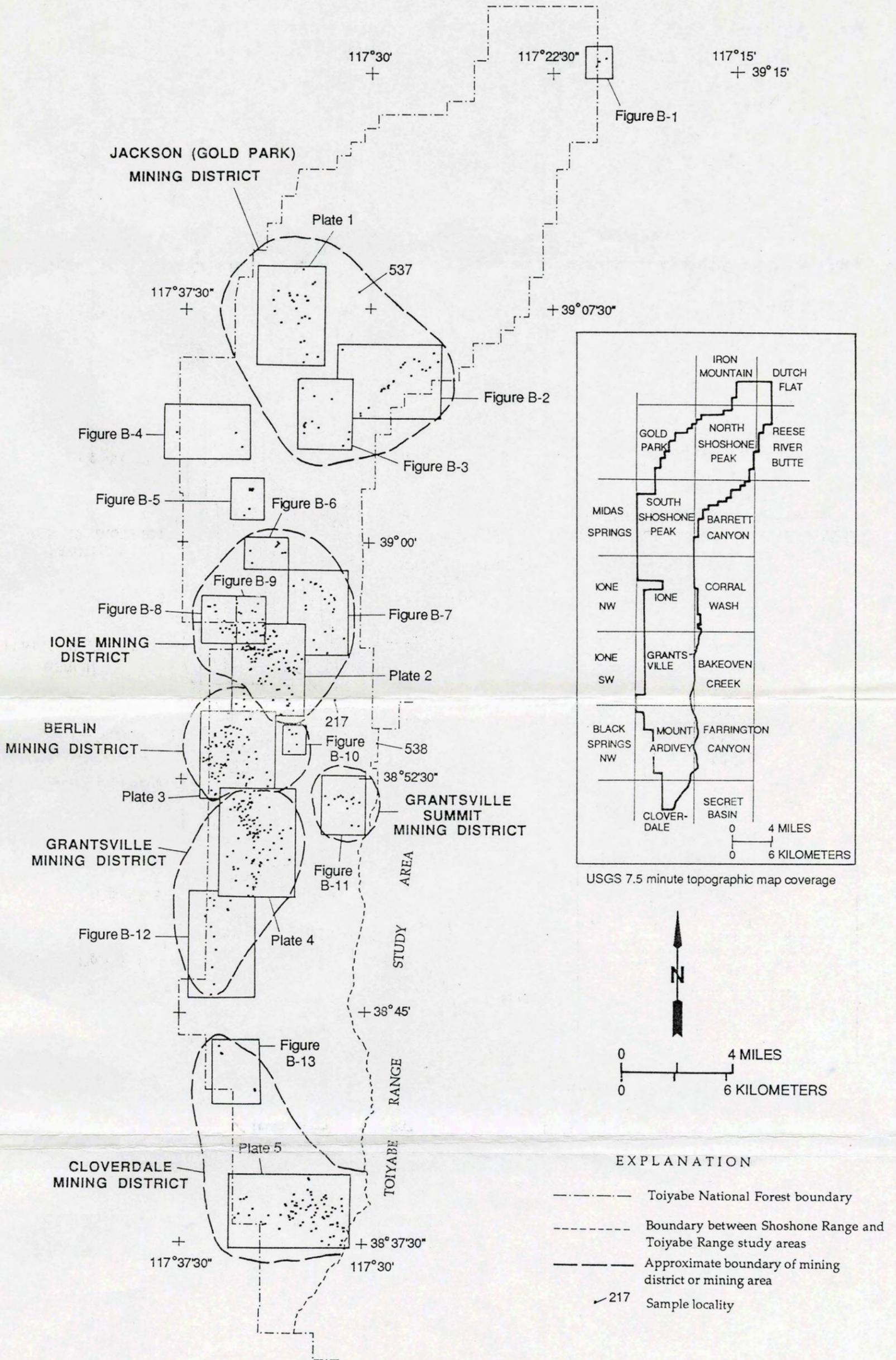


Figure 4.- Index map showing location of mining districts, plates, figures, and sample sites for the Shoshone Range study area

spectroscopy and graphite furnace atomic absorption methods. A few samples were analyzed for fluorine, uranium, tungsten, and barium. All analyses are reported in parts per million (ppm) except where noted.

Many of the numbers in this report have been converted from English units to metric units as part of a metric conversion program within the USBM. The metric number is presented first, followed by the English equivalent in parenthesis. For uniformity, a number in English units quoted from a reference will also follow the metric conversion. Rounding to significant figures to maintain the proper data precision of the converted number with the original may lead to confusion for the reader when attempting to reconvert back to imprecise, original figures. Many of the numbers on the maps were not converted to metric since the overall elevation data is based on English units.

#### ACKNOWLEDGEMENTS

Thanks are due to the many people, companies, and organizations that contributed their efforts to this study. The people at the Nevada Bureau of Mines were especially helpful in accommodating our request for information. Mining companies that were very generous in allowing us access to their mineral data included: Amax Exploration, Inc.; Battle Mountain Exploration Co.; Cominco American Inc.; Gold Fund Ltd.; Homestake Mining Co.; J. Prochnau Co.; Kennecott Exploration Inc.; Marshall Earth Resources Inc.; N.A. Degerstrom Inc.; Nevada Mine Development Corp.; Noranda Exploration, Inc.; Placer Dome US Inc.; Standard Magnesia Co.; and Utah International Inc. Gratitude is extended to the claimants and individuals who supported the study, including Ed Brown, Bill Clem, Ona Flowers, Bus Hedgorth, Robert Miller, and Patricia Phillips. Finally, thanks is also due to the staff of the Toiyabe National Forest.

#### MINING HISTORY

##### Early Metal Mining Activity

Earliest mineral exploration dates back to the 1850's. By 1863, silver-lead-zinc ores were discovered in the Shamrock Canyon area. Additional discoveries were made shortly thereafter, and by 1864 the towns of Union, Grantsville, and Ione (fig. 5, top) were established. Mills were set up in Ione and at the mouth of Knickerbocker Canyon to process ore coming mainly from high-grade deposits from several locations in Shamrock and Grantsville canyon areas. Mining from these rich deposits continued intermittently into the 1890's. While early production records are often incomplete for the 1860's-1880's, there was an estimated production of 1,900 kilograms (61,000 oz) gold and 727,700 kilograms (23.4 million oz) silver (calculated from: Kral, 1951, p. 196-197; Couch and Carpenter, 1943, p. 120-121; Gardiner, 1926, p. 5). Much of this mineral wealth came from impressively rich ores at the Shamrock mines which ran as high as 110,000 grams per metric ton (3,200 oz/ton) silver and 315 grams per metric ton (9.2 oz/ton) gold (Barrett, 1963, p. 3).

In the Gold Park and War Eagle Canyon areas precious metal veins were discovered in the 1860's. By the 1880's several mines and a mill were in operation. The mineral production from the 1880's to the 1950's was about 106 kilograms (3,400 oz) gold and 849 kilograms (27,300 oz) silver, as calculated from Kral (1951, p. 78-79) and U.S. Bureau of Mines unpublished production records.

On the west slopes of the range about 8 kilometers (5 mi) south of Ione, NV, the Berlin mine (fig. 5, bottom) produced gold-silver ores from 1896



Figure 5.--View looking north at town of Ione, and the Hugh and King Midas properties left side (top); and view of the Berlin mine and facilities (bottom).

to 1914. During this period this mine became the focal point for mining activity in the range and the mills at Ione and Knickerbocker were moved to the Berlin camp. Metal values were mainly in gold with approximately 998.3 kilograms (32,100 oz) produced in the Berlin mine area accompanied by 5,007 kilograms (161,000 oz) of silver and lesser amounts of copper and lead (calculated from: Kral, 1951, p. 199; U.S. Bureau of Mines unpublished production records; Nevada Bureau of Mines and Geology, undated report).

The last mineral area to be discovered is situated in the southern part of the range in the Golden Wash and Cloverdale Creek drainages. The Cloverdale mining district was established around 1906 and is in both the Shoshone Range and Toiyabe Range study areas. The Shoshone Range part of the district is centered on the Golden King and Webb mines, where small amounts of precious metal were produced from narrow veins (Kral, 1951, p. 46; U.S. Bureau of Mines unpublished production records). Placer gold was discovered in Golden Wash and in Cloverdale Canyon, but attempts to mine this resource on a large scale in the early 1930's never reached the production stage (Kral, 1951, p. 46-47).

#### Second Round of Metal Mining

Many of the mines that were active early on were reopened intermittently from the 1920's through the 1950's. Most of the production was small and involved cleanup of old deposits, reprocessing of dump material, and extension of existing workings. The 1930's saw a resurgence of small precious metal mines caused by the relatively high price of precious metals during the Great Depression.

World War II and strategic metal stockpiling that followed, encouraged the production of many metals, except gold. The Shoshone Range, however, had few developed metal deposits, other than mercury, to take advantage of higher wartime prices. The reopening of the Alexander mines in the Grantsville mining district during 1941 resulted in a recorded production of about 5,600 kilograms (180,000 oz) silver, 209,000 kilograms (460,000 lb) lead and 95,300 kilograms (210,000 lb) zinc by 1947 (Kral, 1951, p. 202; Couch and Carpenter, 1943, p. 120-121; U.S. Bureau of Mines unpublished production records). Attempts to develop this deposit for tungsten resources in the 1960's were without success.

In 1939, efforts to mine antimony in the southern part of the Grantsville mining district in Milton Canyon were largely unsuccessful and only a few tons of stibnite ore were shipped (Lawrence, 1963, p. 153).

During the 1980's, Marshall Earth Resources Inc. established an office in Ione and proceeded to expand land holdings and to initiate exploration for precious metals in all of the Shoshone Range mining districts. Activities included renovation and expansion of old underground workings, trenching, mining, drilling, dousing, and mapping. MERI controls the Shamrock mine area and continues to search for additional metal resources on the property.

#### Mercury Production

The birth of Nevada's mercury industry occurred in 1907 when cinnabar deposits were discovered in Sheep and Shamrock canyons in the southeast part of the Ione mining district. The Ione Mercury and Nevada Cinnabar mines (fig. 6) were steady producers up to 1928, producing about 410,000 kilograms (12,000 fl) of mercury from lode deposits; approximately 22,000 kilograms (650 fl) were recovered from placer operations (Kral,



Figure 6.--View of mill and retort at the Nevada Cinnabar mine (top), and view of the Ione Mercury mine looking southeast (bottom).

1951, p. 204; Bailey and Phoenix, 1944, p. 151; U.S. Bureau of Mines unpublished production records). A resurgence of mining activity occurred at the Ione Mercury in the 1930's and at the Nevada Cinnabar in the 1940's and 1960's, adding about 48,000 kilograms (1,400 fl) of mercury production (Kral, 1951, p. 204; Holmes, 1958, p. 2; U.S. Bureau of Mines unpublished production records). A number of small properties produced mercury in the Ione mining district and the Grantsville Summit area in the 1930's and 1940's with total production probably not exceeding several thousand kilograms.

#### Development of Industrial Minerals

Fluorite deposits were discovered and developed in the late 1940's and 1950's in an area from the mouth of Union Canyon, south to Grantsville Ridge. About 820 metric tons (900 tons) of high-grade fluorite ore was produced from several properties from 1948 to 1954 (Horton, 1961, p. 16; Jones, 1959, p. 3). In the early 1970's, about 18,100 metric tons (20,000 tons) of lower grade ore was mined and stockpiled at the Sea Bee mine (fig. 7, bottom), and a resource of about 392,800 metric tons (433,000 tons) of 18.5% fluorite was drilled out (Papke, 1979, p. 35). As of early 1993 this resource has not been developed.

An unrecorded amount of barite ore was mined from the Sky mine in the early 1980's and was concentrated in a mill on the property. Production and remaining resources appear to be small and in 1993 there is no activity.

#### Exploration for Low-Grade Precious Metal Deposits

In the last two decades the range has undergone exploration by a number of mining companies for large, disseminated precious metal deposits that were overlooked in the past by miners exploring for smaller high-grade deposits.

Four low-grade, bulk tonnage precious metal deposits were developed during the 1980's. Small deposits were explored and drilled in the Grantsville Summit and Grantsville Ridge areas by Amax Exploration Company, and in the Cloverdale district by Battle Mountain Exploration Company. An open pit operation was developed by Fury Exploration at the Alexander mine (fig. 7, top) with production from 1987 to 1988 of about 3,100 kilograms (100,000 oz) silver and 1.2 kilograms (40 oz) gold (Charles Tyler-consultant, 1991, oral communication).

In 1993, while exploration for disseminated gold continues, exploration activity seems to be decreasing and mining activity is at a standstill.

#### MINING DISTRICTS, PROPERTIES, AND MINERAL RESOURCES

Mining districts, as used in this report, are groupings of mining properties based on geographic proximity, geology, and historic activity. District boundaries are not well defined and, in places, are arbitrary. Some mining properties that are not part of a mining district have been included in the nearest district for organizational purposes. Figure 4 is a key index map that shows the study area's six mining districts along with sample sites and the locations of more detailed maps found in Appendix B and of plates in pockets at the end of this report. The Union district was the first to be formed and was often used to describe five of the districts used in this report: the Ione, Berlin, Union, Grantsville Summit, and Grantsville. The properties on Idlewild Creek, north of Ione, have been referred to in the past as the Midas district. This report includes these properties in the Ione district.



Figure 7--View of the Fury open pit looking north (top), and view of the open pit at the Sea Bee fluorite mine (bottom).

Figure 8 shows mining property locations along with land status, and recent mining claim activity. Properties are arranged in this report into 77 major groups and are named as to the most used or most recent property name. Property production amounts were, in some cases, calculated from blending multiple references, some requiring price-to-weight conversion, or the multiplication of tonnage mined by average grade.

### Jackson Mining District

#### Location

The Jackson (Gold Park) district is located high on the western flank and the crest of the Shoshone Range, covering the area from Park Creek south to the South Fork of Barrett Creek (fig. 8, nos. 2-10). Other properties on the northern side of the range are often included with the district (fig. 8, nos. 1, 11-19).

#### History and Production

The district was discovered in the 1860's by Thomas Barnes, and given the name of North Union (Kral, 1951, p. 76). At first, activity was limited to the mining of rich surface outcroppings of oxidized and enriched ores which were hauled by ox teams to milling plants at Austin, Ellsworth, and Ione (Bedford, 1931, p. 2). The district obtained its present name in the late 1870's after being called Barnes Park district for a short time.

The precious metal production from the district totals about 106 kilograms (3,400 oz) gold and 849 kilograms (27,300 oz) silver (calculated from: Kral, 1951, p. 78-79; U.S. Bureau of Mines unpublished production files). There was also a small production of copper and lead. Mines were active between the 1880's and the 1950's. Mineral production was mainly from the lode deposits at the Star of the West, Artic, War Eagle, and Peterson mines in the main part of the district, and the One Ounce mine on the east side of the range. Ores were processed in several stamp mills with amalgamation and concentration circuits that were set up in the Gold Park Basin where water was available.

#### Geology

In the main part of the district, mineral deposits consist of base-metal quartz fissure veins cutting through metamorphosed andesites and greenstones of the Permian Pablo Formation (Kleinhampl and Ziony, 1984, p. 112-113). The Pablo host rock is part of a large (15.6 sq km) inlier, a gently northwest-tilted fault block surrounded by Tertiary volcanic rocks. Veins trend northeast, steeply dip to the southeast, and range in thickness from a few centimeters to three meters (10 ft), with an average of about 0.6 meter (2 ft). Veins are, in some areas, accompanied by Tertiary (?) dikes (Crosby, 1908, p. 5). Mineralization and hydrothermal alteration in the wallrock is minimal.

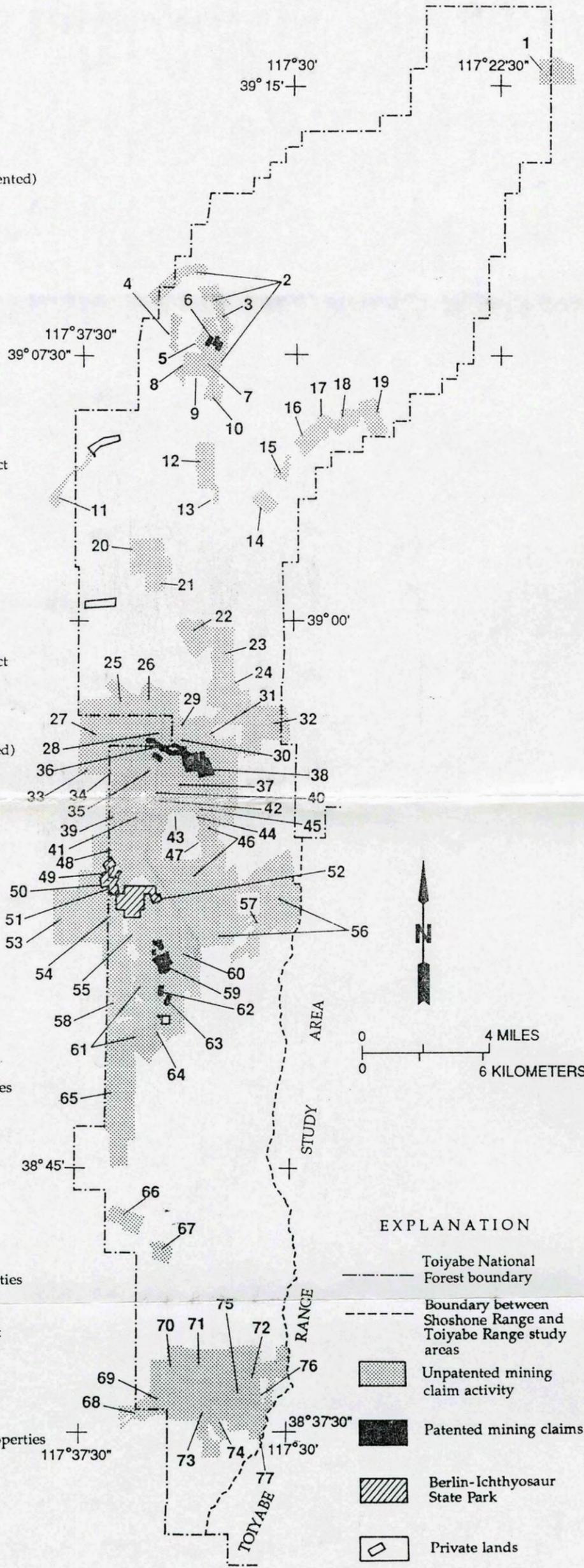
Ore shoots or mineralized portions of the quartz veins consist of variable amounts of pyrite, galena, and chalcopyrite. Ore values were principally gold with a varying gold-silver ratio. Much of the production was from oxidized zones, where ores contained cerussite and other oxidized sulfides. Copper and lead are good indicators of precious metal content, suggesting gold and silver were formed with the base-metal sulfides (Kral, 1951, p. 77).

NUMERIC PROPERTY LIST

1. Anvil prospect
2. Gold Park prospect
3. Stone Cabin placer prospect
4. WEC placer prospect
5. Peterson mine
6. Star of the West mines (patented)
7. War Eagle mine
8. Grey Eagle prospect
9. Bald Eagle prospect
10. Last Chance mine
11. Lebeau prospect
12. Cole prospect
13. Dottie Lee prospect
14. DD prospect
15. Waterfall prospect
16. YB prospect
17. Prominence prospect
18. One Ounce mine
19. Lost Pick Handle prospect
20. Vernal prospect
21. Hazel E prospect
22. Top of the Mountain prospect
23. April View prospect
24. Jenny prospect
25. King Midas mine
26. Hugh prospect
27. Alice placer mine
28. Catherine mine
29. Yellow Cat mine
30. Sun prospect
31. HM prospect
32. Gold Hill prospect
33. Earth Science placer prospect
34. Sheep Canyon prospect
35. Wire prospect
36. Shamrock mines (patented)
37. Moon mine
38. Ione Mercury mine (patented)
39. PDQ prospect
40. Sniffer prospect
41. JJJ prospect
42. Copper King mine
43. Lookout prospect
44. Nevada Cinnabar mine
45. H.G. Norman prospect
46. Mountain prospect
47. Evelyn prospect
48. Boulder prospect
49. Adams Rib mine
50. Berlin mine
51. Spar prospect
52. Richmond mine
53. GHR prospect
54. Sea Bee mine
55. Sky mine
56. Homer prospect
57. Grantsville Summit properties
58. Landmark prospect
59. Alexander mine (patented)
60. Pinto prospect
61. Beth prospect
62. Chicago mine (patented)
63. Centennial mine (patented)
64. Milton Canyon mine
65. MERI prospect
66. Ardvark prospect
67. Iron Rail prospect
68. Golden Wash placer properties
69. Golden Valley prospect
70. Lab prospect
71. Royal-Golden King prospect
72. Webb mine
73. Golden King mine
74. GKL prospect
75. 4s and 2s prospects
76. Joan prospect
77. Cloverdale Creek placer properties

ALPHABETICAL PROPERTY LIST

49. Adams Rib mine
59. Alexander mine (patented)
27. Alice placer mine
1. Anvil prospect
23. April View prospect
66. Ardvark prospect
9. Bald Eagle prospect
50. Berlin mine
61. Beth prospect
48. Boulder prospect
28. Catherine mine
63. Centennial mine (patented)
62. Chicago mine (patented)
77. Cloverdale Creek placer properties
12. Cole prospect
42. Copper King mine
14. DD prospect
13. Dottie Lee Prospect
33. Earth Science placer prospect
47. Evelyn prospect
75. 4s and 2s prospects
53. GHR prospect
74. GKL prospect
32. Gold hill prospect
2. Gold Park prospect
73. Golden King mine
69. Golden Valley prospect
68. Golden Wash placer properties
57. Grantsville Summit properties
8. Grey Eagle prospect
21. Hazel E prospect
45. H.G. Norman prospect
31. HM prospect
56. Homer prospect
26. Hugh prospect
38. Ione Mercury mine (patented)
67. Iron Rail prospect
24. Jenny prospect
41. JJJ prospect
76. Joan prospect
25. King Midas mine
70. Lab prospect
58. Landmark prospect
10. Last Chance mine
11. Lebeau prospect
43. Lookout prospect
19. Lost Pick Handle prospect
65. MERI prospect
64. Milton Canyon mine
37. Moon mine
46. Mountain prospect
44. Nevada Cinnabar mine
18. One Ounce mine
5. Peterson mine
39. PDQ prospect
60. Pinto prospect
17. Prominence prospect
52. Richmond mine
71. Royal-Golden King prospect
54. Sea Bee mine
36. Shamrock mines (patented)
34. Sheep Canyon prospect
55. Sky mine
40. Sniffer prospect
51. Spar prospect
6. Star of the West mines (patented)
3. Stone Cabin placer prospect
30. Sun prospect
22. Top of the Mountain prospect
20. Vernal prospect
7. War Eagle mine
15. Waterfall prospect
72. Webb mine
4. WEC placer prospect
35. Wire prospect
16. YB prospect
29. Yellow Cat mine



EXPLANATION

- Toiyabe National Forest boundary
- - - Boundary between Shoshone Range and Toiyabe Range study areas
- Unpatented mining claim activity
- Patented mining claims
- ▨ Berlin-Ichthyosaur State Park
- Private lands

Figure 8.- Map showing mining claim activity, land status, and property location for the Shoshone Range study area

In addition to the main part of the district, there are a number of mineral occurrences along the east side of the range. These mineral occurrences (fig. 8, nos. 12-19) are associated with faulted and altered Tertiary volcanic rocks where range front faults are intercepted by northwest-trending faults, and exhibit intense fracturing, silicification, propylitic alteration, and bleaching. Several properties, well inside the range front fault system, have a large variety of mineralogy and include uraniferous fluorite, cinnabar, and chalcedony.

#### Recent Mining Activity

Recent activity consists mainly of exploration on the eastern side of the range for disseminated, low-grade, precious metal deposits. In the Gold Park area there is a small amount of placer mining.

The old mines in the main part of the district are inactive. Additional production here would be tied to the discovery of high-grade precious-metal ores in sulfide veins that are extensions at depth of deposits already mined out. Since past production indicates that higher grades were associated with shallow oxide zones, future production is unlikely. Exploration and drilling by Marshall Earth Resources, Inc., in the last ten years has, apparently, failed to find additional resources.

On the eastern side of the range, there has been some exploration for large, epithermal, low-grade precious metal deposits in the pervasively altered, faulted volcanic rocks along the range front. Exploration at the YB and DD prospects by Placid Oil Company and Noranda Exploration has included geological and geochemical mapping, resistivity surveys, and limited drilling. Interest extends into the areas of shallow pediment east of the range front. Other exploration programs include work at the One Ounce mine by Noranda Exploration, Willow Creek Resources, and Homestake Mining Company; and work at the Anvil prospect by Amax and Dome Exploration.

Underground survey work by Evans (1974) established a small resource at the Star of the West mines of 102,000 metric tons (112,000 tons) averaging 12.2 grams per metric ton (0.357 oz/ton) gold and 116 grams per metric ton (3.37 oz/ton) silver. There are no other reported identified resources in the district.

#### Mines, Claims, and Prospects

The following list of 19 properties includes prospects, mines, and claim blocks both within the Jackson mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Anvil

Location: T. 16 N., R. 41 E., secs. 10, SE1/4, 11, S1/2, 14, N1/2, 15, NE1/4

Commodities: Gold, silver, antimony

Size: 25 unpatented lode claims

Samples: Figure B-1, nos. 502-504; samples averaged 0.36% As, with as much as 0.27 ppm Au, 1.6% Sb, 183 ppm Mo, 156 ppm Hg, and 57 ppm U.

Property type: Prospect: a few old shafts and pits; drilled in 1986, exploration target for disseminated gold deposits.

Production: -----

Resources: -----

Geology: Brecciated tuff along the range front fault is moderately argillized and silicified. Finely disseminated pyrite, and hairline quartz veinlets are common in mineralized areas. Stibiconite is associated occasionally with the quartz.

Property name: Bald Eagle

Location: T. 15 N., R. 39 E., sec. 36, W1/2

Commodities: Gold, silver

Size: 12 unpatented lode claims

Samples: Plate 1, nos. 509-510; samples averaged 0.18 ppm Au and 0.02% Pb.

Property type: Prospect: several old shafts, adits, and pits; some recent bulldozer work.

Production: -----

Resources: -----

Geology: Sulfide-bearing quartz veins along faults in meta-andesite breccia.

Property name: Cole

Location: T. 14 N., R. 39 E., secs. 13, W1/2, 14, E1/2, 23, NE1/4, 24, NW1/4

Commodities: Gold, silver, uranium, mercury

Size: 26 unpatented lode claims

Samples: Figure B-3, nos. 528-530; generally low values; sample (no. 530) of amygdaloidal rhyolite had 249 ppm Hg.

Property type: Prospect: numerous bulldozer cuts on hillside

Production: -----

Resources: -----

Geology: Brecciated, spherulitic rhyolite contains secondary quartz, clay, and sparse cinnabar and unidentified radioactive minerals.

Property name: DD

Location: T. 14 N., R. 40 E., secs. 19, SE1/4, 29, NW1/4, 30, NE1/4

Commodities: Gold, silver

Size: 12 unpatented lode claims

Samples: Figure B-3, nos. 466-468; sample (no. 466) of tuff breccia assayed 2.6 ppm Au.

Property type: Prospect: numerous pits, and several shafts and adits; exploration target for disseminated gold deposits.

Production: -----

Resources: -----

Geology: Anomalous gold occurs in silicified and propylitized lithic and lapilli tuffs where the range front faults are cross cut by smaller northwest-trending faults.

Property name: Dottie Lee (War Cloud)

Location: T. 14 N. R. 39 E., sec. 24

Commodities: Gold, silver, fluorite, mercury, uranium

Size: Three unpatented lode claims

Samples: Figure B-3, nos. 448-454; samples assayed as much as 0.5% Hg, 9.6% CaF<sub>2</sub>, 200 ppm U<sub>3</sub>O<sub>8</sub>, 850 ppm Mo.

Property type: Prospect: several old adits and pits; recent bulldozer trenches.

Production: -----

Resources: -----

Geology: Narrow fissure veins of calcite, opal, and fluorite occur in brecciated, silicified ash-flow tuff. Sparse cinnabar and autunite crystals are disseminated in the veins and the wallrock.

Property name: Gold Park

Location: T. 14 N., R. 39 E., sec. 1; T. 15 N., R. 39 E., secs. 14, 15, SE1/4, 22, N1/2, 24, 25, W1/2, 36

Commodities: Gold, silver, lead, copper

Size: 65 unpatented lode claims

Samples: Plate 1, nos. 508, 521, 525-527; samples (nos. 525-526) of quartz-sulfide ore averaged 27.55 g/mt (0.804 oz/ton) Au, 267.4 g/mt (7.8 oz/ton) Ag, 0.6% Cu, 3% Pb, and 75 ppm Te, with as much as 0.27% Zn and 947 ppm Cd.

Property type: Prospect: several old shafts and adits, and many pits; some recent drilling and bulldozer work; exploration area for undiscovered precious metal veins.

Production: -----

Resources: -----

Geology: Quartz veins in Permian greenstone are similar to other mineralized structures in the mining district.

Property name: Grey Eagle (Sunnyside, Trapper)

Location: T. 15 N., R. 39 E., sec. 35, S1/2  
Commodities: Gold, silver, lead, copper  
Size: Six unpatented lode claims  
Samples: Plate 1, nos. 506, 516; sample (no. 506) of fault gouge assayed 11.05 g/mt (0.322 oz/ton) Au.  
Property type: Prospect: one old adit and several pits; recent bulldozer work has replaced part of the adit with a pit.  
Production: -----  
Resources: -----  
Geology: Precious metals occur with galena and pyrite in a quartz vein within faulted meta-andesite.

Property name: Last Chance (Black Mountain)

Location: T. 14 N., R. 39 E., sec. 1  
Commodities: Gold, silver, lead, copper  
Size: 25 unpatented lode claims  
Samples: Plate 1, nos. 511, 531-533, 535; samples (nos. 531, 535) of quartz-sulfide veins averaged 2.74 g/mt (0.08 oz/ton) Au, 137 g/mt (4 oz/ton Ag) 0.11% Cu, 3.4% Pb, and 189 ppm Te.  
Property type: Mine: several old adits and shafts, and numerous pits.  
Production: Small production of gold ore from mill formerly on the property (Kral, 1951, p. 79).  
Resources: -----  
Geology: Precious metals occur with sulfides in quartz veins in brecciated meta-andesite.

Property name: Lebeau

Location: T. 14 N., R. 39 E., secs. 17, SW1/4, 19  
Commodities: Gold, silver  
Size: 11 unpatented lode claims  
Samples: Figure B-4, nos. 505, 539-540; samples contained no significant values.  
Property type: Prospect: several bulldozer cuts  
Production: -----  
Resources: -----  
Geology: Altered tuff and basalt along faults.

Property name: Lost Pick Handle

Location: T. 14 N., R. 39 E., secs. 2, SW1/4, 3, SE1/4, 11,  
Commodities: Gold, silver  
Size: 14 unpatented lode claims  
Samples: Figure B-2, nos. 490-491; samples contained no significant values.  
Property type: Prospect: several old pits; one drill site  
Production: -----  
Resources: -----  
Geology: A range front fault is mineralized in the vicinity of a trachyte plug intruding tuff.

Property name: One Ounce (Gram, Ward)

Location: T. 14 N., R. 40 E., sec. 10

Commodities: Gold, silver

Size: 15 unpatented lode claims

Samples: Figure B-2, nos. 479, 481, 484-489; four samples (nos. 479, 480, 486-487) of quartz and breccia averaged 6.17 g/mt (0.18 oz/ton) Au and 5.49 g/mt (0.16 oz/ton) Ag.

Property type: Mine: numerous adits and pits, and a mill in ruins.

Production: Between 1935 and 1956 about 3.33 kg (107 oz) Au and 2.18 kg (70 oz) Ag from 181 mt (200 tons) of ore milled on the property (calculated from Kral, 1951, p. 198; U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: Precious metals are limited to zones of quartz veinlets and stringers with minor oxidized pyrite in several northeast-trending faults within tuff. Country rock shows pervasive but weak alteration.

Property name: Peterson

Location: T. 15 N., R. 39 E., sec. 26, SE/4

Commodities: Gold, silver, lead, copper

Size: Three unpatented lode claims

Samples: Plate 1, nos. 512-515, 519; samples (nos. 512-513, 515, 519) of quartz veins and weathered sulfides averaged 8.57 g/mt (0.25 oz/ton) Au, 48 g/mt (1.4 oz/ton) Ag, 0.13% Cu, 1.2% Pb, and 0.1% Zn.

Property type: Mine: numerous old adits, shafts and pits; an old miner's camp with a mill and several buildings in ruin.

Production: Between 1912 and 1941, about 16.5 kg (530 oz) Au, 75.9 kg (2,440 oz) Ag, and small amounts of copper and lead (calculated from Kral, 1951, p. 79; U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: Gold and silver is associated with partly oxidized lead minerals that occur in quartz veins within meta-andesite.

Property name: Prominence

Location: T. 14 N., R. 40 E., sec. 9  
Commodities: Gold, silver  
Size: Nine unpatented lode claims  
Samples: Figure B-2, no. 480; sample assayed 26.1 g/mt (0.76 oz/ton) Au and 20.6 g/mt (0.6 oz/ton) Ag.  
Property type: Prospect: one adit  
Production: -----  
Resources: -----  
Geology: Vein consists of clay fault gouge and quartz stringers in tuff.

Property name: Star of the West, Artic, and San Francisco

Location: T. 15 N. R. 39 E., secs. 25, SW1/4, 26, SE1/4  
Commodities: Gold, silver, lead, copper  
Size: Three patented and 12 unpatented lode claims  
Samples: Plate 1, nos. 517-518, 522-524; Samples averaged 9.9 g/mt (0.29 oz/ton) Au, 189 g/mt (5.5 oz/ton) Ag, 0.39% Cu, and 4.3% Pb, with as much as 32.2 g/mt (0.94 oz/ton) Au, 405 g/mt (11.8 oz/ton) Ag, and 0.12% Sb.  
Property type: Mines: numerous adits, shafts and pits; ruins of a mill; several hundred meters of underground workings.  
Production: Between 1882 and 1942, about 51 kg (1,640 oz) Au, 461.2 kg (14,830 oz) Ag, 10,944 kg (24,128 lb) Pb, and 401.9 kg (886 lb) Cu (calculated from Kral, 1951, p. 77; U.S. Bureau of Mines unpublished production records).  
Resources: An identified resource of 101,584 mt (112,000 tons) averaging 12.2 g/mt (0.357 oz/ton) Au and 115.5 g/mt (3.37 oz/ton) Ag (Evans, 1974).  
Geology: Precious metals are associated with galena, cerussite, pyrite, and chalcopyrite in quartz veins. The quartz sulfide veins trend northeast and follow faults in a meta-andesite.

Property name: Stone Cabin

Location: T. 15 N., R. 39 E., secs. 25, E1/2, 24, S1/2  
Commodities: Gold, silver  
Size: Four placer and one millsite unpatented claims  
Samples: Plate 1, no samples taken.  
Property type: Mine: several pits  
Production: Probable small amount of placer gold  
Resources: -----  
Geology: Small amounts of placer gold have washed into Gold Park creek from the gold-bearing veins in the hillsides to the south.

Property name: War Eagle (Black Mountain)

Location: T. 15 N. R. 39 E., sec. 36, NW1/4  
Commodities: Gold, silver, lead  
Size: 12 unpatented lode claims  
Samples: Plate 1, no. 507; sample assayed 14.9 g/mt (0.43 oz/ton) Au, 15.1 g/mt (0.44 oz/ton) Ag, and 0.11% Pb.  
Property type: Mine: several old shafts, adits, and pits.  
Production: Between 1927 and 1956, about 33.6 kg (1,080 oz) Au, 311.6 kg (10,020 oz) Ag, and small amounts of copper and lead (calculated from Kral, 1951, p. 78; U.S. Bureau of Mines unpublished production records). Production came mainly from oxide ore.  
Resources: -----  
Geology: Gold, silver, and lead are associated with galena and cerussite occurring in a quartz vein with limonite within meta-andesite.

Property name: Waterfall

Location: T. 14 N., R. 40 E., secs. 17, SE1/4, 20, N1/2  
Commodities: Gold, silver  
Size: Three unpatented lode claims  
Samples: Figure B-2, nos. 464-465, 469; sample (no. 465) of fractured tuff assayed 0.32 ppm Au.  
Property type: Prospect: one adit and several shafts and pits  
Production: -----  
Resources: -----  
Geology: Range front faults in ash flow tuffs have been chloritized and silicified.

Property name: WEC

Location: T. 15 N., R. 39 E., sec. 27, E1/2  
Commodities: Gold, silver  
Size: Seven unpatented placer claims  
Samples: Plate 1, no samples taken  
Property type: Prospect: several old pits  
Production: -----  
Resources: -----  
Geology: Small amounts of placer gold have washed out of War Eagle Canyon.

Property name: YB (Avery, Blue Bell)

Location: T. 14 N. R. 40 E., sec. 16, NW1/4

Commodities: Gold, silver

Size: 19 unpatented lode claims

Samples: Figure B-2, nos. 470-478; samples assayed as much as 9.43 g/mt (0.27 oz/ton) Au, 22.42 g/t (0.654 oz/ton) Ag, and 164 ppm Mo.

Property type: Prospect: several old shafts, adits, and numerous old pits; recent activity includes drilling; exploration target for disseminated precious metal deposits.

Production: -----

Resources: -----

Geology: Mineralized, fractured tuff and fault gouge along range front fault zones with argillic and silicic alteration, secondary quartz stringers, and limonite.

## Ione Mining District

### Location

The Ione district, as used in this report, includes the hills around the town of Ione, from the break of the high peaks of the Shoshone Range at Bald Mountain, south to the north side of Buffalo Mountain (fig. 8, nos. 20-38, 40, 43-45). This area has also been referred to as the northern part of the Union mining district.

### History and Production

The earliest prospecting in the Shoshone Range was in the 1850's, and by 1864 the town of Ione was established near rich silver deposits in the hills to the southeast. In 1864 Ione became the county seat for the newly formed Nye County (Kral, 1951, p. 195). Initially, production was shipped to facilities in California and Utah. But soon, ore coming from the Shamrock mines, the principle producers in the Ione district, and from the mines to the south in the Grantsville area, were processed in two mills, the Pioneer mill in Ione, Nevada, and the Knickerbocker mill at the mouth of Knickerbocker Canyon. Since production from the district was mainly in the 1860's and 1870's, there are few surviving records of mine output. Estimates made from reports by Kral (1951, p. 196-197), Couch and Carpenter (1943, p. 120-121), and Gardiner (1926, p. 5), combined with unpublished U.S. Bureau of Mines production records, suggest a total production for the district of 72,800 kilograms (23,400,000 oz) of silver, 1,890 kilograms (60,800 oz) gold, and small amounts of copper and lead; almost all from the Shamrock properties. By 1880 mining activity had decreased in the Ione district as the rich ores were depleted in the Shamrock mines. Smaller scale mining operations from 1920 through 1940 were mainly involved with cleanup of what was missed in the old mines and the reprocessing of dump material.

At the turn of the century, large mercury deposits were discovered in the district. Most of the production came from two mines, the Ione Mercury and the Nevada Cinnabar. Over 486,500 kilograms (14,111 fl) of mercury were produced in on-site retorts between the 1900's and the 1960's, with most of the production before the early 1920's (Kral, 1951, p. 204; Bailey and Phoenix, 1944, p. 151, Holmes, 1958, p. 2; U.S. Bureau of Mines unpublished production records). There were several other small mercury mines in the area. The district was the first and one of the largest producers of mercury in Nevada. Activity ceased after known reserves were exhausted and prices declined.

Placer gold mines west of Ione in the Ione Valley were active intermittently between 1909 and 1941, with a production of about 3.1 kilograms (100 oz) gold (Johnson, 1973, p. 99). The Goldfield Rand Co., in 1958, and the Alice Mining Company, in 1980, evaluated the placer deposits to determine if large scale mining operations were feasible. The Alice Mining Company produced about 0.68 kilograms (22 oz) gold by 1981 (Alice Mining Co., unpublished letter, 1981). The King Midas and Hugh mines produced about 20.2 kilograms (650 oz) of placer gold in the same area during 1983 and 1984 (Marshall Earth Resources, Inc., 1984, p. 2, 11).

### Geology

The center and southern parts of the district are underlain either by greenstone and clastic rock of the Permian Pablo Formation or by shale and limestone of Mesozoic age. The eastern and northern parts are covered by Tertiary volcanic rocks. Pre-Tertiary rocks are intruded by quartz monzonite, granodiorite, and diorite stocks and dikes. Pre-

Tertiary structure is mainly high angle normal faults trending northwest, while Tertiary structure trends north.

Precious-base metal deposits in the district are believed to be related to a metallogenic epoch of late Jurassic or early Cretaceous age involving small intrusions ranging from diorite or granodiorite to quartz monzonite (Abrams, 1979, p. 57). Most notable of this type of deposit are the veins worked in the Shamrock mines. The Shamrock or Crown veins have a strike length of about 1,520 meters (5,000 ft) and were mined to a depth of 76 to 91 meters (250 to 300 ft) from the surface where the veins flatten (Firth, 1981, p. 2). The quartz veins contained varying amounts of pyrite, tennantite, argentiferous tetrahedrite, and galena, argentite, bornite, and chalcopyrite. Most of the early production at the Shamrock mines was from zones of oxidation and supergene enrichment containing abundant cerargyrite, acanthite, native silver, and small amounts of native gold. Rich ore shoots along the vein were reported to contain as much as 110,000 grams per metric ton (3,200 oz/ton) silver (Barrett, 1963, p. 3). The host rock for this deposit is a small diorite intrusion and the surrounding sections of Mesozoic greenstone, limestone, and shale.

Similar mineral occurrences are also found in numerous sulfide-quartz veins scattered throughout the Mesozoic greenstone and clastic country rock in areas of faulting and fracturing. The Violet and Catherine mines both have had some mineral production, with ores from the latter having values principally in gold.

Additional precious metal resources may be on the east and north sides of the district where Tertiary volcanics have covered the older rock section. At the Gold Hill prospect, epithermal mineralization may be related to Tertiary volcanic centers farther east. At the head of Idlewild Creek, small, high-grade precious metal occurrences on the Vernal prospect are found in a quartz-pyrite stockwork within a fault breccia. The host rock is a hydrothermally altered, silicified rhyolite dome, and adjacent tuff. Gold occurs as very fine electrum and petzite (silver-gold telluride) grains in the pyrite (McLean, 1983, p. 7). This geologic situation has been interpreted as an old hydrothermal vent with the potential for shallow low grade gold deposits (McLean, 1983, p. 1) or for copper-molybdenum porphyry deposits at depth (Briner and Ernst, 1981, p. 138).

Mercury deposits in the district consist of cinnabar in veinlets, stringers, and as disseminations and painty films along fractures. Deposits are shallow and appear to be localized on old volcanic fumarole or hot spring areas along north-trending faults of Tertiary age. At the Ione Mercury mine, Mesozoic sediments are faulted against Tertiary agglomerates and tuffs. The main ore body was composed of cinnabar in a gangue of calcite, psilomelane, and pyrite in folded calcareous shales. At the Nevada Cinnabar mine, mercury deposits of cinnabar fracture fillings and disseminations are along a fault in silicified Tertiary volcanic rocks.

Placer gold occurrences west of Ione on the Alice and Earth Science properties consist of fine gold accumulated in soil and surface gravels overlying a hard caliche cemented gravel. The gold probably originated from gold-bearing quartz stringers that are fracture fillings in Tertiary rhyolite just north and uphill from the placer area. At the King Midas and Hugh properties remnants of elevated paleograde deposits were the center of interest (Marshall Earth Resources, 1984, p. 7).

### Recent Mining Activity

Since the early 1980's, Marshall Earth Resources Inc. has been procuring properties in the district. Large tracts of land were claimed as the Hugh and King Midas properties on placer deposits northwest of Ione. A placer recovery plant produced for a short period before shutdown.

Marshall Earth Resources has initiated exploration programs at the Shamrock, Catherine (Hugh), Top of the Mountain, Yellow Cat (HM), Nevada Cinnabar, and Ione Mercury properties. Efforts up to 1993 have included mapping, drilling, dousing, sampling, trenching, and rehabilitation and expansion of underground workings. Other than a brief period of mining on the Hugh and King Midas mines, there has been no production from properties in the district.

There has been some recent exploration interest by Homestake Mining Company in gold deposits related to the mercury mineralization on the south side of the district. The volcanic fumarole origin of the large cinnabar deposits mined here in the past, suggests this area has a potential for epithermal, low-grade precious metal deposits. Also, the recognition that high-grade precious metal veins in this district are often associated with mercurian tetrahedrite, has resulted in geochemical exploration of this region by JCP Geologist Company (Sniffer prospect).

In the mid 1980's, exploration interest for Tertiary age, bulk tonnage gold and copper-molybdenum type deposits focused on the Vernal property. The area was mapped in detail, sampled, geochemically interpreted, and diamond drilled by Amselco Exploration, Noranda Exploration, and J. Prochnau & Co. Lack of activity in the last five years suggests results were unfavorable.

Identified resources from the district include: 1) about 61,000 cubic meters (80,000 cu yd) averaging 1.5 grams per cubic meter (0.036 oz/cu yd) placer gold at the Alice mine (Kral, 1951, p. 198), 2) about 45,000 metric tons (50,000 tons) of dump material with 1.0 kilograms per metric ton (2 lb/ton) mercury at the Ione Mercury mine (Bailey and Phoenix, 1942, p. 4), 3) about 160,000 metric tons (176,000 tons) of inferred resource averaging 0.155 kilograms per metric ton (0.31 lb/ton) mercury at the Nevada Cinnabar mine (Calculated from: U.S. Bureau of Mines, 1943a, p. 1; U.S. Bureau of Mines unpublished production records).

### Mines, Claims, and Prospects

The following list of 23 properties includes prospects, mines, and claim blocks both within the Ione mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Alice (Ione, Gold Nugget, Blue Sky)

Location: T. 13 N., R. 39 E., secs. 32, SE1/4, 33, W1/2

Commodities: Gold, silver

Size: 15 unpatented placer claims

Samples: Figure B-8, no samples taken; company sampling of placer gold ranged from 0.034 to 2.4 g/mt (0.001 to 0.07 oz/ton) Au (Marshall Earth Resources, 1981, p. 4).

Property type: Placer mine: numerous old trenches, pits, and drill holes.

Production: Between 1909 and 1941, about 3.1 kg (100 oz) Au (Johnson, 1973, p. 99); about 0.68 kg (22 oz) Au in 1981 (Alice Mining Co., 1981, unpublished letter).

Resources: About 61,000 cu m (80,000 cu yd) gravel averaging 1.5 g/cu m (0.036 oz/cu yd) Au (Kral, 1951, p. 198).

Geology: Placer deposits are in stream gravel at upper edge of a alluvial fan. Gold occurs in soil and surface gravels overlying a hard, caliche cemented gravel about 0.6 to 0.9 m (2 to 3 ft) deep.

Property name: April View (Black Sand)

Location: T. 13 N. R. 39 E., sec. 24

Commodities: Gold, silver, copper

Size: 12 unpatented lode claims

Samples: Figure B-7, nos. 92-93, 96-97, 99-101; high grade (select) samples (nos. 92-93, 101) averaged 6.3% Cu, with as much as 0.32 ppm Au, 171 g/mt (5 oz/ton) Ag, 3.2% As, 1.8% Sb, 246 ppm Hg, and 155 ppm Mo.

Property type: Prospect: numerous pits and bulldozer trenches, several shafts and drill sites

Production: -----

Resources: -----

Geology: Several small fissure veins of quartz, copper oxides, and limonite in silicified, argillized volcanogenic sediments and tuff.

Property name: Catherine (Columbus)

Location: T. 13 N. R. 39 E., sec. 34, E1/2

Commodities: Gold, silver

Size: About 57 ha (140 acres) that are part of the Hugh claim group.

Samples: Plate 2, nos. 7-9, 51, 57-58; sample (no. 9) of fault gouge assayed 0.54 ppm Au and 0.46% As.

Property type: Mine: numerous adits, shafts, and pits; about 600 m (2,000 ft) of underground workings; recently the main workings have been rehabilitated and drilled.

Production: In 1911, 1.76 kg (56.7 oz) Au and 0.958 kg (30.49 oz) Ag (Manchester Mining Co., 1912); recently (1980's) small amounts have been mined and stockpiled.

Resources: -----

Geology: Oxidized sulfide-bearing quartz veins and small replacement bodies contain high-grade, spotty gold along a northwest-trending fault between hydrothermally altered dolomite and greenstone.

Property name: Earth Science

Location: T. 13 N., R. 39 E., secs. 29, 32, 33; T. 12 N., R. 39 E., secs. 4, 5

Commodities: Gold, silver

Size: 1,200 ha (3,000 acres) of placer claims

Samples: Figure B-8, no samples taken

Property type: Prospect: several scattered pits. A large exploration claim block to cover any possible placer deposits discovered outside known placer production areas.

Production: -----

Resources: -----

Geology: Area of range-front pediment and alluvial fans.

Property name: Gold Hill (Spanish Canyon)

Location: T. 12 N. , R. 39 E., sec. 6, N1/2; T. 13 N., R. 39 E.,  
sec. 36, NE1/4; T. 13 N., R. 40 E., secs. 31, 32, W1/2

Commodities: Gold, silver

Size: 55 unpatented lode claims

Samples: Figure B-7, nos. 118-121; samples had slightly elevated  
amounts of As and Sb.

Property type: Prospect: several small pits and drill sites;  
exploration target for low grade gold epithermal  
deposits.

Production: -----

Resources: -----

Geology: Areas of jasperoids in volcanic rocks and minor placer  
gold occurrences.

Property name: H.G.Norman

Location: T. 12 N., R. 39 E., secs. 11, S1/2, 12, S1/2

Commodities: Mercury

Size: 15 unpatented lode claims

Samples: Plate 2, nos. 140, 154; assays contained no significant  
values.

Property type: Prospect: several old caved shafts and adits; more  
recent bulldozer work; a number of drill holes on the  
east side of the claim block.

Production: -----

Resources: -----

Geology: Cinnabar occurs along fractures in a faulted tuff. This  
may be a northern extension of mercury mineralization  
at the Nevada Cinnabar Mine.

Property name: Hazel E (Idlewild)

Location: T. 13 N., R. 39 E., sec. 3  
Commodities: Uranium  
Size: Part of the southern Vernal claim block.  
Samples: Figure B-5, nos. 497-498; sample (no. 497) of altered rhyolite assayed 165 ppm  $U_3O_8$ .  
Property type: Prospect: several bulldozer cuts  
Production: -----  
Resources: -----  
Geology: Radioactivity occurs in a gouge and breccia zone along a faulted rhyolitic tuff.

Property name: HM

Location: T. 12 N., R. 39 E., secs. 1, N1/2, 2, NE1/4; T. 12 N., R. 39 E., sec. 6, NW1/4; T. 13 N., R. 39 E., secs. 35-36  
Commodities: Mercury, gold, silver  
Size: 64 unpatented lode claims  
Samples: Plate 2, nos. 62-63, 67, 126; Fig. B-7, nos. 122-123; assays contained no significant values.  
Property type: Prospect: several old adits, shafts, and pits; claim block covers possible deposits of mercury along the Mercury Mine Fault and of precious metals similar to those at the Shamrock mines to the west.  
Production: -----  
Resources: -----  
Geology: Mineralized Tertiary volcanic and Mesozoic clastic rocks in areas of faulting and fracturing.

Property name: Hugh

Location: T. 13 N., R. 39 E., secs. 26, W1/2, 27, 34, N1/2, 35, W1/2

Commodities: Silver, copper

Size: 56 unpatented lode claims

Samples: Figure B-9, nos. 1-3, 6, 10-11, 17, 33, 38-40, 94-95, 359; quartz ore samples (nos. 1, 3, 11, 38, 40) assayed as much as 0.52 ppm Au, 355 g/mt (10.4 oz/ton) Ag, and 3.8% Cu.

Property type: Prospect: numerous old pits, adits, and shafts; bulldozer work and drill sites associated with recent exploration.

Production: -----

Resources: -----

Geology: Small hydrothermal veins in limestone, quartzite, and greenstone are associated with northwest-trending faults, some of which are extensions of structures at the Catherine and Yellow Cat mines.

Property name: Ione Mercury (Mercury Mining Company)

Location: T. 12 N., R. 39 E., secs. 1, W1/2, 2

Commodities: Mercury

Size: 17 patented lode claims

Samples: Plate 2, nos. 24-25, 66, 125, 130-131, 133-138, 483, 499; samples assayed as much as 7.7% Hg.

Property type: Mine: numerous cuts, trenches, adits, and shafts, and 10 large pits; four open stopes; ruins of a mill and retort; about 1,040 m (3,400 ft) of underground workings.

Production: 252,980 kg (7,337 fl) Hg between 1911 and 1958 (Kral, 1951, p. 204; Holmes, 1958a, p. 2; U.S. Bureau of Mines unpublished production records).

Resources: About 45,000 mt (50,000 tons) of dump material averaging 1.0 kg/mt (2 lb/ton) mercury (Bailey and Phoenix, 1942, p. 4).

Geology: Cinnabar with small amounts of native mercury, occurs as stringers in folded calcareous shales near two vertical, parallel faults, and as disseminations or smears in andesite agglomerate within an old volcanic vent (fig. 9, top).



Figure 9.--View of volcanic agglomerate mercury deposits at the Ione Mercury mine (top), and view of Marshall Earth Resources, Inc., placer recovery plat, King Midas mine (bottom).

Property name: Jenny

Location: T. 13 N., R. 39 E., secs. 24, SE1/4, 25, E1/2; T. 13 N., R. 40 E., sec. 30, W1/2

Commodities: Gold, silver, copper

Size: 29 unpatented lode claims

Samples: Figure B-7, nos. 91, 98, 109-117; sample (no. 114) of ore assayed 15.2 g/mt (0.44 oz/ton) Ag and 0.2% Cu.

Property type: Prospect: numerous pits and trenches; several shafts

Production: -----

Resources: -----

Geology: Copper oxides, limonite, fluorite, and pyrite occur in scattered, small bodies of highly altered, faulted volcanogenic sediments and tuff.

Property name: King Midas (Bald Mountain Bill)

Location: T. 13 N., R. 39 E., secs. 27, W1/2, 28, 29, E1/2, 32, NE1/4, 33

Commodities: Gold, silver, copper, lead

Size: 62 unpatented lode claims

Samples: Figure B-8, nos. 13-15, 20-23, 34-37; B-9, nos. 4-5, 12, 16; quartz-sulfide vein samples (nos. 13, 34, 37) averaged 10.6 g/mt (0.31 oz/ton) Au, 1,046 g/mt (30.5 oz/ton) Ag, 0.15% Cu, 1.3% Pb with as much as 0.21% As, 0.16% Sb, and 0.38% Te.

Property type: Mine: numerous old pits, shafts, and trenches; recent bulldozer cuts and access roads; an operational placer processing plant (fig. 9, bottom).

Production: About 20 kg (650 oz) of placer gold in 1983-84 (Marshall Earth Resources Inc., 1984).

Resources: -----

Geology: Gold-bearing Quaternary (?) channel gravel deposits and reworked placer equivalents were mined in 1983-1984 from surface cuts (fig. 10, top). Old workings are on small, high-grade, gold-bearing stringers in silicified rhyolite. On the southeast corner of the property, sulfide-bearing quartz veins associated with a quartz monzonite intrusion contain gold, silver, copper, and lead.



Figure 10.--View of paleochannel deposits (top), and view of Pelton adit, Shamrock mine (bottom).

Property name: Lookout (Mountain Brow, Pleiades)

Location: T. 12 N., R. 39 E., sec. 11

Commodities: Gold, silver, copper, mercury

Size: 19 unpatented lode claims

Samples: Plate 2, nos. 148-153; high-grade copper ore samples (nos. 148-151) averaged 4.1 g/mt (0.12 oz/ton) Au, 374 g/mt (10.9 oz/ton) Ag, and 5.5% Cu with as much as 0.17% As and 0.95% Sb. Mercury-bearing samples (nos. 149, 152,) averaged 0.05% Hg.

Property type: Prospect: several old shafts, adits, and pits; numerous recent bulldozer cuts.

Production: -----

Resources: -----

Geology: Mercury occurs as cinnabar seam and fracture fillings in faulted interbedded limestone and conglomerate. The precious metals and copper are associated with altered metasedimentary rock adjacent to a quartz diorite dike.

Property name: Moon, Indian Johnnie Dick, Two Injun

Location: T. 12 N. R. 39 E., secs. 2, 3, W1/2, 11, N1/2, 12, NW1/4

Commodities: Mercury, copper

Size: 33 unpatented lode claims

Samples: Plate 2, nos. 82-83, 127-129, 132, 139; one sample (no. 83) of quartz-sulfide ore assayed 0.9 g/mt (0.03 oz/ton) Au, 238 g/t (6.94 oz/ton) Ag, 0.18% Pb, and 0.07% W; one sample (no. 127) had 127 ppm Hg.

Property type: Mine: numerous pits, trenches, and several adits and shafts; two small retorts in ruins.

Production: A small unrecorded production of mercury is likely.

Resources: -----

Geology: At the Two Injun and Johnnie Dick mines, cinnabar occurs both as disseminations in gouge and as fracture fillings in faulted, silicified limestone and conglomerate. This may be a western extension of the mineralized rocks at the Ione mine. On the west side of the property several areas contain minor amounts of copper and tungsten in hydrothermal quartz veins.

Property name: Nevada Cinnabar (Shoshone Quicksilver)

Location: T. 12 N., R. 39 E., secs. 11, SE1/4, 14, NE1/4

Commodities: Mercury

Size: 11 unpatented lode claims.

Samples: Plate 2, nos. 155-157, 500; assays contain no significant values.

Property type: Mine: numerous pits, cuts, shafts, and adits; two open stopes on the main deposit; mill and retort in ruins.

Production: 233,568 kg (6,774 fl) Hg between 1907 and 1969 (Bailey and Phoenix, 1944, p. 151; U.S. Bureau of Mines unpublished production records).

Resources: About 160,000 mt (176,000 tons) of inferred resources averaging 0.155 kg/mt (0.31 lb/ton) Hg (calculated from: U.S. Bureau of Mines, 1943a, p. 1; U.S. Bureau of Mines unpublished production records).

Geology: Cinnabar occurs several ways: 1) in silicified tuff as narrow veins or bands parallel and below a high-angle fault, 2) in the fault gouge, 3) in unaltered tuff as disseminations, 4) as narrow fracture-filling veins in a vitrophyre above the high-angle fault. (Bailey and Phoenix, 1944, p. 152)

Property name: Shamrock (Crown, Wild Emigrant, Phonograph, Indianapolis, Clipper, Northern Star, Stonewall, Keystone)

Location: T. 12 N., R. 39 E., secs. 2, N1/2, 3, N1/2; T. 13 N., R. 39 E., secs. 34, S1/2, 35, S1/2

Commodities: Silver, gold, lead, copper, zinc

Size: 12 patented and 11 unpatented lode claims

Samples: Plate 2, nos. 26-32, 49-50, 55-56, 68-81, 84, 86-87, 482, 520; samples of quartz veins with sulfides (nos. 27-30, 49, 55-56, 68-75, 78, 80-81, 84, 87) averaged 2.06 g/mt (0.06 oz/ton) Au, 360 g/mt (10.5 oz/ton) Ag, and 0.26% Pb, with as much as 9.19 g/mt (0.27 oz/ton) Au, 1,473 g/mt (43 oz/ton) Ag, 2.4% Cu, 1.4% Pb, 0.47% Zn, 0.51% As, and 0.26% Sb. One sample (no. 73) contained 0.1% W.

Property type: Mine: numerous pits, adits, and shafts (fig. 10, bottom); thousands of meters of underground workings are mostly inaccessible; recent development includes rehabilitation of several adits and drilling.

Production: From 1864 to 1940, estimated 72,800 kg (23.4 million oz) Ag, 1,870 kg (60,000 oz) Au, and small amounts of lead and copper (calculated from: Kral, 1951, p. 196-197; Couch and Carpenter, 1943, p. 120-121; U.S. Bureau of Mines unpublished production records; Gardiner, 1926, p. 5).

Resources: -----

Geology: Deposits are hosted by a diorite stock, less than 2.6 sq km (1 sq mi) in extent, and by the surrounding Permian to Jurassic age clastic and metamorphic (greenstone) rocks. Several subparallel northwest-trending quartz fissure veins range from 0.3 to 1.2 m (1 to 4 ft) thick, strike for about 1,520 m (5,000 ft), and are offset about 30 to 90 m (100 to 300 ft) by northeast-trending faults. The veins dip 60 degrees northeast at the surface and flatten out at a depth of about 90 m (300 ft) setting the limits of mining (Firth, 1981, p. 2). Mineralized portions of the quartz veins, called ore shoots, contained high grade silver sulfide and oxide ore, which assayed as much as 110,000 g/mt (3,200 oz/ton) silver (Barrett, 1963, p. 3).

Property name: Sheep Canyon (Cowboy, Hard Time)

Location: T. 12 N., R. 39 E, secs. 3, N1/2, 4, 5, W1/2, 9, N1/2  
Commodities: Gold, silver  
Size: 70 unpatented lode claims  
Samples: Plate 2, no. 88; sample assayed 1.6 g/mt (0.05 oz/ton) Au, 442 g/mt (12.9 oz/ton) Ag, and 0.32% Pb.  
Property type: Prospect: several small pits and placer test trenches; exploration target in pediment area where there could be possible hidden mineral structure extensions from the Shamrock mines to the east.  
Production: -----  
Resources: -----  
Geology: Sulfide-bearing quartz veins in altered, faulted diorite are partly covered by alluvium.

Property name: Sniffer

Location: T. 12 N., R. 39 E., secs. 10, N1/2, 11, NW1/4  
Commodities: Gold, silver  
Size: 18 unpatented lode claims  
Samples: Plate 2, nos. 147, 208-210; sample (no. 147) of quartz with sulfides assayed 12.7 g/mt (0.37 oz/ton) Au, 56.7 g/mt (1.65 oz/ton) Ag, 9.8% Cu, 0.16% Hg, and 0.36% Sb.  
Property type: Prospect: several small pits; exploration target for precious metal veins established with soil sampling for mercury.  
Production: -----  
Resources: -----  
Geology: Area of anomalous amounts of mercury in soil suggest undiscovered precious metal-bearing veins with mercurian tetrahedrite in faulted metamorphic rocks.

Property name: Sun

Location: T. 13 N. R. 39 E., secs. 33, W1/2, 34, 35, SW1/4  
Commodities: Gold, silver, copper, lead, zinc.  
Size: 18 unpatented lode claims  
Samples: Plate 2, nos. 52-54; sample (no. 54) of quartz-sulfide vein assayed 1.64 g/mt (0.048 oz/ton) Au, 848 g/mt (24.7 oz/ton) Ag, and 0.29% Pb.  
Property type: Prospect: numerous pits, trenches, and adits; several drill sites.  
Production: -----  
Resources: -----  
Geology: Mineralized areas on the northern side of the Shamrock diorite stock where: 1) several quartz veins with sulfides are along faults cutting a diorite-greenstone contact; 2) dolomite and greenstone are in fault contact.

Property name: Top of the Mountain

Location: T. 13 N. R. 39 E., secs. 13, NW1/4, 14, 23, NE1/4  
Commodities: Gold, silver, copper  
Size: 27 unpatented lode claims  
Samples: Figure B-6, nos. 18-19, 102-108; one sample (no. 102) of tuff from shaft dump assayed 1.5% Cu and 0.31% Sb; one sample (no. 108) of argillite contained 1.86 g/mt (0.054 oz/ton) Au and 9.8 g/mt (0.29 oz/ton) Ag.  
Property type: Prospect: several adits that have been recently rehabilitated and drilled, four shafts, and numerous pits. Recent exploration for disseminated gold deposit.  
Production: -----  
Resources: -----  
Geology: Faulted and folded metasedimentary rocks and rhyolite contain small veins with pyrite, secondary quartz, and copper oxides.

Property name: Vernal (Sunnyside)

Location: T. 13 N., R. 39 E., secs. 3, 4, NW1/4; T. 14 N., R. 39 E., secs. 34, 33, W1/2

Commodities: Gold, silver

Size: 54 unpatented lode claims

Samples: Figure B-5, nos. 492-496; samples of rhyolite breccia assayed as much as 9 g/mt (0.26 oz/ton) Au and 191 ppm Mo.

Property type: Prospect: numerous old adits, shafts, and pits; recent development work included drill sites and access roads.

Production: -----

Resources: -----

Geology: Highly anomalous gold is associated with silicified, brecciated, or argillically altered rhyolite with quartz-pyrite stockworks.

Property name: Wire

Location: T. 12 N., R. 39 E., sec. 3, S1/2

Commodities: Gold, silver, copper

Size: 13 lode, one placer, and one millsite unpatented claims

Samples: Plate 2, nos. 85, 89-90; samples averaged 1.37 g/mt (0.04 oz/ton) Au, 103 g/mt (3 oz/ton) Ag, 3.5% Cu, 0.7% As, and 1.4% Sb.

Property type: Prospect: several trenches, one shaft, and one larger open pit.

Production: -----

Resources: -----

Geology: High-grade silver-copper oxide and sulfide ore occurs as discontinuous lenses of quartz and breccia along a quartz diorite dike in a northeast trending fault within greenstone-quartzite country rock.

Property name: Yellow Cat (Yellowjacket, Golden Fleece)

Location: T. 13 N., R. 39 E., sec. 35, N1/2

Commodities: Mercury, gold, silver

Size: About 40 ha (100 acres), part of the HM claim group

Samples: Plate 2, nos. 41-42, 59-61; assays contained no significant values.

Property type: Mine: one lower adit that has recently been rehabilitated and drilled; a large, upper open pit with a caved shaft; numerous pits and trenches.

Production: Small amount of mercury in 1930 and 1961 to 1969 (U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: At the lower adit, a hydrothermally altered dolomite and quartzite have discontinuous, gold-bearing quartz veins along a fault. The upper workings have cinnabar occurring as high-grade veinlets in altered dolomite adjacent to the Mercury Mine Fault.

## Berlin Mining District

### Location

The Berlin District includes the west side of the range from Knickerbocker Wash, south to the area around Union Canyon (fig. 8, nos. 39, 41-42, 46-54). The district is centered on the Berlin Mine and has been often referred to as part of the Union mining district.

### History and Production

Initial exploration of the district was most likely in the 1860's when mining activity started in the Ione district to the north and the small town of Union was established in Union Canyon. The Berlin camp was established and the Berlin mine, known then as the B and B mine, was in production by the mid 1890's. In 1898, the mills at Knickerbocker Canyon and at Ione were moved to Berlin to handle the increased production coming from the mine. Sulfide ores were crushed in a stamp mill, concentrated, amalgamated to liberate free gold, and shipped to Salt Lake City, Utah, for reduction (Smith, 1913, p. 3).

A number of smaller mines were also in production at this time, including the Bowler, Good Luck, and Jesse mines to the north of Berlin and the Richmond mine to the south. By 1911 lode mining was declining and most of the production until 1914, when activity stopped, was by cyanide leaching of the tailings at the Berlin mill. Small lode operations continued in the district from the 1920's into the 1940's. Total recorded metal production for the district is about 995 kilograms (32,000 oz) gold, 5,000 kilograms (161,000 oz) silver, 7,521 kilograms (16,580 lb) copper, and 8,838 kilograms (19,485 lb) lead (calculated from: Kral, 1951, p. 199-200; U.S. Bureau of Mines unpublished production records; Nevada Bureau of Mines and Geology, undated. Most of this production is from the Berlin mine from 1897 to 1912.

In 1948, an attempt was made to reopen the Berlin mine by driving a tunnel from the Diana mine to the caved main incline. The attempt failed due to the extensive caving encountered in the Berlin workings.

A large tract of land in the district, south of Union canyon, was made into a state park in 1955 for the preservation of impressive Ichthyosaurs fossils of Triassic age. The state park was expanded in the 1970's to include the historic town of Berlin, the Berlin mine, and about 160 hectares (400 acres) of previously patented mining claims. The Berlin-Ichthyosaur state park covers most of the mines that produced in the district.

Fluorite was discovered at the mouth of Union Canyon in the early 1950's. From 1953 to 1971, 327 metric tons (360 tons) of high-grade fluorite ore were mined at the Sea Bee property and shipped to the Kaiser Mill in Fallon, Nevada; an additional 18,140 metric tons (20,000 tons) of low-grade ore was stockpiled (Papke, 1979, p. 35). By 1972, The Standard Slag Company had drilled out a resource of 392,731 metric tons (433,000 tons) averaging 18.5% fluorite (Papke, 1979, p. 35).

### Geology

Mineral deposits in the district consist of sulfide-quartz fissure veins hosted either in the Pablo or Grantsville formations of Permian and Triassic ages respectively. The geology of the deposit at the Berlin mine, the district's main producer, was described by Daggett (1908). Ore occurs as 0.6- to 1.0- meter (2- to 3-ft) wide quartz veins that are extensively faulted in two directions, thus terminated on all sides by

faults. Veins strike northeast, dip about 45 degrees southeast, and are characterized by an unusual degree of uniformity in width and values. Ores are relatively unoxidized and have a sulfide content of about two percent, containing pyrite, chalcopyrite, galena, sphalerite, and stibnite. Values are principally in gold. At the Richmond mine, ore minerals also included tetrahedrite. Host rock for the mineral deposits at the Berlin mine is a Permian meta-andesite, often referred to as greenstone. Other deposits in the district are either hosted by greenstone or by Triassic calcareous sediments.

Structure in the district is dominated by the northwest-trending Union Canyon fault and a complex system of northwest- or northeast-trending faults that suggest uplift from a possible intrusion at depth. Throughout the terrain are small intrusions and dikes of granodiorite and quartz porphyry.

Mineralized structures at many other metal properties in the district are similar to those at the Berlin mine. The Bowler and Good Luck mines were developed on flat lying, sulfide-quartz veins, and at the Richmond mine quartz veins are segmented by faults in two directions. The old prospects in Buffalo Canyon involve a number of oxidized quartz-sulfide veins in faulted metasedimentary rock and greenstone. Several of the prospects are adjacent to small granodiorite intrusions and have tourmaline as a gangue mineral.

Several other different types of metal occurrences in the district include veins of copper sulfide and carbonate in sheared Triassic schist, slate, and quartzite at the Copper King; and mercury and precious metal in faulted, brecciated, altered Tertiary volcanic rocks at the Evelyn and Mountain prospects on the east side.

Fluorite deposits at the Sea Bee mine occur along two parallel, range-front faults crosscut by a northwest-trending fault in the floor of Union Canyon. Deposits are hosted in brecciated, argillized, and silicified limestone, conglomerate, and siltstone. Fluorite occurs as nodular masses, banded veins, and veinlets that have been broken into fragments 5 to 15 centimeters (2 to 6 in.) wide by movement on the range-front faults after the formation of the deposits. The grade of ore ranges from 15% to 80% fluorite with an average mine run of about 60% fluorite.

At the Spar prospect, fluorite occurs in three jasperoid bodies along northwest-trending faults in Triassic limestone. The fluorite is in vuggy masses, banded veins, and vug fillings. Occurrences are irregularly distributed, and diluted by a gangue of calcite and quartz; overall grades of the occurrence are low.

#### Recent Mining Activity

Most of the mines in the district have been incorporated in the Berlin-Ichthysaur state park and have been removed permanently from mining development. The properties immediately east of the park are also inaccessible since any reasonable access would have to be through the park.

There has been recent (1988) exploration activity for epithermal, low-grade precious metal deposits by Nevada Mine Development Corp. and Golden Hunter Resources. At the Mountain prospect, a large claim block on the east side of the district, Tertiary volcanic rocks have widespread argillic alteration overlapping with localized silicification, alunite mineralization, and breccia pipes. There is also exploration on

the west side at the GHR prospect where projections of the major faults meet in areas of pediment that display jasperoid and fluorite bearing rocks.

#### Mines, Claims, and Prospects

The following list of 12 properties includes prospects, mines, and claim blocks both within the Berlin mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Adams Rib (Doonan)

Location: T. 12 N., R. 39 E., secs. 21, S1/2, 22, SW1/4, 28, NE1/4

Commodities: Gold, silver, copper

Size: 19 unpatented lode claims

Samples: Plate 3, nos. 198-201, 205-206, 226-231, 234; one sample (no. 200) of quartz-sulfide ore assayed 6.35 g/mt (0.19 oz/ton) Au, 164 g/mt (4.78 oz/ton) Ag, and 0.28% Cu. Vein samples were anomalously high in As and Sb.

Property type: Mine: numerous old workings on the surface and underground.

Production: A small amount of gold and silver in 1939 (U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: Sulfide-bearing quartz veins, and siliceous breccia and stockwork on faults between greenstone, limestone, and clastic Triassic age rocks.

Property name: Berlin, Diana, Good Luck (Bowler)

Location: T. 12 N., R. 39 E., secs. 20, SE1/4, 21, SW1/4, 28, W1/2, 29, NE1/4

Commodities: Gold, silver, copper, lead, zinc

Size: 13 patented lode claims and 2 patented placer claims

Samples: Plate 3, nos. 165-166, 177-179, 219-225, 232-233, 235-236, 241-242, 541; samples (nos. 165-166, 177) of ore from Good Luck mine (fig. 11, top) assayed as much as 4.19 g/mt (0.12 oz/ton) Au, 160 g/mt (4.7 oz/ton) Ag, 0.74% Cu, and 0.11% Zn; samples (nos. 221-223) of quartz ore (fig. 11, bottom) from main workings averaged 12.7 g/mt (0.37 oz/ton) Au, 219 g/mt (6.4 oz/ton) Ag with as much as 0.13% Cu, 0.57% Pb, and 0.11% Zn; from mineralized structures near the mine, two samples (nos. 235-236) assayed as much as 2.26 g/mt (0.066 oz/ton) Au, 26.1 g/mt (0.76 oz/ton) Ag, 3.9% Cu, 0.43% Sb, and 121 ppm Mo.

Property type: Mines, incorporated into a state park: about 6,000 m (20,000 ft) of underground workings; numerous shafts, adits, pits, bulldozer trenches; ruins of a stamp mill and a mining camp (fig. 11, bottom).

Production: Between 1898 and 1941: about 995 kg (32,000 oz) Au, 4,790 kg (154,000 oz) Ag, 8,221 kg (18,124 lb) Pb, and 1,712 kg (3,775 lb) copper (calculated from Kral, 1951, p. 199; and U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: Sulfide-bearing quartz veins, 0.6 to 1 m (2 to 3 ft) thick, fill fissures in greenstone. The veins have been extensively faulted into segments, trend northeast, and dip 45 degrees southeast. The longest vein is traceable on the surface for about 460 m (1,500 ft).



Figure 11.--View of old adit and quartz vein at Good Luck mine (top), and view of shaft from 1920's, quartz ore, and stamp mill, Berlin mine (bottom).

Property name: Boulder (Buffalo Canyon)

Location: T. 12 N., R. 39 E., secs. 15, SW1/4, 16, S1/2, 21, N1/2, 22, NW1/4

Commodities: Gold, silver, copper, lead, zinc

Size: 56 unpatented lode claims

Samples: Plate 3, nos. 160-164, 167-176, 180, 182, 186-189, 202-204, 207, 218; samples from veins and gossan in the Buffalo Canyon area assayed as much as 13.9 g/mt (0.41 oz/ton) Au, 186 g/mt (5.4 oz/ton) Ag, 1.8% Cu, 3.7% Pb, 1.8% Zn, and 1% As.

Property type: Prospect: numerous, scattered adits, shafts, and pits.

Production: -----

Resources: -----

Geology: Widespread, narrow quartz veins with sulfide minerals are associated with faulted metasedimentary rocks.

Property name: Copper King (JDS)

Location: T. 12 N., R. 39 E., secs. 10, S1/2, 11, SW1/2, 14, NW1/4, 15, NE1/4

Commodities: Copper, lead, silver, gold

Size: 11 unpatented lode claims

Samples: Plate 2, nos. 145-146; copper ore sample (no. 145) contains 4.9% Cu and 49.9 g/mt (1.5 oz/ton) Ag.

Property type: Mine: one adit, one inclined shaft, and several pits.

Production: Small amounts of copper, lead, silver, and gold in 1926-27, 1948, 1950-51, 1954, and 1956 (U.S. Bureau of Mines unpublished mining records).

Resources: -----

Geology: Chalcopyrite and copper carbonate veins occur along with calcite, barite, and quartz in a northeast-trending bedding-plane fault in altered metasedimentary rocks.

Property name: Evelyn (King, Mini)

Location: T. 12 N., R. 39 E., secs. 14, SE1/4, 23, NE1/4  
Commodities: Mercury  
Size: Three unpatented lode claims  
Samples: Figure A-10, nos. 190-192; one sample of altered tuff contained 431 ppm Hg.  
Property type: Prospect: several pits, bulldozer cuts, and the ruins of a small retort; possible southern extension of the mercury mineralization belt associated with the Nevada Cinnabar mine.  
Production: -----  
Resources: -----  
Geology: Mercury-bearing, altered, faulted tuff.

Property name: GHR

Location: T. 12 N., R. 39 E., secs. 20, E1/2, 29, 30, S1/2, 31, 32, 33, W1/2; T. 11 N., R. 39 E., secs. 5, N1/2, 6, N1/2  
Commodities: Gold, silver  
Size: 150 unpatented lode claims  
Samples: Plate 3, no. 181; sample of quartz vein assayed 23.4 g/mt (0.68 oz/ton) Au.  
Property type: Prospect: a few old placer pits; exploration target for possible precious deposits under the pediment along extensions of mineral-bearing structures exposed to the east in the Berlin district.  
Production: -----  
Resources: -----  
Geology: Area of pediment and alluvium covering Permian and Mesozoic sedimentary and metasedimentary rocks.

Property name: JJJ (Knickerbocker Wash)

Location: T. 12 N. R. 39 E., secs. 9, SE1/4, 10, SW1/4, 15, 16, NE1/4

Commodities: Copper, zinc

Size: 30 unpatented lode claims

Samples: Plate 2 and 3, nos. 141-144, 183-185; one sample (no. 183) assayed 0.29% Cu.

Property type: Prospect: several old adits, shafts, and pits; an old mill in ruins at the mouth of the wash.

Production: -----

Resources: -----

Geology: Metasedimentary rock, granodiorite, limestone, and conglomerate contain sulfide-bearing quartz veins in breccia and fracture zones.

Property name: Mountain

Location: T. 12 N., R. 39 E., secs. 12, S1/2, 13, 22, S1/2, 23, S1/2, 24, 27, N1/2, 26 NW1/4

Commodities: Gold, silver, mercury

Size: 112 unpatented lode claims

Samples: Figure B-10, nos. 193-194; Plate 2, no. 158; Plate 3, nos. 195-197, 214-215, 245; USBM samples were, generally, low in values. Breccia (Plate 3, nos. 214, 215) has been reported to contain 2,640 g/mt (77 oz/ton) Ag (Pratt, 1988, p. 4).

Property type: Prospect: several old pits; mostly undeveloped; exploration target for possible low-grade gold deposits in altered Tertiary volcanic rocks and underlying Pre-Tertiary sedimentary rocks.

Production: -----

Resources: -----

Geology: Three areas of interest are: cinnabar on faults (no. 158), quartz-alunite alteration in fault breccia zones (no. 193), and altered breccia pipes (fig. 12, top) with high silver values (nos. 214-215).



Figure 12.--View of pinnacle of silicified volcanic rock surrounded by breccia zones (top), and view of tetrahedrite-quartz ore from the Richmond mine (bottom).

Property name: PDQ

Location: T. 12 N., R. 39 E., secs. 9, S1/2, 16, 17 E1/2  
Commodities: Gold, silver  
Size: 61 unpatented lode claims  
Samples: Plate 3, no. 159; one sample of sheared greenstone assayed 1.23 ppm Au and 0.13% As.  
Property type: Prospect: several old prospect pits; exploration target for possible mineral deposits under the pediment.  
Production: -----  
Resources: -----  
Geology: Area of pediment and alluvium covering faulted metasedimentary rocks.

Property name: Richmond

Location: T. 12 N., R. 39 E., sec. 27, S1/2  
Commodities: Gold, silver, copper, lead  
Size: Three patented lode claims and one patented millsite  
Samples: Plate 3, nos. 211-213, 216, 243-244, 272-273; one sample (no. 213) of tetrahedrite vein (fig. 12, bottom) assayed an impressive 124 g/mt (3.6 oz/ton) Au, 1,561 g/mt (45.5 oz/ton) Ag, 1.4% Cu, 0.16% Pb, 0.24% Zn, and 0.8% Sb. A 154 ppm Hg content confirms the ore as slightly mercurian.  
Property type: Mine, incorporated into a state park: numerous old adits and pits; about 610 m (2,000 ft) of underground workings; a small mill in ruins.  
Production: Between 1906 and 1963, 8.55 kg (275 oz) Au, 201.2 kg (6,470 oz) Ag, and 1,575 kg (3,476 lb) Cu (Nevada Bureau of Mines and Geology, undated).  
Resources: -----  
Geology: A 0.1- to 1.2-meter (1- to 4-ft) thick, discontinuous quartz vein in greenstone and limestone strikes northeast and is offset by northwest-trending faults. High-grade ore shoots in vein contain tetrahedrite, pyrite, chalcopyrite, and galena.

Property name: Sea Bee (Shoshone Fluorspar, Union Fluorspar)

Location: T. 12 N., R. 39 E., secs. 33, NW1/4, 32,  
NE1/4 Commodities: Fluorine

Size: 10 unpatented lode claims

Samples: Plate 3, nos. 246-249; fluorite ore samples (nos. 246-248) averaged 50.7% CaF<sub>2</sub> with as much as 88% CaF<sub>2</sub>.

Property type: Mine: numerous pits, adits, and trenches; one larger benched open pit.

Production: 327 mt (360 tons) averaging 73% CaF<sub>2</sub> were shipped in 1953 and 1954. About 18,140 mt (20,000 tons) averaging 16% CaF<sub>2</sub> were mined in 1971 and stockpiled (Papke, 1979, p. 35).

Resources: 392,818 mt (433,000 tons) averaging 18.5% CaF<sub>2</sub> (Papke, 1979, p. 35).

Geology: An epithermal ore body is along a northwest-trending range front fault where it was displaced by the northeast-trending Union Canyon Fault. Fluorite lenses within the range front fault zone are nodular or fracture fillings in lightly altered conglomerate, siltstone, and chert.

Property name: Spar (Morton, Vulture)

Location: T. 12 N., R. 39 E., sec. 28, SW1/4

Commodities: Fluorine

Size: Two patented lode claims

Samples: Plate 3, nos. 237-240; fluorite samples averaged 65% CaF<sub>2</sub>.

Property type: Prospect, incorporated into a state park: several old small pits; extensive recent bulldozer work with drill sites.

Production: -----

Resources: -----

Geology: Fluorite is distributed along a northwest-trending fault in three large silicified bodies within altered limestone and conglomerate. The fluorite occurs with calcite and jasper in botryoidal masses or vug fillings.

## Grantsville Summit Mining District

### Location

The Grantsville Summit area is on the crest of the Shoshone Range at the head of Grantsville Canyon (fig. 8, nos. 56-57). This area has been often included in discussions of the Grantsville mining district to the west, but for the purposes of this report has been split out for separate consideration.

### History and Production

Initial prospecting of the Grantsville Summit area probably occurred in the 1860's when the town of Grantsville was established 6.4 kilometers (4 mi) to the west. The earliest mining efforts are evidenced by a number of old workings on copper oxide-stained zones, and some very old claim posts and stone monuments. The copper prospect was known as the Sue, Blue Rock, or Reese River Copper.

In 1941, a mercury deposit was discovered at the San Pedro property on the west side of the crest and by 1942 was in production. The deposit was mined both from open pits and from a shaft, with ore shipped to the Red Rock furnace in Fish Lake Valley, Nevada. The mine was in operation intermittently up to 1962, with a total production of 1,970 kilograms (57 fl) (Bailey and Phoenix, 1944, p. 153; U.S. Bureau of Mines unpublished production records). An estimate by Hughes (1941, p. 3) of the possible size of the mercury deposit at the mine was about 26,300 metric tons (29,000 tons). Bailey and Phoenix (1944, p. 153) suggest an average grade of about 1.6 kilograms per metric ton (3.2 lb/ton) mercury.

### Geology

The Summit area is a structural and erosional inlier of sedimentary and intrusive rocks of Mesozoic age surrounded by an extensive blanket of Tertiary volcanic rocks. The Mesozoic rocks were hydrothermally altered, first by Jurassic or Cretaceous diorite intrusions, then by Tertiary volcanic events. Copper mineralization was probably related to the diorite intrusions and the gold-silver-mercury mineralization related to the Tertiary volcanic events.

Mercury occurs on the west edge of the Mesozoic inlier, in a Tertiary volcanic agglomerate consisting of boulders of tuff, rhyolite, and altered argillite. Cinnabar, the only mercury mineral, replaces boulders or fills fractures in the agglomerate. Ore grades ranged from 1.6 to 4.9 kilograms per metric ton (4 to 12 lb/ton) (Bailey and Phoenix, 1944, p. 153). The overall geology of the area suggests the mercury occurrence represents an old fumarole vent of Tertiary age.

The limited amount of copper minerals are found in skarn and gossan adjacent to a diorite intrusion. The iron-rich skarns are in recrystallized limestone units, and contain diopside, garnet, and epidote. Copper occurs over an area about 910 meters (3,000 ft) long and 60 meters (200 ft) wide as malachite, azurite, and cuprite veinlets in a calcite gangue.

A gold deposit, discovered in the 1980's, occurs on the west edge of the Mesozoic sedimentary rocks inlier. The following geologic description is based on a report by Nuttycombe and others (1989). The deposit is hosted mainly by an altered dolomite, with smaller parts hosted by andesite and rhyolite. The main ore body is in hydrothermally altered, silicified dolomite directly beneath the overlying volcanic units. The

dolomite-volcanic contact acted as a conduit for gold-bearing fluids ascending from Tertiary volcanic activity to reach the reactive carbonate host rock, and was probably the principle control for gold distribution. Higher grade parts of the deposit are where hydrothermal fluids would have accumulated, such as where the dolomite-volcanic contact is at a low angle.

#### Recent Mining Activity

Exploration for minerals in the 1950's and 1960's resulted in little more than claim staking, with interest slowly turning to the low-grade gold deposit potential for the area.

Recent exploration for precious metal deposits at the Grantsville Summit property started with a mapping, sampling, and drilling program by Arrowhead Resources Ltd from 1983 to 1986. Kerademex did additional geologic mapping. In 1987 Amax Exploration obtained the property and continued the mapping and drilling programs. The gold deposit discovered by Amax has been calculated to have a total reserve of 1,800,000 metric tons (2,000,000 tons) averaging 1.78 grams per metric ton (0.052 oz/ton) gold with 36,000 metric tons (40,000 tons) averaging 9.26 grams per metric ton (0.27 oz/ton) gold being open pit minable (Nuttycombe and others, 1989, p. 1). To date (1993), the deposit has not been developed for production, probably because of its small size. Other than some geologic reconnaissance by Amax Exploration (Homer prospect), there is no activity on the copper or mercury occurrences in the area.

#### Mines, Claims, and Prospects

The following list of two properties includes prospects, mines, and claim blocks both within the Grantsville Summit mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Grantsville Summit (San Pedro, Sue)

Location: T. 12 N., R. 40 E., secs. 31, 32. W1/2; T. 11. N., R. 40 E., sec. 6

Commodities: Gold, silver, mercury

Size: 45 unpatented lode claims

Samples: Figure A-11, nos. 299-301, 306-310, 312; samples (nos. 300, 304, 308-310) from copper ores averaged 0.15 ppm Au, 41 g/mt (1.2 oz/ton) Ag, 4.2% Cu, 0.48% As, 0.34% Sb.

Property type: Mine and prospect: past mercury mining resulted in numerous pits, shafts, and trenches; gold prospecting in the 1980's resulted in several drilling programs and extensive bulldozer work.

Production: 1,970 kg (57 fl) of Hg from 1941-1962 (Bailey and Phoenix, 1944, p. 153; U.S. Bureau of Mines unpublished production records).

Resources: About 26,300 mt (29,000 tons) resource (Hughes, 1941, p. 3) averaging 1.6 kg/mt (3.2 lb/ton) Hg (Bailey and Phoenix, 1944, p. 153), and about 1,800,000 mt (2,000,000 tons) averaging 1.78 g/mt (0.052 oz/ton) Au, with 36,000 mt (40,000 tons) averaging 9.26 g/mt (0.27 oz/ton) open pit mineable (Nuttyscombe and others, 1989, p. 1).

Geology: A low-grade gold deposit is associated with dolomite hydrothermally altered by hot spring and fumarolic activity just before and after the deposition of Tertiary lithic tuffs. Mercury occurs as cinnabar in fractured tuff.

Property name: Homer

Location: T. 12 N., R. 39 E., secs. 1, S1/2, 12, 24, S1/2, 25, 26, 36, 35, E1/2; T. 12 N., R. 40 E., secs. 20, S1/2, 29-32; T. 11 N., R. 39 E., secs. 1, 12-14; T. 11 N., R. 40 E., secs. 5-7, 8, NW1/4.

Commodities: Gold, silver

Size: 518 unpatented lode claims

Samples: Figure B-11, nos. 302-304, 311; Plate 4, no. 317; one sample (no. 304) of skarn and limestone breccia assayed 1.6 ppm Au, 42.8 g/mt (1.25 oz/ton) Ag, 4.5% Cu, and 305 ppm Bi.

Property type: Prospect: several old pits; exploration target covering areas of possible mineral structure extensions east of the Grantsville district and around Grantsville Summit area.

Production: -----

Resources: -----

Geology: Tertiary volcanic rocks covering possible extensions of mineralized structures.

## Grantsville Mining District

### Location

The Grantsville district covers the area from Berlin-Ichthyosaur state park, south to Grantsville Canyon, Grantsville Ridge, Milton Canyon, and the range front to Mission Canyon (fig. 8, nos. 55, 58-65). The district is centered on the Alexander mine and the old mining town of Grantsville. The area, as the Ione and Berlin districts to the north, is often referred to in literature as part of the Union mining district.

### History and Production

Discovery of mineral deposits in the district was made by the first wave of prospectors in the Shoshone Range in the late 1850's and 1860's. The rich silver veins in Grantsville Canyon were the center of interest, and by the end of the 1870's, 14 mines were in production, a mill was erected, and the town of Grantsville was established, named after Ulysses Grant (Glanville, 1986, p. 4). The patented claims in the center of the district date from the early 1880's.

The biggest producer was the Alexander mine. This report uses the Alexander to represent a number of mines that were spatially close and were on the same deposit. Other historic names include the Brooklyn, Silver Palace, Grantsville, Great Eastern, Great American Rooster, Webster, and Fury.

By 1891, the Alexander had a 366-meter (1,200-ft) shaft, 152-meter (500-ft) decline, and about 1,600 meters (5,280 ft) of underground workings in eight levels. While most of the production was prior to 1891, the mine reported shipments of ore in 1917, 1921-1922, 1927-1928, 1937-1938, 1941-1944, 1946-1947, 1953-1954, and 1987-1988. Most of the activity after 1891 involved cleaning up parts of the deposit missed by earlier mining operations, and reprocessing dump material. The latest mining effort involved open pit mining of low-grade ore in previously mined areas. Total district metal production is equal to the Alexander mine's production numbers (see district property descriptions) since there was very little metal production outside of the Alexander mine area.

Deposits of fluorite in the district were most likely discovered in the early days of metal mining. Development of these deposits started in the 1940's with activity at the Chicago (Allied, Mary Jane), Last Chance, and Sky (Fluorspar) properties. Larger fluorite deposits are on the east side of Grantsville Ridge, where the Chicago, an old silver mine, produced 527 metric tons (581 tons) of high-grade fluorite ore in 1948, 1949, and 1951 (Horton, 1961, p. 17; Jones, 1959, p. 3). Some of this production was hand sorted to obtain a higher grade. Exploration of the mine and the surrounding area from the late 1950's into the 1970's indicated an estimated resource remaining at the Chicago of 45,000 metric tons (50,000 tons) averaging 45% fluorite (Evans, 1970, p. 2).

In the late 1930's, there was a small production of antimony ore at the Milton Canyon mine. The mine is along both sides of Milton Canyon about 1.6 kilometers (1 mi) south of Grantsville.

### Geology

Bedrock for most of the district is greenstones of the Permian Pablo Formation and clastic and carbonate rocks of the Mesozoic Grantsville and Lunning formations. The east and south parts have been covered by a blanket of Tertiary volcanic rocks. Pre-Tertiary rocks are folded into

an asymmetric, overturned anticline plunging southwest and faulted by pre-Tertiary west-trending normal faults. The southern part of the district is thrust faulted.

Silver-base metal deposits in the Alexander mine area, are related to a 910 meter (3,000 ft) long, 560 meter (1,500 ft) wide, intense alteration zone in Grantsville Canyon. The zone consists of calc-silicate skarn, and an area-wide pyritic alteration, in a fractured, calcareous argillite and a silty limestone. Around the skarn-pyrite zone are a number of smaller mines and prospects where narrow sulfide veins with surface gossan cut through faulted country rock. The larger deposits occur in the skarn-pyrite zone as a series of stacked tabular replacement bodies with up to 10% sulfides in the form of pyrite, sphalerite, galena, and chalcopyrite (Sanguinetti, 1986, p. 13). Scheelite is a minor, erratically distributed constituent. The deposits have supergene alteration with accumulations of oxide ore that would be suitable for heap leaching. These oxide ores were the reserve base for the latest mining operation in the late 1980's.

In addition to the silver-base metal metallization, there was an extensive silica-fluorite mineralization, associated with Tertiary volcanic centers to the east. Bold, cliff-forming outcrops of jasperoid formed along faults from Grantsville Ridge, where they occur along with fluorite and antimony in Mesozoic limestones, to the south end of the district, where occurrences are predominately in volcanic rock. Precious metal deposits have been found associated with this jasperoid belt at several properties (fig. 8, nos. 58, 61) and this area is under exploration for low-grade, bulk-tonnage gold deposits.

Fluorite deposits have been worked on the east side of Grantsville Ridge and to the north of Grantsville Canyon (fig. 8, nos. 55, 62). At the Chicago mine, the fluorite is aligned north-south on the east side of a large jasperoid body in limestone and siltstone. The fluorite occurs in replacement deposits as irregular masses with botryoidal bands and as vug fillings in the jasperoid. A number of occurrences on Grantsville Ridge are similar in nature. To the north at the Sky property, fluorite is exposed along two parallel, north-trending fault zones in siliceous conglomerate. Fluorite occurs in small, low-grade irregular vuggy masses and in veinlets with a gangue of calcite and quartz.

Antimony ore at the Milton Canyon property on the south end of Grantsville Ridge, consisted of hydrothermal veins containing stibnite, antimony oxides, and minor pyrite in faulted and altered limestone. A rhyolite dike cuts the country rock in the vicinity of the occurrence. Stibnite is found as blebs, clusters, and bladed crystalline aggregates. Small, similar stibnite occurrences are found in the Milton Canyon area.

Barite deposits on the Sky property consist of veins and irregular shaped bodies along west-trending faults in both greenstone of the Pablo Formation, and clastic rocks of the Grantsville Formation. There are several occurrences and the larger, more continuous ones are in the greenstone.

#### Recent Mining Activity

In the 1970's and 1980's, the Grantsville Canyon area was evaluated by Union Carbide Corp. for tungsten, porphyry copper, and low-grade, bulk tonnage precious metal deposits. Activity included geochemical, geophysical, and geological mapping; dewatering and sampling of underground workings; and extensive diamond drilling. In the early 1980's Fury Exploration Ltd. developed a near-surface silver resource of 795,000 metric tons (876,000 tons) averaging about 147 grams per metric

ton (4.3 oz/ton) silver (Sanguinetti, 1986, p. 2). Part of this deposit was mined in 1987 and 1988 by open pit and heap leached, leaving about 186,000 metric tons (200,000 tons) of resources. The Fury mine ceased operations after experiencing disappointing silver production. Problems cited were poor recovery in the heap leach circuit, and ore dilution from inefficient mining methods (Charles Tyler-consultant, 1991, oral communication).

Exploration activity in the 1980's and 1990's was concentrated on the search for epithermal, low-grade gold deposits in the district. Areas of exploration activity include: 1) mapping, sampling, and drilling of the Grantsville ridge area by Amax Exploration (Beth prospect); 2) the mapping, sampling and drilling by Amselco Exploration Inc. and Canerta Resources Ltd. of the jasperoid belt that runs from Grantsville Ridge south to Spanish Canyon (Landmark prospect); 3) reconnaissance of range front faulted and altered rocks by Marshall Earth Resources, Inc., (MERI prospect); 4) reconnaissance by Amax Exploration of the potentially mineralized areas between deposits in Grantsville Canyon and Grantsville Summit, which are covered with Tertiary volcanic rocks (Homer prospect).

Some mining of barite on the Sky property in the 1970's and 1980's is indicated by several small stockpiles and an ore loading dock. Marshall Earth Resources, Inc., has built a concentration mill at the Sky and has estimated a resource of about 82,000 metric tons (90,000 tons) barite (McClelland Engineers, Inc., 1980, p. 1).

#### Mines, Claims, and Prospects

The following list of nine properties includes prospects, mines, and claim blocks both within the Grantsville mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Alexander (Brooklyn, Silver Palace, Webster, Grantsville, Great Eastern, Mitchell, Great American Rooster, Fury)

Location: T. 11 N., R. 39 E., secs. 2, W1/2, 3

Commodities: Gold, silver, copper, lead, zinc, tungsten, bismuth

Size: 62 unpatented lode, and 15 patented lode and one patented millsite claims

Samples: Plate 4, nos. 258-264, 275-284, 286-295, 297, 298, 322, 323, 325-327, 330-333, 342, 534; average for veins samples from main workings (nos. 261-263) was 975 g/mt (28.4 oz/ton) Ag, 0.11% Cu, 3.5% Pb, 2.5% Zn, 0.29% Bi, and 0.28% W; samples were anomalously high in Cd, As, Se, and Te. Oxide ore samples were similar but lower in values. A select sample (no. 534) from a dump assayed 20% Pb, had 1.7% W, 0.4% Bi, and 0.02% Te. Outside of main mine area, samples from mineralized structures assayed as much as 8.92 g/mt (0.26 oz/ton) Au (no. 280), 485 g/mt (14.1 oz/ton) Ag (no. 276), 4.3% Cu (no. 277), 0.16% Bi (no. 289), and 0.9% Sb (no. 277).

Property type: Mines: over 8,000 m (5,000 ft) of underground workings with extensive stoping on eight levels. There are heap leach pads and a recovery plant (fig. 13, top).

Production: Between 1866 and 1988: estimated 2.5 kg (80 oz) Au, 37,300 kg (1,200,000 oz) Ag, 56,200 kg (124,000 lb) Cu, 1,130,000 kg (2,500,000 lb) Pb, 322,000 kg (710,000 lb) Zn (calculated from: Couch and Carpenter, 1943, p. 120-121; U.S. Bureau of Mines unpublished production records; Charles Tyler, consultant, 1991, oral commun.).

Resources: About 180,000 mt (200,000 tons) averaging 147 g/mt (4.3 oz/ton) Ag (Charles Tyler, consultant, 1991, oral commun.).

Geology: Ore occurs on the north side of the canyon in a series of stacked tabular tactite beds in altered, faulted argillite (Sanguinetti, 1986, p. 13). Ore consists of sulfide veins and pods containing pyrite, sphalerite, galena, and chalcopyrite. The argillite also contains disseminated sulfides. On the south side of the canyon, pyrite-sphalerite replacement ore bodies occur in limestone. Both areas have spotty occurrences of scheelite.



Figure 13.--View of Fury mine heap leach pad and recovery plant (top), and view of Chicago and Beth properties on Grantsville Ridge on left and Alexander mine center right (bottom).

Property name: Beth

Location: T. 11 N., R. 39 E., secs. 10, 15, 22, 3, S1/2, 11, W1/2, 14, W1/2, 21, NE1/4, 16, SE1/4

Commodities: Gold, silver, fluorine, antimony

Size: 127 unpatented lode claims

Samples: Plate 4, nos. 318, 324, 328-329, 336, 350, 354, 356; samples generally low in values; one sample (no. 356) from a jasperoid outcrop assayed 0.21 ppm Au; one sample (no. 350) of siliceous limestone breccia from an old shaft assayed 0.42% As.

Property type: Prospect: several old workings; current activity includes drilling, geochemical and geologic mapping; exploration target for disseminated gold deposits.

Production: -----

Resources: -----

Geology: Widespread jasperoids stockwork quartz veining, and argillized and bleached silty carbonates are associated with bedding plane and thrust faults in an anticline that underlies the east side of Grantsville Ridge (fig. 13, bottom).

Property name: Centennial (Presidential)

Location: T. 11 N. R. 39 E., sec. 11, W1/2

Commodities: Gold (?), silver, copper

Size: One patented and 12 unpatented lode claims

Samples: Plate 4, nos. 319, 320, 335, 345; one sample (no. 335) of sulfide ore from old shaft contained 202 g/mt (5.9 oz/ton) Ag, 0.38% Cu, 0.42% Pb, 0.13% As, and 0.34% Sb.

Property type: Mine: one old shaft, one adit, and several bulldozer trenches.

Production: Probably a small amount of precious-base metal ore.

Resources: -----

Geology: Quartz and sulfide veins with pyrite and chalcopyrite in silicified, fractured limestone proximal to several dacite porphyry intrusions on the west side; altered volcanic rocks on the east side.

Property name: Chicago (Allied, Mary Jane), Last Chance

Location: T. 11 N., R. 39 E., sec. 10, SE1/4

Commodities: Fluorine, silver, copper

Size: One patented and 16 unpatented lode claims

Samples: Plate 4, nos. 334, 337-341, 343, 344, 346-347; samples (nos. 337, 339) of fluorite ore contain as much as 88.5% CaF<sub>2</sub>; sample (no 346) from ore stockpile contained 457 g/mt (13.3 oz/ton) Ag, 18.9% Cu, 0.4% Pb, 0.8% Zn, 0.3% Hg, 4.7% As, and 10.3% Sb.

Property type: Mine: several old adits and shafts, and numerous pits (fig. 13, bottom).

Production: 527 mt (581 tons) of sorted ore mined, with as much as 92% CaF<sub>2</sub> in 1948, 1949, and 1951 (Horton, 1961, p. 17; Jones, 1959, p. 3) and an estimated average of 85% CaF<sub>2</sub>.

Resources: Estimated resource of 45,000 metric tons (50,000 tons) averaging 45% CaF<sub>2</sub> (Evans, 1970, p. 2).

Geology: North-trending fracture zones contain several small replacement bodies of massive fluorite (fig. 14, top) in brecciated limestone and vug fillings of fluorite in jasperoid.

Property name: Landmark

Location: T. 11 N., R. 39 E., secs. 4, S1/2, 9, 16, N1/2

Commodities: Gold, silver, antimony, fluorine

Size: 65 unpatented lode claims

Samples: Plate 4, nos. 351-353, 542, 543; samples averaged 0.24ppm Au with as much as 0.2% As and 0.76% Sb.

Property type: Prospect: several old adits and pits; many recent bulldozer trenches and drill sites; exploration target for low-grade, disseminated gold deposits.

Production: -----

Resources: -----

Geology: Dolomite in the upper plate of a northwest-trending thrust fault and nearby large, fractured jasperoid outcrops (fig. 14, bottom) contain anomalous gold, antimony, and fluorite.



Figure 14.--Fluorite ore from the Chicago mine (top), and view of jasperoid outcrop on Grantsville Ridge (bottom).

Property name: MERI

Location: T. 11 N., R. 39 E., secs. 16, S1/2, 21, 28, 33; T. 10 N., R. 39 E., secs. 4, 9, N1/2

Commodities: Gold, silver, barium

Size: 114 unpatented lode claims

Samples: Figure A-12, nos. 360-373; samples had elevated values in As and Sb.

Property type: Prospect: several small pits and bulldozer trenches; exploration target for low-grade, disseminated gold deposits.

Production: -----

Resources: -----

Geology: Area of faulted, altered sedimentary rocks in the north and in the south, tuffs along the range front; contains outcrops of jasperoid marking mineralized areas, and one vein of barite.

Property name: Milton Canyon (Kate)

Location: T. 11 N., R. 39 E., sec. 15, NE 1/4

Commodities: Antimony, copper

Size: Seven unpatented lode claims

Samples: Plate 4, nos. 348, 349, 355, 357-358; samples (nos. 348-349, 358) with stibnite averaged 2.6% Sb with as much as 60.2 g/mt (1.8 oz/ton) Ag, 1.4% Cu, and 0.48% As.

Property type: Mine: several old shafts, short adits, and prospect pits.

Production: 27 mt (30 tons) of ore averaging 40% Sb was produced in 1939 (Lawrence, 1963, p. 153).

Resources: -----

Geology: Stibnite and antimony oxides occur as blebs, pods, and crystal clusters (fig. 15, top) in silicified limestone along several fracture zones proximal to a rhyolite dike.



Figure 15.--Antimony ore of stibnite crystals from Milton Canyon mine (top), and view of barite open pit at the Sky mine (bottom).

Property name: Pinto (Burro)

Location: T. 12 N., R. 39 E., secs. 35, E1/2, 36; T. 12 N., R. 40 E., sec. 31, SW1/4; T. 11 N., R. 39 E., secs. 2, W1/2, 1, N1/2, 11, NW1/4

Commodities: Gold, silver

Size: 77 unpatented lode claims

Samples: Plate 4, nos. 313-314, 316, 321; assays contained no significant values.

Property type: Prospect: several old pits and trenches, mostly undeveloped; exploration target for extensions of deposits in Grantsville area that may be under Tertiary volcanic rocks.

Production: -----

Resources: -----

Geology: Most of the property is underlain by Tertiary volcanic rocks. Older workings are on outcrops of sedimentary rocks with quartz veins on the western side of the property.

Property name: Sky (Fluorspar)

Location: T. 12 N., R. 39 E., secs. 26, SW1/4, 27, SE1/4, 33, SE1/4, 34, 35, W1/2; T. 11 N., R. 39 E., secs. 4, N1/2, 5, NE1/4

Commodities: Gold, silver, copper, lead, barium, fluorine

Size: 64 lode, eight placer, and four millsite unpatented claims

Samples: Plate 3, no. 296; Plate 4, nos. 43-48, 250-257, 265-271, 274, 285, 501; samples (nos. 48, 501) of barite ore averaged 55.6% BaSO<sub>4</sub>; samples with sulfide minerals assayed as much as 6.74 g/mt (0.2 oz/ton) Au (no. 251), 406 g/mt (11.8 oz/ton) Ag (no. 267), 7.6% Cu (no. 265), 0.38% Pb (no. 257), and 0.42% Sb.

Property type: Mine: numerous adits, shafts, pits, drill sites, trenches, and one large open pit (fig. 15, bottom); an operational mill and concentrator.

Production: A small amount of sulfide ore has been stockpiled; probably a small production of barite.

Resources: About 82,000 mt (90,000 tons) of BaSO<sub>4</sub> (McClelland Engineers, Inc., 1980, p. 1).

Geology: Sulfide-bearing quartz veins with precious and base metals trend north to northeast in faulted greenstone and clastic rocks; barite is in several locations as fissure veins in clastic rocks. Fluorite is associated with both the barite and silicious, faulted conglomerate on the northern side of the property.

## Cloverdale Mining District

### Location

The Cloverdale (Golden) district is on the southern tip of the Shoshone Range, and covers an area from Merritt Canyon, south to the Golden Wash and Cloverdale Creek areas (fig. 8, nos. 66-77). This district was defined by Kral (1951, p. 43) to include parts of the southern Toiyabe Range and northern Cedar Mountains. This report concerns itself only with the part of the district that lies in the Shoshone Range. The main concentration of lode mining is at the head of the Golden Wash drainage and east into the Cloverdale Creek drainage. Placer mining is in the Golden Wash Basin and creek bottom in Cloverdale Creek. This area in literature is often referred to as either the East Golden or West Golden subdistricts, which are separated by the Shoshone Range crest.

### History and Production

Gold was discovered near the Golden King mine at the head of Golden Wash in 1902. The first camp, Golden, was established in 1906, and a mill was built in 1909. Mining at the Golden King was intermittent with periods of activity from the 1900's through the 1930's. While there is no recorded production figures for the Golden King mine, a small amount of gold-silver ore was probably produced during the mine's years of operation.

The Webb mine, on the east side of the district, was a small lode mining operation active from the 1920's into the 1950's. Mills were built on the property in the 1920's and in 1941. The mine produced a small amount of gold and silver.

On the west slopes of Mt Ardivay, about four miles northwest of the main part of the district, is the Iron Rail property. Workings indicate that activity probably dates back to the 1930's or earlier. Development work here in the 1960's and 1970's defined a small resource of 9,070 metric tons (10,000 tons) of blocked-out ore averaging 343 grams per metric ton (10 oz/ton) silver and 12% lead (B.M. Clem, Consulting Geologist, 1970, written communication).

The district is probably better known for its placer gold occurrences even though there was little production. The estimated production from the district is 3.1 kilograms (100 oz) gold (Johnson, 1973, p. 98). While placer deposits were discovered in the area about 1906, it was not until the 1920's and later that serious exploration reached the Golden Wash and Cloverdale Creek areas. Most of the district's placer gold production was in the 1930's. At this time the Cloverdale Creek area was prospected by 26 shafts over an area of 712 hectares (1,760 acres), and plans were made to mine a defined placer resource using a dragline (Vanderburg, 1936, p. 123). For some reason the project never reached the production stage. Several engineering reports from the 1920's through the 1940's estimated a placer resource of nearly 150,000 cubic meters (200,000 cu yd) with uniform gold values of 1.02 grams per cubic yard (0.025 oz/cu yd) gold (AGS, Inc., 1987, p. 188).

Little is known about the placer mining in Golden Wash, but judging from the amount of diggings in the area there was a small production of gold from the 1900's through the 1950's. Most of the workings date to the 1930's when several small operations were dry washing from shallow gravels. Placer operations in the Golden Wash area were hampered by the flow of water on bedrock surfaces (Kral, 1951, p. 47). Individual properties produced as much as 30 grams (1 oz) per day from gravels that averaged 0.41 grams per cubic meter (0.01 oz/cu yd) gold (Royal Minerals Inc., 1971, p. 2).

## Geology

The district is underlain by Tertiary volcanic rocks consisting principally of tuffs, rhyolitic tuffs, and ash flow tuffs of the Toiyabe Quartz Latite and Bonita Canyon Formation (Kleinhampl and Ziony, 1985, plate A1A). There are some small rhyolite stocks and felsic dikes. The Peavine caldera to the east in the Toiyabe Range, is the most likely source for these rocks. Structure in most of the district suggests a position within the peripheral, ring fracture zone of the Peavine caldera. Mineralized structures in the main part of the district contain only precious metals with anomalous amounts of arsenic and antimony.

At the Golden King mine, parallel, thin, gold-bearing quartz veins are within a sheared, altered tuff. The shear zone strikes west by northwest and dips to the northeast. Rocks in a large area to the west, north, and east of the mine are pervasively silicified, argillized, and propylitized. In this area are a number of workings on small northwest-trending gold-bearing structures, with anomalous high arsenic and antimony and occasional adularia on vein margins. Zones of quartz-cemented, hydrothermal breccia have some of the higher gold values. Occurrences of epithermal precious metals associated with this altered and mineralized terrain have been the main target for recent exploration. This terrain has been interpreted as a possible Tertiary volcanic eruptive center (Kleinhampl and Ziony, 1984, p. 74). On the east side of the district at the Webb mine, gold- and silver-bearing veins are in a northwest-trending, 910 meters (3,000 ft) long shear zone in a rhyolitic tuff. The shear zones contain breccia, quartz, gouge, and iron oxides between argillized and silicified wallrock. A felsic dike has intruded along parts of this structure.

Unlike other mineralized structures in the main part of the district, the quartz fissure vein at the Iron Rail property contains pyrite, sphalerite, chalcopyrite, argentite, galena, and several unidentifiable secondary copper and lead minerals. The vein strikes west by northwest and dips to the northeast in a densely welded, epidotized tuff. This somewhat isolated mineral occurrence is thought to be in an upthrown block with the mineral structure cut off by block-bounding faults (Kleinhampl and Ziony, 1984, p. 76).

The placer deposits in the district are most likely derived from the weathering of a number of small gold-bearing veins in the hills at the head of Golden Wash, and east into the Cloverdale valley. In the Cloverdale Creek area, deposits are in creek gravels in the canyon bottom 13 to 15 meters (42 to 50 ft) deep, and in hillside colluvium below the Webb mine (Johnson, 1973, p. 59).

### Recent Mining Activity

The district caught the attention of several major mining companies in the 1970's and 1980's as having the potential for low-grade, bulk tonnage precious metal deposits. The areas in the vicinity of the Golden King mine and the west side of Cloverdale Creek canyon were mapped and drilled by a succession of companies including Exxon Minerals (Lab prospect), Royal Minerals Inc. (Royal-Golden prospect), Great Basin Exploration Corp. (Joan prospect), and Battle Mountain Exploration Co. (GKL prospect). J. Prochnau & Co. sampled and mapped the Ardvark prospect in the northwest corner of the district.

Activity in the district in the 1990's consisted of land positioning and some minor exploration to further delineate the low-grade, bulk tonnage precious metal resources in the Golden King and in the Cloverdale Creek area. Activity involving placer resources is probably limited to small intermittent operations.

#### Mines, Claims, and Prospects

The following list of 12 properties includes prospects, mines, and claim blocks both within the Cloverdale mining district and in the general vicinity. In certain cases, several properties are discussed under one name. The groupings are made of properties having geographic proximity, similar geology, or common commodities.

Property name: Ardvarik

Location: T. 10 N. R. 39 E., secs. 15, SW1/4, 16, S1/2, 21, NW1/4

Commodities: Gold, silver

Size: 22 unpatented lode claims

Samples: Figure B-13, nos. 374-376; sample (no. 375) of altered tuff and quartz vein assayed 0.37 ppm Au, 36.34 g/mt (1.06 oz/ton) Ag, 0.08% Zn, 216 ppm Mo, and 0.04% Cu.

Property type: Prospect: one adit and several small pits; exploration target for low-grade, disseminated gold deposits.

Production: -----

Resources: -----

Geology: Linear areas of argillic and silicic alteration and limonite in Tertiary tuffs are associated with rhyolite porphyry dikes. The old workings center on a quartz vein with pyrite at a dike-tuff contact.

Property name: Cloverdale Creek Placers (Golden Eagle, Black Hawk)

Location: T. 9 N., R. 40 E., secs. 5, SE1/4, 8, 17, 20, W1/2, 30, NE1/4

Commodities: Gold, silver

Size: About 810 ha (2,000 acres)

Samples: Plate 5, no samples taken

Property type: Mines: numerous pits, trenches, and placer shafts.

Production: Probably a small amount of placer gold between the early 1900's and 1940's.

Resources: 150,000 cu m (200,000 cu yd) averaging 1.02 g/cu m (0.025 oz/cu yd) Au (AGS, Inc., 1987, p. 188).

Geology: The bottom of Cloverdale Creek canyon contains gold-bearing gravels originating from the small gold-bearing quartz veins in altered rhyolitic tuff.

Property name: 4S, 2S

Location: T. 9 N., R. 39 E., secs. 12, SE1/4, 13, E1/2; T. 9 E., R. 40 E., secs. 7, W1/2, 18

Commodities: Gold, silver

Size: 42 unpatented lode claims

Samples: Plate 5, nos. 390-391, 404-408, 410, 412, 415, 437-442, 455, 458; samples assayed as much as 10.5 g/mt (0.31 oz/ton) Au (no. 406), 135.3 g/mt (3.95 oz/ton) Ag (no. 390), and 0.29% As (no. 390).

Property type: Prospect: several old adits and shaft; recent drill sites and bulldozer work.

Production: -----

Resources: -----

Geology: A number of small, precious metal-bearing veins are associated with northwest-trending faults in fractured, silicified, rhyolitic tuff and felsite dikes.

Property name: GKL (Clover)

Location: T. 9 N., R. 39 E., secs. 13, S1/3, 14, S1/2, 23, N1/2, 24, N1/2; T. 9 N. R. 40 E., secs. 18, SW1/4, 19

Commodities: Gold, silver

Size: 56 unpatented lode claims

Samples: Plate 5, nos. 413-414, 417-419, 423, 425-426, 430-432, 434; one sample (no. 414) of altered tuff and rhyolite assayed 1.2 ppm Au, 193 g/mt (5.63 oz/ton) Ag, 0.27% As, and one sample (no. 431) of rhyolite and quartz had 82 ppm Mo.

Property type: Prospect: numerous old pits and shafts; a large pit and bulldozer cuts on the west side.

Production: -----

Resources: -----

Geology: Northwest-trending faults in altered rhyolitic tuff have gold-bearing quartz fissure veins with clay, chalcedony, and adularia.

Property name: Golden King

Location: T. 9 N., R. 39 E., sec. 13, NW1/4

Commodities: Gold, silver

Size: Part of the Royal-Golden King claim group

Samples: Plate 5, nos. 398-399; samples averaged 0.3 ppm Au and 28.15 g/mt (0.821 oz/ton) Ag.

Property type: Mine: several adits, shafts, and numerous pits and extensive bulldozer work; mill site (1909) in ruins.

Production: Probably a small, unrecorded amount of silver and gold in the early 1900's and in the 1930's.

Resources: -----

Geology: Quartz fissure veins and quartz cemented tuff breccia with limonite and clay gouge contain silver. Country rock is a weakly altered rhyolitic tuff cut by northwest-trending faults.

Property name: Golden Valley

Location: T. 9 N., R. 39 E., secs. 14, 15, S1/2

Commodities: Gold, silver

Size: 20 unpatented lode claims

Samples: Plate 5, nos. 381-382, 386-387, 422, 424; samples had, generally, low values except for As, with as much as 0.26% As (no. 422).

Property type: Prospect: numerous pits and trenches, many for placer mining; exploration target for extensions of gold-bearing veins to the east.

Production: -----

Resources: -----

Geology: Argillically altered, faulted tuffs.

Property name: Golden Wash Placers (Daisy Lane, Black Diamond, Golden Hawk, Lloyd)

Location: T. 9 N., R. 39 E., secs. 14, W1/2, 15, 21-22, 23, NW1/4  
Commodities: Gold, silver  
Size: About 486 ha (1,200 acres)  
Samples: Plate 5, no samples taken  
Property type: Mines: numerous pits, trenches, and excavations; several placer shafts.  
Production: A small amount of placer gold from the early 1900's through the 1940's.  
Resources: -----  
Geology: Gold-bearing gravels fill the basin downslope from lode gold occurrences in the Golden King mine area.

Property name: Iron Rail

Location: T. 10 N., R. 39 E., secs. 22, S1/2, 23, SW1/4, 27, NW1/4  
Commodities: Gold, silver, lead, copper, zinc  
Size: 11 unpatented lode claims  
Samples: Figure B-13, nos. 377-378; samples averaged 0.06 ppm Au, 107 g/mt (3.12 oz/ton) Ag, 0.36% Cu, 3.5% Pb, and 0.17% Zn.  
Property type: Prospect: numerous shafts and adits; area of intense bulldozer cuts.  
Production: -----  
Resources: 9,070 mt (10,000 tons) averaging 343 g/mt (10 oz) Ag and 12% Pb (Clem, 1970, written commun.).  
Geology: A quartz fissure vein containing pyrite, galena, cerussite, anglesite, argentite, sphalerite, and secondary copper minerals, within a fault in an altered, densely welded tuff.

Property name: Joan

Location: T. 9 N., R. 40 E., secs. 18, SE1/4, 19, E1/2, 20, W1/2  
Commodities: Gold, silver  
Size: 28 unpatented lode claims  
Samples: Plate 5, nos. 433, 435-436, 443-447, 545-547; one sample (no. 436) of quartz veins and altered tuff assayed 3.4 ppm Au and 9.4 ppm Ag with elevated As values.  
Property type: Prospect: numerous pits and trenches; recent activity includes drill sites and bulldozer cuts.  
Production: -----  
Resources: -----  
Geology: Gold occurs in numerous limonite stained fractures with quartz and intensely silicified breccia pipes within rhyolitic welded tuff.

Property name: Lab

Location: T. 9 N., R. 39 E., secs. 10, SE1/4, 11, W1/2, 14, NW1/4, 15; T. 9 N., R. 40 E., secs. 7, 8, 18, NE1/4  
Commodities: Gold, silver  
Size: 95 unpatented lode claims  
Samples: Plate 5, nos. 383-385, 544; assays contained no significant values.  
Property type: Prospect: exploration target for low-grade, disseminated gold deposits.  
Production: -----  
Resources: -----  
Geology: Faulted, altered volcanic rocks.

Property name: Royal-Golden King

Location: T. 9 N., R. 39 E., secs. 11, E1/2, 12, 13, 14, E1/2

Commodities: Gold, silver

Size: 82 unpatented lode claims

Samples: Plate 5, nos. 388-389, 392-397, 400-403, 409, 411, 416, 420-421, 427-429; one sample (no. 401) of tuff breccia assayed 5.52 ppm Au and 106 g/mt (3.09 oz/ton) Ag.

Property type: Prospect: numerous old shafts, adits, and pits; recent exploration includes numerous drill sites and bulldozer cuts; exploration target for disseminated gold deposits similar to the Round Mountain, Nevada, type.

Production: -----

Resources: -----

Geology: Widespread alteration of brecciated rhyolitic tuff, numerous small gold-bearing veins, felsic intrusions, and adjacent placer gold.

Property name: Webb (East Golden, OK)

Location: T. 9 N., R. 40 E., secs. 7, S1/2, 18, N1/2

Commodities: Gold, silver

Size: 10 unpatented lode claims

Samples: Plate 5, nos. 456-457, 459-463; sample (no. 460) of tuff breccia with quartz assayed 1.76 g/mt (0.051 oz/ton) Au and 165 g/mt (4.81 oz/ton) Ag.

Property type: Mine: several adits, shafts, and pits; about 600 m (2,000 ft) of underground workings; mill in ruins.

Production: Small amounts of gold and silver between 1940 and 1950 (U.S. Bureau of Mines unpublished production records).

Resources: -----

Geology: Quartz fissure vein and gouge is associated with a felsic dike in faulted, brecciated, and silicified rhyolitic tuff.

## MINERAL RESOURCE EVALUATION

### Elements and Their Significance as Exploration Tools

The possibility for unexposed or undiscovered resources can be defined using the presence of anomalous concentrations of certain elements that are associated with economic mineral deposits. Generally, each type of deposit will have its own set of associated elements. Some of these elements, called pathfinders, spread some distance from the deposit, forming enveloping halos or diffusion aureoles. Other elements that are relatively immobile, called indicators, suggest that a mineral deposit is close. Geochemical mapping of pathfinders and indicators, when combined with considerations of bedrock alteration, is a useful tool in finding areas that may host mineral deposits.

Amounts of pathfinder and indicator elements from samples collected during this study are located in figures 16-22. Analytical results are arbitrarily divided into three groups that best graphically display the data. These geochemical location maps were used to help delineate areas deemed likely for future mining activity. The following text, derived from Cox and Singer (1986), Boyle (1974) and Peters (1987, p. 403), lists some of the elements and their significance in mineral exploration for possible deposits in the study area.

#### Precious Metal Deposits

A basic goal of this study was to outline broad areas where gold-silver mineralized zones may exist. Numerous shear and breccia zones, altered zones, quartz veins, and silicified zones were sampled. Gold and silver deposits types most likely to be mined in the area are the disseminated or stockwork, vein, and replacement-skarn types. Epithermal disseminated precious metal deposits have been the center of exploration interest in Nevada for the last several decades. Associated elements, in addition to gold, include As, Ag, Hg, Sb, Tl, Te, Ba, Bi, Mo, W, and F. The fluorine apparent in the fluorite in the central part of the study area has been an attraction to various exploration groups looking for precious metal deposits.

Vein type precious metal deposits have been the source for nearly all the past production in the study area. Associated elements include Zn, Cu, Pb, As, Hg, Ag, Mn, and Ba. Geochemical exploration for precious metal-bearing mercurous tetrahedrite veins in the southern Ione district has focused on Hg since this element is very mobile and detectable in small amounts.

The Alexander mine area in the Grantsville district has replacement-skarn type deposits that have produced mainly silver. Elements associated with these type of deposits are As, Mo, W, Bi, Cu, Pb, Ba, Zn, Fe, Sb, Ag, and Be.

#### Base Metal Deposits

Hydrothermal veins containing copper, lead, and zinc can be found in the Grantsville, Berlin, Ione, and Jackson mining districts. These deposits may be indicated by the following elements: Zn, Pb, Au, Cu, Ag, Hg, Fe, Mn, Cd, As, and Sb. Base metals also occur in replacement-skarn deposits which are described under precious metals.

#### Tungsten Deposits

Skarn deposits, a major source of tungsten, occur in the Alexander mine area in the Grantsville district. This area was explored for tungsten

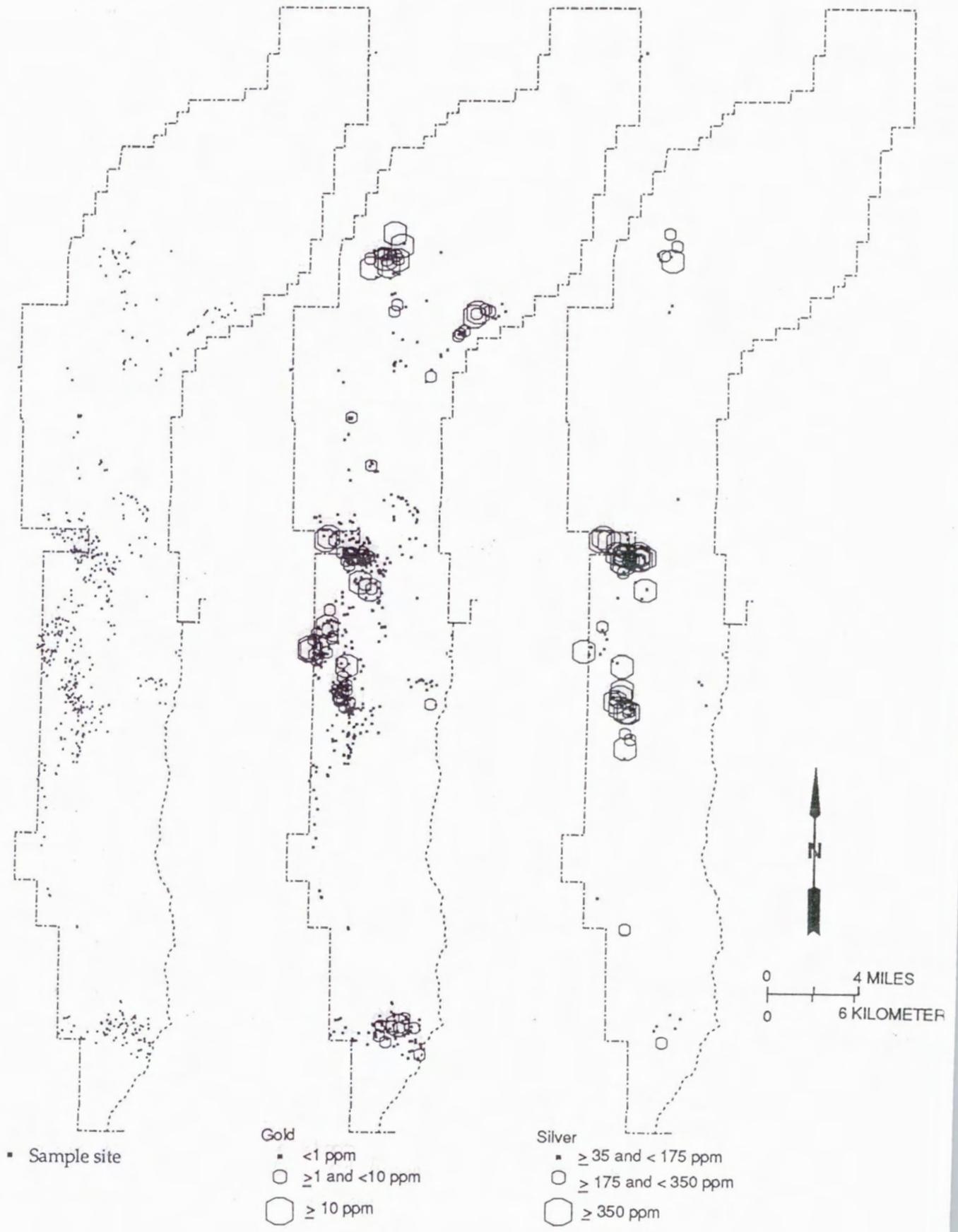


Figure 16.- Map showing sample sites and location of gold and silver analytical results, Shoshone Range study area

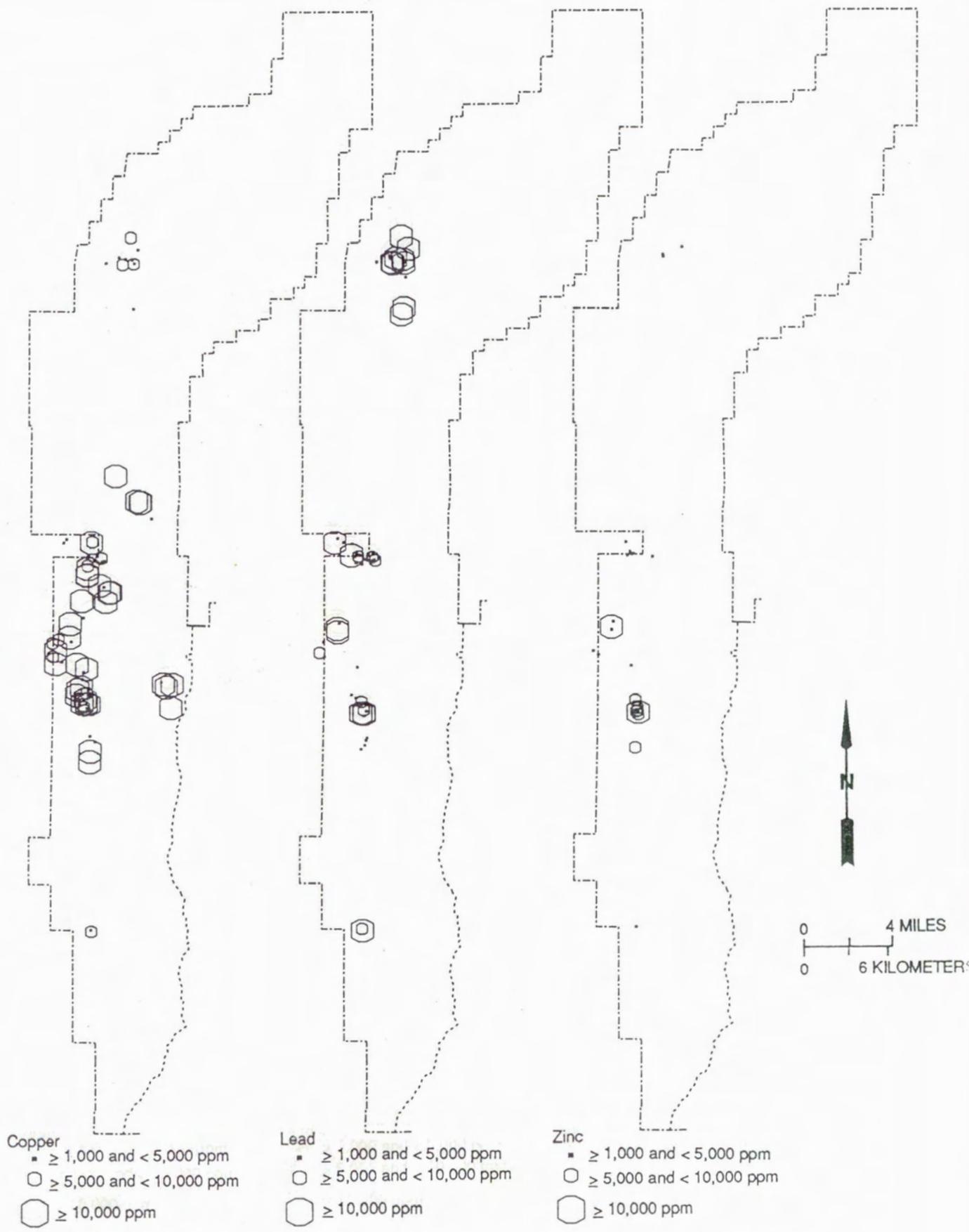


Figure 17.- Map showing location of copper, lead, and zinc analytical results, Shoshone Range study area

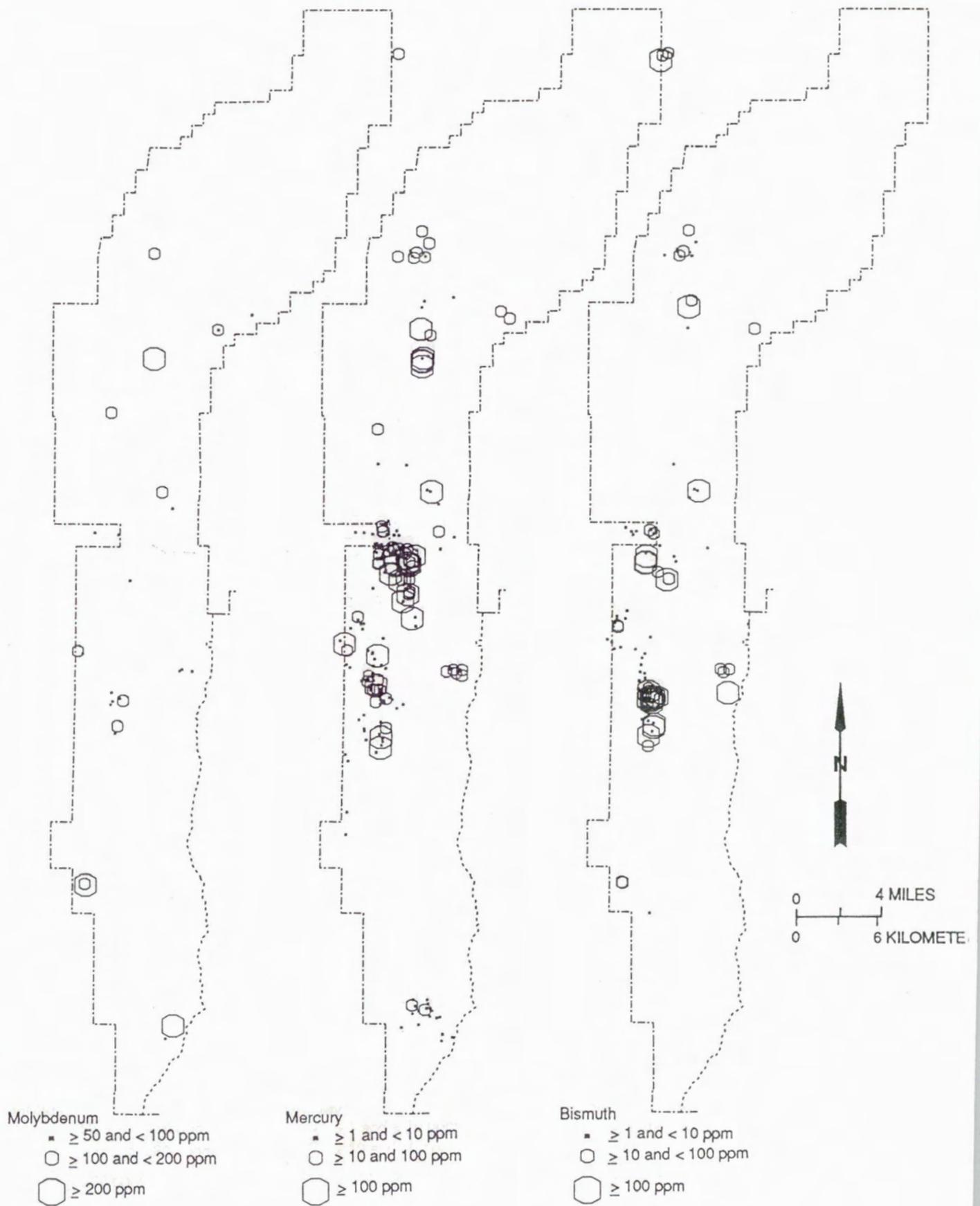


Figure 18.- Map showing location of molybdenum, mercury, and bismuth analytical results, Shoshone Range study area

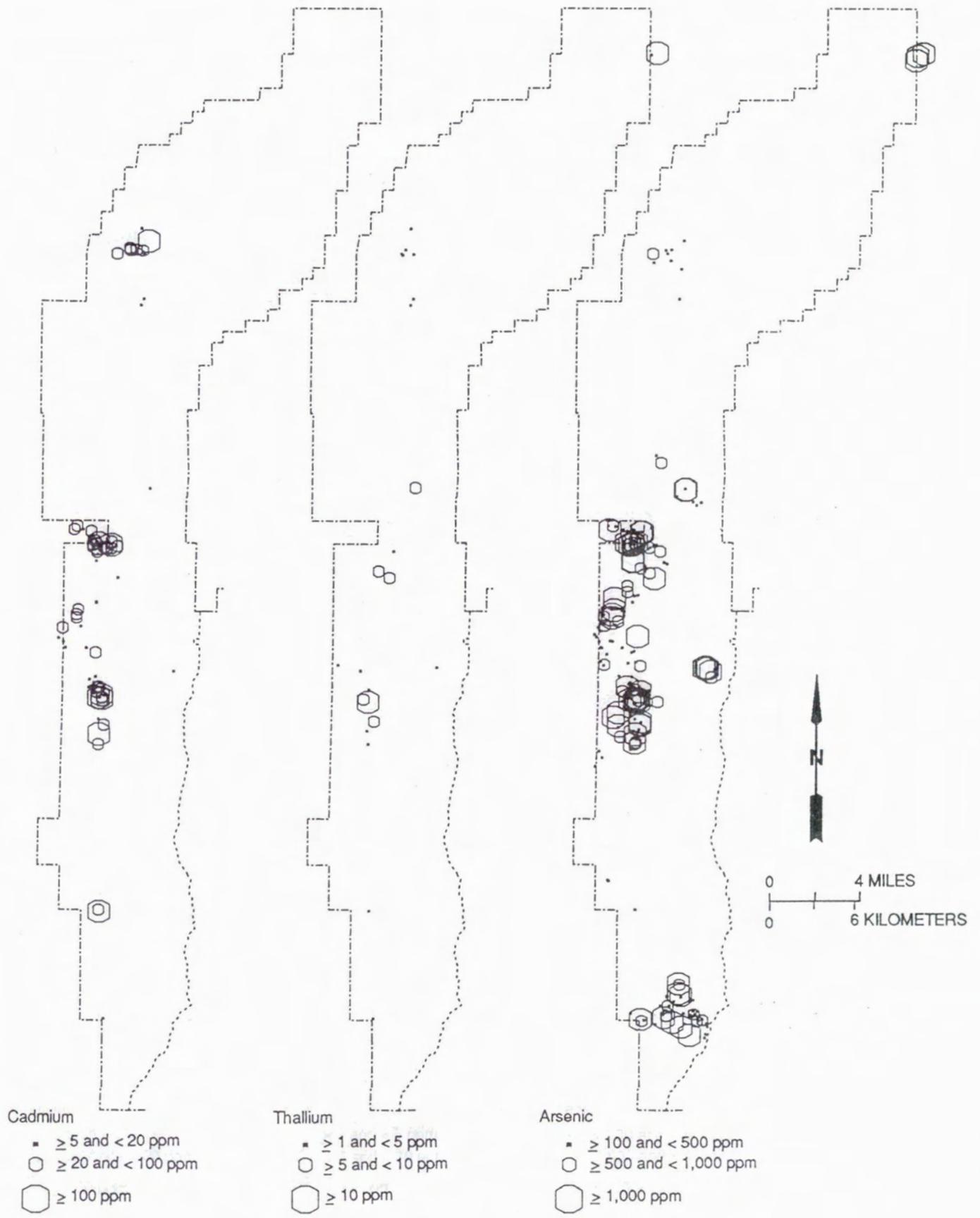


Figure 19.- Map showing location of cadmium, thallium and arsenic analytical results, Shoshone Range study area

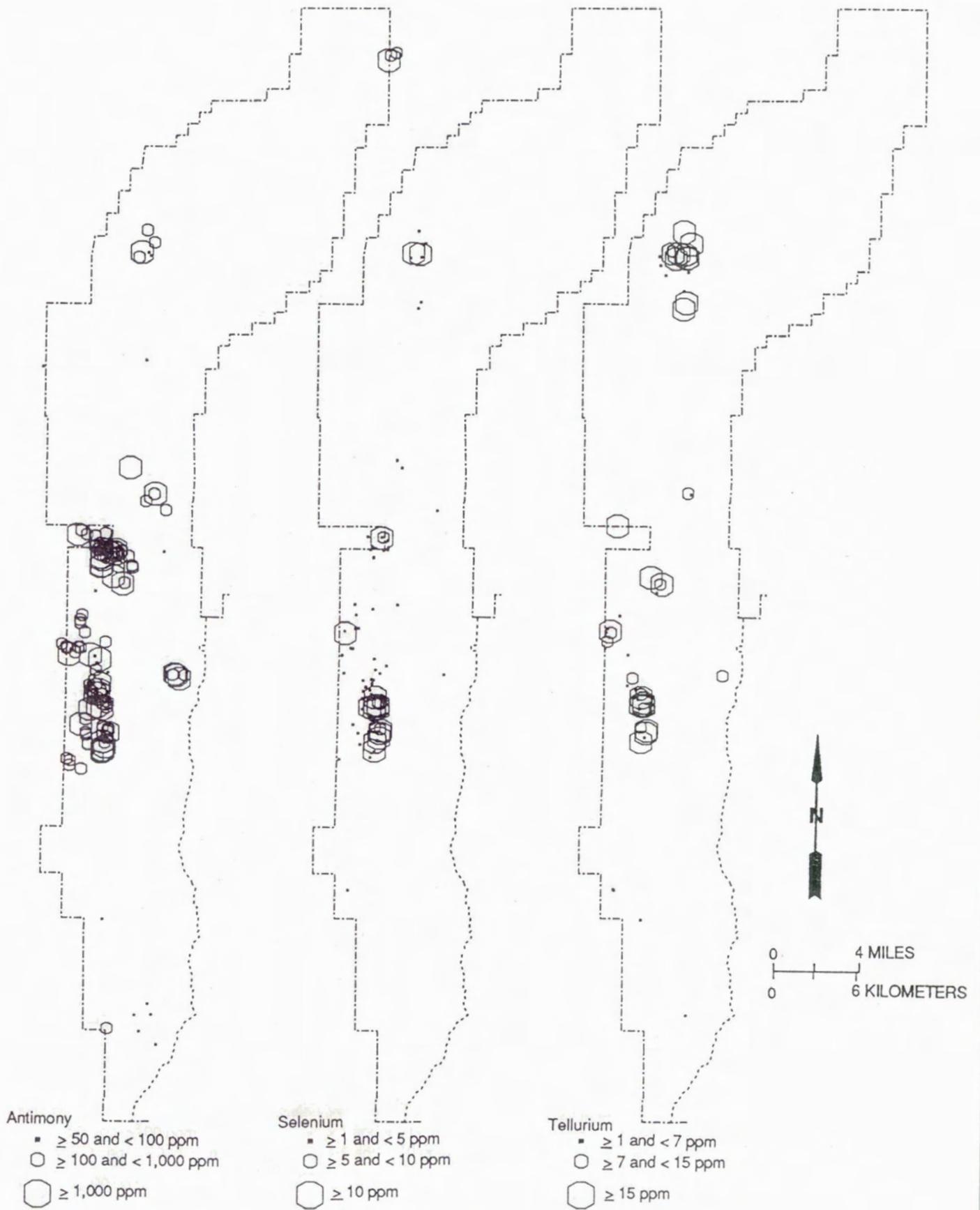


Figure 20.- Map showing location of antimony, selenium, and tellurium analytical results, Shoshone Range study area

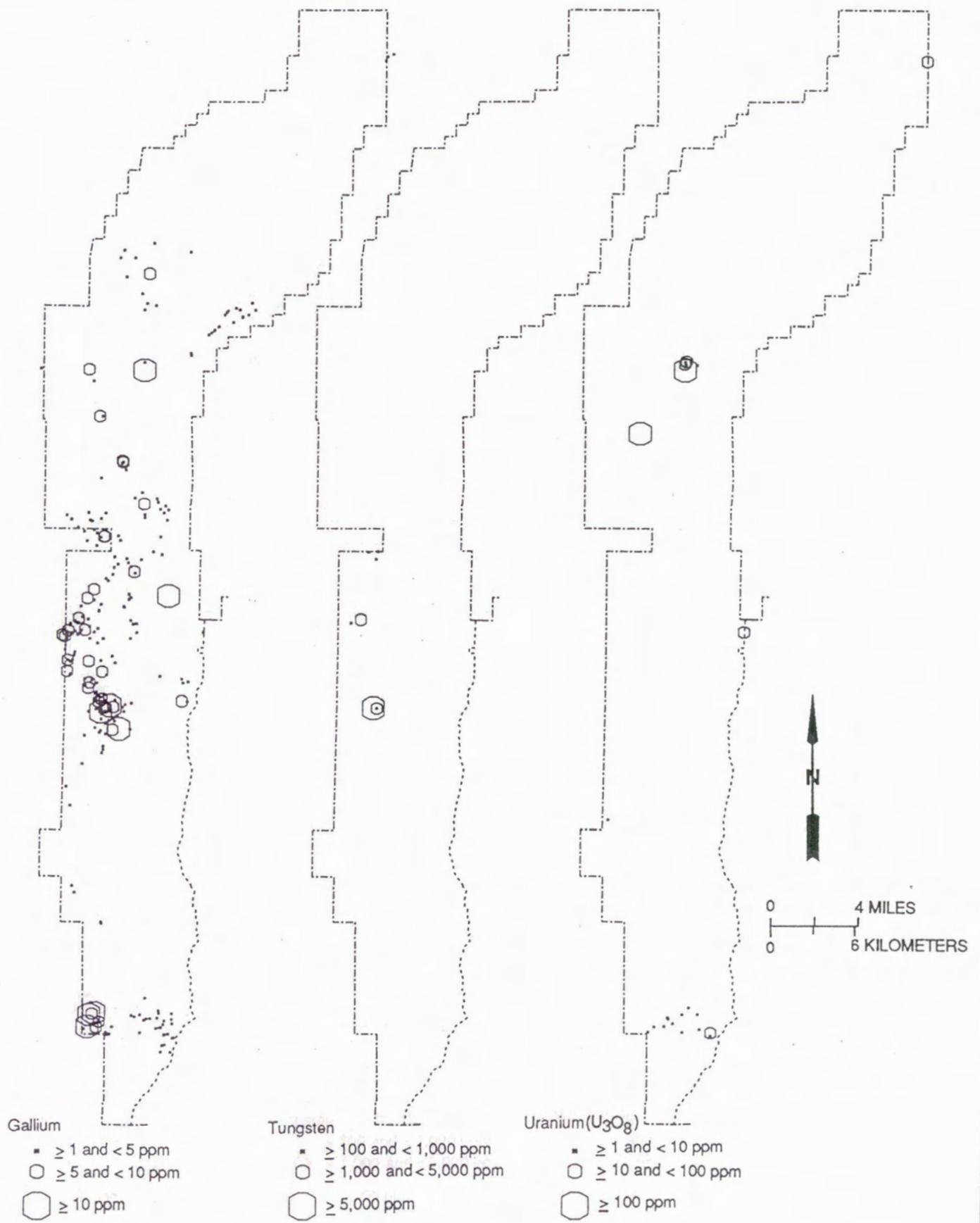


Figure 21.- Map showing location of gallium, tungsten, and uranium ( $U_3O_8$ ) analytical results, Shoshone Range study area

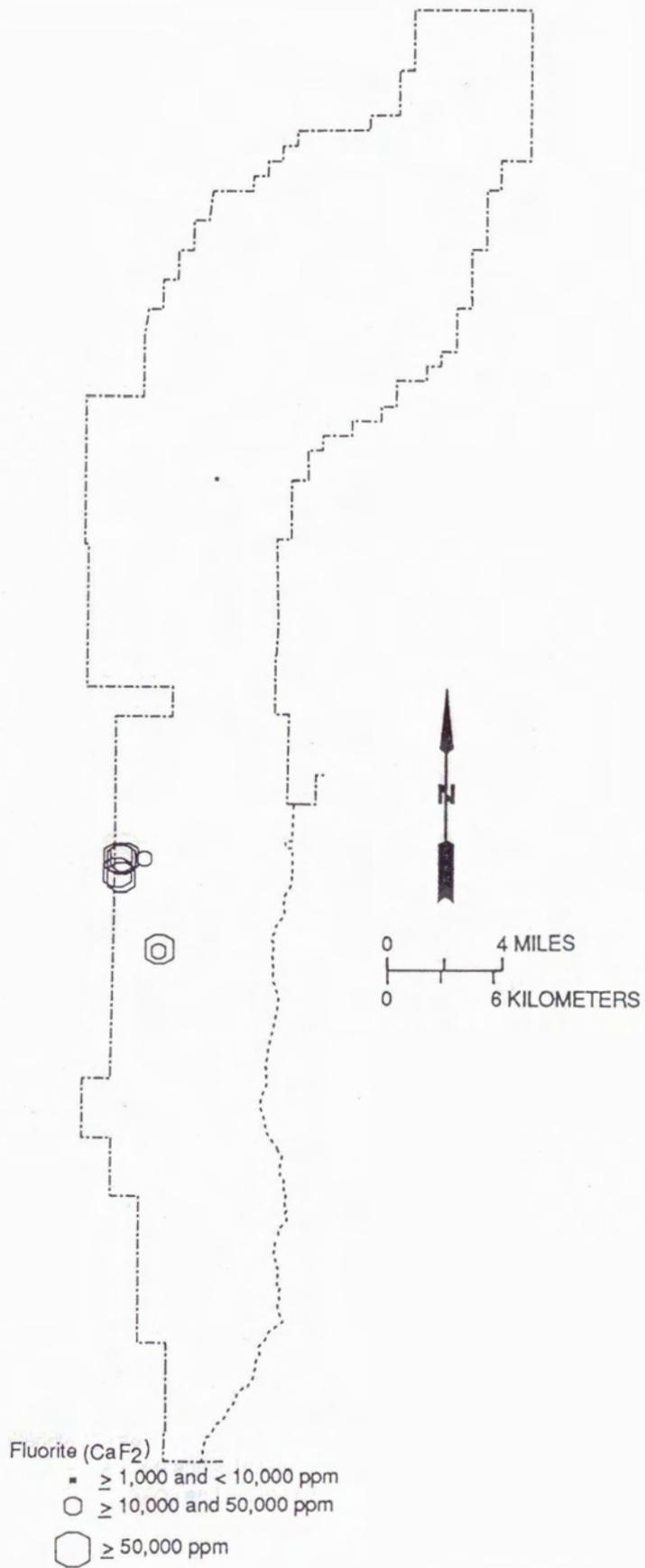


Figure 22.- Map showing location of fluorite ( $\text{CaF}_2$ ) analytical results, Shoshone Range study area

in the past. These deposits are associated with Mo, Sn, Sc, Bi, Cu, Pb, Zn, Fe, Be, As, Au, Ag, B, and F. Quartz vein deposits containing tungsten can vary widely in their elemental associations. Generally, good secondary indicators of tungsten include Sn, Mo, and Bi.

#### Mercury Deposits

Mercury deposits in the Ione district and the Grantsville Summit area are associated with volcanic hot spring systems. Particularly characteristic associates of these deposits are As and Sb. Individual deposits may be enriched in Cu, Ag, Au, Sr, Ba, Zn, Cd, B, Tl, Ge, Pb, Bi, Se, Te, Mo, W, and F.

#### Antimony Deposits

Antimony vein and replacement deposits are in the southern Grantsville district in the Milton Canyon area. These low temperature deposits of stibnite contain enrichments of Sb, Si, Fe, Mn, Ba, Sr, As, Au, Ag, Ca, and Hg. Tingley and Smith (1983, p. 99) state that Se, Fe, Ag, and Cu are associated with antimony in the study area.

#### Fluorite Deposits

Fluorite occurs as hydrothermal vein and replacement deposits in the central parts of the study area. Elements accompanying fluorine in these types of deposits are Ca, Fe, Y, Rb, Hg, S, Si, Ba, Sr, Pb, and Zn; some deposits have Sn, W, Mo, and Cu. Fluorine is very mobile and is an excellent indicator of fluorite deposits.

#### Geology Related to Mineral Deposits

Mineral resources in the Shoshone Range are related to two major geologic events. The first event was during the Mesozoic Era when one or more stocks may have intruded under the range. The second involved volcanic centers during the Tertiary Era. The following discussion of these two events is the basis of understanding for defining the range's resource potential and the areas possible for future mineral activity.

#### Mesozoic Mineralization Event

Mineralization in the Mesozoic accounts for most of the production of precious-base metals and the minor occurrence of tungsten, in the Jackson, Ione, Berlin, and Grantsville districts. A likely cause for this mineralization could be Late Jurassic or early Cretaceous stocks intruded under parts of the range.

There is ample evidence for a large, unexposed intrusion under the central part of the range, from Ione, south into the Grantsville area. Uplift by the emplacement of an intrusion at depth is suggested by extensive northeast- and northwest-trending sets of faults in parts of the Ione, Berlin, and Grantsville districts that could have been caused by vertical compressional forces. Additional evidence for uplift can be found in the horst structures in the pre-Tertiary rocks in the northern and central parts of the range, that have been folded into anticlinal structures in the Grantsville area.

Abrams (1979, p. 80-81) also stated a number of reasons to support the presence of a large intrusion under the study area. He felt that the widespread occurrence of small intermediate-to-acid dikes in the central part of the range may be related to a central source. Regional alteration of bedrock and intrusions, extensive hydrothermal activity, and the similarity of mineral deposits are all cited as evidence.

Regional lineaments in the Basin and Range province are believed to pass under the central Shoshone Range, and could be structural control for the placement of the Mesozoic mineral deposits. Ekren and others (1976, p. 3) believed that the west-trending fault system in Union Canyon is an expression of the Timpahute Lineament, a regional structural feature that may extend deep into the earth's crust. These ancient zones of structural weakness make excellent conduits for intrusions and are often cited as a basic control for the placement of many of the mineral deposits in Nevada.

#### Tertiary Mineralization Event

Most of the mineral exploration in the study area during the last 20 years has been for precious metal deposits associated with Tertiary volcanism. Areas for these deposits include the Cloverdale, Ione, and Grantsville districts, the Grantsville Summit area, and the east range front in the northern part of the range.

Tertiary precious metal deposits in the Shoshone Range originated with the extensional tectonics associated with the Basin and Range province. The thinning of the earth's crust during this time resulted in numerous volcanic complexes surrounded by extensive hot spring activity. Epithermal mineralization occurred around the water conduits below the spring area. These "hot springs" occurrences contain valuable minerals in areas of intense volcanic activity where the parent intrusion was rich in metals, and in areas where the regional heating remobilized pre-Tertiary mineral deposits. These deposits are typified by finely disseminated, micron-size gold or electrum, a large surrounding area of altered country rock, the lack of base metal veins, and an association with mobile elements such as mercury, antimony, and arsenic. They are often referred to as bulk-tonnage, low grade, epithermal gold deposits. Mining districts with epithermal gold deposits typically have a small historic precious metal production and consist of many prospects on small gold-bearing quartz veins, some with associated placer gold deposits. Often overlooked by earlier mining operations, these precious metal resources in Nevada have caused a mining boom during the last 30 years of historic proportions.

In central Nevada, Tertiary volcanic centers are marked by caldera complexes, areas where volcanoes have collapsed, leaving large concentric "ring" structures. East of the Shoshone Range, several of these complexes have been mapped, including the Arc Dome, Toiyabe, and Peavine calderas (Hardyman, in press). Albers and Kleinhampl (1979, p. C2) list some typical geologic settings associated with volcanic centers that include: 1) rim fracture zones that follow the outer edge of the caldera; 2) areas of local uplift that may reflect intrusions beneath; 3) groups of veins, breccia pipes, and breccia zones.

Several other mineral commodities in the range are associated with Tertiary volcanic centers. Mercury resources occur along a Tertiary fault system that is situated in the middle of the range between Grantsville Summit and Ione Canyon. Volcanic fumaroles or hot springs deposited mercury in these structurally weak zones. Epithermal and mesothermal deposits containing fluorite, antimony and barite resources are also found along hydrothermally mineralized structural zones. Uranium occurrences in the northern part of the range are probably related to localized Tertiary solfataric fumarole activity (Garside, 1973, p. 85).

## Areas of Future Mineral Exploration and Development

Areas favorable for future mining activities are displayed on figure 23-25. Activity areas are labeled as to the type of mineral deposit involved and rated as to whether mining activity is likely or just possible. The figures were made using a compilation of USBM field data, geologic maps, past mining activity, production statistics, and published and unpublished mineral information.

### Low-Grade Gold-Silver Deposits

Figure 23 shows areas favorable for mining and exploration activity involving low-grade precious metal deposits. These deposits are related to Tertiary volcanism. The Cloverdale district, in the southern part of the study area, exhibits many of the features expected of a "near caldera" mineralized area, such as rim fracture zones, breccia pipes related to local volcanic vents, and large alteration zones. These features cause much of the district to be classified as favorable for future activity involving epithermal gold resources. Significant exploration and development activities during the 1980's and 1990's have been focused on the epithermal resource possibilities in the district.

In the last ten years, deposits of low-grade, disseminated gold have been defined in the Grantsville Ridge and in the Grantsville Summit areas, and there is every reason to expect that there will be future activity in these areas. There has been exploration activity recently for gold deposits at the Vernal property and along the range front from Bonita to Becker canyons.

Places possible for future mining activity associated with bulk tonnage, low-grade precious metal deposits includes pediment areas near previously discovered gold deposits, mercury resource areas, and various areas that typify geologic features of past hot spring activity.

### Precious-Base Metal Deposits

The likelihood for mining activity involving precious-base metal deposits is displayed in figure 24. These deposits are related to a postulated Mesozoic intrusive event and include hydrothermal fissure vein-type and replacement-type deposits. Possible resources are similar to the high-grade precious-base metal veins that were mined in the Jackson, Ione, Berlin, and Grantsville districts. Most of these resources would probably be mined by expensive underground mining methods and would be unlikely to attract serious mining interest under present (1993) economic conditions. Notably attractive for exploration, is the pediment area west of the Berlin Mine. Deposits at the Berlin were of a higher grade in gold than other nearby deposits, and possible mineralized extensions under the pediment would be an attractive exploration target.

The replacement deposits in Grantsville Canyon at the Alexander mine are large and shallow enough to be mined by open pit methods and there may be mining activity in the near future. Problems with these deposits at the Fury operations (Alexander mine) will have to be solved before open pit mining resumes.

Discovered precious-base metal resources from the Mesozoic Era are limited, for the most part, to the exposed pre-Tertiary rock terrain in the western part of the range. The possibility for additional deposits extends under the volcanic rocks that covers the east, north, and south sides of the range. Gravity studies by Snyder and Healey (1983, p. 7) mapped high anomalies in the east-central part of the range suggesting

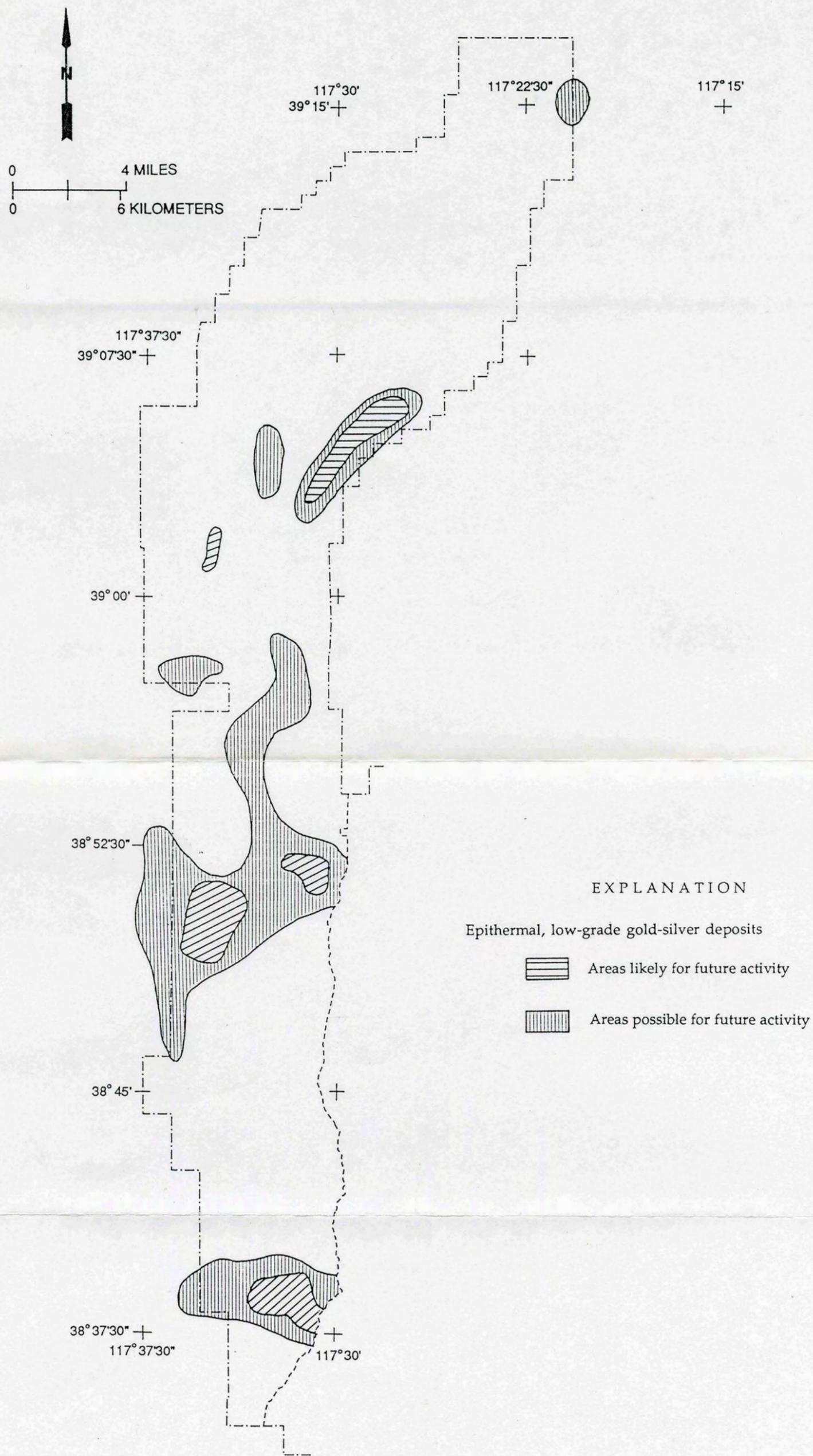


Figure 23.- Map showing areas favorable for future mining activity involving low-grade gold-silver deposits

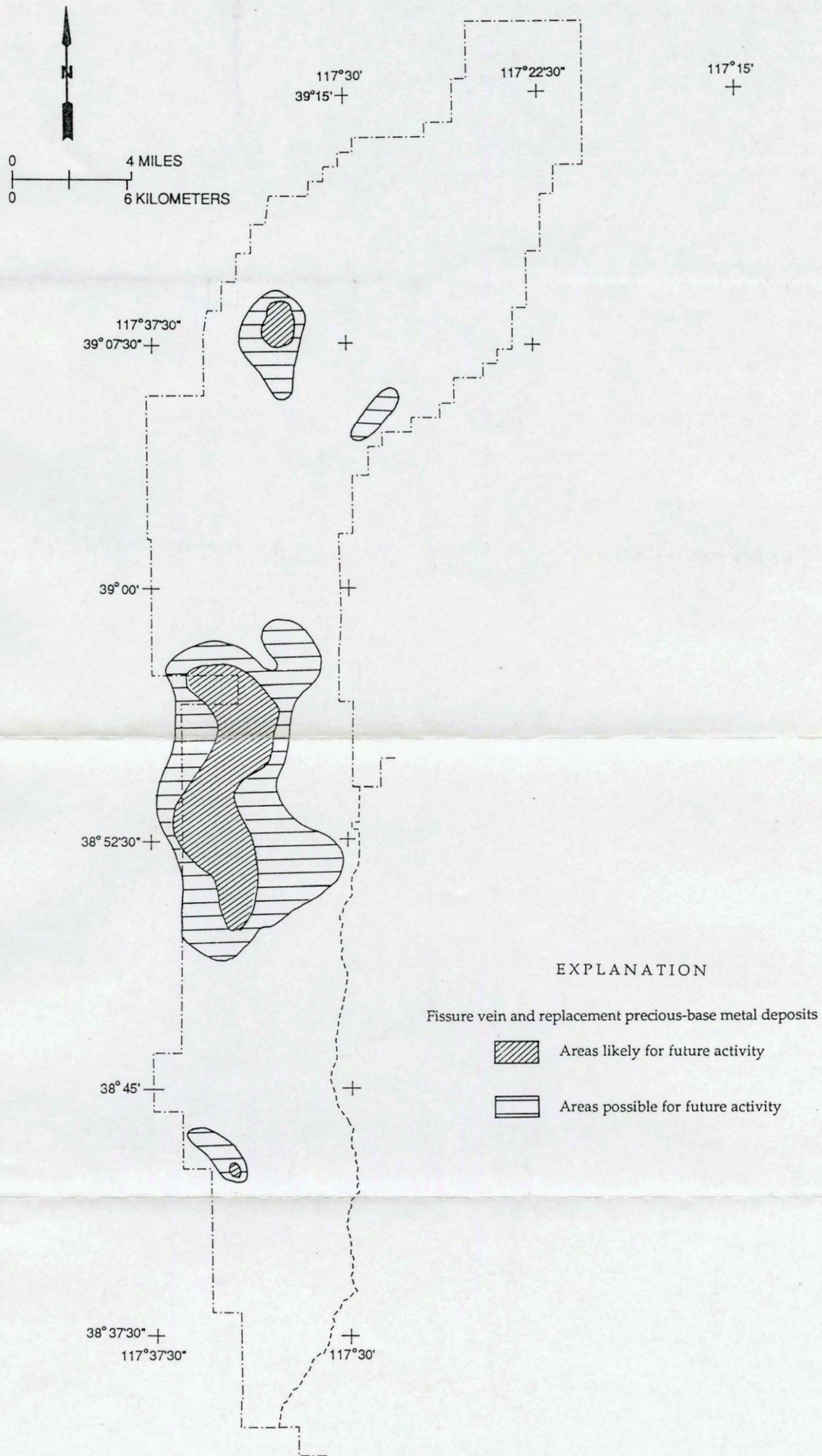


Figure 24.- Map showing areas favorable for future mining activity involving precious-base metal deposits

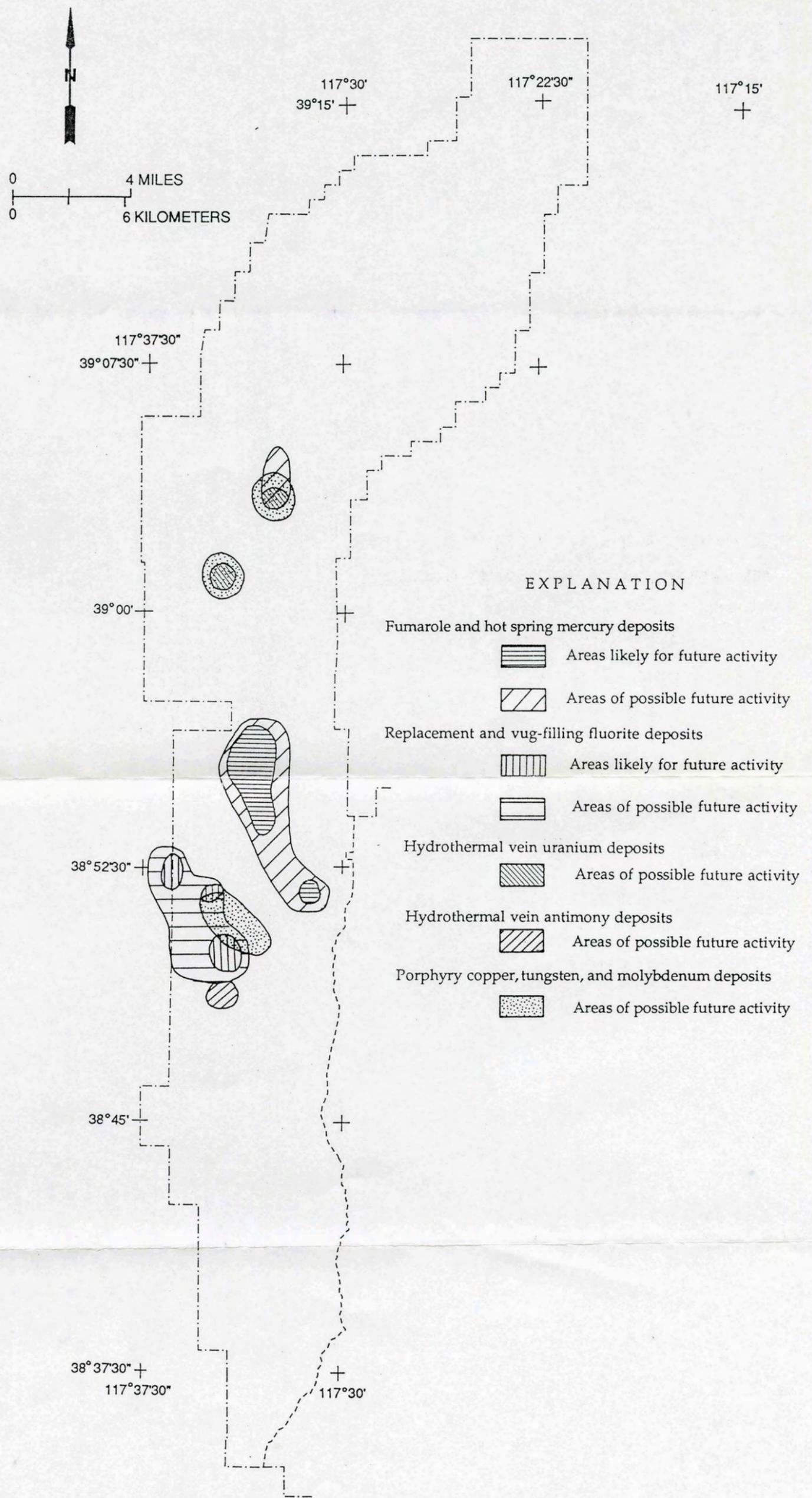


Figure 25.- Map showing areas favorable for future mining activity involving mercury, fluorite, uranium, antimony, copper, tungsten, and molybdenum deposits

that rocks with similar densities to the exposed pre-Tertiary rocks are buried under the Tertiary volcanic rocks. Areas of volcanic rock cover in the central part of the range are, in the early 1990's, being actively explored.

#### Mercury Deposits

Areas of future mining activity involving mercury are displayed in figure 25. Mercury mining in the United States has declined in recent years due to environmental requirements and competition from foreign sources. Areas likely for future activity coincide with areas of known mercury production. Resumption of mining in the range would probably be accompanied by the discovery of additional resources near some of the large, mined-out deposits in the Ione district, and a change in the basic economics of the mercury market.

#### Fluorite, Uranium, and Antimony Deposits

The possibilities for future mining of fluorite, uranium, and antimony are displayed in figure 25. Fluorite resources have been developed in the Berlin and Grantsville districts, and resources have been outlined by drilling at the Sea Bee mine. Future mining activity would be in the vicinity of these known occurrences. The lack of a local market has stalled further development of these resources for the present (1993) time.

Development of antimony deposits in Milton Canyon during the 1930's resulted in a small production. Exposed resources are too small to attract much mining interest in the near future. Any future activity would probably be coupled with the discovery of additional resources in the Milton Canyon area.

Areas of reported uranium occurrence are found at the Dottie Lee and Hazel E properties. While these small uranium shows may result in some future exploration, it is unlikely that there would be enough resources discovered to result in any production.

#### Porphyry Copper, Tungsten, and Molybdenum Deposits

The possibility for mining activity involving copper, tungsten, and molybdenum porphyry deposits is shown in figure 25. A postulated Mesozoic intrusive stock under the range has regional implications as to the potential for porphyry type deposits.

The rich precious-base metal veins in the central parts of the range could represent upper levels of a mineral system that involved large porphyry deposits at depth. Areas of possible mining activity include the Grantsville Canyon area where intense alteration with mineralization is probably associated with a shallow, unexposed pre-Tertiary intrusion suggesting a potential for a porphyry copper deposit with tungsten at depth. Another area favorable for porphyry deposits with associated molybdenum is the Vernal property.

#### MINE DEVELOPMENT COSTS

Mine development costs for several deposit types and sizes are given in tables 1-3. Capitol costs include all expenses incurred to bring the operation to its designed production capacity, and represent the investment required before any return can be expected. Operating costs include all expenses incurred to keep the project operating at its designed capacity. Infrastructure costs will contribute significantly to development costs of remote deposits where construction and

maintenance of access roads, camp facilities, and on-site power generation is required. Infrastructure costs will also be influenced by deposits near small towns where additional housing, utilities, and schools may be required to accommodate the increased population.

Mine development costs not reflected in the tables include pre-operational permitting (environmental assessments, base line studies, legal challenges) and taxes. All models are based on using new equipment, paying standard wages, and expecting normal profits.

Please note that the costs shown are for generic models and may not fit most individual deposits. They are intended only to give the reader a general idea of mine development costs associated with different deposit types and sizes. The U.S. Bureau of Mines Cost Estimating System, available in Information Circulars 9142 and 9143, can be used to estimate costs for individual deposits.

Table 1.--Estimated mining cost in 1992 dollars for surface and underground mining  
[NA, not applicable]

SURFACE MINING	907 mt/day ore (1,000 st/day)		4,536 mt/day ore (5,000 st/day)		9,072 mt/day ore (10,000 st/day)		18,144 mt/day ore (20,000 st/day)		45,360 mt/day ore (50,000 st/day)		90,720 mt/day ore (100,000 st/day)	
	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)
1:1 stripping	8.5	5.74	19.0	2.95	27.1	2.25	45.8	2.05	105.8	1.80	204.4	1.62
3:1 stripping	11.9	8.58	27.3	4.49	45.8	4.09	86.2	3.70	204.4	3.25	NA	NA
5:1 stripping	14.4	10.88	35.1	8.22	66.2	6.14	125.0	5.23	NA	NA	NA	NA

UNDERGROUND MINING	454 mt/day ore (500 st/day)		907 mt/day ore (1,000 st/day)		4,536 mt/day ore (5,000 st/day)		9,072 mt/day ore (10,000 st/day)		18,144 mt/day ore (20,000 st/day)		36,288 mt/day ore (40,000 st/day)	
	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)
Block caving												
Adit	NA	NA	NA	NA	42.8	6.85	72.5	6.13	122.7	5.27	207.7	4.54
Shaft <sup>1/2</sup>	NA	NA	NA	NA	50.3	9.56	83.9	8.17	140.5	6.92	236.4	6.14
Room and pillar												
Adit	5.5	11.46	8.6	10.18	24.2	7.73	37.9	6.87	59.2	6.10	92.5	5.42
Shaft	7.9	17.99	11.9	14.18	31.7	9.72	49.3	8.91	77.0	7.75	121.2	6.55
Cut and fill												
Adit	22.6	41.94	31.1	34.21	65.3	21.31	NA	NA	NA	NA	NA	NA
Shaft	25.0	48.47	34.4	38.21	72.8	23.30	NA	NA	NA	NA	NA	NA
Shrinkage stope												
Adit	8.7	25.89	13.0	22.50	36.2	17.39	NA	NA	NA	NA	NA	NA
Shaft	11.3	32.42	16.3	26.50	43.7	19.38	NA	NA	NA	NA	NA	NA
Sublevel longhole												
Adit	3.7	12.71	5.4	11.21	13.0	8.38	19.1	7.18	NA	NA	NA	NA
Shaft	6.3	19.24	8.7	15.21	20.5	10.37	30.5	9.22	NA	NA	NA	NA
Vertical crater retreat												
Adit	4.8	13.25	8.1	11.49	27.0	8.25	NA	NA	NA	NA	NA	NA
Shaft	7.4	19.78	11.4	15.49	34.5	10.23	NA	NA	NA	NA	NA	NA

<sup>1/2</sup> Shaft cost based on average ore body depth of 914.4 m (1,000 ft)

Table 2.--Estimated milling cost in 1992 dollars for various beneficiation methods  
[NA, not applicable]

MINERAL PROCESSING <sup>1/</sup>	454 mt/day ore (500 st/day)		907 mt/day ore (1,000 st/day)		4,536 mt/day ore (5,000 st/day)		9,072 mt/day ore (10,000 st/day)		18,144 mt/day ore (20,000 st/day)		36,288 mt/day ore (40,000 st/day)	
	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)	Capital Cost (MMS)	Operating Cost (\$/mt)
Gold/silver extraction												
Autoclave-CIL-EW <sup>2/</sup>	12.7	21.59	21.1	18.84	76.1	13.74	130.5	12.00	NA	NA	NA	NA
CIL-EW <sup>2/</sup>	6.1	13.73	9.6	11.29	35.3	7.19	60.2	5.91	NA	NA	NA	NA
CIP-EW <sup>2/</sup>	NA	NA	16.8	12.10	44.1	7.43	66.4	6.02	103.5	4.88	NA	NA
CCD-MC <sup>3/</sup>	16.9	18.53	24.9	15.06	67.7	9.29	103.4	7.55	162.6	6.13	NA	NA
Float-roast-leach	NA	NA	23.2	17.25	60.6	11.61	91.0	9.79	140.3	8.26	NA	NA
Heap leach	NA	NA	11.3	6.31	29.9	4.41	45.1	3.77	71.6	3.23	NA	NA
Base/precious metal extraction												
One product flotation	6.8	14.10	10.4	11.18	34.0	6.52	55.4	5.17	93.5	3.99	158.8	3.17
Two product flotation	7.5	15.24	11.6	11.90	39.6	6.71	65.6	5.24	111.8	4.10	187.3	3.20
Three product flotation	7.8	16.86	12.3	13.28	41.8	7.64	68.5	6.01	118.5	4.74	203.1	3.74
Heavy mineral extraction												
Gravity	4.5	6.60	6.2	5.13	NA	NA	NA	NA	NA	NA	NA	NA

<sup>1/</sup> Includes tailings impoundments averaging 13 ha (32 acres) per 907 mt/d (1,000 st/d) capacity.

<sup>2/</sup> Carbon-in-leach, eletro-winnowing.

<sup>2/</sup> Carbon-in-pulp, eletro-winnowing.

<sup>4/</sup> Counter-current-decantation, Merrill-Crow.

Table 3.--Estimated infrastructure cost in 1992 dollars

INFRASTRUCTURE	Capital Cost (M\$)	Capital Cost (M\$)	Capital Cost (M\$)
Gravel haulage roads <sup>1/</sup> Per km	9.1 m (30 ft) wide 0.126	18.3 m (60 ft) wide 0.187	24.4 m (80 ft) wide 0.515
Power lines Per km	6.1 m (20 ft) poles 0.492	9.1 m (30 ft) poles 0.505	12.2 m (40 ft) poles 0.517

<sup>1/</sup> Based on level terrain requiring no drilling or blasting.

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The following list of publications and reports contains a number of documents that are not published and readily available to the public. Some of the reports are available at the U.S. Bureau of Mines office at East 360 Third Avenue, Spokane, WA 99202. Others would have to be obtained from the authors of the report.

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APPENDIX A

Sample Analysis and Descriptions

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TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
1	select	117 35 1.7	38 57 8.7	Stockpile of brecciated, limonite-stained quartz vein with jasper.
2	grab	117 34 52.7	38 57 22.2	Drill cuttings of andesite with epidote and limonite.
3	grab	117 35 1.3	38 57 30.0	Pit dump of altered andesite conglomerate.
4	grab	117 35 13.6	38 57 51.5	Dump material of fractured, limonite-stained welded tuff.
5	chip	117 35 8.2	38 57 49.1	Across 1.37 m (4.5 ft) pit face of thinly bedded, fractured siltstone.
6	random chip	117 35 18.6	38 58 8.7	Outcrop of fractured, argillically altered tuff.
7	chip	117 34 19.9	38 57 7.3	Across 0.3 m (1 ft) of talc-chlorite stringers within limestone in adit wall.
8	chip	117 34 19.9	38 57 7.3	Across 0.67 m (2.2 ft) shear zone of gouge and limestone breccia in adit wall.
9	select	117 34 19.9	38 57 7.3	Winze dump of limonitic gouge from lenses on intercepting faults.
10	select	117 34 32.2	38 57 14.9	Stockpile of greenstone with malachite along fractures.
11	select	117 34 29.6	38 57 15.6	Stockpile of greenstone and vein quartz with iron and copper stains.
12	grab	117 35 22.6	38 57 4.3	Dump debris of altered diorite.
13	select	117 35 27.2	38 57 12.1	Stockpile of quartz vein with fine disseminations of pyrite, chalcopyrite, galena, and malachite in quartz diorite.
14	grab	117 35 36.2	38 57 19.2	Dump of brecciated quartz with jasper and limonite.
15	random chip	117 35 31.2	38 57 26.2	Trench face of altered andesite.
16	grab	117 35 22.2	38 57 26.7	Pit dump of greenstone with jasper and clay fracture fillings, and small quartz veins.
17	random chip	117 34 40.8	38 57 54.8	Pit face of weathered, altered tuff.
18	grab	117 34 46.9	38 59 49.5	Float of slightly altered crystalline tuff.
19	grab	117 34 41.9	38 59 26.2	Float of siliceous tuff with Liesegang banding.
20	placer	117 36 12.6	38 58 5.2	Across trench face of poorly sorted, altered cobbles and boulders with sand and clay matrix; alluvium from old channel(?).
21	placer	117 36 28.4	38 58 2.5	Trench face of poorly sorted, matrix-supported alluvium.
22	random chip	117 36 23.8	38 58 2.2	Pit face of intensely argillically altered, bleached, faulted rhyolite.
23	grab	117 36 10.1	38 57 52.9	Pit dump of limonitic gouge and altered andesite.
24	select	117 33 10.1	38 55 58.0	Stockpile of massive jasper with small pods of hematite.
25	random chip	117 33 8.3	38 55 58.3	Sheared, intensely altered rhyolitic tuff in face of pit.
26	grab	117 33 59.8	38 56 27.5	Debris from adit working face of faulted, altered diorite with gouge and Liesegang banding.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
27	chip	117 33 59.8	38 56 27.5	Across 0.15 m (0.5 ft) of quartz vein with pyrite, galena and possible tetrahedrite, in adit wall, strikes N. 75° E., dips 45° NW.
28	chip	117 33 56.2	38 56 31.5	Across 0.61 m (2 ft) of quartz vein with weathered sulfides, in adit wall, strikes N. 35° W., dips 55° NE.
29	chip	117 33 56.2	38 56 31.5	Across 0.46 m (1.5 ft) of quartz vein with very fine sulfides throughout, in adit wall, strikes N. 35° W., dips 55° NE.
30	select	117 34 14.5	38 56 29.3	Vein quartz with pyrite and hematite, from shaft dump.
31	chip	117 34 45.1	38 56 43.3	Across 0.37 m (1.2 ft) of quartz vein with sparse sulfides and quartz breccia, in adit wall, strikes E-W, dips 47° N.
32	chip	117 34 45.1	38 56 43.3	Across 0.37 m (1.2 ft) of quartz vein and quartz breccia with minor sulfides, in adit wall, strikes N. 75° W., dips 65° NE.
33	select	117 35 12.8	38 57 12.5	Argillic altered, silicified diorite with jasperoid stringers, from dump.
34	select	117 35 53.5	38 57 12.7	Stockpile of quartz vein with finely disseminated sulfides, and iron oxides and secondary quartz on fractures.
35	select	117 35 58.6	38 57 20.4	Stockpile of altered, silicified greenstone with quartz stringers and iron oxide.
36	random chip	117 35 49.6	38 57 34.8	Greenstone breccia with mylonite and iron stains, in face of open pit.
37	select	117 35 44.9	38 57 20.8	Stockpile of quartz vein having about 5% content of weathered sulfides and copper oxides.
38	select	117 34 34.3	38 57 26.4	Stockpile of quartz and calcite with weathered pyrite, and iron and copper oxides.
39	grab	117 34 40.8	38 57 12.5	Silicious greenstone breccia with abundant limonite, from pit dump.
40	select	117 34 14.2	38 57 25.6	Quartzite breccia with quartz stringers and limonite, off adit dump.
41	random chip	117 33 49.0	38 57 16.4	Faulted quartzite breccia with gouge, in adit wall.
42	random chip	117 33 49.0	38 57 16.4	Faulted quartzite and silicified gouge, in adit wall.
43	select	117 35 2.8	38 51 46.2	Greenstone with stringers of pyrite and calcite, from adit dump.
44	select	117 34 48.0	38 51 39.3	Greenstone breccia with pyrite and quartz, from adit dump.
45	chip	117 34 41.5	38 51 35.0	Across 0.61 m (2 ft) of quartz vein in altered greenstone, in adit wall, strikes N. 83° W., vertical.
46	random chip	117 34 38.3	38 51 42.4	7.62 m (35 ft) wide quartz vein with fluorite and barite, in open pit.
47	random chip	117 34 38.3	38 51 42.4	Pebble conglomerate with fracture fillings of limonite, fluorite and quartz, in wall of open pit.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
48	chip	117 34 38.6	38 51 44.6	Across 0.38 m (1.25 ft) of barite vein with inclusions of greenstone and quartz, in open pit.
49	chip	117 34 43.3	38 56 40.0	Across 0.3 m (1 ft) of fractured quartz vein with disseminations, stringers, and pods of base-metal sulfides, in adit wall.
50	chip	117 34 43.3	38 56 40.0	Across 0.3 m (1 ft) of quartz vein with pyrite stringers, in adit wall.
51	select	117 34 2.3	38 56 59.8	Black limestone breccia, calcite and limonite, from shaft dump.
52	select	117 33 55.1	38 56 45.6	Quartz with sparse pyrite and limonite, from adit dump.
53	select	117 33 47.2	38 56 51.1	Iron-stained limestone breccia from shaft dump.
54	select	117 34 0.1	38 56 44.6	Stockpile of quartz with pyrite, galena, tetrahedrite, and chrysocolla.
55	select	117 34 1.6	38 56 38.6	Stockpile of quartz with galena, tetrahedrite, and chrysocolla.
56	select	117 33 45.4	38 56 35.2	Stockpile of quartz with limonite, and sparse pyrite and galena.
57	grab	117 34 15.2	38 57 7.5	Altered dolomitic limestone with limonite, from winze dump.
58	select	117 33 57.2	38 57 6.2	Dump material of limestone breccia with quartz and limonite.
59	select	117 33 45.7	38 57 14.0	Quartz with limonite, from adit dump.
60	select	117 33 40.7	38 57 6.9	Altered, weathered quartzite with limonite fracture fillings, from shaft dump.
61	random chip	117 33 42.5	38 57 5.6	Intensely altered quartzite with limonite and hematite, in pit wall.
62	grab	117 33 16.6	38 56 38.4	Argillically altered volcanogenic mudflow breccia from adit dump.
63	grab	117 33 16.6	38 56 34.0	Silicified and argillically altered volcanic rock from shaft dump.
64	number not used			
65	number not used			
66	random chip	117 33 22.7	38 56 23.5	Intensely altered tuffs with limonite, in face of open pit.
67	chip	117 33 33.1	38 56 37.0	Across 1.2 m (4 ft) of sheared quartzite with limonite, in shaft.
68	select	117 33 42.1	38 56 35.1	Stockpile of quartz with finely disseminated sulfides, limonite, and malachite.
69	select	117 33 53.3	38 56 31.5	Stockpile of quartz and quartz breccia, with steaks of weathered sulfide minerals.
70	select	117 34 0.5	38 56 30.1	Stockpile of massive quartz with stringers of pyrite, galena, tetrahedrite, and chalcopyrite.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
71	select	117 34 22.8	38 56 32.5	Stockpile of quartz with pyrite, galena, tetrahedrite, malachite, and fracture fillings of secondary quartz.
72	select	117 34 48.7	38 56 46.8	Stockpile of quartz with streaks of finely disseminated pyrite, galena, and sphalerite.
73	select	117 34 53.8	38 56 38.5	Stockpile of iron-stained quartz with limonite and cerussite (?).
74	select	117 34 39.0	38 56 42.0	Stockpile of quartz with secondary quartz fracture fillings, pyrite, tetrahedrite, galena, and malachite.
75	select	117 34 35.4	38 56 40.5	Stockpile of quartz with minor pyrite, galena, tetrahedrite, and malachite.
76	select	117 34 31.1	38 56 32.5	Stockpile of quartz breccia and diorite with limonite.
77	select	117 34 34.3	38 56 44.5	Iron-stained quartz from dump of inclined shaft.
78	select	117 34 25.0	38 56 40.2	Stockpile of quartz with streaks of finely disseminated sulfides and copper oxides.
79	select	117 34 13.1	38 56 37.3	Altered diorite country rock from shaft dump.
80	select	117 34 34.3	38 56 29.7	Stockpile of iron-stained quartz, limonite-filled boxwork, and minor malachite.
81	select	117 34 57.0	38 56 38.0	Stockpile iron-stained quartz and quartz breccia with pyrite, galena, and sphalerite.
82	grab	117 34 33.2	38 56 16.3	Altered quartzite with limonite and minor secondary copper, from shaft dump.
83	select	117 34 31.1	38 56 22.4	Stockpile of quartz with limonite, weathered pyrite, and minor scheelite.
84	select	117 34 43.0	38 56 21.7	Stockpile of quartz with limonite, weathered sulfides, and malachite.
85	select	117 34 41.5	38 56 15.7	Stockpile of altered quartzite with abundant chrysocolla.
86	select	117 34 54.1	38 56 45.9	Iron-stained quartz and boxwork limonite, from dump.
87	select	117 35 3.5	38 56 43.8	Stockpile of quartz, boxwork limonite, and weathered sulfides.
88	select	117 34 50.2	38 56 26.2	Stockpile of iron-stained quartz and boxwork limonite with weathered sulfides.
89	select	117 34 43.0	38 56 2.2	Metasedimentary breccia with limonite, malachite, and azurite, from dump.
90	select	117 34 45.1	38 56 0.2	Stockpile of quartz with malachite, disseminated sulfides, and pockets of black, sooty, weathered sulfides.
91	grab	117 32 32.6	38 58 29.5	Shale with limonite on partings, from pit dump.
92	grab	117 32 8.5	38 58 45.8	Siliceous conglomerate and breccia with quartz, malachite, and azurite, from dump.
93	select	117 32 18.6	38 58 49.6	Stockpile of quartz pebble conglomerate with malachite.
94	grab	117 34 27.1	38 58 7.9	Iron-stained conglomerate from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
95	select	117 34 15.2	38 57 37.8	Breccia with kaolinite and limonite, from dump of inclined shaft.
96	grab	117 33 0.4	38 58 42.2	Iron-stained tuff breccia from pit dump.
97	grab	117 32 38.8	38 58 54.5	Crystal tuff with jasper veinlets, from trench dump.
98	grab	117 31 50.2	38 58 32.8	Vitric tuff with clay, from backhoe pit.
99	grab	117 31 54.1	38 58 41.0	Vitric tuff with abundant clay, from dozer pit.
100	grab	117 32 7.1	38 58 47.1	Volcanogenic conglomerate with hematite, from trench.
101	select	117 32 5.3	38 58 47.1	Sheared, copper-stained conglomerate with weathered sulfides, from shaft dump.
102	select	117 33 21.6	38 59 46.5	Iron-stained, tuff with malachite, limonite, and pyrite, from incline shaft dump.
103	grab	117 33 28.4	38 59 45.5	Siliceous conglomerate with jasper lenses and pervasive limonite, from dozer cut.
104	chip	117 33 36.7	39 0 3.5	Across 0.91 m (3 ft) of fractured argillite with hematite and pyrite, in a stope pillar.
105	select	117 33 36.7	39 0 3.5	Metasedimentary rock with euhedral pyrite, from adit dump.
106	grab	117 33 39.6	39 0 7.2	Contact between argillite with chert pods and vitric tuff, from pit dump.
107	select	117 33 44.3	38 59 57.8	Quartz vein and iron-stained argillite, from pit dump.
108	grab	117 33 40.3	39 0 0.8	Altered argillite with quartz fracture fillings, from pit dump.
109	grab	117 31 21.4	38 57 58.2	Iron-stained, clay-rich conglomerate with quartz veinlets, from pit dump.
110	grab	117 31 23.2	38 57 52.7	Altered, silicified tuff flows with limonite, from pit dump.
111	select	117 31 18.8	38 58 15.8	Altered, iron-stained ash with chert, from trench dump.
112	number not used			
113	grab	117 31 28.2	38 58 25.0	Outcrop of limonitic sandstone, and conglomerate.
114	select	117 31 33.2	38 58 9.1	Stockpile of iron- and copper-stained metasedimentary rock with chalcopyrite, from shaft dump.
115	select	117 31 44.0	38 58 17.3	Limonite and metasedimentary rock with hematite, fluorite, and pyrite, from pit dump.
116	grab	117 32 30.8	38 58 4.8	Tuff with veinlets of clay and quartz, from dozer trench.
117	select	117 32 30.1	38 57 57.4	Iron-stained conglomerate with pyrite and chert, from shaft dump.
118	grab	117 31 23.5	38 57 16.3	Outcrop of fractured jasperoid.
119	select	117 31 42.6	38 57 14.7	Argillically altered sandstone with quartz stringer, from drill site debris.
120	grab	117 30 55.4	38 57 1.3	Jasperoid from dozer pit.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
121	random chip	117 31 37.2	38 56 33.6	Outcrop of iron-stained tuff with Liesegang banding.
122	random chip	117 32 10.7	38 56 58.5	Iron-stained, altered tuff from dozer trench.
123	grab	117 32 3.8	38 56 39.9	Outcrop of rhyolite country rock.
124	random chip	117 32 48.1	38 56 31.0	Rhyolite in dozer trench.
125	select	117 32 55.7	38 56 18.5	Argillically altered rhyolite with some cinnabar, from shaft dump.
126	grab	117 32 39.5	38 56 21.6	Iron-stained rhyolite from dozer cut.
127	select	117 33 51.8	38 55 58.5	Silicified conglomerate with pyrite and pyrolusite, from pit dump.
128	random chip	117 34 0.8	38 56 3.2	Silicified conglomerate with pyrite, from adit dump.
129	grab	117 34 4.4	38 55 47.9	Iron-stained conglomerate with veinlets of epidote and quartz, from adit dump.
130	grab	117 33 34.2	38 56 1.5	Iron-stained vitric tuff from pit dump.
131	select	117 33 35.6	38 56 15.9	Silicified breccia with limonite, from pit dump.
132	grab	117 33 48.6	38 56 10.6	Weathered, iron-stained mylonite from pit dump.
133	random chip	117 32 58.9	38 56 5.3	Altered rhyolite with streaks of limonite and hematite, from trench.
134	select	117 32 51.7	38 56 2.8	Argillically altered rhyolite from shaft dump.
135	select	117 33 10.8	38 56 4.6	Altered andesite agglomerate from open-pit debris.
136	select	117 33 13.7	38 56 3.7	Slate with calcite veins and sparse cinnabar, from open-pit debris.
137	select	117 32 57.1	38 55 51.4	Altered rhyolite from shaft dump.
138	random chip	117 33 0.4	38 55 54.7	Limonitic clay gouge and breccia, from open pit.
139	grab	117 33 21.6	38 55 34.6	Altered calcareous shale from pit debris.
140	select	117 33 10.4	38 55 24.8	Silicified tuff with limonite, from shaft dump.
141	grab	117 34 27.8	38 54 40.3	Float of iron-stained, altered conglomerate.
142	select	117 34 38.6	38 54 38.6	Weathered, silicified, and fractured conglomerate with disseminated pyrite, from adit dump.
143	select	117 34 59.5	38 54 48.7	Altered, iron-stained quartz from adit dump.
144	grab	117 35 19.3	38 54 53.5	Altered granodiorite with limonite, from adit dump.
145	select	117 34 59.9	38 55 2.8	Copper ore of altered, fractured greenstone laced with malachite and calcite, from shaft dump.
146	grab	117 35 0.6	38 55 13.6	Greenstone with calcite and siderite, from pit dump.
147	select	117 34 7.3	38 55 38.2	Quartz with copper oxides, and silicified conglomerate wallrock, from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
148	select	117 33 53.6	38 55 33.1	Siliceous, sheared greenstone and limonite boxwork, from shaft dump.
149	select	117 33 39.2	38 55 21.9	Stockpile of siliceous greenstone with abundant limonite, cuprite, malachite and quartz.
150	select	117 33 34.2	38 55 22.8	Siliceous greenstone with stringers of cuprite and malachite, from pit dump.
151	grab	117 33 48.6	38 55 1.4	Stockpile of sheared andesite with malachite, quartz, and limonite.
152	random chip	117 33 29.9	38 54 34.2	Silicified tuff with limonite, from dozer cut.
153	grab	117 33 28.4	38 54 32.8	Altered, weathered tuff from adit dump.
154	grab	117 33 2.5	38 55 13.3	Bleached, altered tuff from pit dump.
155	grab	117 33 9.0	38 54 55.1	Iron-stained tuff from adit dump.
156	select	117 33 11.5	38 54 49.7	Argillically altered tuff with hematite, from shaft dump
157	select	117 33 14.8	38 54 50.6	Bleached rhyolitic agglomerate with minor disseminated cinnabar, from glory hole.
158	grab	117 32 59.6	38 54 40.3	Iron-stained, sheared tuff from pit dump.
159	random chip	117 35 37.7	38 54 34.6	Outcrop of siliceous, sheared greenstone with limonite.
160	random chip	117 35 44.5	38 54 8.7	Outcrop of iron-stained metasedimentary rock with gossan and quartz veinlets.
161	select	117 36 9.4	38 53 55.5	Granodiorite with manganese, quartz veinlets, and tourmaline, from adit dump.
162	chip	117 36 9.0	38 53 51.3	Across 0.4 m (1.3 ft) of sheared granodiorite with gouge and limonite, from adit portal.
163	grab	117 36 15.8	38 53 39.7	Metasedimentary rock with limonite, hematite, and quartz veinlets, from pit dump.
164	grab	117 36 5.8	38 53 30.9	Limonite and limestone, from pit dump.
165	select	117 36 25.9	38 53 26.5	Calcareous shale with malachite, from adit dump.
166	select	117 36 25.9	38 53 26.5	Quartz vein with pyrite, galena, and clay, from adit dump.
167	select	117 35 38.8	38 54 8.0	Limonite and greenstone, from adit dump.
168	grab	117 35 33.4	38 54 10.9	Metasedimentary rock with malachite and azurite, from pit dump.
169	select	117 35 24.0	38 54 7.8	Faulted quartzite with limonite and calcite, from pit dump.
170	select	117 35 7.1	38 54 3.2	Limonite with calcite and pyrite, from pit dump.
171	select	117 34 50.9	38 53 49.2	Quartzite with quartz veinlets, from adit dump.
172	grab	117 35 11.4	38 53 48.7	Silicified, iron-stained metasedimentary rock from pit dump.
173	select	117 35 30.8	38 53 55.9	Limestone breccia with calcite veinlets, from pit dump.
174	grab	117 35 30.8	38 53 55.9	Greenstone with pyrite, calcite, and garnet, from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
175	select	117 35 44.5	38 53 57.4	Limonite and faulted greenstone, from pit dump.
176	select	117 35 15.7	38 54 5.8	Altered, sheared, and silicified limestone with calcite-quartz veins and some scheelite, from adit dump.
177	select	117 36 19.4	38 53 17.6	Limonite, quartz, and altered metasedimentary rock with some malachite, from adit dump.
178	grab	117 36 16.2	38 53 10.4	Copper- and manganese-stained limestone with limonite, from pit dump.
179	select	117 36 19.4	38 53 31.0	Quartz vein with limonite and tourmaline, from shaft dump.
180	grab	117 36 33.1	38 53 29.7	Outcrop of altered metasedimentary rock, some breccia, and quartz veins.
181	grab	117 36 36.7	38 53 9.7	Quartz vein with limonite, and shale wallrock, from pit dump.
182	grab	117 34 46.9	38 53 44.2	Altered, silicified metasedimentary rock with limonite and clay, from pit dump.
183	select	117 34 54.1	38 54 22.8	Greenstone with calcite veins, chalcopryrite, and hematite, from pit dump.
184	select	117 34 43.7	38 54 24.4	Limonite from shaft dump.
185	select	117 34 43.7	38 54 24.4	Quartz vein and quartz breccia with limonite, from shaft dump.
186	grab	117 34 57.7	38 53 36.0	Silicified metasedimentary rock with quartz filled vugs, from pit dump.
187	grab	117 35 26.5	38 53 34.9	Quartz vein with sparse malachite and chalcopryrite, from pit dump.
188	select	117 35 25.8	38 53 41.1	Siliceous, argillically altered metasedimentary rock from pit dump.
189	select	117 35 43.4	38 53 49.8	Limonite with relict sulfides, quartz, and malachite, from shaft dump.
190	grab	117 33 8.6	38 54 3.4	Float of altered crystalline tuff.
191	select	117 33 1.4	38 53 55.0	Altered lithic tuff with limonite, from pit debris.
192	select	117 32 51.4	38 53 56.0	Iron-stained welded tuff from trench debris.
193	grab	117 32 49.6	38 53 35.6	Altered tuff with limonite and alunite(?), from trench dump.
194	random chip	117 33 9.4	38 53 22.2	Outcrop of slightly siliceous tuff country rock.
195	grab	117 34 46.9	38 53 11.3	Bleached, argillically altered tuff from pit dump.
196	random chip	117 34 27.8	38 53 7.6	Sheared, altered limestone and clay gouge, from adit wall.
197	random chip	117 34 30.4	38 53 21.2	Outcrop of faulted tuff with quartz.
198	random chip	117 35 10.3	38 53 18.2	Silicified, brecciated metasedimentary rock from pit.
199	grab	117 35 10.7	38 53 21.4	Altered ash flow tuff from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
200	select	117 35 29.4	38 53 29.1	Quartz vein with pyrite, chalcopyrite, malachite, azurite, and iron oxides, from trench dump.
201	select	117 35 35.5	38 53 32.4	Quartz with clay, limonite, and hematite, from pit dump.
202	select	117 35 38.4	38 53 36.3	Quartz vein from pit dump.
203	select	117 35 35.2	38 53 40.6	Altered greenstone with malachite and azurite, from pit dump.
204	grab	117 35 54.6	38 53 38.2	Quartz, argillite, and greenstone, from adit dump.
205	select	117 35 47.0	38 53 30.2	Quartz vein with iron oxides, from shaft dump.
206	select	117 35 45.2	38 53 31.7	Fault gouge and fractured metasedimentary rock, from adit debris.
207	select	117 36 7.2	38 53 34.3	Quartz with chalcopyrite, malachite, and azurite, from pit dump.
208	random chip	117 34 17.4	38 55 33.2	Granodiorite with hematite, from pit wall.
209	random chip	117 34 24.2	38 55 38.6	Argillically altered granodiorite from pit wall.
210	grab	117 34 20.3	38 55 43.8	Iron-stained metasedimentary rock with calcite and quartz, from pit dump.
211	grab	117 34 59.5	38 52 32.2	Altered, fractured limestone with quartz veins and limonite, from pit dump.
212	select	117 34 58.4	38 52 35.0	Quartz vein with pyrite, malachite, and covellite(?), from adit dump.
213	select	117 34 44.4	38 52 28.6	Quartz vein with tetrahedrite and chalcopyrite, from adit dump.
214	random chip	117 34 2.6	38 52 41.7	Outcrop of rhyolitic quartz stockwork and crackle breccia.
215	random chip	117 33 53.6	38 52 26.7	Rhyolitic crackle breccia from pit.
216	random chip	117 34 37.2	38 52 31.5	Outcrop of fractured jasperoid with clay and limonite fracture fillings.
217	grab	117 31 17.4	38 55 1.7	Weathered, altered tuff from pit dump.
218	select	117 35 54.6	38 54 1.9	Metasedimentary rock with tourmaline and quartz, from pit dump.
219	select	117 36 27.4	38 53 6.8	Quartz vein with limonite and argillite, from pit dump.
220	select	117 36 22.7	38 53 6.8	Altered, sheared quartz with pyrite, chlorite, and limonite, from pit dump.
221	random chip	117 36 31.0	38 53 4.3	Quartz vein with pyrite and hematite, from adit dump.
222	select	117 36 37.8	38 53 2.1	Quartz with pyrite, chalcopyrite, galena, sphalerite, and tetrahedrite, from adit dump.
223	select	117 36 22.3	38 52 53.2	Quartz with limonite and hematite, from shaft dump.
224	select	117 36 20.2	38 52 57.2	Chloritized breccia with pyrite, from shaft dump.
225	grab	117 36 4.7	38 52 58.4	Quartz with limonite and argillite, from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
226	select	117 35 54.6	38 52 56.9	Quartz vein from pit dump.
227	select	117 35 48.5	38 52 55.0	Quartz vein and quartz stockwork with limonite, from adit dump.
228	select	117 35 41.6	38 52 53.9	Quartz with pyrite and malachite, from shaft dump.
229	select	117 35 37.0	38 53 6.1	Quartz vein with sparse sulfides, from shaft dump.
230	select	117 35 37.7	38 53 15.1	Quartz stockwork in argillite with limonite, from shaft dump.
231	select	117 35 44.5	38 52 57.9	Quartz with limonite and hematite, from shaft dump.
232	select	117 36 11.2	38 52 53.7	Quartz vein with altered pyrite and secondary quartz, from adit dump.
233	grab	117 35 57.5	38 52 43.4	Quartz vein with malachite, from pit dump.
234	grab	117 35 54.6	38 52 50.1	Fractured, silicified shale from pit dump.
235	grab	117 36 14.0	38 52 39.0	Quartz with chalcopyrite, limonite, and jasper, from pit dump.
236	select	117 36 16.2	38 52 39.8	Argillically altered metasedimentary rock with abundant malachite, from pit dump.
237	select	117 36 16.2	38 52 32.9	Fluorite vein with altered metasedimentary rock, from pit dump.
238	select	117 36 16.2	38 52 32.9	Fractured conglomerate with clay and limonite, from pit dump.
239	select	117 36 8.3	38 52 29.1	Banded fluorite with some interbedded calcite, from trench dump.
240	grab	117 36 1.1	38 52 33.8	Botryoidal fluorite with limestone, from pit dump.
241	select	117 35 48.1	38 52 36.0	Altered limestone with quartz and clay, from trench dump.
242	select	117 35 59.3	38 52 23.8	Quartz vein with iron oxides, from pit dump.
243	select	117 35 13.2	38 52 30.5	Massive fluorite with gypsum and quartz, from adit.
244	grab	117 35 12.5	38 52 39.4	Quartz vein with copper oxides, from pit dump.
245	select	117 34 51.6	38 52 56.9	Limestone stained by limonite, from pit dump.
246	select	117 36 17.3	38 52 6.9	Vein of botryoidal fluorite from pit debris.
247	select	117 36 17.3	38 52 6.9	Faulted, altered limestone with fluorite breccia, from pit debris.
248	select	117 36 8.3	38 51 58.3	Iron-stained metasedimentary rock with pods of fluorite, from pit dump.
249	select	117 36 6.8	38 52 0.2	Limonite with some quartz, from pit dump.
250	select	117 35 23.3	38 51 49.7	Outcrop of sheared shale with limonite.
251	select	117 35 12.1	38 51 32.7	Quartz with sparse sulfides, from shaft dump.
252	select	117 35 13.9	38 51 28.8	Greenstone with malachite and azurite, from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
253	select	117 35 21.1	38 51 34.3	Quartz with iron and manganese oxides, from shaft dump.
254	select	117 35 9.6	38 51 41.0	Argillically altered metasedimentary rock with malachite, from trench dump.
255	select	117 35 6.7	38 51 36.0	Quartz with sparse pyrite, from shaft dump.
256	select	117 34 54.1	38 51 30.6	Quartz vein with chalcopyrite, pyrite, malachite, from shaft dump.
257	select	117 35 1.3	38 51 26.5	Quartz with pyrite, galena, and chalcopyrite, from adit dump.
258	select	117 34 52.3	38 51 16.3	Altered metasedimentary rock with pyrite, from shaft dump.
259	select	117 34 48.0	38 51 19.5	Limestone, and quartz with streaks of fine sulfides and copper oxides, from adit dump.
260	select	117 35 8.9	38 51 17.1	Quartz with oxides of iron and copper, from pit dump.
261	random chip	117 34 23.9	38 50 43.9	Silicified limestone with chalcopyrite, galena, pyrite, and sphalerite, from adit room pillar.
262	random chip	117 34 23.9	38 50 43.9	Silicified limestone with chalcopyrite, galena, pyrite, and sphalerite, from stope wall.
263	random chip	117 34 23.9	38 50 43.9	Altered shale with clay and iron oxides, from adit wall.
264	random chip	117 34 24.2	38 50 46.2	Iron-stained shale from open pit debris.
265	select	117 34 58.8	38 51 46.9	Greenstone breccia with massive cuprite, chalcopyrite, malachite and azurite, from shaft dump.
266	select	117 34 44.0	38 51 44.0	Quartz with disseminated pyrite, from adit dump.
267	select	117 34 43.0	38 51 33.0	Quartz with chalcopyrite, pyrite, and tetrahedrite, from shaft dump.
268	select	117 34 43.0	38 51 52.0	Quartz with manganese, iron oxides, and sparse pyrite, from pit dump.
269	select	117 34 42.6	38 52 0.2	Silicified siltstone with quartz veinlets and some pyrite, from pit dump.
270	select	117 34 55.6	38 52 3.7	Quartz vein with chalcopyrite and iron oxides, from trench dump.
271	select	117 34 32.5	38 52 6.0	Siliceous limestone with limonitic jasper and quartz breccia, from pit dump.
272	select	117 34 52.7	38 52 20.1	Metasedimentary breccia with quartz and malachite, from trench dump.
273	select	117 34 53.4	38 52 15.8	Quartz with sparse pyrite, from adit dump.
274	grab	117 34 18.8	38 51 58.0	Outcrop of silicious metasedimentary breccia.
275	select	117 35 4.6	38 51 14.0	Fractured quartz with chalcopyrite, pyrite, and malachite, from shaft dump.
276	select	117 35 4.2	38 51 8.1	Stockpile of quartz vein with pyrite, chalcopyrite, and malachite.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
277	select	117 34 57.0	38 51 10.4	Sheared metasedimentary rock with malachite and ankerite, from shaft dump.
278	select	117 34 50.9	38 51 1.5	Quartz and metasedimentary rock with malachite, from shaft dump.
279	select	117 34 44.4	38 51 10.5	Metasedimentary rock with pyrite, malachite, azurite, and ankerite, from shaft dump.
280	select	117 34 49.1	38 50 54.1	Quartz ore with pyrite, chalcopyrite, malachite, and sparse galena, from inclined shaft dump.
281	random chip	117 34 43.7	38 50 47.5	Outcrop of silicified metasedimentary rocks with iron oxides.
282	select	117 34 58.4	38 50 59.9	Quartz with limonite and pyrite, from shaft dump.
283	grab	117 33 52.6	38 50 51.8	Silicified argillite with iron oxides and sparse pyrite, from adit dump.
284	grab	117 33 52.9	38 51 1.0	Argillically altered argillite from shaft dump.
285	select	117 33 55.8	38 51 35.0	Quartz and boxwork limonite with weathered pyrite, from shaft dump.
286	select	117 34 17.4	38 50 48.7	Fractured quartz with weathered sulfides, from shaft dump.
287	select	117 34 18.5	38 51 0.0	Limonite and sheared, altered metasedimentary rock, from shaft dump.
288	grab	117 34 25.3	38 51 14.5	Fractured argillite with iron oxides, from shaft dump.
289	select	117 34 32.5	38 51 3.5	Limonite and quartz breccia with weathered sulfides, from adit dump.
290	select	117 34 25.3	38 50 52.0	Quartz vein with pyrite, galena, and sphalerite, from adit dump.
291	select	117 34 31.8	38 51 10.3	Quartz with pyrite, galena, and sphalerite, and silicified argillite, from adit dump.
292	select	117 34 36.1	38 51 8.9	Calcite vein and breccia with azurite, malachite, and limonite, from shaft dump.
293	grab	117 34 41.5	38 50 58.1	Silicified metasedimentary rocks with pyrite, malachite, and quartz, from shaft dump.
294	grab	117 34 42.6	38 50 43.7	Silicified metasedimentary rocks with finely disseminated pyrite, from adit dump.
295	select	117 34 49.1	38 50 41.3	Limonite and limestone, from adit dump.
296	grab	117 34 0.5	38 52 15.2	Limestone with calcite veins, from trench dump.
297	grab	117 33 58.3	38 50 45.9	Limonite with quartz veinlets, from pit dump.
298	grab	117 34 7.3	38 50 50.2	Silicious limonite from pit dump.
299	grab	117 30 34.2	38 51 50.9	Silicious metasedimentary rock with jasper veins, from pit dump.
300	grab	117 30 29.5	38 51 54.3	Altered metasedimentary rock with iron and copper oxides, from dozer cut.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
301	select	117 30 30.2	38 51 41.9	Argillically altered tuff from shaft dump.
302	grab	117 30 15.1	38 51 44.6	Altered rhyolite with limonite, from pit dump.
303	random chip	117 30 16.6	38 50 59.5	Altered andesite lava and breccia, from dozer trench.
304	select	117 30 33.1	38 51 1.0	Skarn and silicious limestone breccia with malachite, from trench dump.
305	grab	117 30 44.3	38 51 32.9	Silicified limonite and limestone, from trench dump.
306	grab	117 31 16.3	38 51 51.2	Lithic tuff with limonite, from trench dump.
307	random chip	117 31 7.3	38 51 55.2	Altered, faulted dolomite from trench wall.
308	select	117 31 0.8	38 51 58.0	Weathered limonite from dozer trench.
309	select	117 30 55.8	38 51 54.9	Silicified dolomite with malachite and azurite, from shaft dump.
310	select	117 30 46.8	38 51 47.5	Stockpile of altered limestone with malachite, azurite, and turquoise.
311	grab	117 31 31.8	38 51 39.9	Weathered vitric tuff from trench dump.
312	grab	117 31 39.4	38 51 56.7	Lithic tuff with limonite, from trench dump.
313	grab	117 33 3.6	38 50 54.9	Iron-stained vitric tuff from pit dump.
314	grab	117 33 22.3	38 50 51.0	Sheared tuff from trench dump.
315	grab	117 33 30.2	38 50 44.8	Altered lithic tuff from trench dump.
316	grab	117 33 25.6	38 50 35.3	Altered rhyolite with iron oxides, from pit dump.
317	random chip	117 33 6.1	38 49 54.4	Outcrop of altered lithic tuff.
318	grab	117 33 59.4	38 49 53.6	Weathered diorite from trench dump.
319	select	117 33 40.3	38 49 57.5	Diorite with quartz veinlets and hematite, from pit dump.
320	select	117 33 53.6	38 50 13.3	Altered lithic tuff from pit dump.
321	grab	117 33 25.9	38 50 15.7	Vitric tuff from pit dump.
322	grab	117 33 45.0	38 50 26.1	Argillically altered tuff from pit dump.
323	select	117 35 11.0	38 50 59.7	Metasedimentary rocks with jasperoid and Liesegang banding, from shaft dump.
324	select	117 35 11.0	38 50 35.1	Limestone with limonite and stibnite(?), from adit dump.
325	select	117 34 29.6	38 50 43.9	Silicified limestone and limonite, from adit dump.
326	select	117 34 22.1	38 50 36.4	Skarn and faulted limestone, from shaft dump.
327	select	117 34 23.2	38 50 37.8	Quartz with pyrite, galena, and sphalerite, from adit dump.
328	select	117 34 33.2	38 50 17.6	Fluorite and minor calcite in quartz breccia, from adit dump.
329	grab	117 34 33.2	38 50 17.7	Iron-stained quartz breccia with calcite and fluorite, from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
330	select	117 34 32.9	38 50 29.2	Outcrop of silicified limestone with veinlets of fluorite.
331	grab	117 34 32.9	38 50 39.1	Limonite and silicified limestone, from trench dump.
332	select	117 34 35.0	38 50 36.2	Limonite and altered limestone, from shaft dump.
333	grab	117 34 10.2	38 50 14.2	Altered, weathered lithic tuff from pit dump.
334	select	117 34 14.2	38 49 47.2	Stockpile of quartz with limonite and weathered sulfides.
335	select	117 34 17.4	38 49 41.3	Limonite and boxwork limonite with pyrite, chalcopyrite and malachite, from dump of inclined shaft.
336	select	117 34 51.6	38 49 57.6	Marble with manganese stains, from pit dump.
337	select	117 34 36.5	38 49 51.7	Massive botryoidal fluorite and sheared limestone, from adit dump.
338	grab	117 34 34.3	38 49 50.9	Sheared limestone from adit dump.
339	random chip	117 34 38.3	38 49 46.8	Limestone with cavities filled with fluorite, from adit portal.
340	select	117 34 32.9	38 49 54.4	Silicified limestone and limonitic boxwork with malachite and azurite, from shaft dump.
341	select	117 34 37.2	38 49 26.7	Limestone with iron oxides, from adit dump.
342	random chip	117 34 18.8	38 50 7.5	Altered tuff with clay, from pit wall.
343	select	117 34 16.7	38 49 49.8	Limonite, jasper, and altered limestone with iron oxides, from pit dump.
344	grab	117 34 19.6	38 49 43.7	Altered metasedimentary rock with iron oxides, from pit dump.
345	select	117 34 21.0	38 49 30.0	Silicified limestone with disseminated pyrite, quartz and limonite, from shaft dump.
346	select	117 34 32.2	38 49 21.0	Stockpile of limonite and altered limestone with abundant malachite, azurite, turquoise, cuprite, and stibnite(?).
347	grab	117 34 27.1	38 49 16.5	Altered dacite dike with iron oxides, from pit debris.
348	grab	117 34 26.4	38 49 9.0	Stockpile of boxwork limonite with quartz.
349	select	117 34 30.0	38 49 0.7	Altered limestone with iron oxides, from adit dump.
350	grab	117 35 23.6	38 50 10.6	Siliceous limestone breccia and skarn, from shaft dump.
351	grab	117 35 38.0	38 49 59.6	Silicified limestone and jasper with limonite and secondary quartz, on fractures from pit dump.
352	select	117 35 22.9	38 49 40.0	Iron-stained jasperoid and limestone breccia, from drill site debris.
353	random chip	117 35 16.4	38 49 13.4	Outcrop of massive jasperoid with limonite.
354	random chip	117 34 48.0	38 49 3.4	Outcrop of faulted, altered limestone.
355	select	117 34 33.6	38 48 56.8	Silicified limestone with malachite and azurite, from shaft dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
356	select	117 34 45.8	38 48 44.5	Iron-stained jasperoid from drill pad debris.
357	random chip	117 34 34.7	38 48 44.0	Altered vitric tuff from pit dump.
358	select	117 34 33.6	38 49 1.5	Silicified limestone with radiating stibnite crystals altered to stibiconite, from shaft dump.
359	placer	117 34 32.9	38 57 52.2	Sand and gravel in small stockpile.
360	grab	117 36 19.1	38 48 39.8	Iron-stained, sheared argillite from trench dump.
361	grab	117 36 9.0	38 48 35.6	Iron-stained quartzite from pit dump.
362	select	117 36 10.1	38 48 24.9	Argillite and jasperoid, from pit dump.
363	random chip	117 35 34.8	38 48 16.5	Outcrop of limonitic jasperoid.
364	select	117 35 36.2	38 48 18.9	Slope debris of limestone beneath jasperoid cap.
365	select	117 35 29.4	38 48 35.5	Altered shale beneath jasperoid cap, from shaft dump.
366	grab	117 36 25.6	38 48 16.9	Iron-stained interbedded limestone and shale from pit debris.
367	select	117 36 31.0	38 48 4.8	Limonite, limestone breccia, and quartz vein with iron oxides, from pit dump.
368	random chip	117 36 16.6	38 47 44.3	Outcrop of silica flooded breccia.
369	grab	117 36 8.6	38 47 25.5	Float of iron-stained chert.
370	random chip	117 36 3.6	38 47 0.5	Altered weltd tuff from slope debris.
371	random chip	117 36 12.6	38 46 26.8	Outcrop of weltd tuff and jasperoid.
372	grab	117 36 7.9	38 45 54.4	Float of altered tuff.
373	grab	117 36 15.5	38 45 34.6	Altered tuffs from trench dump.
374	select	117 35 49.9	38 43 42.1	Silicified tuff with limonite, from adit dump.
375	random chip	117 35 47.4	38 43 40.2	Quartz vein in fractured tuff with weathered pyrite, from pit.
376	grab	117 35 54.6	38 43 56.0	Float of altered tuff.
377	select	117 34 27.1	38 42 33.4	Fault gouge with weathered sulfides, from adit portal debris.
378	select	117 34 26.0	38 42 30.3	Stockpile of quartz with pyrite, chalcopyrite, galena.
379	number not used			
380	number not used			
381	grab	117 35 14.3	38 38 22.9	Altered tuff from trench dump.
382	grab	117 35 4.9	38 38 30.6	Gouge and argillically altered tuff, from pit dump.
383	grab	117 34 59.9	38 38 58.2	Altered, fractured tuff from pit dump.
384	random chip	117 34 45.1	38 39 2.6	Tuff from pit wall.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
385	random chip	117 34 51.6	38 38 59.1	Argillically altered tuff from pit wall.
386	random chip	117 34 30.0	38 38 40.5	Altered ash fall tuff weathered to clay, from pit wall.
387	random chip	117 34 38.3	38 38 27.6	Iron-stained tuff and clay, from trench wall.
388	random chip	117 32 12.8	38 39 36.4	Fault gouge and altered tuff with iron oxides, from pit wall.
389	grab	117 32 15.4	38 39 39.7	Silicified, iron-stained tuff, and clay, from shaft dump.
390	grab	117 32 8.5	38 39 12.8	Bleached tuff with drusy quartz on fractures, from shaft dump.
391	grab	117 32 7.4	38 39 7.3	Silicified tuff with weathered pyrite and drusy quartz, from pit debris.
392	grab	117 32 16.1	38 39 17.3	Silicified tuff with Liesegang banding and chloritic alteration, from trench debris.
393	grab	117 33 11.2	38 38 49.2	Welded tuff with Liesegang banding, from pit dump.
394	grab	117 33 9.4	38 38 46.4	Silicified, bleached tuff breccia from shaft dump.
395	grab	117 32 53.5	38 38 55.1	Iron-stained, siliceous tuff breccia from shaft dump.
396	grab	117 32 43.4	38 38 52.0	Quartz vein, and altered, silicified tuff with sparse pyrite, from pit dump.
397	grab	117 32 49.6	38 39 8.1	Float of silicified tuff with quartz stringers.
398	random chip	117 32 55.7	38 38 35.6	Iron-stained rhyolite tuff breccia and clay, from adit portal.
399	select	117 32 51.7	38 38 34.8	Silicified tuff with secondary quartz on fractures, from adit dump.
400	select	117 32 44.9	38 38 31.7	Silicified tuff breccia with limonite and chlorite, from shaft dump.
401	select	117 32 47.4	38 38 46.8	Silicified tuff breccia with limonite, from shaft dump.
402	grab	117 32 42.7	38 38 46.5	Outcrop of volcanic ash and banded chert.
403	select	117 32 44.9	38 38 31.6	Silicified tuff with quartz, chlorite, and limonite, from shaft dump.
404	grab	117 32 14.6	38 38 44.2	Altered quartz breccia from shaft dump.
405	grab	117 32 8.9	38 38 47.4	Altered, silicified tuff with hematite, from shaft dump.
406	grab	117 31 57.0	38 38 48.3	Fractured, silicified tuff with limonite, from adit dump.
407	grab	117 31 52.7	38 38 41.9	Silicified rhyolitic tuff from trench dump.
408	select	117 31 56.3	38 38 33.7	Faulted tuff with quartz and limonite, from pit dump.
409	grab	117 32 33.0	38 38 41.1	Silicified rhyolitic tuff with limonite after pyrite, from shaft dump.
410	grab	117 32 4.9	38 38 58.3	Silicified, iron-stained crystal tuff and tuff breccia, from pit debris.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
411	grab	117 32 28.0	38 38 57.0	Bleached, altered tuff with silica alteration, from pit dump.
412	grab	117 32 19.7	38 38 38.5	Bleached, argillically altered, silicified tuff from adit dump.
413	random chip	117 32 27.2	38 38 15.0	Argillically altered, silicified tuff with Liesegang banding and some chlorite, from pit.
414	select	117 32 33.0	38 38 8.6	Chloritized tuff with limonite, from shaft dump.
415	grab	117 31 59.2	38 38 28.6	Outcrop of bleached, silicified tuff with weathered pyrite.
416	random chip	117 32 6.4	38 38 24.5	Fractured, silicified tuff with quartz veinlets, from pit.
417	grab	117 32 1.7	38 38 15.4	Altered crystal tuff with some quartz, from pit dump.
418	select	117 32 6.7	38 37 57.9	Argillically altered, chloritized, fractured tuff, from adit dump.
419	grab	117 31 55.2	38 38 3.0	Bleached, altered tuff with some secondary quartz on fractures, from pit dump.
420	grab	117 32 52.4	38 38 22.7	Silicified tuff with Liesegang banding, from pit dump.
421	grab	117 32 59.6	38 38 19.7	Intensely argillically altered tuff with iron and manganese oxides, from trench dump.
422	grab	117 34 9.1	38 38 15.2	Silicified tuff with limonite, from pit dump.
423	random chip	117 33 58.7	38 38 11.5	Faulted, argillically altered tuff from pit.
424	random chip	117 34 5.2	38 38 10.3	Fractured, altered welded tuff with iron oxides, from trench wall.
425	random chip	117 33 24.5	38 38 2.2	Argillically altered tuff from open pit wall.
426	number not used			
427	grab	117 33 21.6	38 38 28.8	Silicified tuff breccia from shaft dump.
428	random chip	117 33 2.5	38 38 28.0	Silicified tuff breccia with clay and iron oxides, from shaft collar.
429	select	117 33 0.4	38 38 24.6	Silicified tuff breccia with iron oxides, from pit dump.
430	grab	117 33 51.1	38 38 27.8	Iron-stained rhyolitic breccia from shaft dump.
431	grab	117 31 41.2	38 37 38.6	Iron-stain rhyolite and quartz, from trench dump.
432	grab	117 31 23.9	38 37 31.1	Weathered tuff debris from dozer cut.
433	grab	117 31 11.6	38 37 48.3	Altered rhyolitic tuff with iron and manganese oxides, from trench dump.
434	grab	117 31 20.3	38 37 46.3	Argillically altered tuff with limonite, from pit dump.
435	grab	117 30 54.7	38 37 31.0	Siliceous tuff with chalcedony, from dozer cut debris.
436	grab	117 30 51.5	38 37 39.7	Quartz vein and welded tuff, from shaft dump.
437	grab	117 31 17.8	38 38 34.2	Fractured, silicified welded tuff from shaft dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
438	random chip	117 31 25.3	38 38 26.6	Altered, fractured tuff from shaft collar.
439	grab	117 31 31.4	38 38 35.2	Argillic, siliceous tuff breccia with some chlorite, from pit dump.
440	random chip	117 31 28.9	38 38 27.0	Silicified tuff with limonite, from pit.
441	grab	117 31 36.1	38 38 22.2	Altered, silicified tuff breccia with limonite, from pit dump.
442	random chip	117 31 39.4	38 38 25.0	Fractured, silicified tuff from adit portal.
443	grab	117 31 19.2	38 38 10.2	Altered, welded tuff breccia with iron oxides, from shaft dump.
444	grab	117 31 14.5	38 38 10.7	Silicified, fractured tuff with limonite, from shaft dump.
445	grab	117 31 2.6	38 38 6.8	Bleached, silicified tuff from pit dump.
446	chip	117 31 2.6	38 38 13.0	Across 3.05 m (10 ft) of altered tuff breccia with limonite, from drill site.
447	random chip	117 31 2.6	38 38 14.5	Outcrop of intensely brecciated and silicified tuff with iron oxides.
448	grab	117 32 17.9	39 3 58.3	Altered, silicified tuff breccia from pit dump.
449	grab	117 32 35.5	39 3 46.9	Altered, silicified tuff breccia from adit dump.
450	grab	117 32 36.6	39 3 52.5	Silicified tuff breccia with iron oxides and Liesegang banding, from dozer trench.
451	grab	117 32 33.4	39 3 55.4	Altered tuff breccia with iron oxides, from trench debris.
452	select	117 32 38.0	39 3 49.5	Silicified tuff breccia with veinlets of quartz and fine cinnabar, from adit dump.
453	select	117 32 36.6	39 3 35.7	Altered lapilli tuff with veinlets of chalcedony, fluorite, cinnabar, and autunite, from adit dump.
454	grab	117 32 1.7	39 3 46.2	Bleached rhyolitic tuff with secondary quartz, from pit dump.
455	grab	117 31 8.0	38 38 41.1	Tuff and chalcedony, from adit dump.
456	grab	117 31 15.6	38 38 43.2	Faulted, iron-stained rhyolite from shaft dump.
457	random chip	117 31 36.1	38 38 49.6	Altered, iron-stained tuff breccia and gouge, from adit portal.
458	grab	117 30 51.1	38 38 36.6	Silicified tuff with iron oxides and weathered pyrite, from trench dump.
459	chip	117 31 31.1	38 39 0.4	Across 0.61 m (2 ft) of fault gouge and siliceous tuff, from adit wall.
460	grab	117 31 37.6	38 39 3.1	Altered tuff breccia with quartz, from shaft dump.
461	grab	117 31 42.6	38 38 57.5	Bleached tuff with secondary quartz and limonite on fractures, from adit dump.
462	grab	117 30 52.6	38 39 0.1	Iron-stained tuff from pit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
463	grab	117 31 32.5	38 39 6.8	Iron-stained rhyolite from adit dump.
464	chip	117 30 17.3	39 4 8.8	Across 0.3 m (1 ft) of chloritized, silicified tuff from adit wall.
465	grab	117 30 18.0	39 4 13.9	Fractured, chloritized, silicified tuff from shaft dump.
466	grab	117 30 47.2	39 3 24.0	Silicified tuff breccia from adit dump.
467	grab	117 31 0.1	39 3 11.5	Silicified tuff breccia with iron oxides and quartz stringers, from adit dump.
468	grab	117 30 45.4	39 3 38.2	Silicified tuff breccia with iron oxides and chalcedony, from pit dump.
469	random chip	117 29 57.5	39 4 24.2	Fractured, silicified tuff and jasperoid, from pit.
470	grab	117 29 11.0	39 5 6.1	Iron-stained, argillically altered tuff from pit dump.
471	grab	117 29 8.9	39 5 8.4	Altered, fractured tuff with limonite, from shaft dump.
472	grab	117 29 21.1	39 5 2.5	Fault gouge with quartz stringers, from shaft dump.
473	random chip	117 29 19.0	39 5 1.4	Fault gouge with quartz stringers, in adit wall.
474	grab	117 29 25.8	39 5 0.0	Silicified tuff with quartz veinlets, from pit dump.
475	random chip	117 29 27.2	39 4 56.4	Faulted tuff and gouge with iron oxides and quartz veins, in adit wall.
476	grab	117 29 10.3	39 5 2.8	Altered, tuffaceous sandstone with Liesegang banding, from trench dump.
477	chip	117 28 57.7	39 5 15.4	Across 0.7 m (1.5 ft) of silicified, iron-stained tuff breccia from adit wall.
478	grab	117 28 56.3	39 5 16.4	Tuff breccia from pit dump.
479	chip	117 28 29.6	39 5 52.1	Across 0.38 m (1.25 ft) of gouge with quartz stringers, from adit wall.
480	grab	117 28 39.7	39 5 42.5	Fault gouge and tuff breccia with quartz stringers, from adit dump.
481	grab	117 28 34.0	39 5 48.0	Silicified, fractured tuff with chlorite and quartz veinlets, from adit dump.
482	random chip	117 34 14.5	38 56 30.0	Quartz vein with galena and malachite, from pit wall.
483	select	117 33 18.0	38 56 14.4	Greenstone with veinlets of cinnabar, from pit debris.
484	chip	117 28 13.1	39 5 26.4	Across 0.91 m (3 ft) of iron-stained tuff breccia in adit wall.
485	grab	117 27 46.1	39 5 38.9	Altered, silicified tuff with iron and manganese oxides, from pit dump.
486	grab	117 27 54.4	39 5 54.6	Andesite breccia with quartz blebs, from adit dump.
487	chip	117 28 6.2	39 5 58.5	Across 0.61 m (1 ft) of gouge and andesite breccia with quartz stringers from adit wall.
488	grab	117 27 36.7	39 5 36.7	Iron-stained tuff breccia from adit dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
489	grab	117 27 27.4	39 5 42.9	Outcrop of iron-stained tuff and tuff breccia.
490	grab	117 27 7.2	39 5 53.7	Outcrop of fractured tuff at drill site.
491	grab	117 27 18.0	39 6 10.2	Float of rhyolitic tuff with iron stains.
492	grab	117 34 40.4	39 1 48.4	Siliceous rhyolite breccia with argillic alteration, from adit dump.
493	select	117 34 41.5	39 1 49.4	Silicified rhyolite breccia with argillic alteration, from adit dump.
494	select	117 34 42.6	39 1 44.9	Argillic altered rhyolite with limonite after pyrite, from adit dump.
495	grab	117 34 48.7	39 1 45.4	Rhyolite breccia with quartz blebs, from adit dump.
496	grab	117 34 48.7	39 1 48.8	Silicified, iron-stained rhyolite from shaft dump.
497	grab	117 34 49.4	39 1 10.3	Altered rhyolite with limonite after pyrite, from pit dump.
498	grab	117 35 1.7	39 0 57.9	Quartz latite with chloritic alteration, from pit dump.
499	random chip	117 33 12.2	38 56 2.8	Shale with cinnabar on fractures, from trench wall.
500	select	117 33 14.8	38 55 2.4	Silicified tuff with iron oxides, from retort stockpile.
501	select	117 35 31.2	38 51 29.7	Stockpile of barite.
502	grab	117 20 33.7	39 15 31.5	Silicified tuff breccia with chalcedony, from pit dump.
503	grab	117 20 16.1	39 15 37.6	Altered tuff breccia with chalcedony and iron oxides, from pit dump.
504	select	117 20 39.5	39 15 22.2	Altered, fractured tuff with iron oxides and stibnite, from shaft dump.
505	grab	117 37 47.3	39 3 36.8	Iron-stained tuff breccia from trench dump.
506	grab	117 33 49.7	39 7 30.2	Fault gouge with chalcedony, from adit dump.
507	select	117 32 57.5	39 7 35.0	Quartz and limonitic boxwork with sparse pyrite and galena, from adit dump.
508	select	117 32 35.9	39 7 19.9	Andesite breccia with quartz infilling and gouge, from shaft dump.
509	select	117 32 43.8	39 7 17.1	Andesite breccia with quartz flooding, from adit dump.
510	select	117 32 52.1	39 7 6.2	Andesite breccia with quartz stringers, from adit dump.
511	select	117 32 46.0	39 6 29.7	Altered andesite with pyrite, from adit dump.
512	select	117 33 13.3	39 7 59.5	Quartz vein with weathered sulfides, ankerite, and malachite, from adit dump.
513	select	117 33 15.1	39 8 4.6	Stockpile of quartz vein and quartz breccia with weathered sulfides and malachite, from adit dump.
514	grab	117 33 41.4	39 8 9.1	Outcrop of altered tuff and tuff conglomerate.
515	select	117 33 52.9	39 7 51.4	Altered andesite with weathered sulfides, iron oxides and malachite, from shaft dump.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
516	chip	117 33 33.8	39 7 8.1	Across 0.3 m (1 ft) of fractured andesite, gouge, and quartz, in pit wall.
517	select	117 33 4.0	39 7 48.1	Stockpile of quartz with pyrite, galena, chalcopyrite, in ore bin.
518	select	117 32 55.7	39 8 0.6	Stockpile of andesite breccia and quartz with galena, and chalcopyrite, and limonite.
519	select	117 33 7.9	39 7 51.4	Quartz with weathered pyrite and galena, from adit dump.
520	grab	117 34 53.0	38 56 53.3	Metasedimentary breccia with quartz stringers and iron oxides, from pit dump.
521	select	117 32 25.1	39 7 15.7	Quartz, gouge, and faulted andesite, from pit dump.
522	random chip	117 32 28.7	39 7 50.3	Quartz, gouge and fractured andesite with pyrite, chalcopyrite, and malachite, from adit wall.
523	random chip	117 32 31.2	39 7 49.8	Fracture quartz with pyrite, galena, and chalcopyrite, from stope pillar.
524	select	117 32 35.5	39 7 58.4	Andesite with pyrite, galena, and chalcopyrite, from adit dump.
525	select	117 32 40.2	39 8 49.8	Quartz with pyrite, galena, chalcopyrite, from pit dump.
526	select	117 32 17.9	39 8 21.8	Stockpile of quartz with pyrite, galena, chalcopyrite, near old mill site.
527	grab	117 32 12.1	39 8 25.6	Altered tuff in adit dump.
528	grab	117 31 28.9	39 4 41.3	Float of altered andesite with Liesegang banding.
529	grab	117 32 12.5	39 4 47.1	Altered tuff with limonite, from pit dump.
530	grab	117 32 41.3	39 5 2.3	Amygdaloidal rhyolite and rhyolitic breccia, from hillside cut dumps.
531	select	117 32 38.8	39 5 51.9	Quartz and andesite with pyrite, galena, and limonite, from adit dump.
532	select	117 32 37.7	39 6 32.1	Quartz breccia and gouge, from shaft dump.
533	grab	117 32 4.2	39 6 2.2	Siliceous conglomerate from pit dump.
534	select	117 34 34.3	38 50 45.5	Altered limestone and scheelite, from adit dump.
535	select	117 32 30.8	39 6 6.6	Quartz vein in andesite with weathered sulfides and iron oxides, from adit dump.
536	grab	117 31 3.0	39 6 15.8	Float of altered, fractured tuff with Liesegang banding.
537	grab	117 30 22.0	39 8 6.1	Float of weathered tuff.
538	grab	117 29 32.6	38 53 38.6	Altered tuff breccia with chlorite and iron oxides, from pit debris.
539	random chip	117 35 23.3	39 3 36.1	Argillically altered basalt from trench wall.
540	random chip	117 35 8.2	39 3 9.0	Faulted basalt with limonite, from trench wall.

TABLE A-1.--Sample locations and descriptions, Shoshone Range, Nevada--Continued.

Sample number	Sample type	Location		Sample Descriptions
		Longitude	Latitude	
541	chip	117 36 24.5	38 52 56.1	Across 0.3 m (1 ft) of quartz and fractured phyllite with iron oxides and malachite, from adit wall.
542	random chip	117 35 11.4	38 49 36.4	Outcrop of jasperoid.
543	grab	117 35 21.8	38 49 34.6	Limestone breccia with sparse stibnite, from adit dump.
544	select	117 30 51.5	38 38 29.7	Iron-stained tuff with quartz veinlets.
545	select	117 30 50.5	38 37 32.5	Iron-stained, bleached tuff.
546	select	117 30 48.1	38 37 28.1	Silicified, iron-stained tuff.
547	grab	117 30 51.1	38 37 32.2	Drill cuttings of tuff.

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
1	0.4330	355.00	906.00	1875.00	1730.00	30.10	2.40	-0.25	54.20	-0.49	109.00	493.00	1.03	0.74	-0.49	NA
2	0.0020	0.42	67.00	8.38	18.20	3.19	-0.10	-0.25	0.11	-0.49	10.60	2.64	-0.99	-0.49	3.01	NA
3	-0.0005	0.03	3.63	6.04	18.70	2.79	-0.10	-0.24	0.13	-0.49	5.66	3.00	-0.98	-0.49	1.29	NA
4	-0.0005	0.10	3.80	10.10	54.60	3.99	-0.10	-0.24	-0.10	-0.48	8.74	2.31	-0.97	-0.48	1.27	NA
5	0.0010	0.03	8.73	10.10	19.20	0.31	-0.10	-0.24	-0.10	-0.47	13.30	7.10	-0.95	-0.47	1.39	NA
6	0.0010	0.03	2.45	9.56	16.60	2.05	-0.10	-0.25	0.10	-0.49	13.50	1.43	-0.98	-0.49	1.08	NA
7	0.0030	0.07	1.33	0.96	5.19	0.18	0.74	-0.24	-0.10	-0.48	19.40	1.36	-0.97	-0.48	-0.48	NA
8	0.1610	2.17	38.60	21.60	20.30	15.40	1.24	4.27	0.35	0.74	135.00	16.20	1.95	-0.48	0.92	NA
9	0.5370	5.95	202.00	47.40	-9.61	34.60	8.63	20.40	-0.96	-4.80	4639.00	30.50	26.50	-4.80	-4.80	NA
10	0.1870	63.20	37500.00	-2.40	67.40	1.65	25.90	15.30	1.62	-4.80	12.70	211.00	-9.61	-4.80	8.55	NA
11	0.2230	9.62	6655.00	2.24	58.00	3.82	21.00	2.40	0.43	-0.49	29.70	34.60	-0.98	-0.49	6.52	NA
12	0.0170	1.38	135.00	6.25	13.40	3.56	-0.10	1.43	0.21	-0.50	14.40	4.78	-0.99	-0.50	1.62	NA
13	3.8500	394.00	825.00	2254.00	405.00	88.70	3.57	2.30	12.10	-0.49	76.70	144.00	-0.97	-0.49	-0.49	NA
14	0.9800	1.30	211.00	79.30	29.90	6.67	0.73	-0.24	0.49	-0.49	430.00	16.00	-0.98	-0.49	-0.49	NA
15	0.0030	0.35	100.00	14.40	49.10	1.86	-0.10	-0.24	-0.10	-0.48	3.75	2.13	-0.95	-0.48	4.29	NA
16	0.2840	3.98	44.20	206.00	95.40	10.20	-0.10	-0.24	0.88	-0.48	70.10	29.50	-0.97	-0.48	-0.48	NA
17	0.0050	0.06	10.00	11.10	20.10	0.98	-0.10	-0.25	-0.10	-0.49	16.30	1.95	-0.98	-0.49	1.30	NA
18	0.0060	1.42	8.46	9.09	10.50	10.30	2.01	-0.24	-0.10	-0.48	77.20	3.31	-0.97	-0.48	0.82	NA
19	-0.0005	0.07	9.34	10.60	29.90	5.34	-0.10	-0.25	0.13	-0.49	8.81	1.25	-0.98	-0.49	1.77	NA
20	Nil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	Nil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0.0020	0.03	5.64	3.45	13.70	1.05	0.29	-0.24	-0.10	-0.49	11.10	10.40	-0.98	-0.49	2.06	NA
23	0.0010	0.03	6.33	7.31	33.00	2.35	-0.10	-0.24	-0.10	-0.49	42.60	14.90	-0.98	-0.49	2.22	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
24	0.1080	0.62	69.80	46.60	178.00	10.40	182.00	-2.38	-0.95	-4.76	219.00	100.00	-9.52	-4.76	-4.76	NA
25	-0.0490	0.32	32.30	18.60	10.90	1.22	717.00	-2.45	-0.98	-4.90	21.80	20.00	-9.80	-4.90	-4.90	NA
26	0.0140	1.27	14.60	25.90	110.00	0.91	0.36	-0.25	0.97	-0.49	69.40	23.50	-0.99	-0.49	4.72	NA
27	1.5600	198.00	549.00	1053.00	119.00	11.50	3.23	-0.23	7.94	-0.47	101.00	138.00	-0.94	-0.47	-0.47	NA
28	9.1900	219.00	244.00	1040.00	171.00	13.20	15.80	-0.24	2.46	-0.47	70.40	56.50	-0.94	-0.47	-0.47	NA
29	2.6200	298.00	121.00	1425.00	342.00	13.10	0.28	-0.24	11.50	-0.48	771.00	220.00	-0.96	-0.48	-0.48	NA
30	3.1000	278.00	267.00	968.00	184.00	12.50	7.09	-0.24	6.16	-0.47	79.70	86.30	-0.95	-0.47	-0.47	NA
31	0.2240	10.00	38.40	265.00	164.00	15.90	-0.10	-0.24	3.90	-0.47	117.00	7.71	-0.95	-0.47	-0.47	NA
32	1.1800	54.90	78.60	1624.00	271.00	13.90	0.13	-0.25	14.00	-0.50	1759.00	34.00	1.00	-0.50	-0.50	NA
33	0.0090	0.41	430.00	11.00	15.60	9.28	-0.10	1.12	0.37	-0.50	106.00	22.60	-0.99	0.56	-0.50	NA
34	17.8000	1801.00	1491.00	31100.00	852.00	23.10	8.43	-2.47	58.20	-4.95	2096.00	1625.00	-9.90	-4.95	-4.95	18.00 W
35	0.1050	3.42	235.00	175.00	87.10	5.89	-0.10	-0.24	0.84	-0.47	128.00	29.30	-0.95	-0.47	-0.47	NA
36	0.0140	1.39	11.60	54.10	52.40	1.01	-0.10	-0.24	0.16	-0.48	4.90	2.59	-0.95	3837.00	4.33	NA
37	10.4000	946.00	2063.00	4784.00	358.00	33.80	0.94	1.74	27.70	-0.46	813.00	839.00	0.92	-0.46	-0.46	NA
38	0.5170	68.90	324.00	555.00	27.90	13.60	13.40	-0.24	1.50	-0.49	14.60	17.40	-0.98	-0.49	-0.49	NA
39	0.0760	0.71	62.10	13.20	22.10	6.97	0.57	0.96	0.16	-0.46	192.00	5.81	-0.93	-0.46	2.18	NA
40	0.0280	0.69	10.80	5.92	5.84	14.60	0.63	-0.23	-0.09	-0.46	17.10	5.07	-0.92	-0.46	-0.46	NA
41	0.2420	0.56	13.20	8.71	11.70	9.74	6.78	-0.24	-0.10	0.86	106.00	15.60	-0.97	-0.48	1.75	NA
42	0.0260	0.14	2.63	2.51	3.45	2.92	1.70	-0.23	-0.09	0.70	44.20	5.87	-0.94	-0.47	0.49	NA
43	-0.0005	0.33	408.00	3.83	22.60	20.60	0.15	-0.24	0.11	-0.48	19.00	2.29	-0.96	-0.48	2.67	NA
44	0.6840	1.11	26.20	5.64	26.20	7.29	-0.09	-0.23	0.14	-0.46	40.20	5.94	-0.92	-0.46	1.75	NA
45	0.0130	0.78	5.06	424.00	10.70	13.50	-0.10	-0.25	-0.10	-0.49	19.80	2.58	1.49	-0.49	-0.49	NA
46	0.0310	0.49	95.50	14.70	3.90	8.99	0.22	-0.25	-0.10	-0.49	18.70	9.41	1.22	-0.49	-0.49	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
47	-0.0005	0.53	255.00	3.24	2.98	6.17	1.34	-0.23	-0.09	-0.47	8.52	35.10	-0.94	-0.47	0.86	NA
48	-0.0005	0.10	29.60	1.96	3.99	4.82	-0.10	-0.24	-0.10	-0.48	4.34	1.15	-0.97	-0.48	-0.48	39.66% BaSO <sub>4</sub>
49	5.0400	1439.00	2400.00	9140.00	1789.00	18.40	4.87	-2.31	69.00	-4.63	2805.00	1073.00	-9.25	-4.63	-4.63	NA
50	0.5400	42.90	75.40	122.00	203.00	15.10	1.60	-0.24	9.05	-0.47	135.00	32.70	-0.95	-0.47	-0.47	NA
51	0.0130	1.67	9.52	17.20	13.10	2.62	0.88	0.78	0.37	-0.47	42.70	5.51	1.68	-0.47	-0.47	NA
52	0.2660	1.29	5.87	15.50	6.22	18.60	0.60	-0.23	0.19	-0.46	26.00	2.98	-0.91	-0.46	-0.46	NA
53	0.0160	0.47	16.60	4.15	5.98	3.92	0.82	-0.24	0.11	-0.48	104.00	22.30	-0.95	-0.48	-0.48	NA
54	1.6400	848.00	758.00	2851.00	216.00	17.90	4.13	-0.23	22.20	-0.46	186.00	624.00	1.02	-0.46	-0.46	NA
55	2.7500	383.00	6272.00	7208.00	618.00	29.90	49.10	5.36	122.00	-0.48	211.00	2580.00	2.42	-0.48	-0.48	NA
56	1.6000	113.00	210.00	268.00	419.00	16.80	0.45	-0.25	9.54	-0.49	89.80	102.00	-0.98	-0.49	-0.49	-10.00 W
57	0.0550	1.71	286.00	43.50	16.00	74.90	3.54	9.14	-0.96	-4.80	1985.00	69.40	9.83	-4.80	-4.80	NA
58	0.0160	0.33	27.60	5.79	6.01	11.30	1.92	-0.24	0.16	-0.47	67.90	23.80	-0.95	-0.47	-0.47	NA
59	0.5230	0.39	4.66	1.98	1.22	12.70	0.81	-0.23	-0.09	-0.46	7.76	2.71	-0.91	-0.46	-0.46	NA
60	-0.0005	0.06	3.99	5.24	8.95	1.98	0.21	-0.24	0.36	-0.49	24.80	12.60	-0.97	-0.49	-0.49	NA
61	0.0080	0.07	21.70	8.03	78.90	10.10	2.22	-0.24	0.56	-0.48	62.40	14.30	-0.96	-0.48	1.27	NA
62	-0.0005	0.10	4.17	9.79	23.50	4.21	0.55	-0.23	-0.09	-0.46	27.20	5.47	-0.92	-0.46	0.98	NA
63	0.0010	0.07	1.80	6.99	22.00	5.08	25.20	-0.24	-0.10	-0.49	12.50	2.48	-0.97	-0.49	0.94	NA
64	Number not used															
65	Number not used															
66	0.0300	0.20	33.60	14.40	64.60	5.65	48.10	0.37	0.17	1.29	616.00	108.00	-0.95	-0.48	1.92	NA
67	0.0380	0.16	39.10	8.80	30.10	5.73	2.35	0.26	0.15	-0.46	212.00	38.90	-0.92	-0.46	0.99	-10.00
68	1.7200	777.00	577.00	2332.00	1603.00	14.80	19.40	-0.23	78.70	-0.46	158.00	386.00	-0.93	0.67	-0.46	NA
69	3.6600	982.00	1568.00	7212.00	491.00	17.90	2.50	0.49	14.00	-0.49	365.00	298.00	-0.98	-0.49	-0.49	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
70	1.3300	1473.00	1419.00	2171.00	874.00	13.20	2.57	-2.31	47.60	-4.63	93.60	1219.00	-9.25	-4.63	-4.63	NA
71	0.4000	261.00	2880.00	2214.00	801.00	22.80	6.07	-2.35	55.80	-4.71	304.00	1610.00	-9.43	-4.71	-4.71	NA
72	0.3910	224.00	189.00	1510.00	4717.00	17.30	3.08	-0.25	67.30	-0.49	120.00	105.00	1.18	-0.49	-0.49	NA
73	0.9230	292.00	226.00	4552.00	941.00	18.40	0.26	-0.24	19.90	-0.47	1539.00	196.00	1.19	-0.47	-0.47	980.00 W
74	7.0400	894.00	1186.00	3740.00	1993.00	15.00	2.95	-0.23	145.00	-0.47	811.00	980.00	1.41	0.59	-0.47	NA
75	0.3120	32.20	698.00	101.00	71.90	15.30	7.98	-0.24	4.30	-0.49	206.00	198.00	-0.98	-0.49	-0.49	NA
76	0.6690	52.80	69.50	106.00	110.00	14.70	0.90	-0.23	2.41	-0.47	100.00	99.90	-0.94	-0.47	-0.47	NA
77	1.1400	8.34	9.42	63.00	122.00	15.90	1.36	-0.24	2.74	-0.48	1532.00	13.60	-0.96	-0.48	-0.48	NA
78	0.3110	199.00	714.00	530.00	479.00	13.30	0.35	-0.24	18.30	-0.48	544.00	124.00	-0.96	-0.48	-0.48	185.00 U <sub>3</sub> O <sub>8</sub>
79	0.0210	0.58	7.67	3.93	18.30	7.65	-0.09	-0.23	0.11	-0.46	200.00	4.47	1.27	-0.46	-0.46	NA
80	1.5400	103.00	106.00	382.00	124.00	15.10	0.99	-0.24	3.86	-0.49	629.00	30.20	-0.97	-0.49	-0.49	NA
81	0.4200	58.10	121.00	936.00	2825.00	15.80	2.04	-0.24	37.60	-0.49	856.00	51.30	-0.98	-0.49	-0.49	NA
82	0.0100	0.63	164.00	5.39	6.95	13.00	5.16	-0.23	0.12	-0.46	35.40	71.00	-0.91	-0.46	-0.46	NA
83	0.9150	238.00	174.00	1807.00	649.00	16.20	2.04	-0.24	10.60	-0.47	274.00	225.00	-0.95	-0.47	-0.47	665.00 W
84	0.9330	573.00	5190.00	653.00	114.00	12.30	81.10	3.79	32.20	-0.47	356.00	3704.00	2.20	-0.47	-0.47	NA
85	3.7300	68.50	44800.00	221.00	721.00	15.50	-0.96	171.00	15.90	-4.80	279.00	5224.00	-9.61	-4.80	-4.80	NA
86	0.0900	4.15	50.30	26.70	32.60	15.10	1.26	-0.23	1.03	-0.47	68.20	37.20	-0.94	-0.47	-0.47	NA
87	3.8100	422.00	392.00	14000.00	852.00	24.00	-0.95	-2.38	16.10	-4.76	5079.00	277.00	-9.52	-4.76	-4.76	75.00 W
88	1.6000	442.00	337.00	3160.00	469.00	20.70	6.28	-0.24	17.10	-0.47	346.00	187.00	-0.95	-0.47	-0.47	NA
89	0.1460	57.20	20700.00	34.10	99.20	13.70	40.80	104.00	2.57	-4.71	18500.00	17300.00	-9.43	-4.71	-4.71	NA
90	0.1840	183.00	40900.00	38.30	310.00	23.30	94.00	222.00	19.30	-4.80	2119.00	18300.00	-9.61	-4.80	-4.80	NA
91	0.0020	0.85	168.00	15.40	55.60	1.38	0.31	1.03	0.15	-0.50	180.00	125.00	-1.00	-0.50	5.15	NA
92	0.0880	2.56	32800.00	10.70	91.70	12.00	7.33	4.19	2.43	-4.80	1068.00	538.00	-9.61	6.54	-4.80	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
93	0.0110	0.98	84100.00	2.50	34.60	6.20	1.89	2.44	3.06	6.52	65.60	31.40	-9.70	12.50	-4.85	NA
94	-0.0005	0.11	176.00	4.03	10.80	3.30	-0.10	-0.24	-0.10	-0.48	9.20	6.16	-0.96	-0.48	1.37	NA
95	0.0140	0.15	64.00	3.38	3.76	6.14	1.00	-0.23	0.14	-0.46	74.50	7.42	-0.92	-0.46	0.56	NA
96	-0.0005	0.10	33.40	8.39	58.30	6.80	-0.09	-0.23	-0.09	-0.46	7.17	7.74	-0.92	-0.46	1.73	NA
97	-0.0005	0.09	14.50	7.45	16.70	5.05	0.37	-0.24	-0.10	-0.47	5.06	5.51	-0.95	-0.47	1.53	NA
98	-0.0005	0.14	10.30	13.00	33.70	6.80	-0.10	-0.24	-0.10	-0.48	11.90	3.29	-0.97	-0.48	1.83	NA
99	-0.0005	0.05	7.42	9.36	30.30	6.89	-0.09	-0.23	-0.09	-0.47	9.36	2.64	-0.94	-0.47	1.90	NA
100	0.0020	0.07	76.70	3.55	5.77	4.95	-0.10	0.33	-0.10	-0.49	193.00	8.85	-0.97	-0.49	0.59	NA
101	0.3200	171.00	70900.00	93.20	719.00	155.00	246.00	310.00	16.20	-4.85	31800.00	18000.00	-9.70	-4.85	-4.85	NA
102	0.2620	9.29	14500.00	16.40	463.00	9.45	8.08	1.66	4.22	-0.46	989.00	3093.00	2.59	-0.46	-0.46	NA
103	-0.0005	0.18	105.00	4.50	15.80	4.81	0.25	-0.23	-0.09	-0.46	30.80	27.20	-0.93	-0.46	2.73	NA
104	0.0580	0.18	28.40	3.87	8.18	2.13	-0.10	-0.25	-0.10	-0.50	45.70	9.51	-1.00	-0.50	3.04	NA
105	0.0580	0.23	41.70	3.72	16.50	10.10	-0.10	0.34	-0.10	-0.48	257.00	6.18	3.47	-0.48	5.69	NA
106	-0.0005	0.11	22.10	17.80	64.90	3.24	-0.10	-0.24	0.19	-0.48	7.84	5.07	-0.96	-0.48	7.79	NA
107	0.1160	1.19	42.30	3.41	1.56	14.00	0.15	-0.24	-0.10	-0.48	10.60	11.40	-0.96	-0.48	-0.48	NA
108	1.8600	9.80	20.40	3.81	4.27	9.91	0.26	-0.25	-0.10	-0.49	60.10	3.86	-0.99	-0.49	1.52	NA
109	0.0010	0.09	61.70	2.32	3.21	5.24	0.16	-0.24	-0.10	-0.49	8.18	6.18	-0.98	-0.49	0.51	NA
110	0.0040	0.09	18.20	4.95	91.60	1.79	-0.09	-0.23	-0.09	-0.46	18.00	1.93	-0.92	-0.46	4.69	NA
111	-0.0005	0.17	120.00	13.00	28.00	5.38	-0.10	0.46	-0.10	-0.50	135.00	7.67	-0.99	-0.50	1.54	NA
112	Number not used															
113	-0.0005	0.08	7.89	10.40	42.90	4.72	-0.10	-0.24	0.13	-0.48	5.20	5.38	-0.95	-0.48	1.09	NA
114	0.0380	15.20	2159.00	562.00	48.00	52.00	0.66	-0.24	0.48	-0.48	148.00	102.00	1.02	-0.48	1.15	NA
115	0.0150	0.89	25.10	8.12	8.10	15.20	1.62	-0.25	-0.10	-0.50	361.00	36.30	-0.99	-0.50	4.26	-10.00 U <sub>2</sub> O <sub>6</sub>

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
116	-0.0005	0.07	7.63	9.14	17.70	2.80	-0.10	-0.25	-0.10	-0.49	4.41	2.06	-0.99	-0.49	1.82	NA
117	-0.0005	0.01	10.90	3.57	6.23	3.79	-0.09	-0.23	-0.09	-0.47	10.10	9.27	-0.94	-0.47	1.04	NA
118	0.0290	0.19	16.30	2.93	2.92	14.10	-0.09	-0.23	-0.09	-0.46	14.40	3.92	-0.92	-0.46	0.71	NA
119	0.0020	-0.01	5.52	3.11	11.30	1.93	11.10	-0.24	-0.10	-0.47	2.48	10.70	-0.95	-0.47	4.66	NA
120	0.0160	0.03	4.70	0.83	-0.97	6.99	2.74	-0.24	-0.10	-0.49	2.25	3.82	-0.97	-0.49	0.72	NA
121	0.0020	1.29	172.00	11.10	21.20	2.74	1.46	1.64	0.17	-0.48	98.60	60.60	-0.96	-0.48	1.09	NA
122	0.0010	0.04	6.95	1.57	1.78	3.15	0.95	-0.24	-0.10	-0.49	5.28	6.20	-0.98	-0.49	0.50	NA
123	0.0020	0.04	3.19	7.44	20.30	2.20	0.11	-0.24	-0.10	-0.49	9.07	2.70	-0.98	-0.49	1.41	NA
124	0.0010	0.04	4.42	6.07	6.33	4.83	1.06	-0.25	-0.10	-0.49	10.90	13.20	-0.99	-0.49	0.96	NA
125	0.0010	0.04	2.85	3.27	3.32	4.54	938.00	-0.24	-0.10	-0.48	1.90	0.59	-0.97	-0.48	0.67	NA
126	0.0010	0.06	4.58	7.46	17.70	3.08	-0.10	-0.24	-0.10	-0.48	4.00	0.91	-0.95	-0.48	1.22	NA
127	0.0020	0.15	34.60	3.89	6.50	8.76	127.00	-0.24	-0.10	-0.48	23.00	124.00	-0.96	-0.48	0.48	NA
128	0.0040	0.15	94.10	2.20	19.20	3.18	0.69	-0.24	-0.10	-0.49	20.80	16.20	-0.98	-0.49	2.55	NA
129	0.0030	0.08	110.00	2.00	45.60	0.96	35.40	-0.24	0.10	-0.48	12.80	12.10	-0.96	-0.48	3.65	NA
130	0.0020	0.11	7.91	10.40	17.10	2.38	0.55	-0.24	-0.10	-0.47	13.30	1.71	-0.95	-0.47	0.89	NA
131	0.2960	3.30	13.10	90.10	24.20	12.30	0.20	-0.23	0.17	-0.47	42.20	18.20	-0.94	-0.47	-0.47	NA
132	0.0250	0.18	33.50	5.73	51.50	1.58	8.10	-0.24	-0.10	-0.47	70.10	14.80	-0.95	-0.47	2.68	NA
133	0.0020	0.06	1.53	11.20	9.33	1.65	0.72	-0.24	-0.10	-0.48	10.70	17.10	-0.96	-0.48	0.87	NA
134	0.0010	0.04	1.27	8.10	11.40	1.74	0.40	-0.24	-0.10	-0.47	7.47	20.10	-0.94	-0.47	0.95	NA
135	0.0020	0.10	55.60	16.30	38.90	2.07	30.30	0.46	0.25	-0.49	40.30	19.50	-0.97	-0.49	2.28	NA
136	-0.0005	0.04	11.80	1.72	8.66	1.09	128.00	-0.23	-0.09	-0.47	8.57	3.09	-0.94	-0.47	-0.47	NA
137	0.0010	0.05	1.89	6.19	30.30	2.22	0.90	-0.25	-0.10	-0.50	8.15	3.86	-1.00	-0.50	1.09	NA
138	0.0030	0.05	16.20	10.60	46.20	4.92	16.80	-0.25	0.10	-0.49	179.00	24.60	-0.98	-0.49	5.34	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
139	-0.0005	0.09	19.10	7.55	39.10	0.65	0.24	-0.23	0.75	-0.47	33.70	3.31	-0.94	-0.47	-0.47	NA
140	0.0010	0.13	2.28	5.28	2.18	4.02	16.70	-0.24	-0.10	-0.49	13.00	1.17	-0.97	-0.49	0.57	NA
141	0.0010	0.19	80.10	10.00	10.00	10.80	-0.10	-0.24	0.11	-0.49	305.00	5.20	-0.97	-0.49	0.94	NA
142	0.0030	0.21	62.70	3.48	18.40	10.90	0.29	-0.24	-0.10	-0.49	162.00	3.06	-0.97	-0.49	3.97	NA
143	0.0850	1.71	298.00	12.60	24.80	10.00	0.10	-0.23	0.33	-0.46	585.00	12.60	-0.93	-0.46	1.47	NA
144	0.0070	0.11	18.60	9.15	43.60	1.56	0.11	-0.24	-0.10	-0.48	48.10	0.92	-0.97	-0.48	8.28	NA
145	0.0570	49.90	48800.00	194.00	338.00	15.50	6.55	-2.33	3.62	-4.67	647.00	76.10	-9.34	-4.67	-4.67	NA
146	0.0400	0.30	188.00	10.70	41.20	1.74	-0.10	-0.24	0.19	-0.48	8.31	0.57	-0.96	-0.48	6.52	NA
147	12.7000	56.70	98000.00	6.18	37.70	10.70	1558.00	81.20	3.89	7.02	158.00	3618.00	-9.34	17.40	-4.67	NA
148	2.6800	27.90	1572.00	7.89	101.00	22.70	2.24	0.45	0.61	-0.49	620.00	42.80	-0.98	-0.49	0.61	NA
149	11.1000	1339.00	31200.00	47.90	221.00	72.90	127.00	180.00	6.20	-4.95	1677.00	9520.00	-9.90	8.61	-4.95	NA
150	2.0300	89.10	147000.00	-2.42	56.90	11.50	11.40	25.10	4.94	7.81	21.60	252.00	-9.70	21.10	-4.85	NA
151	0.2500	35.80	41200.00	5.40	47.40	2.36	-0.94	-2.35	1.71	-4.71	21.80	43.40	-9.43	5.37	-4.71	NA
152	0.0020	0.29	187.00	15.70	17.40	12.90	907.00	0.25	-0.10	-0.50	79.10	36.10	1.21	-0.50	3.60	NA
153	0.0030	0.45	82.80	5.20	2.85	4.82	4.06	-0.24	-0.09	-0.47	7.67	5.80	-0.94	-0.47	1.04	NA
154	-0.0005	0.17	45.00	7.57	5.78	2.36	0.90	-0.24	-0.10	-0.48	3.61	2.13	-0.97	-0.48	0.85	NA
155	0.0050	0.42	64.70	6.63	17.30	2.52	18.20	-0.24	-0.10	-0.48	6.97	7.93	-0.96	-0.48	1.07	NA
156	0.0010	0.17	32.40	18.40	3.20	2.98	20.30	0.44	-0.10	-0.48	6.70	2.94	-0.97	-0.48	0.91	NA
157	-0.0005	0.14	15.20	15.00	5.85	4.61	207.00	0.38	-0.10	-0.48	6.38	4.10	-0.96	-0.48	1.00	NA
158	0.0030	0.07	9.77	6.26	7.10	1.90	0.10	-0.23	-0.09	-0.47	3.44	1.23	-0.94	-0.47	0.87	NA
159	1.2300	1.63	148.00	77.60	193.00	9.47	-0.09	-0.23	2.22	-0.47	1281.00	44.60	3.18	-0.47	2.33	NA
160	0.0070	0.20	99.20	19.40	227.00	6.77	-0.09	-0.23	0.35	-0.47	160.00	11.80	-0.94	-0.47	5.57	NA
161	0.2200	0.55	84.70	107.00	185.00	18.90	0.10	2.68	1.98	-0.47	169.00	3.72	-0.95	-0.47	1.31	10.00 W

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
162	0.2500	1.12	424.00	314.00	388.00	9.19	-0.09	5.00	1.83	-0.47	668.00	8.14	-0.94	-0.47	4.77	20.00 W
163	2.5500	0.62	372.00	25.70	55.90	15.80	-0.10	9.72	0.68	-0.49	88.30	10.10	-0.98	1.00	9.74	NA
164	0.0680	1.07	208.00	580.00	337.00	3.51	1.53	44.00	-0.96	-4.80	899.00	40.20	10.20	11.60	-4.80	NA
165	0.1620	160.00	7363.00	16.00	738.00	4.17	-0.09	0.97	25.30	-0.46	242.00	21.00	-0.91	-0.46	5.82	NA
166	4.1900	6.82	53.70	1060.00	99.40	13.60	-0.09	0.54	2.49	-0.47	369.00	10.80	-0.93	-0.47	-0.47	NA
167	0.2480	14.30	115.00	2323.00	3920.00	8.16	-0.93	4.48	64.50	-4.63	12100.00	177.00	-9.25	5.90	-4.63	NA
168	0.0320	20.20	15400.00	31.20	233.00	3.32	-0.10	-0.24	1.89	-0.47	224.00	32.00	2.30	-0.47	2.81	NA
169	0.0150	0.58	66.30	15.20	19.80	8.12	-0.10	-0.24	0.27	-0.48	72.70	4.57	-0.97	-0.48	-0.48	NA
170	0.0120	0.40	20.40	4.02	11.50	6.22	-0.09	-0.23	0.10	-0.47	107.00	3.45	-0.94	-0.47	-0.47	NA
171	0.0010	0.09	65.60	2.77	2.37	14.50	-0.10	-0.25	-0.10	-0.49	9.68	1.67	-0.99	-0.49	-0.49	NA
172	0.0010	1.05	809.00	5.98	59.70	2.89	-0.09	-0.23	0.24	-0.47	19.60	9.61	-0.94	-0.47	4.05	NA
173	0.0010	0.06	12.00	10.90	43.80	0.69	-0.10	-0.24	0.36	-0.48	21.40	1.79	-0.95	-0.48	1.08	NA
174	-0.0005	0.04	6.69	2.07	57.50	1.51	-0.09	-0.23	-0.09	-0.47	3.72	0.77	-0.94	-0.47	4.28	NA
175	13.9000	186.00	642.00	37200.00	18200.00	15.60	19.50	-2.31	91.10	-4.63	6331.00	215.00	-9.25	-4.63	4.70	615.00 W
176	0.9080	2.71	32.70	166.00	109.00	13.30	0.22	-0.25	0.74	-0.49	277.00	9.92	-0.98	-0.49	2.25	2750.00 W
177	0.0860	11.10	512.00	787.00	619.00	18.10	0.13	0.96	4.06	-0.48	320.00	21.00	-0.96	0.49	4.07	NA
178	0.2530	76.60	37900.00	-2.42	42.40	3.37	-0.97	-2.42	2.11	-4.85	12.20	17.30	-9.70	7.12	-4.85	NA
179	0.0290	0.41	153.00	20.70	74.00	12.50	-0.10	3.64	0.62	-0.48	73.70	2.78	-0.96	1.57	1.55	NA
180	0.0050	0.25	85.90	20.80	37.90	5.35	-0.09	0.51	0.12	-0.46	52.80	6.47	-0.91	-0.46	8.02	NA
181	23.4000	5.85	26.80	14.30	5.28	16.00	-0.10	-0.24	-0.10	-0.47	113.00	3.88	-0.95	-0.47	-0.47	NA
182	0.0290	0.10	13.50	24.70	26.10	5.23	-0.10	-0.24	0.14	-0.48	13.30	2.13	-0.96	-0.48	2.38	NA
183	-0.0490	1.52	2878.00	6.46	-9.80	4.90	-0.98	-2.45	-0.98	-4.90	-9.80	-2.45	-9.80	-4.90	-4.90	NA
184	0.0030	0.36	166.00	19.70	359.00	16.70	0.17	-0.24	5.93	-0.47	202.00	12.00	2.84	0.54	1.24	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
185	0.0020	0.94	74.70	6.01	13.40	15.60	-0.10	-0.25	0.11	-0.49	53.90	10.30	-0.98	-0.49	-0.49	NA
186	0.0020	0.14	63.50	5.94	63.70	9.30	-0.10	-0.24	-0.10	-0.47	15.90	0.95	-0.95	-0.47	3.02	NA
187	1.1200	7.19	463.00	2.54	20.10	15.20	-0.09	-0.23	0.18	-0.47	8.47	21.40	-0.94	-0.47	-0.47	NA
188	0.0180	2.21	42.60	16.10	26.80	28.40	2.66	-0.24	0.33	-0.48	955.00	88.30	1.62	-0.48	7.29	NA
189	1.7000	121.00	309.00	26100.00	3768.00	22.40	3.08	3.94	60.30	-4.80	10200.00	385.00	-9.61	-4.80	-4.80	NA
190	0.0050	0.24	3.44	60.60	14.80	5.05	0.25	-0.23	0.17	-0.47	29.50	1.66	-0.94	-0.47	2.07	NA
191	0.0120	0.24	7.42	47.00	8.89	6.08	431.00	0.25	-0.10	-0.49	28.10	1.29	-0.97	-0.49	3.38	NA
192	0.0010	0.05	3.44	15.30	15.90	3.60	3.92	-0.23	-0.09	-0.47	6.48	0.82	-0.93	-0.47	1.27	NA
193	0.0010	0.06	2.46	11.60	4.30	4.83	8.51	-0.24	-0.10	-0.47	10.90	0.88	-0.94	-0.47	1.39	NA
194	-0.0005	0.03	3.06	6.93	26.90	1.98	-0.10	-0.24	-0.10	-0.48	2.51	0.49	-0.96	-0.48	1.33	NA
195	0.0010	0.04	5.98	25.30	15.20	4.74	-0.10	-0.24	0.15	-0.48	8.85	1.25	-0.97	-0.48	2.47	NA
196	0.0020	0.21	95.10	124.00	734.00	3.94	9.25	1.43	3.21	-0.48	2487.00	120.00	-0.95	-0.48	0.77	NA
197	0.0010	0.07	4.68	15.90	9.01	5.92	-0.09	-0.23	0.13	-0.46	19.20	2.24	-0.93	-0.46	1.27	NA
198	0.0050	0.33	41.80	12.30	8.52	14.00	-0.10	-0.24	0.15	-0.48	90.60	15.30	-0.95	-0.48	0.62	NA
199	-0.0005	0.11	6.99	11.60	25.60	4.86	-0.10	-0.25	0.13	-0.50	13.90	3.00	-0.99	-0.50	1.77	NA
200	6.3500	164.00	2807.00	31.30	100.00	13.10	2.34	0.80	5.84	-0.47	49.60	830.00	-0.93	-0.47	-0.47	NA
201	0.2130	1.04	14.40	5.66	22.10	28.20	0.41	-0.24	-0.10	-0.48	457.00	28.00	-0.96	-0.48	0.79	-10.00 W
202	0.0040	0.39	21.30	5.69	20.40	13.30	-0.10	-0.24	-0.10	-0.49	19.20	2.71	-0.98	-0.49	1.00	NA
203	0.0440	41.40	18800.00	8.24	54.20	1.83	2.84	-0.23	1.54	-0.47	16.60	92.20	1.03	0.90	4.67	NA
204	-0.0005	0.19	54.90	6.82	70.00	8.72	-0.10	-0.24	-0.10	-0.47	14.30	1.98	-0.94	-0.47	3.88	NA
205	0.7720	0.28	23.70	2.16	24.10	9.50	-0.09	-0.23	-0.09	-0.47	35.20	4.03	-0.93	-0.47	2.30	NA
206	0.0080	0.61	153.00	8.91	423.00	8.26	-0.09	-0.23	0.31	-0.47	84.60	40.50	-0.93	-0.47	3.91	NA
207	0.0190	7.64	7766.00	12.10	30.90	9.35	-0.09	35.00	1.31	-0.47	214.00	-0.23	2.96	16.90	2.17	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
208	0.0010	0.04	34.70	4.20	20.40	2.76	-0.09	-0.23	-0.09	-0.46	6.12	0.76	-0.92	-0.46	1.87	NA
209	0.0010	0.04	37.40	4.83	16.40	3.30	4.51	-0.23	-0.09	-0.47	37.10	5.71	-0.93	-0.47	1.17	NA
210	0.4900	6.82	21.10	4.71	74.00	7.28	1.73	-0.23	0.49	-0.47	832.00	41.50	-0.93	-0.47	0.55	NA
211	0.0070	0.85	14.40	5.30	45.50	4.38	1.38	-0.24	0.11	-0.48	17.10	7.95	-0.95	-0.48	-0.48	NA
212	1.0500	67.80	643.00	1.94	51.30	14.20	2.93	-0.24	1.42	-0.48	34.60	92.70	-0.96	-0.48	0.79	NA
213	124.0000	1561.00	14200.00	1593.00	2414.00	14.90	154.00	3.95	56.00	-4.85	379.00	7957.00	-9.70	-4.85	-4.85	NA
214	0.0090	1.79	20.50	13.70	30.60	3.46	0.18	-0.23	0.12	0.47	3.23	9.71	-0.94	-0.47	1.24	NA
215	0.0420	2.59	26.60	9.51	19.90	4.79	0.28	-0.25	0.16	-0.49	2.59	13.60	-0.99	-0.49	1.24	NA
216	0.0450	1.16	23.70	8.01	7.95	40.60	0.59	-0.24	-0.10	0.75	124.00	24.50	2.49	-0.49	1.24	NA
217	0.0040	0.10	49.60	16.40	50.80	1.16	-0.10	-0.24	-0.10	-0.48	46.80	1.65	-0.97	-0.48	13.40	NA
218	0.0010	0.39	16.60	18.80	86.30	6.90	-0.10	-0.25	1.40	-0.50	28.70	2.74	-1.00	-0.50	1.72	NA
219	0.2310	0.53	6.91	1.60	2.11	15.60	-0.09	-0.23	-0.09	-0.47	10.40	2.32	-0.94	-0.47	-0.47	NA
220	-0.0005	0.38	47.80	2.84	8.43	9.66	-0.10	-0.24	-0.10	-0.48	4.92	4.15	-0.96	-0.48	1.79	NA
221	11.0000	11.00	61.70	268.00	93.70	14.70	-0.09	-0.23	1.47	-0.46	230.00	8.16	-0.93	-0.46	-0.46	NA
222	20.4000	552.00	1349.00	5566.00	1042.00	19.40	1.01	3.90	16.60	-4.58	42.10	423.00	-9.17	-4.58	-4.58	NA
223	6.4500	98.00	401.00	1807.00	1116.00	14.80	-0.10	-0.24	16.90	-0.48	308.00	135.00	-0.95	1.25	-0.48	NA
224	0.3250	1.02	10.10	22.60	31.90	1.87	-0.10	-0.24	0.20	-0.48	95.80	2.97	-0.96	-0.48	0.64	NA
225	0.1440	0.58	27.20	26.10	20.00	15.40	-0.10	-0.24	0.14	-0.48	16.10	2.61	-0.95	-0.48	0.70	NA
226	0.3450	0.85	10.40	5.89	4.43	14.30	-0.09	-0.23	-0.09	-0.46	67.60	3.08	-0.93	-0.46	-0.46	NA
227	0.4840	70.00	164.00	5.26	18.00	21.20	-0.10	0.93	0.15	-0.48	174.00	246.00	1.05	-0.48	0.91	NA
228	0.2710	34.90	922.00	3.60	54.00	26.70	0.26	0.49	0.80	-0.47	125.00	592.00	1.56	-0.47	-0.47	NA
229	0.1000	35.10	423.00	7.54	16.10	17.00	-0.10	-0.25	0.72	-0.50	28.00	70.50	-1.00	-0.50	-0.50	NA
230	0.0650	0.64	22.50	3.06	9.92	15.00	-0.09	-0.23	-0.09	-0.46	13.00	4.33	-0.92	-0.46	-0.46	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
231	5.8200	2.96	35.30	2.06	6.10	13.00	0.15	-0.24	-0.10	-0.48	53.80	2.61	-0.96	-0.48	0.56	NA
232	0.1270	0.09	14.20	1.46	7.78	11.80	-0.10	-0.24	-0.10	-0.49	18.10	2.65	-0.98	-0.49	-0.49	NA
233	0.2110	5.74	3095.00	4.58	173.00	19.40	0.45	3.67	0.79	-0.46	35.60	138.00	-0.91	0.81	2.55	NA
234	0.0020	0.05	14.60	4.30	56.40	3.23	0.25	-0.25	-0.10	-0.50	6.39	2.85	-1.00	-0.50	4.70	NA
235	2.2600	27.10	344.00	16.60	10.90	15.70	0.36	0.96	0.22	-0.47	441.00	43.00	1.10	0.52	0.96	NA
236	0.1110	26.10	39400.00	32.00	476.00	121.00	11.00	8.16	6.90	-4.71	195.00	4349.00	-9.43	-4.71	-4.71	NA
237	0.0110	0.22	50.40	2.92	3.88	8.21	0.63	0.34	-0.09	-0.47	23.50	21.20	-0.93	-0.47	1.63	64.00% CaF <sub>2</sub>
238	0.0060	0.25	94.60	6.46	24.00	10.40	0.36	-0.24	0.12	-0.49	27.60	23.30	-0.98	-0.49	6.28	NA
239	0.0090	0.21	7.45	2.10	4.02	8.18	-0.09	-0.23	-0.09	-0.47	13.60	3.52	-0.93	-0.47	1.13	70.50% CaF <sub>2</sub>
240	0.0120	0.13	7.66	8.23	3.93	56.10	0.11	0.85	-0.09	-0.47	47.90	5.25	-0.94	-0.47	1.77	60.50% CaF <sub>2</sub>
241	0.0360	1.62	68.80	847.00	194.00	14.10	0.20	-0.23	0.54	-0.46	74.10	11.50	-0.92	-0.46	0.80	NA
242	0.0160	0.50	24.20	4.98	3.95	14.40	0.22	-0.24	-0.10	-0.49	129.00	9.04	-0.97	-0.49	0.92	NA
243	0.0050	0.39	7.07	4.03	31.90	2.13	0.18	-0.23	-0.09	-0.47	33.30	3.06	-0.94	-0.47	7.76	46.00% CaF <sub>2</sub>
244	0.7750	140.00	11800.00	3.03	280.00	13.80	4.29	3.84	9.17	-0.48	138.00	3932.00	-0.96	2.07	0.61	NA
245	-0.0005	0.07	8.69	3.89	25.90	1.22	-0.09	-0.23	0.16	-0.47	8.95	27.90	-0.93	-0.47	-0.47	NA
246	0.0120	0.19	12.50	0.78	2.34	1.82	0.23	0.34	-0.10	-0.50	36.90	8.39	-0.99	-0.50	0.78	88.00% CaF <sub>2</sub>
247	0.0770	0.65	25.20	5.33	13.40	15.30	1.49	-0.23	0.10	-0.46	264.00	16.50	-0.92	-0.46	5.97	8.65% CaF <sub>2</sub>
248	0.0090	0.23	16.70	6.53	39.80	46.20	0.46	0.74	0.66	-0.47	262.00	23.40	1.02	-0.47	4.47	55.50% CaF <sub>2</sub>
249	-0.0005	0.10	5.59	16.60	61.70	6.57	1.75	-0.24	0.56	4.50	958.00	24.90	-0.95	-0.48	4.84	-10.00 W
250	0.1800	0.08	73.70	10.00	62.00	7.22	0.53	-0.24	-0.10	-0.48	51.80	4.32	-0.97	-0.48	3.35	NA
251	6.7400	24.00	802.00	70.30	89.90	10.80	2.92	0.86	1.58	-0.49	31.80	53.80	-0.98	-0.49	-0.49	NA
252	0.0050	9.45	11500.00	6.25	131.00	1.40	51.00	-0.24	0.69	-0.48	28.20	368.00	-0.96	1.73	6.21	NA
253	0.0140	0.20	34.00	3.29	5.44	19.90	0.24	0.26	-0.09	-0.47	200.00	9.65	-0.94	-0.47	2.34	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
254	0.0100	15.80	18300.00	7.93	46.80	1.53	16.90	-0.24	1.22	-0.48	13.60	11.90	1.05	0.71	6.30	NA
255	0.0810	0.46	187.00	4.76	8.99	16.70	0.56	-0.24	-0.10	-0.48	25.60	8.49	-0.96	-0.48	-0.48	NA
256	1.7200	55.40	2797.00	5.62	66.10	15.10	2.16	-0.24	1.77	-0.49	36.50	252.00	-0.98	-0.49	-0.49	10.00 W
257	5.8200	23.60	790.00	3780.00	376.00	13.60	0.51	1.60	6.18	-0.47	13.10	34.40	1.75	-0.47	-0.47	NA
258	0.0210	2.61	175.00	47.00	102.00	7.27	0.42	-0.24	0.94	-0.48	152.00	26.40	-0.95	-0.48	2.48	NA
259	0.5310	466.00	21100.00	1839.00	144.00	6.86	125.00	0.95	13.60	-0.48	245.00	1828.00	1.96	2.45	2.04	NA
260	1.0400	132.00	3277.00	458.00	55.90	28.60	0.49	-0.24	4.29	-0.47	63.80	227.00	1.04	-0.47	0.72	NA
261	-0.0490	988.00	983.00	31500.00	28100.00	20.10	1.88	3061.00	528.00	-4.67	40.00	27.90	49.90	175.00	9.90	2350.00 W
262	-0.0490	1636.00	1095.00	54200.00	45400.00	34.30	2.27	5121.00	833.00	-4.85	76.10	36.10	107.00	268.00	7.93	4500.00 W
263	0.0030	302.00	1345.00	19700.00	3191.00	35.00	2.88	624.00	53.20	-4.63	3305.00	166.00	17.00	45.10	-4.63	580.00 W
264	0.0030	476.00	531.00	11100.00	6963.00	24.00	-0.93	1611.00	51.40	-4.63	34.10	6.74	22.70	118.00	5.99	NA
265	-0.0490	10.10	76400.00	82.30	30.40	7.59	1.22	6.18	3.17	4.93	24.10	53.80	-9.80	11.50	-4.90	NA
266	2.3200	5.80	563.00	40.90	47.30	15.00	0.81	3.30	0.80	-0.48	23.70	37.90	1.37	-0.48	-0.48	NA
267	6.2700	406.00	9032.00	26.70	725.00	14.70	16.80	4.78	15.50	-0.47	157.00	4193.00	2.47	-0.47	-0.47	NA
268	0.4590	0.52	18.50	11.20	9.41	11.40	-0.09	0.79	0.13	-0.46	11.50	46.60	-0.92	-0.46	-0.46	NA
269	0.0020	1.68	43.20	8.89	35.10	6.73	0.16	0.62	0.18	-0.48	95.20	7.29	-0.96	-0.48	0.64	NA
270	2.0100	22.40	2330.00	695.00	50.00	11.90	1.77	3.61	1.72	-0.49	122.00	199.00	-0.99	-0.49	-0.49	NA
271	0.0210	0.46	19.70	115.00	111.00	29.40	1.14	0.45	1.03	0.62	209.00	19.60	1.62	-0.48	6.56	NA
272	0.0700	17.90	4996.00	8.85	32.10	22.10	3.03	1.33	0.47	-0.47	14.50	50.70	-0.95	-0.47	-0.47	NA
273	0.0220	0.29	0.42	7.50	4.96	17.80	-0.09	0.44	0.10	-0.47	4.82	2.52	-0.94	-0.47	-0.47	NA
274	0.0230	0.25	33.60	13.60	11.90	41.10	2.71	-0.23	0.30	0.47	543.00	62.90	2.02	-0.47	2.25	NA
275	1.9500	200.00	4040.00	11.80	70.60	17.00	5.09	0.38	4.18	-0.46	53.20	273.00	-0.91	-0.46	-0.46	NA
276	4.9600	485.00	2571.00	48.20	188.00	14.00	2.71	1.39	9.45	-0.47	34.20	510.00	-0.94	-0.47	-0.47	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
277	2.9000	125.00	42800.00	22.80	217.00	16.60	38.50	-2.35	12.00	-4.71	1167.00	8893.00	-9.43	-4.71	-4.71	NA
278	0.0840	26.10	6518.00	20.50	31.70	13.90	0.92	-0.24	5.11	-0.47	114.00	221.00	-0.94	-0.47	2.03	NA
279	0.0870	52.90	20600.00	16.60	128.00	5.34	13.10	0.63	11.30	-0.47	209.00	1878.00	1.89	1.77	1.06	NA
280	8.9200	383.00	9261.00	102.00	114.00	13.70	1.43	11.40	5.28	-0.48	234.00	189.00	-0.96	-0.48	-0.48	NA
281	0.0060	0.10	82.10	53.10	33.40	11.60	0.14	1.07	1.10	-0.50	253.00	23.40	-0.99	-0.50	-0.50	NA
282	0.5250	1.20	39.30	7.80	7.57	14.80	-0.10	-0.24	0.11	-0.48	47.90	5.79	-0.95	-0.48	-0.48	NA
283	0.0010	0.30	22.30	4.91	5.19	4.54	0.33	0.34	-0.10	-0.50	93.80	9.06	-0.99	-0.50	0.84	NA
284	0.0390	0.44	35.30	8.85	46.90	7.48	0.49	-0.23	-0.09	-0.47	144.00	10.20	-0.94	-0.47	3.46	NA
285	0.0410	0.47	44.50	125.00	62.90	15.50	-0.10	-0.24	0.17	-0.48	54.30	21.20	-0.97	-0.48	0.84	NA
286	-0.0005	156.00	553.00	2223.00	155.00	39.10	10.00	930.00	9.53	-0.49	198.00	836.00	7.60	3.93	-0.49	NA
287	-0.0005	0.34	134.00	1.58	28.30	12.80	0.23	-0.24	-0.10	-0.48	1371.00	91.10	-0.97	-0.48	2.51	NA
288	-0.0005	0.57	82.80	6.13	28.30	3.61	0.22	1.77	-0.09	-0.46	97.90	4.70	-0.92	-0.46	3.86	NA
289	1.0700	222.00	564.00	4259.00	301.00	57.60	1.89	1604.00	2.34	4.47	574.00	68.00	10.20	72.10	6.93	NA
290	-0.0005	182.00	44.50	7426.00	8481.00	10.20	0.45	483.00	165.00	-0.48	135.00	113.00	8.31	17.10	-0.48	NA
291	0.1160	34.10	543.00	7517.00	5691.00	16.40	2.30	38.50	98.40	-4.58	85.60	29.60	-9.17	8.28	-4.58	NA
292	0.0110	48.60	35100.00	106.00	86.50	42.10	18.30	-2.45	25.70	-4.90	412.00	996.00	-9.80	-4.90	-4.90	NA
293	0.0040	46.50	4069.00	904.00	892.00	32.20	-0.10	93.50	24.30	-0.48	82.70	83.40	1.10	4.86	5.44	NA
294	0.0720	0.70	35.70	89.00	44.10	3.24	0.23	2.44	0.26	-0.47	248.00	34.80	-0.94	-0.47	2.98	NA
295	0.1520	2.35	66.50	21.60	379.00	37.50	16.50	-0.25	2.68	5.75	6118.00	2076.00	11.50	-0.50	3.91	NA
296	-0.0005	0.14	9.17	3.32	31.20	1.75	-0.10	-0.24	1.92	-0.49	14.90	2.47	1.06	-0.49	-0.49	NA
297	0.0160	2.94	485.00	26.30	73.30	109.00	1.21	34.00	0.25	-0.48	195.00	35.50	3.89	5.45	6.31	NA
298	0.0080	37.20	326.00	914.00	15.20	66.10	1.48	144.00	0.24	-0.46	403.00	26.50	3.86	5.89	27.30	NA
299	0.0040	0.27	49.30	17.80	53.40	8.47	3.42	0.40	0.43	-0.49	186.00	22.90	-0.98	-0.49	1.10	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
300	0.2420	9.83	35700.00	17.70	45.90	59.50	21.60	14.60	1.83	-4.76	263.00	669.00	-9.52	7.49	-4.76	NA
301	0.0010	0.07	-0.05	12.30	8.87	3.07	42.00	-0.24	-0.10	-0.48	152.00	10.10	-0.97	-0.48	1.96	NA
302	0.0010	0.03	11.70	5.97	22.10	7.78	0.55	0.29	-0.09	-0.46	29.80	1.08	-0.92	-0.46	1.21	NA
303	0.0040	0.03	17.90	1.11	36.10	1.50	-0.10	-0.24	-0.10	-0.48	3.64	-0.24	-0.95	-0.48	3.95	NA
304	1.6300	42.80	44600.00	12.50	32.30	7.54	-0.97	305.00	2.75	-4.85	87.60	16.10	-9.70	-4.85	6.56	NA
305	0.2300	0.28	109.00	9.33	20.80	8.51	1.99	0.58	-0.09	-0.46	672.00	7.86	0.96	-0.46	0.98	NA
306	0.0010	0.09	49.60	14.00	13.80	3.03	14.50	0.29	-0.09	-0.47	38.20	4.95	-0.93	-0.47	0.60	NA
307	0.0690	0.32	106.00	32.10	179.00	55.70	1.82	-0.23	0.35	2.35	4425.00	350.00	1.31	-0.46	-0.46	NA
308	0.1840	0.44	1043.00	145.00	539.00	52.70	1.76	-2.40	1.67	-4.80	12400.00	5665.00	-9.61	-4.80	-4.80	NA
309	0.0690	35.80	49200.00	14.90	167.00	22.00	39.10	66.00	3.75	-4.95	3139.00	2628.00	-9.90	-4.95	-4.95	NA
310	0.0910	116.00	77100.00	12.40	395.00	1.39	68.60	27.50	10.10	-4.71	3439.00	4503.00	-9.43	-4.71	-4.71	NA
311	0.0010	0.23	157.00	5.32	20.20	4.14	0.41	-0.25	0.11	-0.49	87.10	18.30	-0.99	-0.49	0.60	NA
312	0.0010	0.13	35.90	4.92	28.40	3.60	-0.09	-0.23	-0.09	-0.46	11.10	4.08	-0.92	-0.46	1.22	NA
313	0.0020	0.15	86.90	10.60	30.20	6.65	0.15	-0.23	0.15	-0.46	19.20	5.54	-0.92	-0.46	1.33	NA
314	0.0020	0.06	8.91	14.80	31.90	4.43	0.95	-0.23	0.18	-0.47	16.40	1.89	-0.94	-0.47	1.07	12.00 W
315	0.0010	0.04	13.70	16.80	40.50	4.20	0.64	-0.24	0.20	-0.48	12.40	4.42	-0.95	-0.48	1.92	-10.00 W
316	0.0020	0.11	23.50	9.87	54.80	30.90	4.85	-0.24	0.31	-0.48	514.00	30.40	-0.96	-0.48	1.57	NA
317	-0.0005	0.05	11.60	8.96	30.20	5.59	-0.09	-0.23	0.11	-0.47	2.57	0.90	-0.94	-0.47	1.26	NA
318	0.0010	-0.01	7.28	1.07	12.90	2.75	0.10	-0.23	-0.09	-0.46	8.30	1.43	-0.93	-0.46	5.21	NA
319	0.0050	-0.14	-0.48	5.59	13.70	4.12	-0.95	-2.38	-0.95	-4.76	34.20	11.70	-9.52	-4.76	32.70	NA
320	0.0010	0.09	6.27	20.00	44.80	1.64	0.12	0.41	-0.09	-0.46	50.50	1.47	-0.93	-0.46	3.51	NA
321	0.0010	0.05	4.10	16.40	32.10	4.02	0.24	0.72	0.17	-0.48	8.98	1.88	-0.96	-0.48	0.78	NA
322	0.0040	0.11	11.20	21.30	57.50	31.70	1.66	0.76	0.13	-0.47	248.00	5.76	-0.93	-0.47	3.57	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
323	0.0330	0.88	62.70	5.82	6.68	12.20	0.74	-0.23	0.13	-0.47	641.00	44.60	1.18	-0.47	0.49	NA
324	0.0020	-0.01	8.57	460.00	153.00	1.20	-0.09	-0.23	0.51	-0.46	378.00	4500.00	1.09	-0.46	2.90	NA
325	0.0030	5.21	877.00	53.90	5592.00	75.60	1.68	3.29	6.27	-4.85	1855.00	38.20	-9.70	-4.85	-4.85	NA
326	0.0220	3.44	190.00	84.90	157.00	18.30	0.56	7.63	1.68	-0.46	1473.00	88.20	1.95	-0.46	1.85	NA
327	0.0160	97.30	509.00	2169.00	5775.00	42.90	4.29	2398.00	81.90	-0.46	867.00	220.00	22.00	7.66	-0.46	NA
328	0.0210	0.60	13.50	10.80	72.30	8.33	0.34	4.60	1.64	0.71	169.00	15.80	1.76	-0.48	4.76	NA
329	0.0110	0.66	17.20	11.70	52.50	13.20	0.38	6.56	1.60	-0.47	451.00	26.50	1.35	-0.47	4.63	NA
330	0.0350	2.28	13.90	73.80	91.00	12.80	0.67	6.31	1.07	-0.47	415.00	17.70	-0.95	0.50	1.79	NA
331	0.0510	0.36	253.00	6.73	16.50	30.50	-0.09	7.07	0.39	-0.46	1704.00	14.60	1.02	0.64	4.43	NA
332	0.2640	24.60	34.80	450.00	60.40	88.10	5.86	31.90	1.07	45.30	6843.00	1172.00	31.40	1.90	21.80	NA
333	0.0040	0.15	5.41	16.30	30.50	6.95	0.33	0.60	0.18	-0.47	40.20	5.83	-0.93	-0.47	1.52	NA
334	0.0080	89.50	41.50	3974.00	60.70	122.00	0.43	478.00	1.56	0.76	392.00	187.00	32.00	88.70	-0.49	NA
335	0.0220	202.00	3809.00	4210.00	280.00	33.20	21.50	348.00	48.50	-0.50	1315.00	3362.00	55.10	32.50	-0.50	NA
336	0.0040	0.51	13.70	14.40	20.80	4.48	0.34	1.34	0.10	-0.48	34.20	15.20	-0.95	-0.48	4.33	NA
337	0.0110	0.41	4.35	6.37	2.06	7.27	0.27	0.58	-0.10	-0.48	8.05	10.60	-0.96	-0.48	0.63	88.50% CaF <sub>2</sub>
338	0.0780	0.47	8.39	6.60	6.95	46.30	0.26	0.29	-0.09	-0.47	38.10	18.20	-0.94	-0.47	3.72	NA
339	0.0060	0.56	11.20	6.93	33.60	15.70	0.64	0.56	0.16	-0.47	19.50	8.67	-0.94	-0.47	3.78	13.25% CaF <sub>2</sub>
340	0.2140	314.00	1430.00	645.00	48.50	20.40	7.67	5.12	10.80	-0.48	434.00	811.00	5.03	11.80	-0.48	NA
341	0.0820	1.02	22.30	19.40	32.10	23.70	1.76	-0.24	0.34	1.53	252.00	60.10	-0.97	-0.48	-0.48	NA
342	0.0100	0.59	8.72	11.10	23.10	12.00	0.31	-0.24	0.11	-0.47	24.90	14.70	-0.95	-0.47	2.12	NA
343	0.0140	2.08	71.10	54.50	195.00	36.60	0.27	7.62	1.70	6.14	4703.00	834.00	6.40	0.67	-0.49	NA
344	0.0090	0.30	100.00	30.70	96.10	40.30	0.19	-0.23	1.03	-0.47	1704.00	764.00	2.46	-0.47	4.04	10.00 W
345	0.0190	15.30	71.90	2183.00	54.40	64.40	0.92	3.23	3.05	-0.46	330.00	453.00	10.50	3.08	-0.46	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
346	0.2190	457.00	189000.00	4036.00	7612.00	46.60	3430.00	243.00	175.00	-4.80	47700.00	10300.00	17.80	39.20	-4.80	NA
347	0.0060	0.83	313.00	18.50	78.30	1.34	4.26	0.54	0.35	-0.48	292.00	170.00	-0.96	-0.48	2.79	NA
348	0.0480	1.20	290.00	46.20	102.00	11.00	5.43	0.78	0.61	-0.49	294.00	1460.00	-0.99	-0.49	1.19	NA
349	0.0340	0.43	27.10	13.00	34.00	10.60	1.96	0.28	0.17	-0.46	661.00	2693.00	-0.92	-0.46	1.83	NA
350	0.0010	0.08	14.90	3.27	105.00	9.28	1.28	-0.25	0.29	-0.50	4194.00	154.00	-0.99	-0.50	-0.50	NA
351	0.1810	0.22	13.20	43.90	15.70	22.00	3.70	-0.24	-0.10	-0.49	1408.00	7601.00	2.81	-0.49	-0.49	NA
352	0.6350	0.38	18.50	44.20	14.10	16.20	9.22	-0.24	0.15	-0.48	1982.00	437.00	1.61	-0.48	2.04	NA
353	0.0660	0.23	18.50	10.70	66.70	15.00	2.14	-0.24	1.15	0.60	954.00	267.00	2.60	-0.48	0.89	NA
354	0.0020	0.04	17.30	3.16	30.00	1.47	-0.10	-0.25	-0.10	-0.49	54.40	6.29	-0.98	-0.49	-0.49	NA
355	0.0870	60.20	14200.00	65.00	610.00	7.55	151.00	14.50	35.30	1.64	713.00	7436.00	2.15	-0.47	-0.47	NA
356	0.2140	2.92	108.00	12.50	13.60	25.90	1.90	-0.23	0.28	-0.46	185.00	201.00	1.52	-0.46	0.65	NA
357	0.0020	0.12	10.20	17.10	23.40	6.56	0.22	-0.25	-0.10	-0.49	30.90	28.00	-0.99	-0.49	-0.49	NA
358	0.0400	2.71	21.40	6.67	-9.61	34.00	-0.96	-2.40	-0.96	-4.80	4790.00	93100.00	18.10	-4.80	-4.80	NA
359	Trace	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
360	0.0720	1.40	14.90	12.20	42.80	11.50	2.32	-0.23	0.34	-0.46	164.00	813.00	1.19	-0.46	0.87	NA
361	0.0030	0.14	7.24	2.36	3.16	40.20	-0.09	-0.24	-0.09	-0.47	35.60	218.00	-0.94	-0.47	-0.47	NA
362	0.0060	0.25	11.80	8.01	26.80	5.33	1.28	-0.23	0.17	-0.46	158.00	180.00	-0.91	-0.46	0.72	NA
363	0.0090	0.48	9.01	4.88	6.66	30.90	0.16	-0.24	0.13	-0.47	47.90	424.00	-0.94	-0.47	-0.47	NA
364	0.0030	0.12	12.20	11.90	19.20	4.16	-0.09	-0.23	0.21	-0.47	42.00	8.95	-0.94	-0.47	-0.47	NA
365	0.0100	0.13	33.70	17.00	50.60	5.11	-0.10	-0.24	0.30	-0.47	45.10	24.90	-0.95	-0.47	3.49	NA
366	0.0046	0.05	9.25	5.88	21.25	1.75	0.22	-0.25	0.35	-0.50	20.21	2.85	-1.00	-0.50	-0.50	NA
367	0.0072	0.10	3.33	21.02	16.14	6.69	0.20	-0.25	-0.10	-0.50	108.85	8.82	-1.00	-0.50	-0.50	2.00 W
368	0.0472	0.10	4.23	3.22	7.06	4.70	-0.10	-0.25	-0.10	-0.50	73.31	1.33	-1.00	-0.50	1.17	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
369	0.0020	0.17	8.17	46.45	35.65	3.89	0.13	-0.25	0.19	-0.50	16.87	10.70	-1.00	-0.50	-0.50	NA
370	-0.0005	0.44	11.44	62.69	43.99	5.35	0.11	-0.25	0.19	-0.50	89.76	2.09	-1.00	-0.50	2.35	NA
371	-0.0005	0.09	1.24	46.14	7.63	1.58	3.23	-0.25	-0.10	-0.50	1.49	3.19	-1.00	-0.50	-0.50	2.50 U <sub>3</sub> O <sub>8</sub>
372	-0.0005	0.11	6.25	20.26	33.95	1.32	-0.10	-0.25	0.13	-0.50	8.08	0.44	-1.00	-0.50	0.98	NA
373	0.0200	0.89	5.02	14.75	13.35	4.24	1.18	-0.25	-0.10	-0.50	71.57	3.81	-1.00	-0.50	-0.50	NA
374	0.1916	6.35	105.09	113.16	145.69	119.84	-0.10	10.53	1.00	-0.50	245.59	4.03	-1.00	1.26	-0.50	NA
375	0.3680	36.34	421.99	145.33	808.92	215.87	-0.10	10.16	0.30	-0.50	275.25	14.36	4.06	1.31	4.98	NA
376	-0.0005	0.12	3.03	14.18	38.90	1.16	0.47	-0.25	0.12	-0.50	6.24	0.48	-1.00	-0.50	1.58	NA
377	0.0964	19.16	1026.99	7841.96	3455.88	6.15	0.44	0.81	39.31	-0.50	496.75	27.93	-1.00	-0.50	4.30	NA
378	0.0240	194.79	6255.09	63046.60	21.35	1.26	0.48	5.44	128.44	4.21	20.64	99.94	-1.00	3.22	4.77	NA
379	Number not used															
380	Number not used															
381	0.0026	0.14	6.56	6.37	29.22	2.88	-0.10	-0.25	-0.10	-0.50	25.50	0.64	-1.00	-0.50	1.56	NA
382	0.0032	0.04	23.42	21.63	44.62	0.86	0.19	0.61	-0.10	-0.50	46.63	1.83	-1.00	-0.50	15.28	NA
383	0.0010	-0.01	22.62	20.86	78.91	1.70	-0.10	0.51	0.27	-0.50	51.23	1.41	-1.00	-0.50	14.60	NA
384	0.0024	0.01	28.27	15.76	103.77	0.99	-0.10	-0.25	0.13	0.91	42.85	0.98	-1.00	-0.50	10.48	NA
385	0.0036	0.02	37.49	21.30	67.85	3.17	0.16	0.41	0.21	-0.50	25.44	0.74	-1.00	-0.50	9.19	NA
386	0.0360	0.10	9.34	18.88	48.41	0.58	0.24	-0.25	-0.10	-0.50	81.48	2.96	-1.00	-0.50	6.38	NA
387	0.0023	-0.01	12.02	16.13	38.81	1.25	0.31	0.53	-0.10	-0.50	214.83	5.39	-1.00	-0.50	9.38	NA
388	0.0862	0.72	8.43	14.26	57.21	1.56	-0.10	-0.25	-0.10	-0.50	848.71	8.57	-1.00	-0.50	2.40	NA
389	0.2820	1.24	4.96	12.18	10.12	5.37	0.12	-0.25	-0.10	-0.50	2049.01	28.59	-1.00	-0.50	-0.50	NA
390	0.5260	135.33	6.38	22.80	6.95	13.70	0.16	-0.25	-0.10	0.69	2915.08	85.11	-1.00	-0.50	-0.50	5.80 U <sub>3</sub> O <sub>8</sub>
391	0.2594	5.54	5.60	16.33	15.62	4.10	1.17	-0.25	0.12	-0.50	498.97	24.75	-1.00	-0.50	-0.50	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
392	0.8810	5.46	7.95	22.07	14.86	26.45	-0.10	-0.25	-0.10	-0.50	1702.08	9.70	-1.00	-0.50	-0.50	NA
393	0.0154	0.20	3.82	10.22	18.49	1.29	-0.10	-0.25	-0.10	-0.50	23.76	3.27	-1.00	-0.50	-0.50	4.60 U <sub>3</sub> O <sub>8</sub>
394	0.3990	2.03	5.66	12.77	20.09	2.09	0.94	-0.25	-0.10	-0.50	148.80	12.59	-1.00	-0.50	-0.50	4.00 U <sub>3</sub> O <sub>8</sub>
395	0.0296	0.86	6.40	9.30	39.76	2.43	29.34	-0.25	0.11	-0.50	59.89	2.75	-1.00	-0.50	1.15	NA
396	0.3230	21.52	6.04	96.38	47.71	13.56	2.31	-0.25	0.19	-0.50	64.04	3.64	-1.00	-0.50	1.46	NA
397	0.0278	1.77	12.43	21.90	23.04	9.79	5.99	-0.25	0.12	-0.50	141.55	5.56	-1.00	-0.50	-0.50	NA
398	0.3270	38.13	8.16	34.37	46.00	6.52	-0.10	-0.25	0.36	-0.50	245.52	12.23	-1.00	-0.50	-0.50	9.30 U <sub>3</sub> O <sub>8</sub>
399	0.2684	18.17	9.01	11.88	6.86	5.77	1.13	-0.25	-0.10	-0.50	113.60	10.31	-1.00	-0.50	-0.50	NA
400	0.1236	2.44	3.58	9.77	10.69	14.36	-0.10	0.32	-0.10	-0.50	109.08	5.86	-1.00	-0.50	-0.50	NA
401	5.5220	105.69	16.80	47.14	34.29	4.86	0.54	-0.25	0.12	-0.50	506.34	54.42	-1.00	-0.50	0.72	NA
402	0.1256	2.35	18.00	68.23	49.16	21.02	0.41	0.66	0.19	-0.50	112.67	23.33	-1.00	-0.50	-0.50	NA
403	0.2002	5.62	8.11	18.94	22.02	3.73	-0.10	-0.25	0.11	-0.50	133.91	4.62	-1.00	-0.50	-0.50	NA
404	1.0250	20.38	45.82	118.26	52.80	2.54	50.55	-0.25	0.26	-0.50	42.22	12.89	-1.00	0.74	1.87	NA
405	0.2108	19.70	43.99	81.55	61.85	18.45	3.32	-0.25	0.34	0.52	240.64	6.22	-1.00	2.96	1.04	NA
406	10.5570	9.30	4.68	33.67	36.22	2.26	1.31	-0.25	-0.10	-0.50	61.52	58.79	-1.00	-0.50	1.00	NA
407	1.0960	106.70	6.92	57.50	20.85	2.13	1.77	-0.25	-0.10	-0.50	73.41	9.72	-1.00	-0.50	-0.50	NA
408	0.1316	2.03	11.14	10.00	21.64	4.59	0.60	-0.25	-0.10	-0.50	97.89	4.43	-1.00	-0.50	0.95	NA
409	0.6260	18.12	15.22	222.09	56.91	5.83	1.00	-0.25	0.35	0.62	95.83	1.50	-1.00	-0.50	0.74	NA
410	0.1492	7.30	18.20	34.60	27.55	1.93	3.21	-0.25	0.27	-0.50	65.89	7.10	-1.00	-0.50	0.88	NA
411	0.1352	1.10	7.97	24.06	32.98	3.09	0.50	0.29	-0.10	-0.50	115.43	1.91	-1.00	-0.50	1.10	5.10 U <sub>3</sub> O <sub>8</sub>
412	0.1060	2.78	2.97	19.17	11.31	1.89	-0.10	-0.25	0.12	-0.50	68.88	3.47	-1.00	-0.50	0.50	NA
413	0.0022	0.06	2.89	11.64	26.91	1.18	-0.10	0.32	-0.10	-0.50	5.49	1.09	-1.00	-0.50	1.36	3.50 U <sub>3</sub> O <sub>8</sub>
414	1.1510	192.96	19.12	135.36	46.58	17.44	1.65	0.40	0.29	0.52	2741.64	82.05	-1.00	-0.50	-0.50	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
415	0.1970	5.44	6.90	15.00	7.37	47.79	1.09	-0.25	-0.10	-0.50	147.77	9.20	-1.00	-0.50	0.65	NA
416	0.0418	1.06	8.01	14.41	17.65	2.68	0.31	0.73	-0.10	-0.50	73.18	5.01	-1.00	-0.50	0.62	NA
417	0.0228	0.45	4.88	7.40	21.57	1.02	0.47	-0.25	0.19	-0.50	92.62	5.03	-1.00	-0.50	-0.50	NA
418	0.2024	2.21	4.96	34.30	25.08	7.47	0.26	0.87	-0.10	-0.50	1502.56	15.51	-1.00	-0.50	-0.50	NA
419	0.0228	0.52	2.85	14.65	23.17	1.33	0.38	-0.25	-0.10	-0.50	127.33	5.54	-1.00	-0.50	0.93	NA
420	1.7210	16.03	11.74	15.50	53.76	39.58	0.57	-0.25	0.26	-0.50	521.81	40.01	-1.00	-0.50	-0.50	NA
421	0.0142	0.13	6.49	20.74	34.58	4.08	0.45	0.35	0.39	-0.50	1363.25	38.02	-1.00	-0.50	-0.50	NA
422	0.0812	0.18	39.98	43.65	629.99	8.64	0.29	-0.25	7.75	2.11	2646.76	190.09	-1.00	-0.50	2.43	5.70 U <sub>3</sub> O <sub>8</sub>
423	0.0150	0.34	13.99	15.62	94.53	5.04	0.49	-0.25	0.37	-0.50	355.74	15.28	-1.00	-0.50	1.21	NA
424	0.0388	0.08	13.88	31.18	132.54	3.01	-0.10	-0.25	1.57	-0.50	610.47	42.19	-1.00	-0.50	1.06	NA
425	0.0284	1.06	7.02	55.19	102.77	3.23	1.15	0.53	0.65	0.80	325.30	46.06	-1.00	-0.50	0.72	NA
426	number not used															
427	0.0794	0.20	4.39	6.84	54.70	3.73	0.10	-0.25	0.65	-0.50	93.51	12.82	-1.00	-0.50	-0.50	7.00 U <sub>3</sub> O <sub>8</sub>
428	0.0978	1.81	5.01	17.25	22.80	0.92	0.42	0.34	-0.10	-0.50	152.48	12.60	-1.00	-0.50	0.56	NA
429	0.1194	0.49	3.45	19.72	20.14	1.78	0.41	0.31	-0.10	-0.50	141.34	41.93	-1.00	-0.50	-0.50	NA
430	0.0284	0.15	4.08	11.32	23.42	1.55	0.29	-0.25	0.23	-0.50	33.61	3.26	-1.00	-0.50	1.02	6.00 U <sub>3</sub> O <sub>8</sub>
431	0.2080	1.12	3.08	22.81	7.08	82.26	0.23	-0.25	-0.10	-0.50	1368.46	58.70	-1.00	-0.50	-0.50	NA
432	0.0116	0.06	2.99	10.07	18.60	1.76	2.09	0.46	-0.10	-0.50	13.17	2.60	-1.00	-0.50	1.14	NA
433	0.0038	0.06	1.62	21.96	31.25	0.61	0.27	0.92	0.12	-0.50	31.07	4.03	-1.00	-0.50	1.14	NA
434	0.0056	0.20	3.56	21.38	45.12	8.21	1.00	-0.25	-0.10	-0.50	68.72	8.07	-1.00	-0.50	1.39	NA
435	0.0080	0.01	6.16	6.30	15.89	3.97	0.14	-0.25	0.17	0.61	335.60	21.43	-1.00	-0.50	2.38	NA
436	3.3670	9.42	9.07	11.57	8.24	7.32	9.74	-0.25	-0.10	-0.50	306.64	27.10	-1.00	-0.50	0.52	NA
437	0.0900	1.11	9.96	9.35	44.75	1.45	0.14	-0.25	-0.10	-0.50	195.30	6.10	-1.00	-0.50	1.08	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
438	0.2140	2.81	13.76	16.77	16.76	16.78	0.77	0.31	-0.10	-0.50	259.73	8.70	-1.00	-0.50	1.40	NA
439	0.7040	12.90	23.50	113.48	27.23	26.46	0.13	-0.25	-0.10	-0.50	396.49	4.60	-1.00	-0.50	0.83	NA
440	0.1318	1.42	11.99	27.00	10.49	20.65	3.21	-0.25	-0.10	0.50	524.71	6.50	-1.00	-0.50	1.56	NA
441	0.1426	1.16	11.53	30.36	33.69	13.49	0.53	-0.25	0.33	-0.50	412.17	3.50	-1.00	-0.50	0.56	4.70 U <sub>3</sub> O <sub>8</sub>
442	0.1300	1.64	26.53	17.91	11.97	7.52	7.53	-0.25	-0.10	-0.50	173.97	14.00	-1.00	-0.50	2.39	NA
443	0.3000	7.35	12.22	449.18	23.19	527.32	0.96	-0.25	-0.10	-0.50	679.29	14.90	-1.00	-0.50	-0.50	NA
444	0.1344	2.56	6.45	13.07	6.43	29.57	0.12	-0.25	-0.10	-0.50	103.25	1.10	-1.00	-0.50	1.42	NA
445	0.0454	0.13	3.33	4.16	10.93	0.76	-0.10	-0.25	-0.10	0.55	45.26	5.10	-1.00	-0.50	0.78	5.30 U <sub>3</sub> O <sub>8</sub>
446	0.3620	7.56	17.09	20.69	29.27	7.04	0.85	-0.25	0.21	0.70	726.89	24.40	-1.00	-0.50	1.85	NA
447	0.4220	2.81	10.17	21.23	28.78	8.90	0.43	-0.25	-0.10	-0.50	348.88	8.20	-1.00	-0.50	-0.50	15.30 U <sub>3</sub> O <sub>8</sub>
448	-0.0005	0.04	1.39	14.07	8.13	1.28	1.28	-0.25	-0.10	0.65	3.55	0.40	-1.00	-0.50	0.63	2.40 U <sub>3</sub> O <sub>8</sub>
449	0.0024	0.04	3.11	14.05	23.71	1.49	235.72	0.33	-0.10	-0.50	4.10	0.70	-1.00	-0.50	0.95	3.90 U <sub>3</sub> O <sub>8</sub>
450	0.0016	0.02	3.75	20.74	7.91	4.59	3.53	0.43	-0.10	-0.50	8.13	66.80	-1.00	-0.50	1.12	1.10 U <sub>3</sub> O <sub>8</sub>
451	0.0226	-0.01	4.95	44.01	187.78	850.41	182.63	-0.25	0.16	-0.50	50.97	11.20	-1.00	-0.50	-0.50	40.10 U <sub>3</sub> O <sub>8</sub>
452	0.0048	0.09	3.82	4.01	10.29	4.87	4926.66	-0.25	-0.10	-0.50	4.12	0.60	-1.00	-0.50	0.87	11.80 U <sub>3</sub> O <sub>8</sub>
453	0.0204	0.11	2.90	35.28	103.84	48.55	1092.14	-0.25	0.33	-0.50	20.55	6.20	-1.00	-0.50	21.63	9.60% CaF <sub>2</sub> 200.60 U <sub>3</sub> O <sub>8</sub>
454	0.1162	0.16	3.62	11.66	15.69	8.54	0.59	-0.25	0.12	-0.50	27.96	0.90	-1.00	-0.50	0.56	2.40 U <sub>3</sub> O <sub>8</sub>
455	2.7070	3.94	6.72	12.14	3.98	2.26	-0.10	0.31	-0.10	-0.50	36.53	2.20	-1.00	-0.50	0.67	NA
456	0.1544	0.15	6.71	6.50	8.90	1.90	0.21	-0.25	-0.10	-0.50	41.28	30.90	-1.00	-0.50	1.21	NA
457	0.0348	1.31	9.05	16.32	42.62	1.08	-0.10	-0.25	-0.10	-0.50	56.67	2.90	-1.00	-0.50	2.49	NA
458	0.0202	0.27	4.98	7.73	7.03	2.46	0.18	-0.25	-0.10	-0.50	34.18	6.00	-1.00	-0.50	1.64	NA
459	0.1378	2.04	10.26	24.39	30.43	2.04	-0.10	-0.25	0.38	-0.50	166.78	11.50	-1.00	-0.50	1.58	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
460	1.7610	165.26	12.71	20.97	12.14	11.18	-0.10	-0.25	-0.10	-0.50	176.99	18.80	-1.00	-0.50	-0.50	NA
461	0.1602	13.31	17.09	10.66	14.34	2.74	-0.10	-0.25	-0.10	-0.50	322.67	14.90	-1.00	-0.50	0.67	5.50 U <sub>3</sub> O <sub>8</sub>
462	0.0048	-0.01	5.04	2.08	10.48	1.26	-0.10	-0.25	-0.10	-0.50	35.25	0.60	-1.00	-0.50	3.51	NA
463	0.0268	0.69	5.47	13.34	8.54	0.87	0.96	-0.25	-0.10	-0.50	15.92	1.10	-1.00	-0.50	1.55	NA
464	0.0102	0.03	1.72	10.14	3.96	0.82	0.41	0.76	0.32	-0.50	6.19	0.60	-1.00	-0.50	4.25	NA
465	0.3160	0.10	3.06	26.13	4.28	5.31	0.29	0.28	-0.10	-0.50	4.95	1.50	-1.00	-0.50	1.05	NA
466	2.6360	2.55	8.76	17.81	5.48	49.30	0.29	-0.25	-0.10	-0.50	15.38	2.60	-1.00	-0.50	0.70	NA
467	0.0584	0.07	3.25	24.69	4.78	7.65	0.24	-0.25	-0.10	-0.50	14.93	0.70	-1.00	-0.50	0.61	NA
468	0.0244	0.06	3.41	22.91	7.29	4.35	0.21	-0.25	-0.10	-0.50	32.76	0.80	-1.00	-0.50	0.73	NA
469	0.0546	-0.01	3.23	6.18	1.41	11.83	0.23	-0.25	-0.10	-0.50	3.03	0.60	-1.00	-0.50	0.63	NA
470	0.1318	0.33	10.71	9.89	15.18	1.20	0.34	0.39	-0.10	-0.50	42.56	0.60	-1.00	-0.50	1.51	NA
471	9.4270	6.07	2.40	12.24	4.90	7.26	0.16	-0.25	-0.10	-0.50	5.55	0.48	-1.00	-0.50	1.00	NA
472	1.5050	2.17	3.55	4.71	7.09	163.84	-0.10	-0.25	-0.10	-0.50	32.51	0.98	-1.00	-0.50	-0.50	NA
473	0.7610	22.42	28.35	206.72	87.56	85.33	0.42	11.23	2.38	-0.50	13.83	0.93	-1.00	-0.50	1.89	NA
474	0.2218	1.69	1.60	3.23	1.60	30.07	0.28	-0.25	-0.10	-0.50	11.39	0.38	-1.00	-0.50	0.72	NA
475	1.2120	1.16	3.06	19.47	10.64	1.80	0.30	-0.25	-0.10	-0.50	2.37	1.23	-1.00	-0.50	1.16	NA
476	0.0650	0.03	1.69	17.14	2.40	0.51	0.13	0.50	-0.10	-0.50	1.93	3.54	-1.00	-0.50	0.69	NA
477	0.0394	0.05	1.61	14.52	7.53	1.28	0.21	-0.25	-0.10	-0.50	4.67	-0.20	-1.00	-0.50	1.60	NA
478	0.2216	-0.01	2.50	4.60	7.57	5.25	0.15	-0.25	-0.10	-0.50	11.16	-0.20	-1.00	-0.50	1.05	NA
479	10.1800	8.93	21.31	23.10	5.72	20.08	0.58	-0.25	-0.10	-0.50	1.41	2.27	-1.00	-0.50	2.71	NA
480	25.9410	19.95	6.65	5.22	2.18	13.85	76.94	0.50	-0.10	-0.50	9.24	1.57	-1.00	-0.50	1.52	NA
481	3.0720	5.24	3.83	9.73	10.46	17.07	0.23	0.80	-0.10	-0.50	28.40	2.78	-1.00	-0.50	1.53	NA
482	4.0330	-0.01	900.25	3340.58	181.13	8.97	11.96	0.75	46.64	-0.50	325.68	727.97	-1.00	-0.50	-0.50	3.00 W

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
483	0.0234	2.28	12.82	6.34	-1.00	0.81	77533.90	6.41	0.11	-0.50	63.53	17.75	-1.00	-0.50	2.34	NA
484	0.0780	0.10	2.98	5.05	2.52	1.46	15.84	-0.25	-0.10	-0.50	5.61	1.86	-1.00	-0.50	1.08	NA
485	0.0302	0.14	4.18	19.10	10.13	1.67	0.83	-0.25	0.14	-0.50	9.91	0.26	-1.00	-0.50	1.01	NA
486	6.5160	6.24	4.26	11.16	5.47	1.84	0.43	-0.25	-0.10	-0.50	6.29	0.41	-1.00	-0.50	1.08	NA
487	5.5180	4.92	4.76	18.31	7.81	1.00	0.23	-0.25	-0.10	-0.50	2.78	0.51	-1.00	-0.50	1.78	NA
488	0.0870	11.15	2.78	29.49	5.28	98.49	0.24	-0.25	-0.10	-0.50	17.64	3.39	-1.00	-0.50	-0.50	NA
489	0.0080	-0.01	2.30	9.84	14.43	0.80	0.13	-0.25	-0.10	-0.50	12.79	0.36	-1.00	-0.50	1.51	NA
490	0.0058	0.41	31.04	381.73	17.33	1.48	0.30	0.33	-0.10	-0.50	1.08	3.69	-1.00	-0.50	1.70	NA
491	0.0028	0.15	2.66	15.89	55.09	2.15	-0.10	-0.25	0.27	-0.50	2.75	0.62	-1.00	-0.50	1.52	NA
492	0.1250	0.28	3.62	20.19	6.04	5.57	0.44	-0.25	-0.10	-0.50	23.68	0.52	-1.00	-0.50	1.11	NA
493	9.0020	7.42	3.13	38.20	3.46	190.57	0.14	-0.25	-0.10	-0.50	34.30	6.78	-1.00	-0.50	-0.50	NA
494	0.8300	3.08	3.35	11.40	4.62	10.56	0.17	-0.25	-0.10	-0.50	4.92	0.76	-1.00	-0.50	0.81	NA
495	0.4610	0.92	6.70	69.08	2.73	23.50	0.19	-0.25	-0.10	-0.50	8.54	1.64	-1.00	-0.50	0.68	NA
496	0.1640	1.05	14.81	17.36	27.76	16.43	0.31	-0.25	0.14	-0.50	12.11	1.85	-1.00	-0.50	5.48	NA
497	0.0092	0.13	3.46	89.93	74.44	47.40	46.04	-0.25	0.37	-0.50	24.01	5.33	-1.00	-0.50	-0.50	165.20 U <sub>3</sub> O <sub>8</sub>
498	0.0056	0.05	4.00	14.45	22.85	29.25	0.41	0.36	0.10	-0.50	18.61	1.67	-1.00	-0.50	0.96	NA
499	0.1196	3.80	865.98	1.96	5.88	3.42	1141.39	1.00	-0.10	-0.50	34.73	446.06	-1.00	-0.50	0.53	NA
500	0.0096	0.35	4.43	27.57	4.83	1.74	-0.10	-0.25	-0.10	-0.50	10.93	8.04	-1.00	-0.50	1.22	NA
501	0.0076	0.07	21.29	29.92	-1.00	0.25	1.03	-0.25	-0.10	-0.50	6.37	1.12	-1.00	-0.50	-0.50	71.54% BaSO <sub>4</sub>
502	0.0308	0.04	4.47	15.34	-1.00	15.21	14.70	-0.25	-0.10	1.12	1394.92	120.43	-1.00	-0.50	1.39	NA
503	0.0024	0.05	2.81	7.08	-1.00	183.06	43.47	-0.25	-0.10	31.49	6722.01	110.81	-1.00	-0.50	1.54	NA
504	0.2658	0.52	12.97	21.18	1.11	39.94	156.10	-0.25	0.37	0.70	2738.77	15720.87	-1.00	-0.50	2.94	56.60 U <sub>3</sub> O <sub>8</sub>
505	0.0040	0.03	18.93	10.15	12.85	0.77	0.61	-0.25	-0.10	-0.50	20.17	71.98	-1.00	-0.50	2.77	NA

TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
506	11.0460	4.99	29.19	700.46	105.99	6.11	0.22	-0.25	1.68	-0.50	106.78	10.79	-1.00	1.04	0.77	NA
507	14.9380	15.12	80.10	1136.84	37.54	6.28	0.85	0.57	2.09	-0.50	163.75	16.73	-1.00	2.38	-0.50	NA
508	0.0760	0.71	43.34	110.40	39.32	2.64	0.28	0.47	2.72	-0.50	10.47	3.13	-1.00	-0.50	-0.50	NA
509	0.2556	1.58	82.74	218.28	33.14	5.10	0.31	0.26	1.96	-0.50	32.49	5.16	-1.00	-0.50	-0.50	NA
510	0.1036	1.29	59.37	118.33	89.54	4.77	0.19	0.29	2.51	-0.50	35.82	9.14	-1.00	-0.50	0.61	NA
511	0.0132	0.19	126.36	27.43	20.02	1.03	0.21	0.32	0.12	-0.50	2.89	1.03	-1.00	-0.50	1.83	NA
512	8.5370	55.99	885.61	1481.49	2028.46	3.48	5.01	1.19	46.39	-0.50	114.35	5.26	-1.00	21.11	-0.50	NA
513	6.7630	44.65	1517.67	4581.10	1345.48	3.23	4.02	1.28	33.12	-0.50	80.28	10.81	-1.00	11.15	-0.50	NA
514	0.0006	0.04	3.82	13.43	48.29	1.26	-0.10	-0.25	0.12	0.54	6.10	0.31	-1.00	-0.50	2.58	NA
515	7.0180	6.39	2020.89	3183.58	723.45	3.57	19.19	1.87	22.22	-0.50	710.23	14.46	-1.00	1.25	1.36	NA
516	0.4990	6.12	289.87	529.51	362.78	1.40	0.94	0.63	4.18	-0.50	52.64	34.13	-1.00	2.78	1.31	NA
517	7.3220	130.04	6155.49	47878.80	30.52	4.49	15.87	5.56	16.64	2.86	72.51	123.44	1.29	30.15	-0.50	NA
518	4.6330	270.62	4501.59	69055.70	-1.00	1.35	90.15	12.05	60.22	3.57	208.23	1205.54	25.04	56.26	-0.50	NA
519	11.4150	89.43	927.64	40352.10	90.07	6.17	2.24	28.42	8.60	2.33	179.22	30.71	-1.00	4.08	2.60	NA
520	0.0536	0.45	171.42	37.14	43.34	4.68	0.37	0.25	0.88	-0.50	276.97	60.17	-1.00	-0.50	1.33	7.00 W
521	0.3390	4.83	636.92	2126.41	108.86	2.89	0.26	-0.25	4.03	-0.50	248.89	4.06	-1.00	1.68	6.89	NA
522	1.2270	32.45	1782.34	1466.12	48.18	19.95	3.35	1.60	3.10	-0.50	32.40	51.46	-1.00	17.39	-0.50	NA
523	32.2010	405.58	5497.50	42916.90	5.62	25.09	36.59	9.47	13.68	2.33	8.62	26.43	3.97	267.20	-0.50	NA
524	3.7020	101.17	1808.37	54067.70	55.20	100.86	9.08	3.45	31.58	0.85	66.48	86.18	16.33	16.59	-0.50	NA
525	17.5060	241.65	9310.28	35497.50	5.25	4.91	26.65	11.76	19.68	2.03	70.55	255.44	4.21	88.55	-0.50	NA
526	37.5960	292.82	2696.29	24808.70	2728.57	3.73	28.08	3.35	946.65	0.57	116.31	252.57	4.01	60.41	-0.50	NA
527	0.0112	0.09	4.30	17.71	68.96	2.36	-0.10	0.28	0.12	0.51	2.94	-0.25	-1.00	-0.50	2.10	NA
528	0.0056	0.10	6.84	24.36	43.45	2.47	0.19	-0.25	0.17	-0.50	4.17	2.46	-1.00	-0.50	0.50	NA

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TABLE A-2.--Sample Analyses, Shoshone Range, Nevada--Continued  
(Analyses in ppm; -, less than; NA, not analyzed)

Sample No.	Gold	Silver	Copper	Lead	Zinc	Molybdenum	Mercury	Bismuth	Cadmium	Thallium	Arsenic	Antimony	Selenium	Tellurium	Gallium	Miscellaneous
529	0.0116	0.09	4.32	35.39	30.43	1.93	13.86	0.49	0.13	-0.50	1.33	5.58	-1.00	-0.50	0.60	NA
530	0.0198	0.83	8.08	297.37	44.65	2.00	249.35	1.60	0.17	-0.50	4.82	19.33	-1.00	-0.50	0.78	NA
531	2.3260	131.16	463.76	37158.20	334.85	27.11	8.51	203.34	9.94	1.58	15.69	10.36	3.61	217.34	1.20	NA
532	0.5660	2.70	57.21	173.47	31.45	6.57	0.20	0.83	0.66	-0.50	26.96	5.70	-1.00	5.46	-0.50	NA
533	0.0046	0.12	7.76	30.59	39.35	0.37	0.19	0.50	0.14	-0.50	2.23	-0.25	-1.00	-0.50	2.18	NA
534	0.0208	908.61	529.31	20621.50	2930.44	26.51	2.07	4134.70	697.25	-0.50	93.05	249.41	13.52	237.37	3.87	17400.00 W
535	3.2740	143.05	1824.26	31441.90	349.55	32.22	1.84	19.70	6.60	1.43	265.14	34.79	1.93	160.81	1.62	NA
536	0.0056	0.15	3.22	32.36	28.74	11.86	1.14	0.98	-0.10	-0.50	2.38	1.30	-1.00	-0.50	0.99	NA
537	0.0006	0.07	3.53	17.99	66.22	0.79	0.13	-0.25	0.12	-0.50	-1.00	0.40	-1.00	-0.50	1.35	NA
538	0.0106	0.79	8.26	58.90	49.52	1.13	0.12	2.04	0.42	-0.50	7.17	1.62	-1.00	-0.50	1.57	26.00 U <sub>2</sub> O <sub>6</sub>
539	0.0072	0.11	22.41	21.62	46.52	0.74	0.15	-0.25	-0.10	0.63	3.71	1.04	-1.00	-0.50	7.21	NA
540	0.0010	0.11	21.82	8.12	38.41	0.84	0.24	-0.25	-0.10	-0.50	2.61	0.26	-1.00	-0.50	3.99	NA
541	0.6550	28.11	7342.25	17.91	19.51	0.74	169.46	6.45	-0.10	-0.50	6.73	105.55	-1.00	-0.50	1.81	NA
542	0.1226	0.11	14.89	12.87	5.25	14.01	0.98	0.28	-0.10	-0.50	61.59	45.02	-1.00	-0.50	0.51	NA
543	0.1970	0.45	9.89	18.24	47.27	5.37	1.14	-0.25	0.16	-0.50	271.02	706.79	-1.00	-0.50	0.57	33.00 W
544	0.0394	30.20	9.01	11.61	20.93	3.83	0.25	0.63	-0.10	-0.50	50.62	4.51	-1.00	-0.50	1.56	NA
545	0.0382	0.45	11.27	18.99	41.12	15.20	0.23	-0.25	-0.10	-0.50	172.65	12.58	-1.00	-0.50	1.14	NA
546	0.0651	0.60	8.20	10.23	27.06	2.39	0.29	0.32	-0.10	0.54	251.72	24.54	-1.00	-0.50	0.67	NA
547	0.2454	1.04	11.09	56.67	55.53	9.46	-0.10	0.29	-0.10	-0.50	250.55	7.49	-1.00	-0.50	1.38	NA

APPENDIX B

Property Maps

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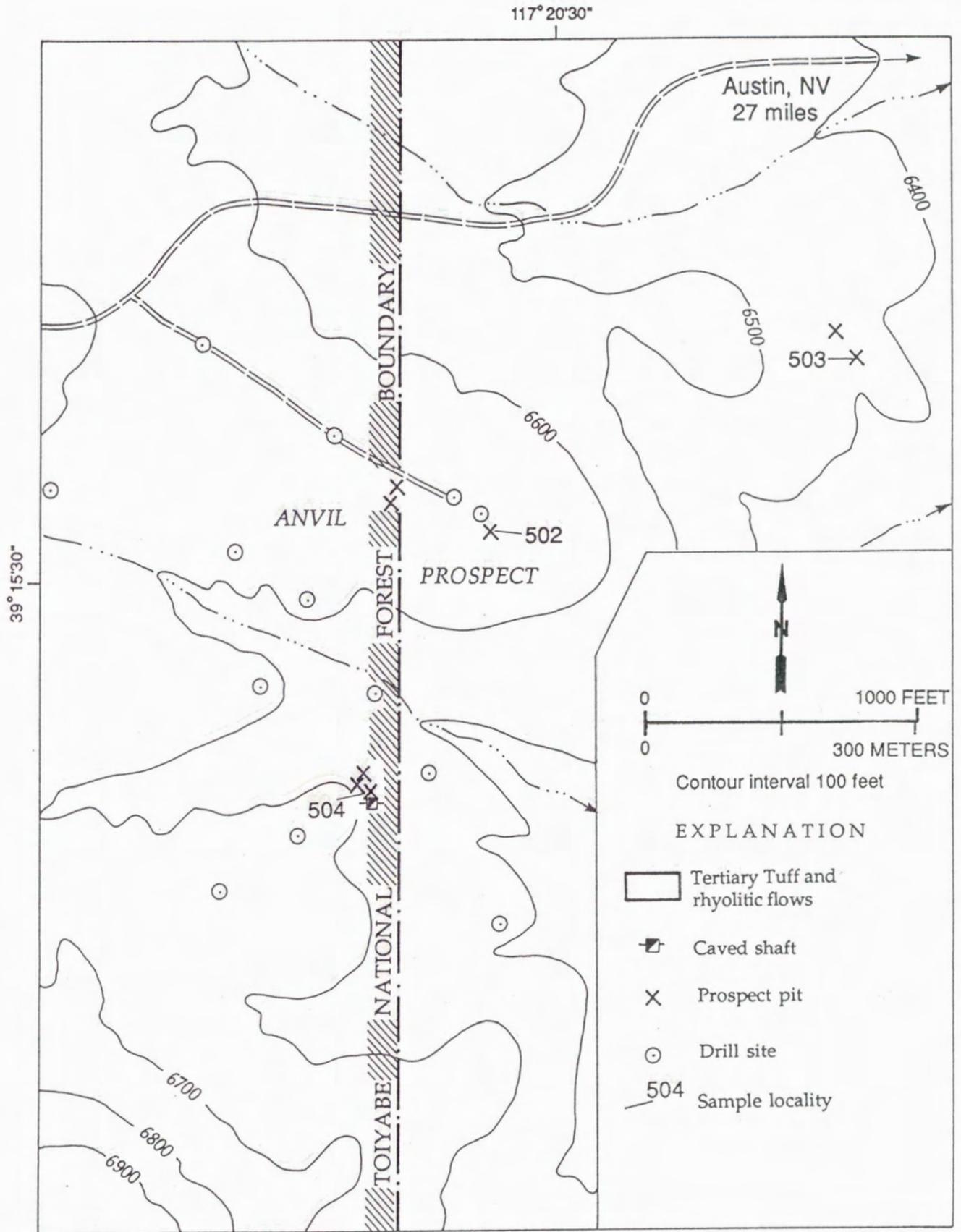


Figure B-1.- Workings, sample sites, and geology of the Anvil property, and vicinity

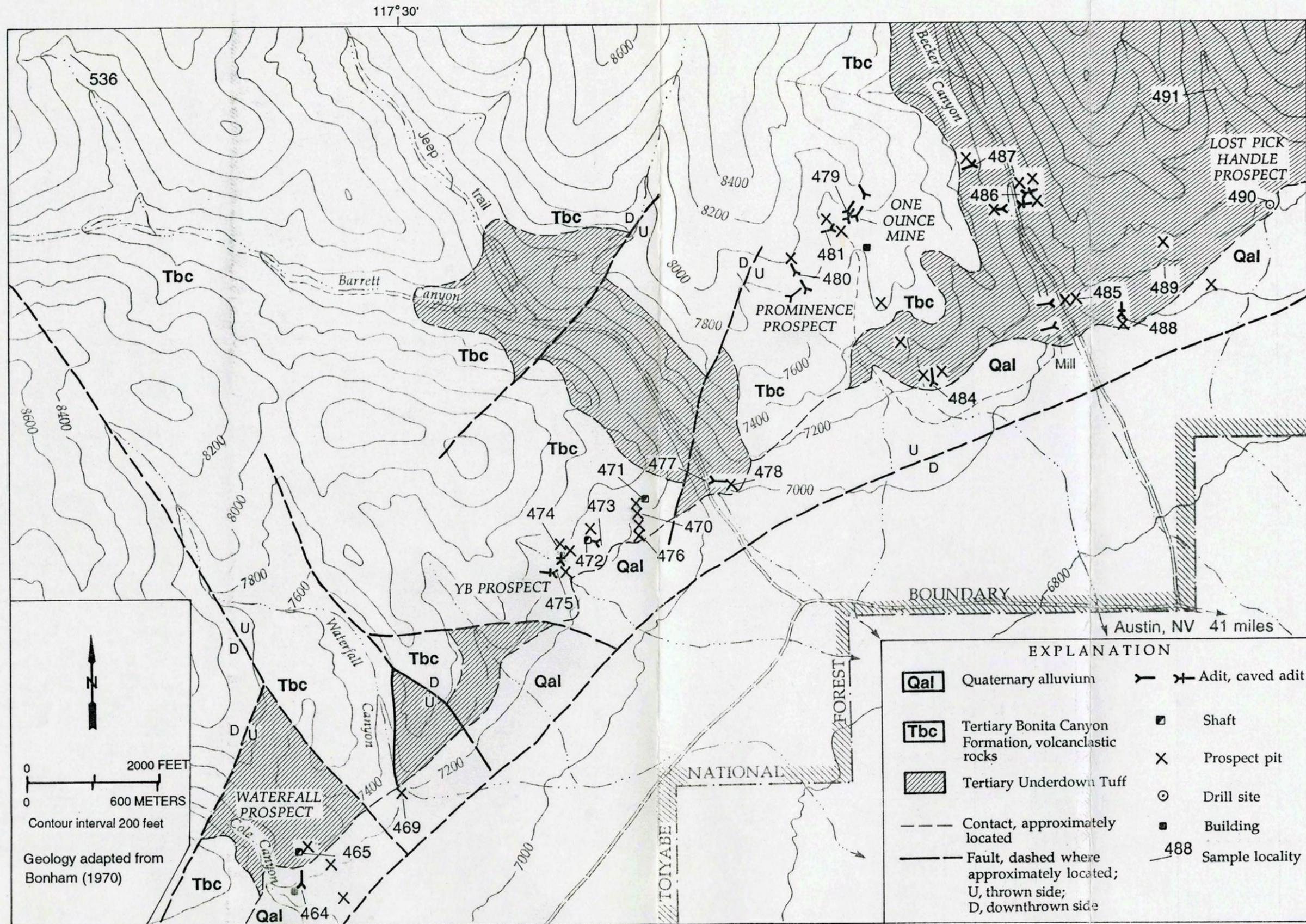


Figure B-2.- Workings, sample sites, and geology of the One Ounce, Lost Pick Handle, Prominence, YB, and Waterfall properties, and vicinity

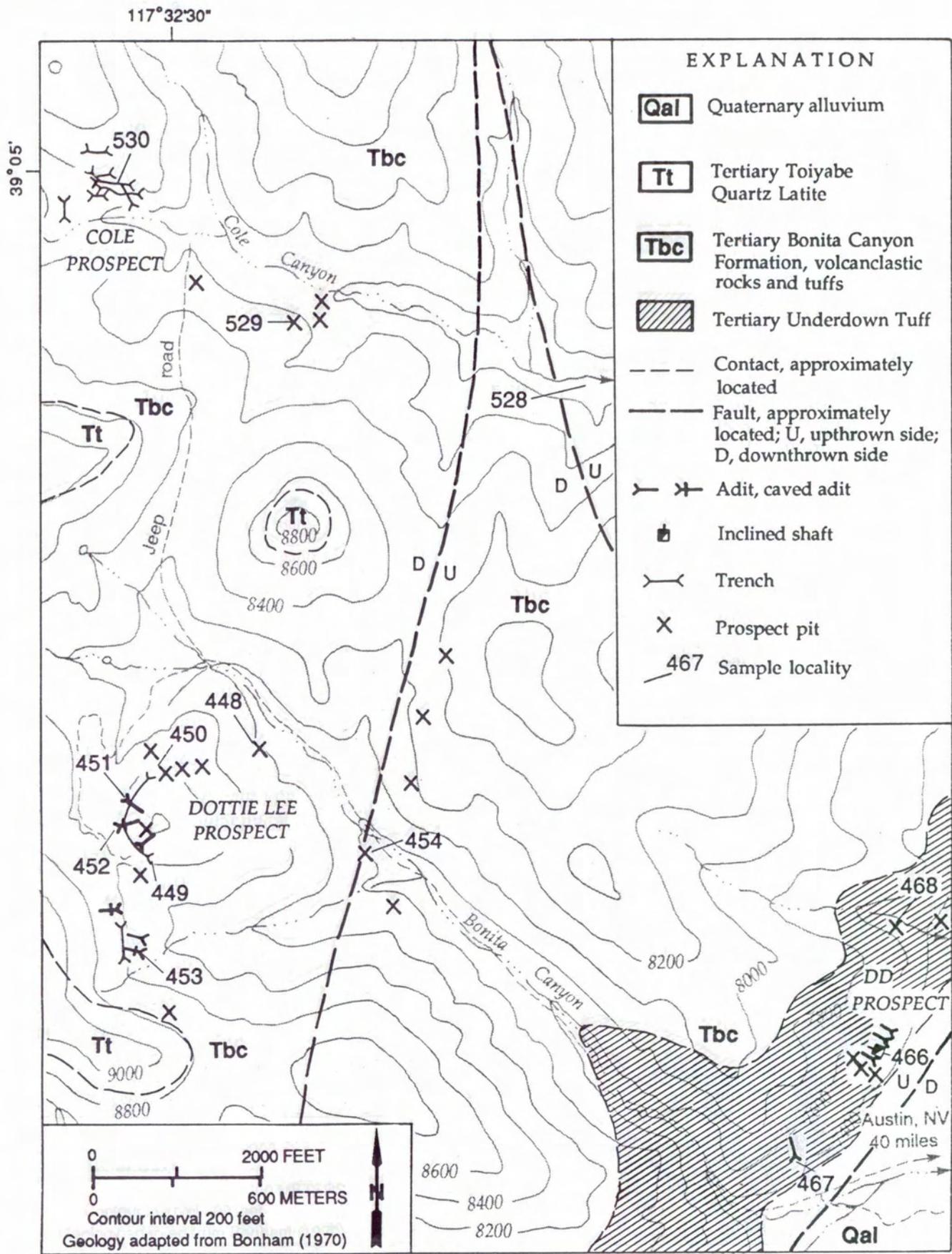


Figure B-3.- Workings, sample sites, and geology of the Dottie Lee and DD properties, and vicinity

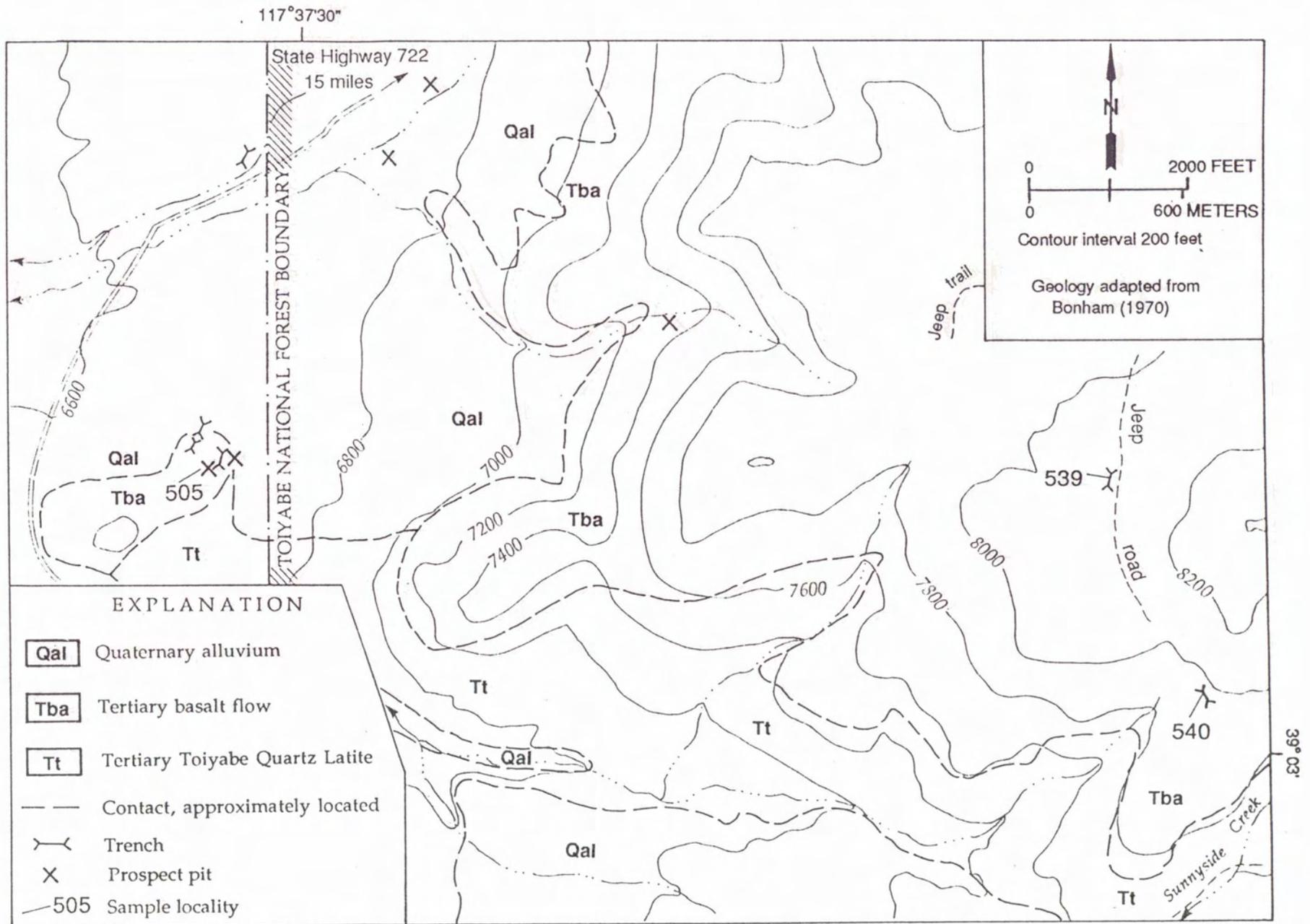


Figure B-4.- Workings, sample sites, and geology of the Lebeau property, and vicinity

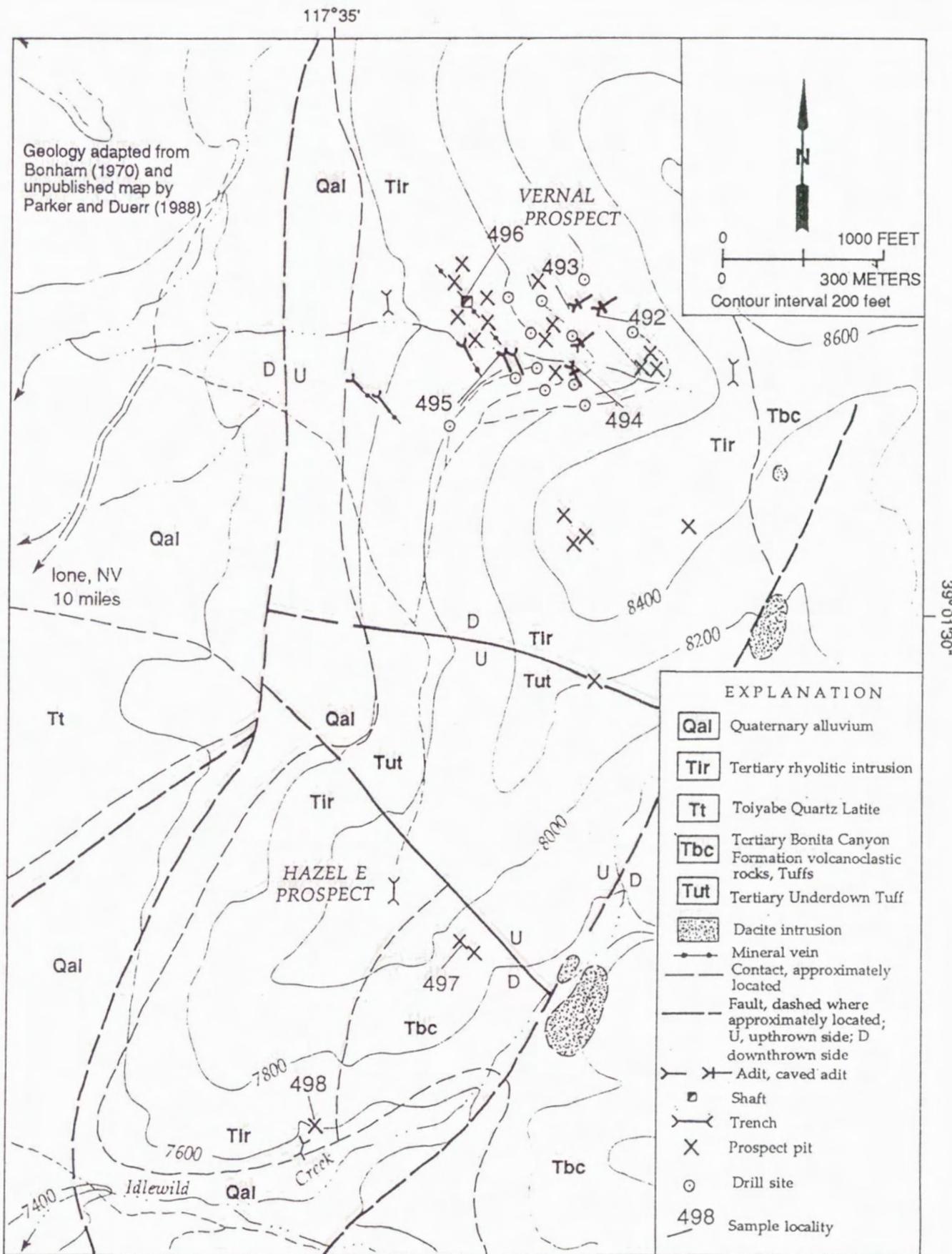


Figure B-5.--Workings, sample sites, and geology of the Vernal and Hazel E properties and vicinity

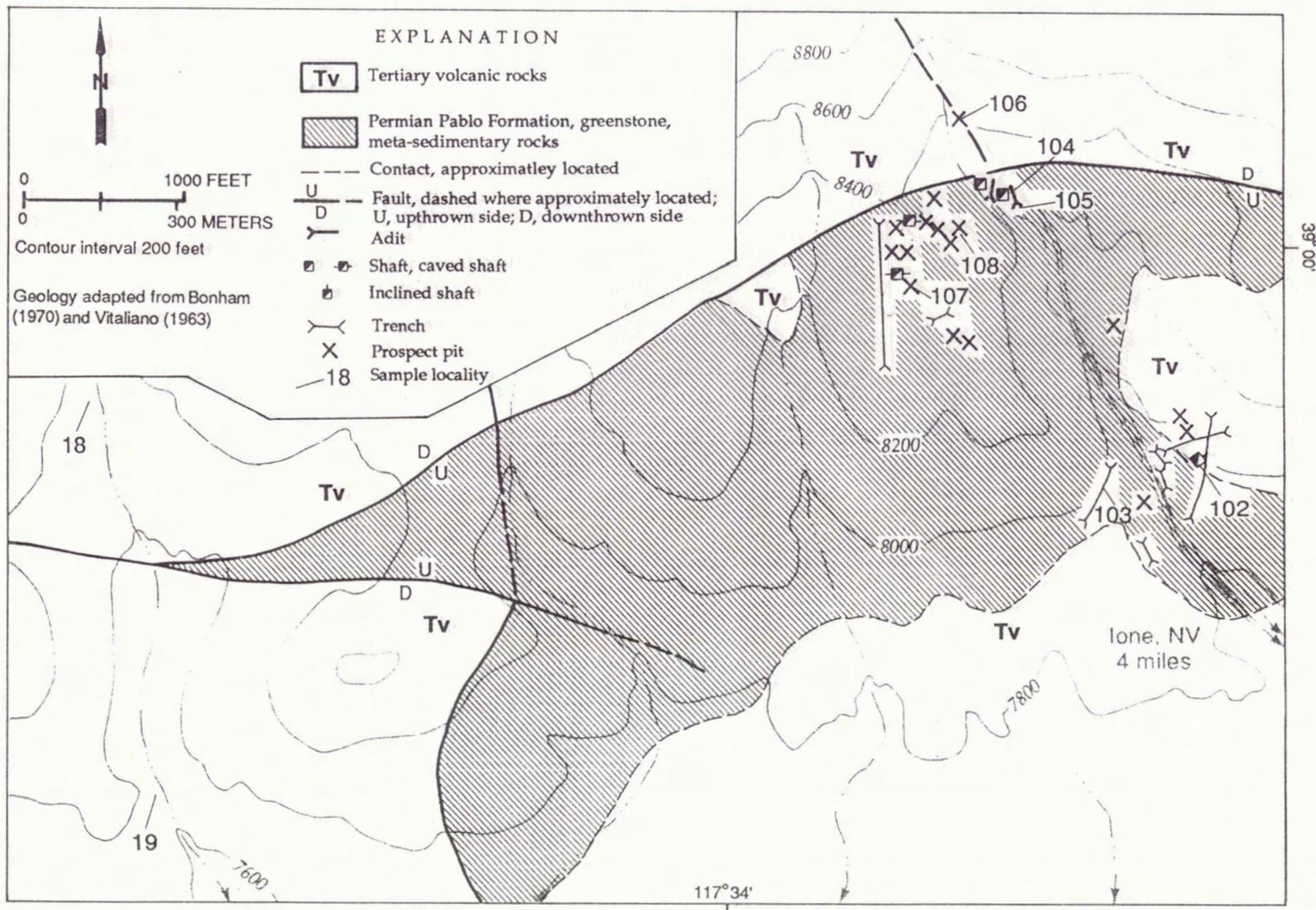


Figure B-6.- Workings, sample sites, and geology of the Top of the Mountain property, and vicinity

117°32'30"

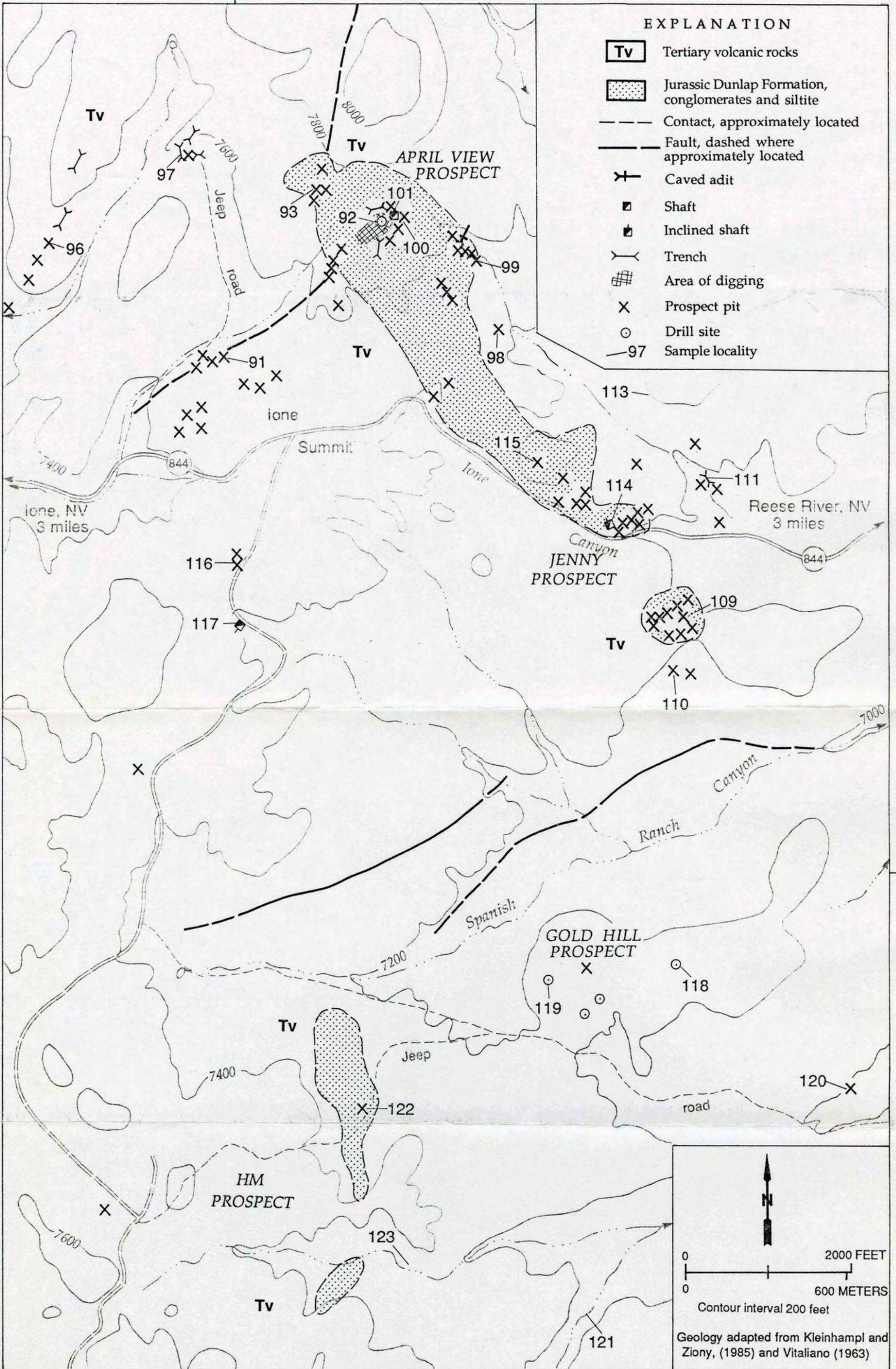


Figure B-7.- Workings, sample sites, and geology of the April View, Jenny, and Gold Hill properties, and vicinity



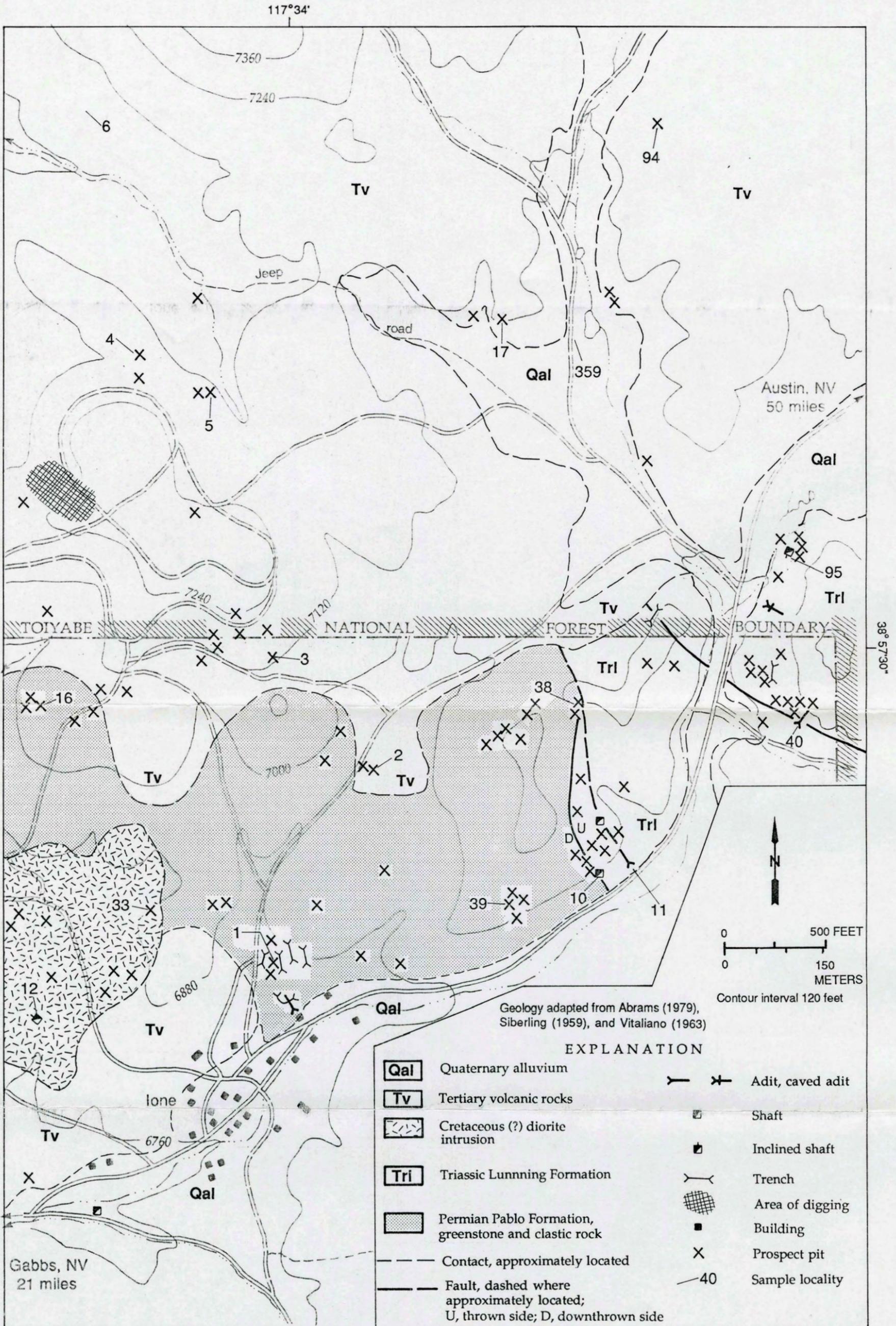


Figure B-9.- Workings, sample sites, and geology of the Hughes property, and vicinity

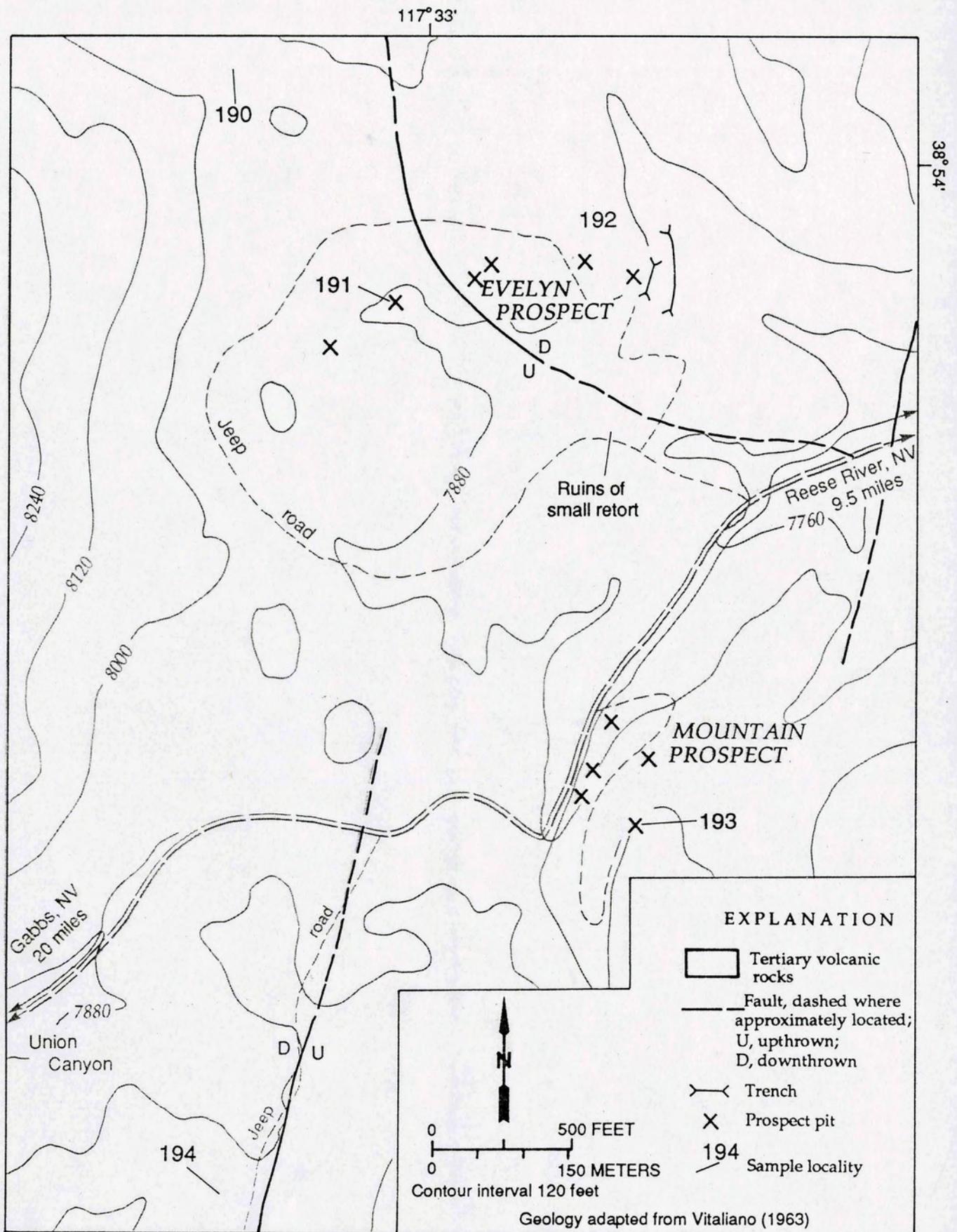


Figure B-10.- Workings, sample sites, and geology of the Evelyn and Mountain properties, and vicinity

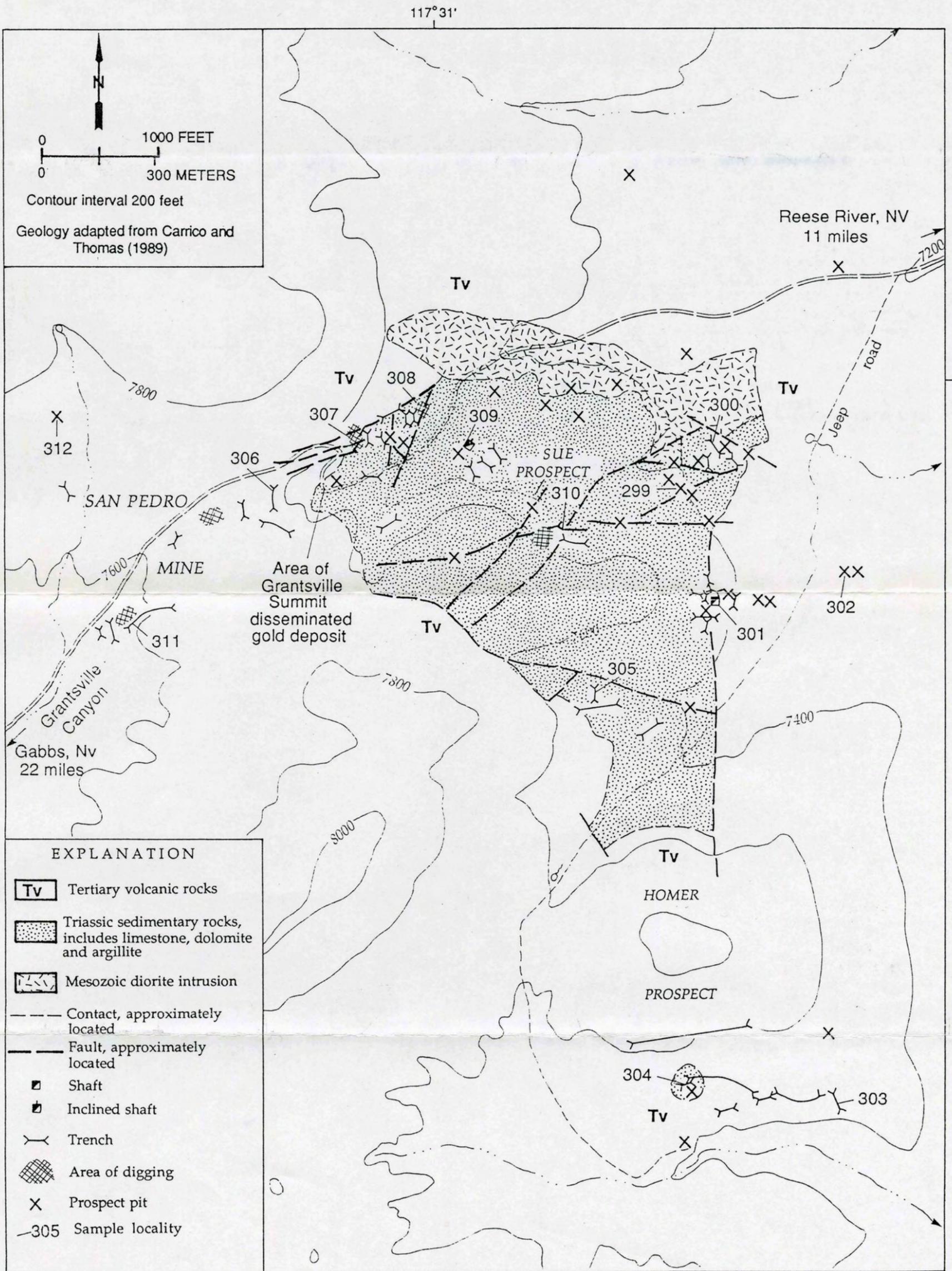


Figure B-11.- Workings, sample sites, and geology of the Grantsville Summit properties, and vicinity

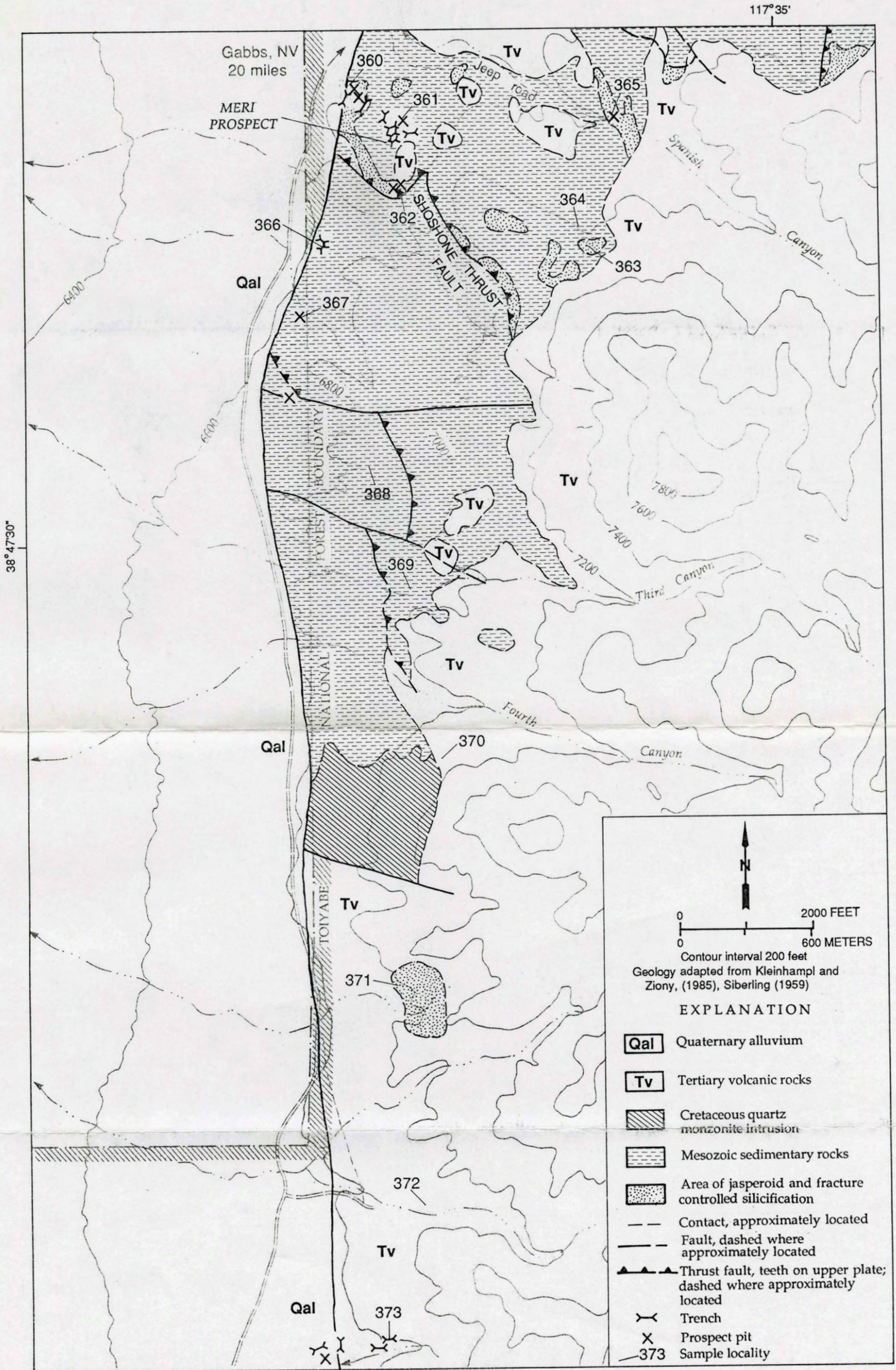


Figure B-12.- Workings, sample sites, and geology of the MERI property, and vicinity

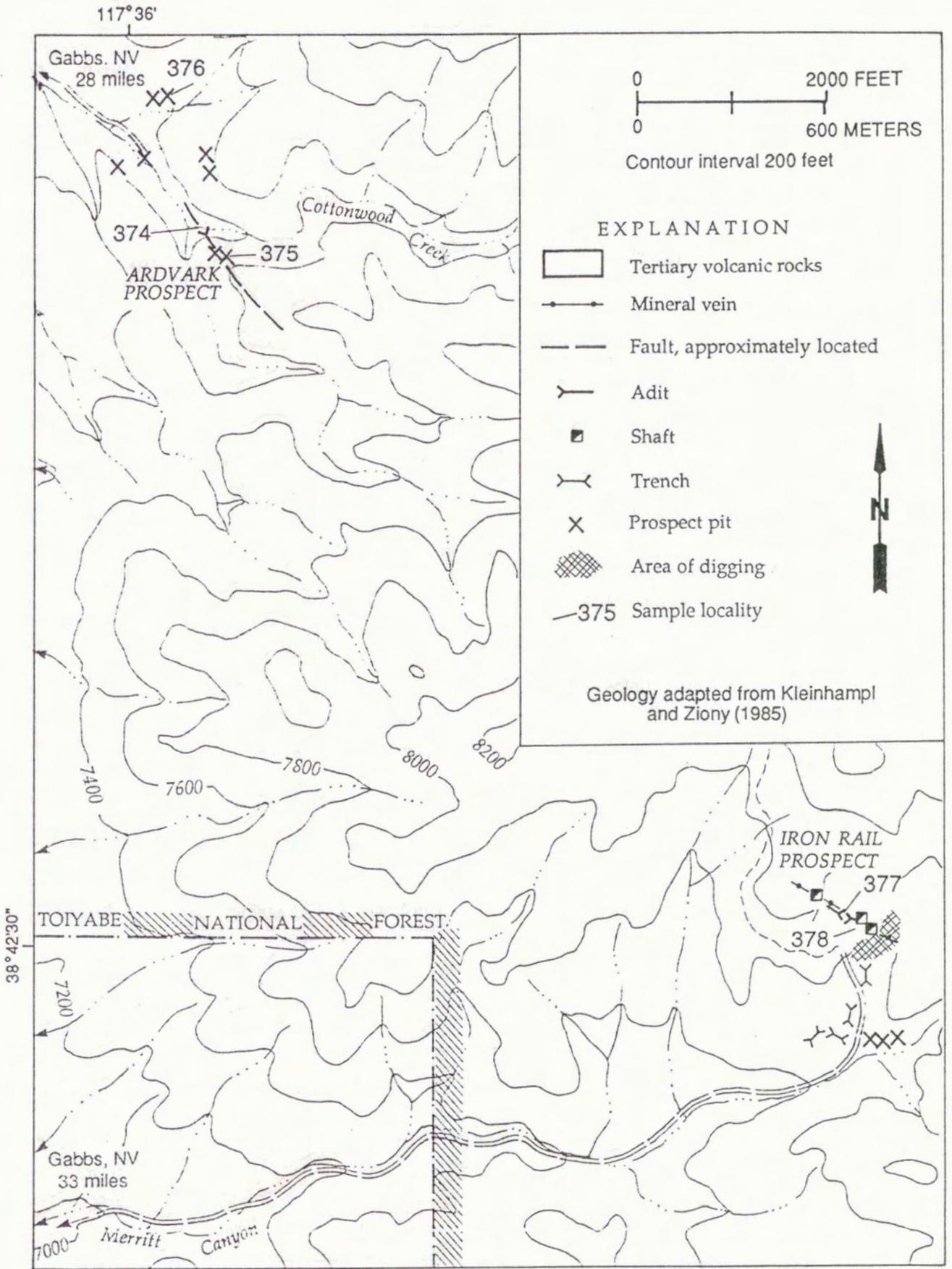


Figure B-13.- Workings, sample sites, and geology of the Ardvark and Iron Rail properties, and vicinity

APPENDIX C

Commodity Highlights

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### Appendix C.--Commodities Highlights

The following commodity highlights give background market information concerning the uses, prices, and import reliance of certain minerals or commodities found in the Shoshone Range study area. The source for these highlights is the U.S. Bureau of Mines annual publication Mineral Commodity Summaries, 1993 (1993). Please refer to this publication for additional information.

## Antimony

(Data in metric tons of antimony content, unless noted)

1. **Domestic Production and Use:** Primary antimony metal and oxide were produced by six companies operating six plants utilizing both foreign and domestic material. Two plants were in Texas, and there was one each in Idaho, Montana, Nebraska, and New Jersey. Antimony was recovered as a byproduct from the smelting of domestic lead and silver-copper ores. The estimated value of primary antimony metal and oxide production in 1992 was \$40 million. The estimated distribution of antimony uses were flame retardants, 72%; transportation, including batteries, 10%; chemicals, 10%; ceramics and glass, 4%; and other, 4%.
  
2. **Salient Statistics-United States:**

	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>
Production: Mine, silver-copper, lead, and stibnite ores	W	W	W	W	W
Refinery: Primary plants <sup>1</sup>	17,616	18,954	20,070	16,032	18,000
Secondary plants	16,172	19,501	20,351	20,898	19,000
Imports for consumption	30,027	25,165	29,403	28,833	29,000
Exports of metal, alloys, and oxide	1,851	2,143	7,730	4,446	5,000
Consumption, apparent <sup>2</sup>	42,751	41,499	38,963	41,988	43,000
Price, average, cents per pound <sup>3</sup>	103.9	94.3	81.8	82.0	80.0
Stocks, yearend	6,498	6,270	8,175	10,166	9,000
Employment, plant <sup>4</sup>	110	100	110	115	120
Net import reliance <sup>4</sup> as a percent of apparent consumption	65	56	51	53	58
  
3. **Recycling:** Approximately 18,400 tons or which is equivalent to 97% of the total secondary antimony was recovered as antimonial lead, most of which was consumed by the battery industry.
  
4. **Import Sources (1988-91):** Metal: China, 86%; Hong Kong, 4%; Mexico, 3%; Thailand, 3%; and other, 4%. Ore and concentrate: China, 40%; Mexico, 22%; Bolivia, 14%; Guatemala, 9%; and other, 15%. Oxide: China, 36%; Republic of South Africa, 23%; Mexico, 18%; Bolivia, 7%; and other, 16%. Total: China, 61%; Mexico, 11%; Republic of South Africa, 9%; Hong Kong, 4%; and other, 15%.
  
5. **Tariff:**

	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <sup>5</sup> <u>1/1/93</u>
Ore and concentrates	2617.10.0000	Free	Free.
Antimony and articles thereof, including waste and scrap	8110.00.0000	Free	4.4¢/kg.
Antimony oxide	2825.80.0000	Free	4.4¢/kg.
  
6. **Depletion Allowance:** 22% (Domestic), 14% (Foreign).

\*Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Includes antimony recovered from domestic and foreign ores.

<sup>2</sup>Domestic mine production + secondary production from old scrap + net import reliance (see footnote 4).

<sup>3</sup>New York dealer price for 99.5% to 99.6% metal, c.i.f. U.S. ports.

<sup>4</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>5</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>6</sup>See Appendix D for definitions.

<sup>7</sup>Excludes U.S. production.

<sup>8</sup>As constituted before Dec. 1991.

Antimony--Continued

7. Government Stockpile:

Stockpile Status-9-30-92

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Antimony	80,287	32,658	-	-

8. **Events, Trends, and Issues:** In 1992 antimony production from domestic source materials was largely derived from recycling of lead-antimony batteries. Recycling plus U.S. mine output supplied less than one-half of the estimated domestic demand.

On April 25, 1991, a coalition of five U.S. antimony trioxide producers and/or manufacturers of antimony trioxide-based products filed an antidumping petition with the International Trade Commission (ITC) and the U.S. Department of Commerce (DOC), charging China with unfair trade practices.

On February 28, 1992, the DOC announced its final determination that Chinese antimony trioxide entering the United States should be assessed the following weighted-average dumping margins: China National Metals & Minerals Import & Export Corp. (Minmetals), 80.64%; China National Nonferrous Metals Import & Export Corp. (CNIEC), 13.05%; and all others, 33.10%. However, the ITC unanimously determined that imports of refined antimony trioxide from the People's Republic of China did not materially injure or threaten to injure this particular U.S. industry. For further information see Federal Register, v. 57, No. 40, February 28, 1992, pp. 6801-6808; and Federal Register, v. 57, No. 73, April 15, 1992, p. 13118.

Environmental and ecological problems associated with the treatment of antimony metal and ores were minimal because emissions and effluents were controlled at the processing plants.

9. World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves <sup>a</sup> <u>1991</u>	Reserve base <sup>a</sup> <u>1992<sup>a</sup></u>
	W	W		
United States			82,000	91,000
Bolivia	7,532	7,500	308,000	317,000
Mexico	2,900	2,600	181,000	227,000
South Africa, Republic of	4,500	4,500	236,000	254,000
Other countries	<u>49,798</u>	<u>46,000</u>	<u>3,393,000</u>	<u>3,811,000</u>
World total	764,730	760,600	4,200,000	4,700,000

10. **World Resources:** U.S. resources are mainly in Idaho, Nevada, Alaska, and Montana. Principal identified world resources, estimated at 5.1 million tons, are in China, Bolivia, the U.S.S.R., the Republic of South Africa, and Mexico. Additional antimony resources may occur in "Mississippi Valley Type" lead deposits in the Eastern United States.

11. **Substitutes:** Compounds of titanium, zinc, chromium, tin, and zirconium substitute for antimony chemicals in paint, pigments, frits, and enamels. Combinations of calcium, strontium, tin, copper, selenium, sulfur, and cadmium can be used as substitutes for hardening lead. Selected organic compounds and hydrated aluminum oxide are widely accepted alternative materials in flame-retardant systems.

## Arsenic

(Data in metric tons, unless noted)

1. **Domestic Production and Use:** Arsenic trioxide was imported and converted to arsenic acid for use in the production of wood preservatives by three companies, most of whose plants are in the southeastern United States. Nearly all arsenic was consumed in compound form, mainly by two producers of agricultural chemicals and three producers of wood preservative chemicals. Metallic arsenic was used in nonferrous alloys and in the electronics industry for semiconductor materials. The estimated end-use distribution of arsenic in 1992 was 66% in wood preservatives, 23% in agricultural chemicals (principally herbicides and desiccants), 4% in glass, 4% in nonferrous alloys, and 3% in other uses. The total value of arsenic metal and compounds consumed was estimated to be about \$15 million.
  
2. **Salient Statistics—United States:**

	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>
Imports for consumption:					
Metal	600	928	796	1,007	820
Arsenic trioxide <sup>1</sup>	28,056	28,348	26,256	27,142	28,000
Arsenic compounds <sup>2</sup>	215	50	21	374	80
Exports <sup>3</sup>	400	126	149	233	60
Consumption, apparent, arsenic content	22,300	22,300	20,500	21,600	22,000
Price, cents per pound, average: <sup>4</sup>					
Trioxide, Mexican	33	27	23	25	29
Metal, Chinese	73	47	180	68	57
Stocks, yearend, refinery, arsenic content	100	100	100	-	-
Net import reliance <sup>5</sup> as a percent of apparent consumption	100	100	100	100	100
  
3. **Recycling:** None.
  
4. **Import Sources (1988-91):** Chile, 22%; France, 19%; Mexico, 16%; and other, 43%.
  
5. **Tariff:**

Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN* <u>1/1/93</u>
Metal	2804.80.0000	Free	13.2¢/kg.
Trioxide	2811.29.1000	Free	Free.
Sulfide	2813.90.1000	Free	Free.
Acid <sup>7</sup>	2811.19.0000	3.1¢/kg	6.6¢/kg.
  
6. **Depletion Allowance:** 14% (Domestic), 14% (Foreign).
  
7. **Government Stockpile:** None.

\*Estimated.

<sup>1</sup>Arsenic trioxide (As<sub>2</sub>O<sub>3</sub>) contains 75.7% arsenic by weight.

<sup>2</sup>Arsenic compounds include arsenic acid and arsenic sulfide.

<sup>3</sup>Exports for 1988 include compounds; exports for 1989 through 1992 include metal only.

<sup>4</sup>Calculated from Bureau of the Census import data.

<sup>5</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>6</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>7</sup>Tariff is free for Israel, Caribbean Basin Countries, and designated Beneficiary Developing Countries. For Canada, the tariff is 1.8¢/kg.

<sup>8</sup>See Appendix D for definitions. Reserves for the United States were 50,000 metric tons and the reserve base was 80,000 tons.

<sup>9</sup>As constituted before Dec. 1991.

Arsenic--Continued

8. **Events, Trends, and Issues:** In January 1992, a Panamanian ship traveling from New York to Baltimore via the Delaware Bay encountered a storm off the coast of Cape May, NJ, and lost four containers of arsenic trioxide weighing a total of 75 metric tons. Some \$2.7 million in Superfund cleanup money was approved by the Environmental Protection Agency (EPA) to help cover the costs of the extensive search and recovery of the arsenic-containing drums, although total cleanup costs were approximately \$5 million. The U.S. Coast Guard recovered three of the four shipping containers, but the fourth container was never located. The Coast Guard concluded its cleanup operation before yearend.

EPA's Waste Management Division, Office of Solid Waste and Emergency Response, sponsored a workshop in August in Alexandria, VA, on removal, recovery, treatment, and disposal of arsenic and mercury.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>1</sup>	Reserve base <sup>1</sup>
	<u>1991</u>	<u>1992<sup>2</sup></u>		
United States	-	-		
Belgium	3,000	3,000		
Canada	400	400		
Chile	7,000	7,000		
China	10,000	10,000		
France	3,000	2,000		
Mexico	4,960	5,000		
Namibia	1,804	2,000		
Peru	500	500		
Philippines	5,000	5,000		
Sweden	2,500	1,000		
U.S.S.R. <sup>3</sup>	7,000	7,000		
Other countries	<u>1,800</u>	<u>1,800</u>		
World total (rounded)	47,000	45,000	<u>1,000,000</u>	<u>1,500,000</u>

10. **World Resources:** World resources of copper and lead contain about 11 million tons of arsenic. Substantial resources of arsenic occur in copper ores in northern Peru and the Philippines, and in copper-gold ores in Chile. In addition, world gold resources, particularly in Canada, contain substantial resources of arsenic.
11. **Substitutes:** Substitutes for arsenic exist in most major end uses, although arsenic may be the preferred material because of its lower cost and superior qualities. In agricultural uses, synthetic organic compounds such as paraquat may be substituted for arsenical pesticides, herbicides, and desiccants. The wood preservatives pentachlorophenol and creosote may be substituted for chromated copper arsenate where odor and paintability are not problems. Nonwood alternatives such as concrete and steel may be substituted for arsenical pressure-treated wood.

## Barite

(Data in thousand metric tons, unless noted)

1. **Domestic Production and Use:** Barite production in 1992 decreased to 410,000 tons and was valued at \$17 million. The leading five companies supplied over 90% of the domestic output. Production came from five States, with about 88% of the total coming from Nevada. The second largest producing State was Georgia. Nearly 90% of the barite sold in the United States was used as a weighting agent in oil- and gas-well-drilling fluids, mostly in the Gulf of Mexico and Pacific coast areas. Barite was also used in the production of paint, rubber, glass, and barium chemicals.

2. Salient Statistics-United States:	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>
Production, mine	404	290	430	448	410
Imports for consumption:					
Crude barite	1,232	987	988	841	420
Ground barite	15	47	57	46	35
Other	14	11	10	10	12
Exports	1	10	9	43	1
Consumption, apparent <sup>1</sup>	1,664	1,325	1,476	1,302	874
Consumption <sup>2</sup> (ground and crushed)	1,612	1,277	1,434	1,267	800
Price, average value, dollars per ton,					
mine	38.40	43.53	37.21	47.57	41.90
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, mine and mill <sup>4</sup>	400	400	400	400	350
Net import reliance <sup>3</sup> as a percent of apparent consumption	76	78	71	66	53

3. **Recycling:** None.

4. **Import Sources (1988-91):** China, 71%; India, 17%; Mexico, 4%; Morocco, 3%; and other, 5%.

5. Tariff:	Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <sup>4</sup> <u>1/1/93</u>
	Crude barite	2511.10.5000	\$1.25/mt	\$3.94/mt.
	Ground barite	2511.10.1000	\$3.20/mt	\$7.38/mt.
	Witherite <sup>5</sup>	2511.20.0000	3% ad val.	30% ad val.
	Oxide, hydroxide, and peroxide <sup>6</sup>	2816.30.0000	2% ad val.	10.5% ad val.
	Other chlorides <sup>6</sup>	2827.38.0000	4.2% ad val.	28.5% ad val.
	Other sulfates	2833.27.0000	0.4¢/kg	2.8¢/kg.
	Other nitrates <sup>6</sup>	2834.29.5000	3.5% ad val.	10% ad val.
	Carbonate	2836.60.0000	0.9¢/kg	3.3¢/kg.

6. **Depletion Allowance:** 14% (Domestic), 14% (Foreign).

7. **Government Stockpile:** None.

\*Estimated. NA Not available.

<sup>1</sup>Sold or used by domestic mines - exports + imports.

<sup>2</sup>Domestic and imported crude barite sold or used by domestic grinding establishments.

<sup>3</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>4</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>5</sup>Per metric ton.

<sup>6</sup>Ad valorem per kilogram.

<sup>7</sup>Oil & Gas Journal, PennWell Publishing Co., Tulsa, OK, Sept. 21, 1992, p. 50.

<sup>8</sup>See Appendix D for definitions.

<sup>9</sup>As constituted before Dec. 1991.

Barite--Continued

8. **Events, Trends, and Issues:** The demand for barite, as indicated by the ground and crushed barite consumption figure, declined strongly from that of 1991. The decrease resulted from the declining petroleum prices to a level that discouraged oil and gas drilling in the United States through the first half of the year. The drill rig count in the United States in June was 596 rigs. After that the count rose strongly, reaching 756 for the week of October 2. The increase seemed to come from the rise in the price of natural gas and replacement of capacity after Hurricane Andrew damaged 850 to 900 MMcf of gas production, and 50,000 to 90,000 barrels per day oil production in the Gulf of Mexico. One forecast puts the average rig count at about 900 for 1993 and 960 in 1994.<sup>7</sup> The longer term trend in barite prices was to drift downwards from 1982 to 1987 and to stay at the 1987 level in terms of constant dollars. This corresponds to the decline of drilling rigs from nearly 5,000 U.S. rigs in 1982 to the 850 to 1,100 range in 1987 and less than 600 in the summer of 1992.

Imports for consumption of lower cost foreign barite slightly exceeded domestic production. Apparently, domestic sellers chose to reduce imports and continue domestic mines rather than reduce employment, and shut down mines and mills. Major sources of imported barite are China, India, and Mexico. One of the factors allowing the lower cost of foreign barite is the cheaper (per ton-mile) cost of ocean transportation as compared to rail transportation from Georgia and Missouri to the end-use regions. Nevada mines, crushers, and grinders are competitive in the California market.

The principal environmental impact of chemically inert barite is the land disturbance normally associated with mining. Mud pits at petroleum drilling sites which contain some barite are treated differently according to chemical content other than barite. The mud in the pits may be dewatered and covered, dewatered and spread over the ground, or transported to special waste handling facilities.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>a</sup>	Reserve base <sup>a</sup>
	1991	1992 <sup>a</sup>		
United States	448	410	30,000	60,000
Algeria	53	50	2,000	8,000
Brazil	65	65	1,000	2,000
China	1,800	1,800	40,000	150,000
Czechoslovakia	85	60	NA	NA
France	90	90	2,000	2,500
Germany, Federal Republic of	168	170	1,000	1,500
India	500	525	30,000	32,000
Ireland	100	100	1,000	1,500
Italy	49	50	2,000	2,000
Mexico	210	200	7,000	8,500
Morocco	360	350	10,000	11,000
Poland	25	30	NA	NA
Romania	26	30	NA	NA
Thailand	100	100	9,000	15,000
Turkey	275	300	4,000	20,000
U.S.S.R. <sup>a</sup>	450	400	10,000	75,000
United Kingdom	65	70	NA	NA
Other countries	410	400	21,000	111,000
World total (may be rounded)	5,280	5,200	170,000	500,000

10. **World Resources:** In the United States, identified resources of barite are estimated to be 100 million tons, and hypothetical resources include an additional 150 million tons. The world's barite resources in all categories are about 2 billion tons, but only about 500 million tons are identified.

11. **Substitutes:** In the drilling mud market, alternatives to barite include celestite, ilmenite, iron ore, and synthetic hematite that is manufactured in the Federal Republic of Germany. However, none of these substitutes has had a major impact on the barite drilling mud industry.

## Copper

(Data in thousand metric tons of copper content, unless noted)

1. **Domestic Production and Use:** Domestic mine production in 1992 was about 1.7 million tons, valued at \$4.1 billion. The principal mining States, in descending order, were Arizona, New Mexico, Utah, Michigan and Montana; copper also was recovered at mines in seven other States. Fourteen mines accounted for more than 95% of mine production. Eight primary and 5 secondary smelters, 10 electrolytic and 6 fire refineries, and 14 electrowinning plants were operating at yearend. Refined copper was consumed at 20 wire rod mills, 41 brass mills and about 750 foundries, chemical plants, and miscellaneous manufacturers. Copper was consumed<sup>1</sup> in building construction, 41%; electrical and electronic products, 24%; industrial machinery and equipment, 13%; transportation, 12%; and consumer and general products, 10%.

2. Salient Statistics-United States:	1988	1989	1990	1991	1992 <sup>2</sup>
Production: Mine	1,417	1,498	1,588	1,631	1,720
Refinery: Primary <sup>3</sup>	1,406	1,477	1,577	1,577	1,670
Secondary <sup>3</sup>	446	480	441	418	420
Copper from all old scrap	518	548	536	533	550
Imports for consumption:					
Ores and concentrates	3	47	92	61	70
Refined	332	300	262	289	300
All imports	513	515	512	512	550
Exports: Ores and concentrates	211	267	258	253	200
Refined	58	130	211	263	200
All exports	557	725	780	802	600
Consumption: Refined, reported	2,210	2,203	2,150	2,048	2,220
Apparent, total <sup>4</sup>	2,214	2,185	2,168	2,105	2,300
Price, average, cents per pound:					
Domestic producer, cathode	120.51	130.95	123.16	109.3	107.0
London Metal Exchange, high-grade	117.92	128.91	121.02	106.2	103.0
Stocks, yearend, refined <sup>5</sup>	77	87	81	112	140
Employment, mine and mill, thousands	11.9	12.4	12.9	13.7	14
Net import reliance <sup>6</sup> as a percent of apparent consumption	13	7	3	E	3

3. **Recycling:** Old scrap, converted to refined metal and alloys, provided 547,000 tons of copper, or 24% of apparent consumption. Purchased new scrap, derived from fabricating operations, yielded 700,000 tons of contained copper. Of the total copper recovered from scrap, smelters and refiners recovered 32%; ingot makers, 11%; brass mills, 49%; and miscellaneous manufacturers, foundries and chemical plants, 8%. About 77% of the copper contained in new scrap was consumed at brass mills. Copper in all old and new, refined or remelted scrap comprised 42% of U.S. copper supply.

4. **Import Sources (1988-91):** Canada, 46%; Chile, 22%; Mexico, 12%; and other, 20%. Refined copper comprised 58% of total imports, including unalloyed and alloyed scrap.

5. Tariff:	Item	Number	Most favored nation (MFN) 1/1/93	Canada 1/1/93	Non-MFN <sup>7</sup> 1/1/93
	Unrefined copper; anodes	7402.00.0000	1% ad val. <sup>8</sup>	Free	6% ad val. <sup>8</sup>
	Refined and alloys, unwrought	7403.00.0000	1% ad val.	Free	6% ad val.
	Copper powder	7406.10.0000	5.4% ad val.	3.2% ad val.	49% ad val.
	Copper wire (bare)	7408.11.6000	4% ad val.	2.4% ad val.	28% ad val.

<sup>2</sup>Estimated. E Net exporter.

<sup>3</sup>Some electrical components are included in each end use. Estimated after Copper Development Association, 1992.

<sup>4</sup>From domestic and imported materials.

<sup>5</sup>From new and old scrap at primary and secondary refineries.

<sup>6</sup>Defined as primary refined production + copper from old scrap + refined imports - refined exports ± changes in refined stocks.

<sup>7</sup>Held by industry and by Commodity Exchange Inc.; excludes Government stocks.

<sup>8</sup>Defined as imports - exports + adjustments for Government and industry stock changes for refined copper.

<sup>9</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>10</sup>Value of copper content.

<sup>11</sup>As constituted before Apr. 1992.

<sup>12</sup>See Appendix D for definitions.

<sup>13</sup>As constituted before Dec. 1991.

Copper--Continued

6. Depletion Allowance: 15% (Domestic), 14% (Foreign).

7. Government Stockpile:

Stockpile Status-9-30-92

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Refined copper	907	20	-	-

In addition to the quantity of refined copper shown above, the stockpile contained 6,124 tons of copper in brass and 548 tons of nonstockpile-grade material.

8. **Events, Trends, and Issues:** World copper production was higher despite continued disruptions caused by decreasing ore grades, strikes, political disruptions, industry deterioration, smelter constraints and other problems. U.S. and Chilean copper mine production continued to rise during the year, contributing to a new world record. Mine production might have been higher except for continued production losses caused by the severe deterioration in the copper industries of Yugoslavia,<sup>9</sup> the Republics of the former U.S.S.R., Zaire, and Zambia. Zaire was producing at about one-third of its previous potential. A month-long strike in Poland and the continued global smelter bottleneck also affected copper deliveries. The long-planned Texas City, TX, smelter project was canceled, but plans were announced for a new smelter at Garfield, UT. Mine closures included the Tyrone mine and mill in the United States. The high smelter/refinery charges began to ease as excess concentrates were transported to places such as the Republics of the former U.S.S.R., Poland and Zambia for processing. By the third quarter, copper supplies were easing as additional copper was becoming available from concentrates that had been shunted to these countries for smelting and as the world's economies continued to reflect the spreading recession. Parts of Europe and Japan were especially affected. Even so, world copper consumption set another record, largely owing to significant growth in countries such as China.

Copper consumption improved in the United States and was estimated to be about 8% higher than in 1991. U.S. exports of copper materials and semifabricates continued to be high, prompted by the continued dollar weakness and demand from Mexico, Canada, and the Far East. China, in particular, continued to take an increased share of scrap and other raw materials. It was estimated that domestic copper consumption in 1993 will exceed 2.2 million tons and that mine production will approach 1.8 million tons.

9. World Mine Production, Reserves, and Reserve Base:

<u>1991</u>	<u>Production</u>		<u>Reserves<sup>10</sup></u>	<u>Reserve base<sup>10</sup></u>
	<u>1992<sup>2</sup></u>			
United States	1,631	1,720	45,000	90,000
Australia	311	330	7,000	21,000
Canada	777	780	11,000	23,000
Chile	1,814	1,870	88,000	140,000
China	300	380	3,000	8,000
Indonesia	212	260	11,000	17,000
Peru	382	370	7,000	25,000
Philippines	151	135	7,000	11,000
Poland	390	400	20,000	36,000
Zaire	252	165	10,000	30,000
Zambia	387	360	12,000	34,000
U.S.S.R. <sup>11</sup>	550	550	37,000	54,000
Other countries	<u>1,600</u>	<u>1,580</u>	<u>50,000</u>	<u>98,000</u>
World total (may be rounded)	8,800	8,900	310,000	590,000

10. **World Resources:** Land-based resources are estimated at 1.6 billion tons of copper, and resources in deep-sea nodules are estimated at 0.7 billion tons.

11. **Substitutes:** Aluminum substitutes for copper in some products such as electrical equipment, automobile radiators, and refrigerator tubing. Titanium and steel are used in heat exchangers, and steel is used for artillery shell casings. Optical fiber substitutes for copper in some telecommunications applications. Plastics also substitute for copper in water pipe, plumbing fixtures, and many structural applications.

## Fluorite

(Data in thousand metric tons, unless noted)

1. **Domestic Production and Use:** One company in southern Illinois shipped an estimated 50,000 tons of fluorspar in 1992. Zinc and lead concentrates were produced as coproducts of processing in Illinois.

More than 65% of the reported fluorspar consumption in the United States in 1992 went into the production of hydrofluoric acid, the primary ingredient from which virtually all organic and inorganic fluorine-bearing chemicals are produced. Hydrofluoric acid is also a key ingredient in the processing of aluminum and uranium. An estimated 15% of the fluorspar was consumed as a flux in steelmaking and in iron and steel foundries. The remainder was consumed in aluminum fluoride manufacture, primary aluminum production, glass manufacture, enamels, welding-rod coatings, and other end uses or products.

To supplement domestic fluorine supplies, about 60,000 tons of fluosilicic acid (equivalent to 105,600 tons of 92% fluorspar) was recovered from phosphoric acid plants processing phosphate rock. Fluosilicic acid was used primarily to make aluminum fluoride for the aluminum industry and in water fluoridation, either directly or after processing into sodium silicofluoride.

2. Salient Statistics—United States:	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>
Production: Finished, all grades <sup>1</sup>	64	66	64	58	50
Fluorspar equivalent from phosphate rock	93	91	82	106	106
Imports for consumption:					
Acidspar	546	554	407	276	295
Metspar	144	102	107	100	115
Fluorspar equivalent from hydrofluoric acid plus cryolite	187	204	161	128	85
Exports <sup>2</sup> , ceramic- and acid-grade	3	5	15	74	60
Consumption: Apparent <sup>3</sup>	725	694	567	366	399
Reported: Acidspar	W	W	W	W	W
Metspar <sup>4</sup>	W	W	W	W	W
Total	651	642	565	484	365
Stocks, yearend, consumer	56	79	75	69	70
Employment, mine and mill <sup>5</sup>	200	200	180	180	180
Net import reliance <sup>6</sup> as a percent of apparent consumption	90	92	91	84	87

3. **Recycling:** Primary aluminum producers recycled fluorides from smelting operations. There was no recycling in other consuming industries.

4. **Import Sources (1988-91):** Mexico, 41%; Republic of South Africa, 23%; China, 23%; Canada, 4%; and other, 9%.

5. Tariff:	Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <sup>6</sup> <u>1/1/93</u>
	Acid grade (more than 97% CaF <sub>2</sub> )	2529.22.0000	\$2.10/lt	\$5.60/lt.
	Metallurgical grade (less than 97% CaF <sub>2</sub> )	2529.21.0000	13.5% ad val.	13.5% ad val.

6. **Depletion Allowance:** 22% (Domestic), 14% (Foreign).

\*Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Shipments.

<sup>2</sup>Export levels higher than U.S. shipments are the result of imports reexported.

<sup>3</sup>Excludes fluorspar equivalent of fluosilicic acid, hydrofluoric acid, and cryolite.

<sup>4</sup>Includes fluorspar briquets.

<sup>5</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>6</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>7</sup>See Appendix D for definitions.

<sup>8</sup>Measured as 100% calcium fluoride.

<sup>9</sup>As constituted before Dec. 1991.

<sup>10</sup>Includes the United States.

Fluorite-Continued

7. **Government Stockpile:** The Defense Logistics Agency, Defense National Stockpile Center, was authorized to sell 20,000 short tons (18,144 metric tons) of metallurgical-grade fluorspar from the stockpile. The material was available from 11 different stockpile locations in Connecticut, Indiana, New Mexico, and Pennsylvania. It was classified as Metallurgical Grades A and B and contained material with a gross CaF<sub>2</sub> content ranging from 63% to 89% with SiO<sub>2</sub> content ranging from 3.6% to 10.5%. The sale was to take place during fiscal year 1992. The offering received one bid for 4,000 pounds, which was accepted.

In addition to the data shown below, the stockpile also contains 899 short tons (816 metric tons) of nonstockpile, acid-grade material and 116,777 short tons (105,938 metric tons) of nonstockpile, metallurgical-grade material.

Stockpile Status-9-30-92  
(Thousand short tons)

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Acid grade	900	893	-	-
Metallurgical grade	310	294	-	-

8. **Events, Trends, and Issues:** Legislation called for the modernization of the National Defense Stockpile. It included a section on disposal of obsolete and excess materials contained in the National Defense Stockpile. The list of excess materials contained 44 items and included all stockpiled metallurgical-grade and acid-grade fluorspar.

The President advanced the schedule restricting the production and importation of chlorofluorocarbons (CFC's) and ordered the phase out of the production of CFC's by the end of 1995. In addition, the Environmental Protection Agency was scheduled to issue rules and proposals to regulate the use and disposal of CFC's captured when servicing motor vehicles and refrigeration equipment.

Parties to the Montreal Protocol on Substances That Deplete the Ozone Layer met in Copenhagen, Denmark, in November 1992 to enact changes moving up the production phaseout dates for CFC's and to cap production and establish a production phaseout schedule for hydrochlorofluorocarbons.

Suspension of the 13.5% ad valorem tariff on metallurgical-grade imports expired December 31, 1992. The temporary suspension had been part of the Customs and Trade Act of 1990, signed into law August 20, 1990.

9. **World Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>1</sup>	Reserve base <sup>1</sup>
	1991	1992 <sup>2</sup>		
United States	58	50	W	10,000
China	1,600	1,300	27,000	46,000
France	200	100	10,000	14,000
Italy	100	50	6,000	7,000
Kenya	88	80	2,000	3,000
Mexico	352	300	19,000	23,000
Mongolia	520	400	20,000	30,000
South Africa, Republic of	270	250	30,000	36,000
Spain	90	70	6,000	8,000
United Kingdom	80	80	2,000	3,000
U.S.S.R. <sup>3</sup>	350	320	62,000	94,000
Other countries	640	600	25,000	37,000
World total (may be rounded)	4,350	3,600	210,000	310,000

10. **World Resources:** Identified world fluorspar resources were approximately 400 million tons of contained fluorspar. Resources of equivalent fluorspar from domestic phosphate rock are approximately 32 million tons. World resources of fluorspar from phosphate rock are estimated at 330 million tons.

11. **Substitutes:** Olivine and/or dolomitic limestone were used as substitute fluxes for fluorspar. Gaseous hydrocarbons and carbon dioxide have been substituted for chlorofluorocarbons (CFC's) as aerosol propellants, hydrocarbons for CFC's in plastic foam production, and aqueous cleaning agents for CFC's in cleaning printed circuit boards.

Gold

(Data in metric tons of gold content, unless noted)  
1 metric ton (1,000 kg) = 32150.7 troy ounces.

1. **Domestic Production and Use:** Gold was produced by about 200 lode mines, nearly all in Western States, a dozen or more large placer mines, nearly all in Alaska, and numerous small placer mines, mostly in Alaska and Western States. About 10% of domestic gold was recovered as a byproduct of processing base metals, chiefly copper. Twenty-five mines yielded 68% of the gold produced. The value of 1992 mine production was more than \$3.6 billion. Commercial-grade refined gold came from about 2 dozen producers. A few dozen companies, out of several thousand companies and artisans, dominated the fabrication of gold into useful products. Nearly all jewelry manufacturing was centered in the New York, NY, and Providence, RI, areas. Estimated uses in 1992 were as follows: jewelry and arts, 70%; industrial (mainly electronic), 23%; and dental, 7%.

2. Salient Statistics-United States:	1988	1989	1990	1991	1992 <sup>a</sup>
Production: Mine	201	266	295	290	320
Refinery: Primary	138	184	225	222	260
Secondary (incl. toll)	128	158	144	156	200
Imports <sup>1 2</sup>	93	153	98	179	NA
Exports <sup>1 2</sup>	328	211	296	284	360
Consumption, reported	112	115	118	114	100
Demand, apparent <sup>1 3</sup>	194	341	244	306	NA
Stocks, yearend, Treasury <sup>4</sup>	8,145	8,147	8,146	8,146	8,150
Price, dollars per ounce	438.31	382.58	384.93	363.29	350.00
Employment, mine and mill <sup>5</sup>	13,100	15,100	16,000	15,000	14,400
Net import reliance <sup>6</sup> as a percent of apparent consumption	E	E	E	E	NA

3. **Recycling:** Conversion of old scrap to refined gold provided about 60 metric tons of metal to the market, a quantity equivalent to about 60% of domestic gold consumption. The balance of secondary production was from prompt industrial scrap, partly toll refined.

4. **Import Sources (1988-91):<sup>2</sup>** Canada, 50%; Switzerland, 13%; Chile, 6%; and other, 31%.

5. Tariff:	Item	Number	Most favored nation (MFN) 1/1/93	Non-MFN <sup>6</sup> 1/1/93
	Nonmonetary bullion	7108.12.1010	Free	Free.
	Doré	7108.12.1020	Free	Free.
	Waste and scrap, including metal clad with gold but excluding sweepings containing other precious metals	7112.10.0000	Free	Free.

<sup>a</sup>Estimated. NA Not available. E Net exporter.

<sup>1</sup>Excludes gold contained in fabricated items and official monetary gold. Also excludes estimates of net imports of gold coin (in metric tons): 17.9 (1988), 13.2 (1989), 8.5 (1990), 3.5 (1991), NA (1992).

<sup>2</sup>Excludes net bullion flow (in metric tons) to the market from foreign stocks at the New York Federal Reserve Bank: 208.3 (1988), 132.2 (1989), 51.5 (1990), 61.6 (1991), and 60.0 (estimated, 1992).

<sup>3</sup>Defined as refinery production from primary materials + refinery production from old scrap + net bullion flow to market from foreign stocks at the New York Federal Reserve Bank + net imports of bullion. May include some gold held for investment purposes.

<sup>4</sup>Includes gold in Exchange Stabilization Fund. Stocks were valued at the official price of \$42.22 per troy ounce.

<sup>5</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>6</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>7</sup>See Appendix D.

<sup>8</sup>As constituted before Dec. 1991.

<sup>9</sup>Excludes China and some other countries for which data are not available.

Gold--Continued

6. **Depletion Allowance:** 15% (Domestic), 14% (Foreign).
7. **Government Stockpile:** The U.S. Department of the Treasury maintains stocks of gold (see section 2 above) and the General Services Administration administers a Government-wide secondary precious metals recovery program.
8. **Events, Trends, and Issues:** Despite continuing weak gold prices, the United States maintained its position as the world's second largest gold-producing nation, after the Republic of South Africa. Nevada and California were again the Nation's dominant gold-producing States, together accounting for about 70% of the U.S. total. U.S. gold exploration activity, having apparently peaked about 1988, continued to trend downward. Improved business, investment, and regulatory climates elsewhere, especially in Latin America, continued to attract explorers from throughout North America. It is estimated that in 1993 domestic mine production of gold will be about 330 metric tons.

The Engelhard Industries/London daily final price of gold during the first three-quarters of the year was bound by highs of about \$360 per troy ounce in January and July, and a low of about \$336 in May, its lowest level since April 1986. Some factors contributing to the lackluster performance of the price during 1992 included periodic heavy bullion sales to the market by some central banks, producers, and investors, a deteriorating and unsettled world economic situation accompanied by fluctuating currency values and some apparent asset deflation, continuing conflict and uncertainty in eastern Europe, and the reluctance of many investors to seek the safe haven of gold for some of their assets while benefitting from the widespread availability of alternative investment vehicles.

Environmental pollution abatement continued to be of concern to domestic gold producers, especially in Alaska, where there are many small placer mines. Provisions for reclamation of mined land is an integral part of an increasing number of gold mine plans.

Changes in the world reserves and reserve base numbers from numbers published earlier reflect adjustments for depletion and new gold discoveries.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>7</sup>	Reserve base <sup>7</sup>
	<u>1991</u>	<u>1992<sup>c</sup></u>		
United States	290	320	4,770	5,050
Australia	234	240	2,150	2,300
Brazil	89	90	940	1,080
Canada	172	170	1,780	3,300
China <sup>a</sup>	120	140	NA	NA
South Africa, Republic of	601	600	20,000	22,000
U.S.S.R. <sup>b</sup>	240	230	6,220	7,780
Other countries	<u>366</u>	<u>380</u>	<u>8,040</u>	<u>9,100</u>
World total (may be rounded)	2,110	2,170	*44,000	*51,000

Of an estimated 112,000 tons of gold mined from historical times through 1992, about 15% is believed to have been lost, used in dissipative industrial uses, or otherwise unrecoverable or unaccounted for. Of the remaining 95,000 tons, an estimated 36,000 tons are official stocks held by central banks and nearly 59,000 tons are privately held as coin, bullion, and jewelry.

10. **World Resources:** Total world resources of gold are estimated at 75,000 metric tons, of which 15% to 20% are byproduct resources. The Republic of South Africa has about one-half of world resources, and Brazil, the U.S.S.R., and the United States have about 12% each. Some of the 9,000-ton U.S. resource would be recovered as byproduct gold.
11. **Substitutes:** Base metals clad with gold alloys are widely used in electrical/electronic and jewelry products to economize on gold; many of these products are continually redesigned to maintain high utility standards with lower gold content. Generally, palladium, platinum, and silver may substitute for gold.

Lead

(Data in thousand metric tons of lead content, unless noted)

1. **Domestic Production and Use:** The value of recoverable mined lead in 1992, based on the average U.S. producer price, was \$317 million. Seven lead mines in Missouri plus lead-producing mines in Alaska, Colorado, Idaho, and Montana yielded virtually all of the total. Primary lead was processed at two smelter-refineries in Missouri, a smelter in Montana, and a refinery in Nebraska. About 99% of secondary production came from 31 plants with annual capacities of 6,000 tons or more, 2 of which had permanently closed by midyear. Lead was consumed at about 220 manufacturing plants. Transportation was the major end use, with about 70% consumed in batteries, fuel tanks, solder, seals, and bearings. Electrical, electronic, and communications uses (including batteries), ammunition, TV glass, construction (including radiation shielding), and protective coatings accounted for more than 25% of consumption. The balance was used in ballast and weights, ceramics and crystal glass, tubes and containers, type metal, foil, wire, kame, and specialized chemicals.

2. Salient Statistics-United States:	1988	1989	1990	1991	1992*
Production: Mine, lead in concentrates	394	420	495	477	410
Primary refinery:					
From domestic ore	371	379	386	324	290
From imported materials <sup>1</sup>	21	17	18	22	10
Secondary refinery, old scrap	691	842	874	830	830
Imports for consumption, lead in concentrates	21	5	11	12	7
Exports, lead in concentrates	21	57	57	88	70
Imports for consumption, metal, wrought and unwrought	152	122	97	122	195
Exports, metal, wrought and unwrought	14	34	64	102	65
Consumption: Reported	1,231	1,278	1,275	1,246	1,240
Apparent	1,226	1,333	1,297	1,227	1,220
Price, average, cents per pound: U.S.	37.1	39.4	46.0	33.5	36.0
London	29.7	30.6	37.1	25.3	26.0
Stocks, metal, producers, consumers, yearend	105	98	112	81	120
Employment: Mine and mill (peak)	1,400	1,800	2,100	2,300	1,700
Primary smelter, refineries	800	800	800	700	600
Secondary smelters, refineries	1,600	1,700	1,800	1,700	1,700
Net import reliance <sup>2</sup> as a percent of apparent consumption	13	8	3	6	8

3. **Recycling:** Recovery of lead from scrap batteries was approximately 760,000 tons (756,000 in 1991).

4. **Import Sources (1988-91):** Lead in concentrates: Canada, 36%; Peru, 27%; Australia, 17%; Mexico, 17%; and other, 3%. Metal, wrought and unwrought: Canada, 70%; Mexico, 22%; Australia, 3%; Peru, 1%; and other, 4%. Total lead content: Canada, 67%; Mexico, 21%; Australia, 4%; Peru, 3%; and other, 5%.

5. Tariff:	Item	Number	Most favored nation(MFN) 1/1/93	Non-MFN <sup>3</sup> 1/1/93
Unwrought lead (except bullion)	7801		3.0% ad val. <sup>4</sup>	10.0% ad val.

6. **Depletion Allowance:** 22% (Domestic), 14% (Foreign).

7. **Government Stockpile:**

Stockpile Status-9-30-92				
Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Lead	998	545	-	-

\*Estimated.

<sup>1</sup>Included in imports for calculating net import reliance (see footnote 2).

<sup>2</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>3</sup>For a list of Non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>4</sup>Total rate not to be less than 2.342¢/kg lead content.

<sup>5</sup>See Appendix D for definitions.

Lead--Continued

8. **Events, Trends, and Issues:** After considerable growth in domestic refinery production and consumption during 1987-89, and a leveling out in 1990, all sectors in 1992 continued to reflect recessionary conditions. Although one small and one medium-sized secondary plant closed permanently during the year, there was little loss of capacity as a new smelter-refinery came on stream in midyear, and capacity utilization continued to be about 82% in that sector. World demand declined for the third year in a row, to about 5.5 million tons compared to about 5.6 million tons in 1991, 5.8 million tons in 1990, and 1989's record 6.05 million tons. At yearend, world metal and battery stocks were at high levels. North American lead prices during 1992 were slightly above 1991 prices, in spite of level demand. This was thought to be primarily psychological owing to perceived potential supply disruptions resulting from labor problems at Herculaneum, MO, and Trail, B.C., Canada, primary smelters. In the U.S., producer prices averaged 34.2 to 34.5 cents per pound on a weekly basis through June, then rose gradually to 38.8 cents in early September before falling back as domestic and world lead stocks continued to rise. This occurred even though the Nation's largest primary smelter, at Herculaneum, struck at the end of July, was operated at about one-half capacity through yearend by salaried personnel.

Although there was considerable legislative and regulatory investigation activity relative to lead in 1992, only the final drinking water regulations were promulgated. Numerous hearings were held concerning reauthorization of the Resource Conservation and Recovery Act, with proposed amendments affecting lead relative to packaging, and deposits on batteries with mandatory take-back procedures; mining wastes apparently would not be included. Other bills in various hearing stages dealt with labeling of all lead products, premanufacture notification and approval for any new lead products, comprehensive inventorying of lead products, leaching and content standards in plumbing fixtures, tightening of paint and packaging standards, and excise taxes on all lead produced or imported with the revenue to be applied to a comprehensive lead-based paint abatement program. In the second half of the year, the largest domestic secondary producer and the largest battery-metal integrated producer both announced plans, with permitting already underway, to build large smelter-refineries in the southeast. This occurred in spite of a strict new EPA ambient-air lead standard, and new source performance standards (total air emissions) for secondary plants, both pending at yearend.

Domestic mine production of lead in 1993 is expected to be about the same as in 1992, with continued exports from Alaska. The U.S. secondary plants are expected to continue producing at relatively high levels as individual States continue to enact and enforce battery disposal or mandatory recycling laws. Future growth in lead demand is contingent on the development of cost-competitive electric vehicles for general and new industrial uses, power supply load-leveling systems, and expanded use of uninterruptible power supply batteries, especially for networked computer systems of all capacities. Sealed lead-acid batteries will continue to replace nickel-cadmium and lithium batteries in some household and military "consumer" applications.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>1</sup>	Reserve base <sup>2</sup>
	1991	1992 <sup>2</sup>		
United States	477	410	10,000	22,000
Australia	531	525	10,000	35,000
Canada	278	330	6,000	13,000
China	320	320	7,000	11,000
Mexico	168	180	1,000	2,000
Morocco	70	75	500	1,000
Peru	200	185	2,000	3,000
South Africa, Republic of	76	75	2,000	3,000
Sweden	85	105	500	1,000
Other countries	1,055	995	24,000	36,000
World total (may be rounded)	3,260	3,200	63,000	130,000

10. **World Resources:** In recent years significant lead resources have been demonstrated in association with zinc and/or silver or copper in Alaska, Australia, Canada, China, India, Mexico, Pakistan, and the Republic of South Africa. Identified subeconomic lead resources of the world are about 1.4 billion tons.
11. **Substitutes:** Substitution of plastics has reduced the use of lead in building construction, electrical cable covering, and cans and containers. Aluminum, tin, iron, and plastics compete with lead in other packaging and protective coatings, and tin has replaced lead in solder for new or replacement potable water systems in the United States.

Mercury

(Data in metric tons of mercury content, unless noted)  
1 metric ton (1,000 kilograms) = 29.0082 flasks

1. **Domestic Production and Use:** Mercury was produced as a byproduct at eight gold mining operations in Nevada, California, and Utah. Several companies in the Eastern United States recovered secondary mercury from worn out or obsolete items, such as dental amalgams, batteries, and instruments. Mercury was also recovered at chlorine and caustic soda plants and from U.S. Department of Energy stocks of secondary mercury. The value of mercury used domestically was estimated at less than \$3 million. It was estimated that approximately 30% of the mercury consumed domestically was used for electrical and electronic applications; an additional 30%, in the manufacture of chlorine and caustic soda; and the remaining 40% for applications such as measuring and control instruments and dental equipment.

2. Salient Statistics-United States:	1988	1989	1990	1991	1992*
Production: Mine <sup>1</sup>	W	W	114	58	60
Secondary, industrial	278	137	93	122	100
Imports for consumption	329	131	15	56	100
Exports	NA	221	311	786	400
Shipments from Government stocks: <sup>2</sup>					
National Defense Stockpile	52	170	52	103	100
U.S. Department of Energy	214	180	193	215	400
Consumption: Reported	1,593	1,214	720	473	500
Apparent	NA	W	W	W	W
Price, average value, dollars per flask, New York, dealer	335.52	287.72	249.22	122.42	180.00
Stocks, yearend: Mine	W	W	W	W	W
Consumer and dealer	338	217	202	157	100
Employment, mine and mill, average	12	25	21	3	NA
Net import reliance <sup>3</sup> as a percent of apparent consumption	W	W	W	W	W

3. **Recycling:** From 1987 to 1991, annual production from old scrap averaged nearly 180 metric tons, equivalent to 16% of the average industrial demand during that period.

4. **Import Sources (1988-91):** Spain, 52%; China, 25%; Canada, 12%; Algeria, 6%; and other, 5%.

5. Tariff:	Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <sup>4</sup> <u>1/1/93</u>
	Mercury	2805.40.0000	16.5¢/kg	55.1¢/kg.

6. **Depletion Allowance:** 22% (Domestic), 14% (Foreign).

7. **Government Stockpile:** In addition to the quantities shown below, 327 metric tons of secondary mercury was held by the U.S. Department of Energy at Oak Ridge, TN.

Stockpile Status-9-30-92

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Mercury	362	5,063	48	267

\*Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Includes only mercury recovered as a byproduct of gold mining. Mercury recovered as a principal product during 1988-90 was withheld to avoid disclosing company proprietary data.

<sup>2</sup>Metal sold from the National Defense Stockpile as excess to goal, and surplus secondary mercury released from U.S. Department of Energy stocks.

<sup>3</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>4</sup>For a list of non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>5</sup>See Appendix D for definitions.

<sup>6</sup>As constituted before Dec. 1991.

Mercury--Continued

8. **Events, Trends, and Issues:** During 1992, domestic mercury demand remained weak. Over the long term, U.S. mercury consumption is expected to decline, owing in part to increasing concern about the potential environmental problems associated with mercury use, and to increasingly stringent regulations affecting the use, handling, and disposal of mercury.

Of particular concern is the large quantity of mercury currently held by the Federal Government. At the current rate of demand, about 500 metric tons per year, the Government holds enough excess mercury to supply total domestic demand for nearly 10 years. This excess mercury presents the Government with a quandary. One Government agency, although constrained to avoid unduly disrupting the shrinking mercury market, is attempting to dispose of the excess material. These sales regain some of the tax money spent over the years to purchase and store the mercury, and provide funds to purchase material currently judged to be needed for national defense purposes. However, other Government agencies, concerned about the potential health and environmental problems associated with mercury, are proposing increasingly stringent regulations to control the metal's use and ultimate disposition.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>1</sup>	Reserve base <sup>1</sup>
	1991	1992 <sup>2</sup>		
United States	58	60	3,000	4,000
Algeria	431	400	2,000	3,000
Italy	-	-	-	69,000
Mexico	720	700	5,000	9,000
Spain	450	500	76,000	90,000
Turkey	60	100	3,000	7,000
U.S.S.R. <sup>3</sup>	1,900	2,000	10,000	17,000
Other countries	<u>975</u>	<u>1,000</u>	<u>27,000</u>	<u>41,000</u>
World total (may be rounded)	4,600	4,800	130,000	240,000

10. **World Resources:** World mercury resources are estimated at nearly 600,000 metric tons, principally in Spain, the U.S.S.R.<sup>3</sup>, Yugoslavia, and Italy. At present production rates, sufficient resources are available for about 100 years.
11. **Substitutes:** Present and potential mercury substitutes include lithium, zinc-air, and nickel-cadmium cells in batteries; diaphragm and membrane cells in the electrolytic production of chlorine and caustic soda; composite ceramic materials for dental fillings; and organic mildewcides in latex paints.

## Silver

(Data in metric tons of silver content, unless noted)  
1 metric ton (1,000 kilograms) = 32,150.7 troy ounces

1. **Domestic Production and Use:** Silver produced by about 150 mines in 17 States had an estimated value of \$230 million. The following four States accounted for more than two-thirds of the 1992 mine production: Nevada, 34%; Idaho, 16%; Montana, 11%; and Arizona, 7%. There were 22 principal refiners of commercial-grade silver. The principal silver fabricators were located primarily in the Northeast. About 30 fabricators accounted for more than 90% of the silver consumed in arts and industry. The remainder was consumed mostly by small companies and artisans. Approximately 50% of the refined silver consumed domestically during 1992 was used in the manufacture of photographic products; 21% in electrical and electronic products; 9% in electroplated ware, sterlingware, and jewelry; and 20% in other uses.

2. Salient Statistics—United States:	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992<sup>a</sup></u>
Production: Mine	1,661	2,007	2,125	1,848	1,800
Refinery: Primary	1,474	1,718	1,598	1,879	2,000
Secondary (old scrap)	852	714	454	229	100
Imports for consumption <sup>1</sup>	2,757	3,302	3,344	4,151	4,000
Exports <sup>1</sup>	998	1,280	1,848	1,681	2,000
Shipments from Government stockpile excesses	207	337	107	255	300
Consumption, reported: Industrial	NA	NA	NA	NA	NA
Coinage	275	264	265	285	270
Demand, apparent <sup>2</sup>	4,142	5,063	4,014	3,846	3,900
Price, average, New York, dollars per troy ounce	6.54	5.50	4.82	4.04	4.00
Stocks, yearend: Treasury Department <sup>3</sup>	1,201	997	840	1,028	NA
Industry, COMEX, CBT <sup>4</sup>	6,342	8,339	9,219	9,373	9,400
Department of Defense	81	81	31	23	20
Employment, mine and mill <sup>5</sup>	2,300	2,800	2,600	1,900	1,700
Net import reliance <sup>6</sup> as a percent of apparent consumption	(?)	(?)	(?)	(?)	(?)

3. **Recycling:** About 100 metric tons of silver was recovered from old scrap in 1992, equivalent to 3% of the apparent demand for refined bullion. About 1,800 metric tons was recovered from new scrap.

4. **Import Sources (1988-91):** Mexico, 41%; Canada, 32%; United Kingdom, 6%; Peru, 6%; and other, 15%.

5. Tariff:	Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <sup>a</sup> <u>1/1/93</u>
Ores and concentrates		2603, 2607, 2608, 2616	1.7¢/kg on lead content	8.8¢/kg on copper content + 3.3¢/kg on lead content + 3.7¢/kg on zinc content.
Powder		7106.10.0000	Free	Free.
Unwrought		7106.91.0000	Free	Free.
Waste and scrap		7112	Free	Free.

<sup>a</sup>Estimated. NA Not available.

<sup>1</sup>Excludes coinage.

<sup>2</sup>Defined as refinery production from primary materials + refinery production from old scrap + net imports of bullion. Represents not only the quantity of silver required by the domestic fabricating industry, some of which may be placed in stocks, but also the quantity of silver demanded by U.S. investors.

<sup>3</sup>Balance in Mint only.

<sup>4</sup>Industry: Refiner, fabricator, and dealer. COMEX: Commodity Exchange Inc., New York. CBT: Chicago Board of Trade.

<sup>5</sup>Source: Mine Safety and Health Administration.

<sup>6</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>7</sup>The United States is a net importer of silver; however, changes in unreported investor stocks preclude calculation of a meaningful net import reliance.

<sup>8</sup>For a list of non-MFN trade areas, see U.S. Bureau of Mines (1993), Appendix B.

<sup>9</sup>Includes silver recoverable as a byproduct of base metal ores. See Appendix D for definitions.

<sup>10</sup>As constituted before Dec. 1991.

Silver--Continued

6. Depletion Allowance: 15% (Domestic), 14% (Foreign).

7. Government Stockpile:

Stockpile Status-9-30-92

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Silver	-	2,255	-	275

8. Events, Trends, and Issues: U.S. silver production, as estimated from preliminary data, declined for the second consecutive year. During 1991, operating levels at a number of silver-producing mines were reduced or the mines were temporarily idled. In 1992, operations at these mines generally remained unchanged. Additionally, other mines either closed or operated at reduced rates during the year. The low silver price was cited most often by company officials when discussing these decisions. The types of mines most impacted by current market conditions were those for whom silver was the primary product. To illustrate the growing importance of polymetallic deposits to domestic silver production, in 1985, 39% of U.S. mined silver was recovered as a byproduct; in 1991, more than 55% was a byproduct.

The Government continued to dispose of the silver held in the National Defense Stockpile (NDS), using it for the production of commemorative coins and the Eagle silver bullion coins. In nearly 11 years, from 1982 through late 1992, the Government has reduced the quantity of silver held in the NDS from nearly 4,300 metric tons to less than 2,300 metric tons.

In 1992 the average silver price decreased for the fifth consecutive year. Throughout the first 9 months, the daily price ranged between \$3.50 and \$4.50 per troy ounce. Analysts attributed the silver price weakness to weak industrial demand caused in part by the U.S. economic recession. Also cited as a factor in the weak price was the lack of investor demand for the metal.

9. World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves <sup>a</sup>	Reserve base <sup>a</sup>
	1991	1992 <sup>a</sup>		
United States	1,848	1,800	31,000	72,000
Canada	1,400	1,200	37,000	47,000
Mexico	2,196	2,000	37,000	40,000
Peru	1,770	1,500	25,000	37,000
U.S.S.R. <sup>10</sup>	1,300	1,200	44,000	50,000
Other countries	<u>6,209</u>	<u>6,000</u>	<u>106,000</u>	<u>174,000</u>
World total (may be rounded)	14,723	13,700	280,000	420,000

10. World Resources: Approximately two-thirds of world silver resources are associated with copper, lead, and zinc deposits. The remaining one-third is in vein deposits in which silver is the principal metallic component. Although most recent discoveries have been primarily gold and silver deposits, significant future reserves and resources are expected to be the result of major base metal discoveries that contain byproduct silver.

11. Substitutes: Aluminum and rhodium substitute for silver in mirrors and other reflecting surfaces. Tantalum can be used in place of silver for surgical plates, pins, and sutures. Stainless steel is an alternate material used widely in the manufacture of table flatware. Nonsilver batteries being developed may replace silver batteries in some applications. Silverless black and white film, film with reduced silver content, and xerography are alternatives to some uses of silver in photography.

**Tungsten**

(Data in metric tons of tungsten content, unless noted)

1. **Domestic Production and Use:** In 1992 one mine in California produced tungsten concentrate. The mine was operated at an annual rate well below capacity. End uses of tungsten included metalworking, mining, and construction machinery and equipment, 68%; lamps and lighting, 12%; electrical and electronic machinery and equipment and transportation, 11%; chemicals, 3%; and other, 6%. The total estimated value of primary tungsten materials consumed in 1992 was \$200 million.
  
2. **Salient Statistics-United States:**

	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>
Production, mine shipments	W	W	W	W	W
Imports for consumption, concentrate	8,045	7,896	6,420	7,837	2,000
Exports, concentrate	172	203	139	21	50
Government stockpile shipments, concentrate	524	466	-	-	-
Consumption: Reported, concentrate	7,832	7,725	15,878	15,309	3,100
Apparent, all forms	11,065	10,474	28,438	211,797	9,600
Price, concentrate, dollars per mtu WO <sub>3</sub> , <sup>3</sup> average:					
U.S. spot market, Metals Week	59	54	42	61	58
European market	58	61	54	59	60
Stocks, producer and consumer, yearend concentrate	520	1,271	1,093	1,804	700
Employment, mine and mill	124	139	119	57	15
Net import reliance <sup>4</sup> as a percent of apparent consumption	86	84	81	91	85
  
3. **Recycling:** During 1992 the quantity of scrap reprocessed into intermediates was about 3,200 tons.
  
4. **Import Sources (1988-91):** China, 53%; Bolivia, 8%; Germany, 6%; Peru, 6%; and other, 27%.
  
5. **Tariff:**

	Item	Number	Most favored nation (MFN) <u>1/1/93</u>	Non-MFN <u>1/1/93</u>
	Ore and concentrate	2611.00.0000	37.5¢/kg W cont.	\$1.10/kg W cont.
	Ferrotungsten	7202.80.0000	5.6% ad val.	35.0% ad val.
	Tungsten powders	8101.10.0000	10.5% ad val.	58.0% ad val.
	Ammonium tungstate	2841.80.0000	10.0% ad val.	49.5% ad val.
	Tungsten carbide	2849.90.3000	10.5% ad val.	55.5% ad val.
  
6. **Depletion Allowance:** 22% (Domestic), 14% (Foreign).
  
7. **Government Stockpile:** During the first 9 months of 1992, there were no disposals of nonstockpile-grade tungsten materials. About 5 tons of ore and concentrate acquired under the Defense Production Act of 1950 remained committed for disposal. In addition to the stockpile-grade quantities shown below, the stockpile contained the following quantities of nonstockpile-grade material: ore and concentrate, 10,060; ferrotungsten, 537; metal powder, 151; and carbide powder, 51.

**Stockpile Status-9-30-92**

	Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
	Ore and concentrate	35,938	24,575	1	-
	Metal powder	726	711	-	-
	Ferrotungsten	-	381	-	-
	Carbide powder	907	871	-	-

\*Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Excludes 2 months of withheld data.

<sup>2</sup>Delay in recording material imported at yearend 1990 believed to have caused significant statistical distortion. Consumption estimated to be about 10,100 metric tons for each year.

<sup>3</sup>A metric ton unit (mtu) of tungsten trioxide (WO<sub>3</sub>) contains 7.93 kilograms of tungsten.

<sup>4</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>5</sup>See Appendix D for definitions.

<sup>6</sup>As constituted before Dec. 1991.

Tungsten--Continued

8. **Events, Trends, and Issues:** Apparent consumption of tungsten products declined by about 5% during 1992 compared with the average apparent consumption for the previous 2 years, reflecting a reaction to the weak U.S. economy. Demand for tungsten generally was lower throughout all end-use sectors.

The pattern of U.S. imports of primary and intermediate tungsten materials changed significantly in 1992 because of the 151% antidumping tariff placed on imports of concentrates from China. Without China as a viable source of concentrates, U.S. processors turned to other producers for their source of concentrates. These suppliers included Bolivia, Burma, Mexico, Peru, Portugal, Rwanda, and Thailand. The remaining U.S. demand for tungsten feed materials was met through increased imports from China of the intermediates ammonium paratungstate (APT), sodium tungstate, and tungsten oxide, and through increased use of scrap. Overall, the U.S. and world demand for concentrates decreased in 1992. This decrease and declining prices prompted the closure of the Sangdong Mine in the Republic of Korea.

Two major U.S. processors of tungsten entered into sales agreements in 1992. One company signed a letter of understanding to sell its tungsten carbide powder production business to a German firm. In this transaction, the selling company was to continue to produce tungsten wire filament in support of its lamp and lighting manufacturing business, being supplied by the German firm with the metal powder necessary for their operations. In another transaction, an American company sold part of its lamp and lighting business to another German firm and part to a newly formed international consortium. Affected by the sale was all of the American company's electrical products group, including its tungsten processing and products manufacturing facility.

No disposals of tungsten from the Defense Stockpile were authorized in the FY 1993 defense authorization bill signed by the President in October 1992. Tungsten was placed in a "high-risk" category, principally because of the uncertainty of its supply from other countries.

On June 17, 1992, the Russian Federation received Most-Favored-Nation trade status with the United States. As a result of the tariff reductions associated with this new trade status, appreciable interest was expressed by industry toward importing certain forms of tungsten, including bar, rod, and metal powder.

9. **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>d</sup>	Reserve base <sup>e</sup>
	1991	1992 <sup>c</sup>		
United States	W	W	150,000	210,000
Australia	237	200	5,000	129,000
Austria	1,400	1,100	10,000	15,000
Bolivia	1,060	1,000	58,000	110,000
Brazil	500	400	20,000	20,000
Burma	300	200	15,000	34,000
Canada	-	-	260,000	493,000
China	25,000	25,000	1,050,000	1,400,000
France	-	-	20,000	20,000
Korea, Republic of	1,037	400	58,000	77,000
Portugal	1,400	1,400	26,000	26,000
Thailand	300	300	30,000	30,000
U.S.S.R. <sup>6</sup>	8,000	6,000	280,000	400,000
Other countries	<u>3,726</u>	<u>3,800</u>	<u>317,000</u>	<u>395,000</u>
World total (may be rounded)	42,960	39,800	2,300,000	3,400,000

10. **World Resources:** More than 90% of the world's estimated tungsten resources are located outside the United States, with about 41% located in China. Other than China and the United States, countries with significant resource potential are Australia, Austria, Bolivia, Brazil, Burma, Canada, North Korea, the Republic of Korea, Peru, Portugal, Spain, Thailand, Turkey, and the U.S.S.R.<sup>6</sup>
11. **Substitutes:** Cemented tungsten carbide remained a primary cutting-tool insert material because of its versatility in meeting technical requirements in many turning and milling operations. However, ceramics, ceramic-metallic composites, and other materials continued to be developed and utilized as substitutes to meet the changing needs of the world market. Increased quantities of carbide cutting-tool inserts were coated with nitrides, oxides, and carbides to extend the life of the inserts. Tungsten remained the preferred and essentially unsubstitutable material for filaments, electrodes, and contacts in lamp and lighting applications.

Zinc

(Data in thousand metric tons of zinc content, unless noted)

1. **Domestic Production and Use:** Based on the price of metal, the value of mine production in 1992 was \$676 million. The 25 leading mines accounted for 99% of mine output, with the top 5 producing 67%. About 90% of the total mine output was produced in Alaska, Missouri, New York, and Tennessee. Four primary and 10 secondary smelters produced slab zinc. About 74% of the slab zinc consumption was in Illinois, Indiana, Michigan, New York, Ohio, and Pennsylvania. Construction materials accounted for about 45% of slab zinc consumption; transportation, 20%; machinery, 12%; electrical, 11%; and other uses, 12%. Of the total slab zinc consumed, galvanizing accounted for 53%; zinc-base alloys, 20%; brass and bronze, 14%; and other, 13%. About 230,000 tons of zinc in compounds and dusts was consumed, mainly by the chemical, agricultural, rubber, and paint industries. Major coproducts of zinc mining and smelting were lead, cadmium, silver, and sulfur.

2. Salient Statistics-United States:	1988	1989	1990	1991	1992 <sup>e</sup>
Production: Mine, recoverable	244	276	515	518	520
Primary slab zinc	241	260	263	253	255
Secondary slab zinc <sup>1</sup>	89	98	96	124	125
Zinc from old scrap	97	117	109	120	120
Imports for consumption					
Ore and concentrate	63	41	47	45	40
Slab zinc, scrap, and compounds	833	790	723	637	710
Exports: Slab zinc, scrap, and compounds	107	136	128	112	120
Ore and concentrate	34	79	220	381	310
Shipments from Government stockpile	-	-	-	-	-
Consumption: Apparent, slab zinc	1,089	1,060	992	933	1,005
Apparent, all forms <sup>1</sup>	1,340	1,311	1,240	1,165	1,225
Industrial demand	1,106	1,004	1,049	835	964
Price, average, cents per pound:					
Domestic producers	60.2	82.0	74.6	52.8	59.0
London Metal Exchange, cash	51.1	77.6	66.5	50.7	57.0
Stocks, slab zinc, yearend	86	91	87	79	75
Employment: Mine and mill <sup>4</sup>	2,200	2,350	2,500	2,100	2,300
Smelter primary <sup>4</sup>	1,500	1,500	1,500	1,500	1,500
Net import reliance <sup>2</sup> as a percent of industrial demand	69	61	41	24	34

3. **Recycling:** In 1992 an estimated 360,000 tons of zinc in waste and scrap, including 120,000 tons in old scrap, was recovered in the form of slab zinc, brass, zinc-base alloys, dust, oxide, and other chemicals. Another 90,000 tons of zinc in scrap was exported, whereas 40,000 tons was imported.
4. **Import Sources (1988-91):** Ore, concentrate: Canada, 37%; Mexico, 32%; Peru, 25%; and other, 6%. Metal: Canada, 62%; Mexico, 6%; Spain, 5%; and other, 27%. Combined total: Canada, 60%; Mexico, 11%; Peru, 5%; Spain, 5%; and other, 19%.

5. Tariff:	Item	Number	Most favored nation (MFN) 1/1/93	Canada 1/1/93	Non-MFN 1/1/93
	Ore and concentrate	2608.00.0030	1.7¢/kg on lead content	0.8¢/kg on lead content	3.7¢/kg on zinc content.
	Unwrought metal	7901.11.1000	1.5% ad val	0.7% ad val	5.0% ad val.
	Alloys, casting-grade	7901.12.1000	19.0% ad val	9.5% ad val	45.0% ad val.
	Alloys	7901.20.0000	19.0% ad val	9.5% ad val	45.0% ad val.
	Waste and scrap	7902.00.0000	2.1% ad val	Free	11.0% ad val.
	Hard zinc spelter	2620.11.0000	1.5% ad val	0.7% ad val	5.0% ad val.
	Zinc oxide	2817.00.0000	Free	Free	5.5% ad val.

<sup>e</sup>Estimated.

<sup>1</sup>Includes production from new and old scrap.

<sup>2</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>3</sup>Figures for these years are lower because of a sharp rise in exports of concentrates. If calculated on a refined zinc-only basis, they would be, in order, 64%, 61%, and 64%, about the same as pre-1990 levels.

<sup>4</sup>Zinc content of concentrate and direct shipping ore.

<sup>5</sup>See Appendix D for definitions.

Zinc--Continued

6. Depletion Allowance: 22% (Domestic), 14% (Foreign).

7. Government Stockpile:

Stockpile Status-9-30-92

Material	Goal	Uncommitted inventory	Committed inventory	Disposals Jan.-Sept. 92
Zinc	1,293	343	-	-

8. Events, Trends, and Issues: Domestic zinc mine production was only marginally higher than in the previous year but, nonetheless, was the highest since 1965. Two zinc-producing mines, one in Oregon and the other in Tennessee, opened during the year. Five zinc-producing mines that closed in 1991, mainly owing to low metal prices, remained closed despite improved zinc prices in 1992. Alaska again accounted for about one-half of the U.S. total output, even though the Red Dog Mine in northwestern Alaska continued to produce below rated capacity. Domestic exports of zinc in concentrates were slightly less than last year's record high, but were about 300,000 tons for the second straight year. Because domestic primary smelting capacity is woefully lacking, the United States, at least through the next decade, was expected to remain one of the major world exporters of zinc concentrates, but also was expected to remain the world's largest importer of refined zinc.

Small gains were made in domestic metal production, mainly a result of increased output derived from steelmaking electric-arc-furnace (EAF) dusts. Three, new, EAF-dust-processing plants were commissioned in 1992, raising U.S. potential zinc-recovery capacity from this source material to about 94,000 tons per year. Despite slow growth in the U.S. economy in 1992, domestic slab zinc consumption increased about 8%, owing to higher consumption in all major use sectors, most notably in the galvanizing sector. Imports rose substantially to meet increased requirements.

Virtually all U.S. and world zinc prices were tied to London Metal Exchange (LME) pricing in 1992. Despite large increases in world metal stocks as the year progressed, zinc prices rose substantially through September, owing in part, to a continuous options-related squeeze at the LME. In October, prices fell in response to softening world demand and rising stock levels. Metal stocks held in LME warehouses more than doubled during the year, resulting in the LME becoming the principal world depository for zinc stocks. In the United States the LME expanded its warehouse network to six locations: Baltimore, MD; Chicago, IL; Long Beach, CA; Louisville, KY; New Haven, CT; and Toledo, OH.

Environmental concerns in the zinc-producing sector were more associated with coproduct and byproduct elements, such as lead, cadmium, and sulfur. The Occupational Safety and Health Administration substantially tightened cadmium exposure standards for workers in zinc/cadmium refineries; however cadmium facilities in zinc plants will be allowed to operate at higher cadmium levels if worker exposure is limited. The Basel Convention, which governs the transboundary movements of hazardous waste and scrap between nations, was ratified by the U.S. Senate; as of mid-November the U.S. Congress had not passed implementing legislation.

9. World Mine Production, Reserves, and Reserve Base:

	Mine production <sup>1</sup>		Reserves <sup>2</sup>	Reserve base <sup>3</sup>
	1991	1992 <sup>4</sup>		
United States	547	550	16,000	50,000
Australia	1,048	1,000	17,000	65,000
Canada	1,148	1,290	21,000	56,000
China	650	720	5,000	9,000
Mexico	301	310	6,000	8,000
Peru	623	595	7,000	12,000
Other countries	2,965	2,900	72,000	125,000
World total (may be rounded)	7,282	7,365	140,000	330,000

10. World Resources: Conventional identified zinc resources of the world are about 1.8 billion tons. Zinc-bearing coals, mostly in the central United States, also have a resource potential of millions of tons of zinc that might be recovered during coal beneficiation.

11. Substitutes: Aluminum, plastics, and magnesium are major competitors as diecasting material. Aluminum, steel, and plastics substitute for galvanized sheet uses. Plastic coatings, paint, cadmium and aluminum alloys coatings replace zinc for corrosion protection; aluminum alloys are used in place of brass. Many elements are competitors of zinc in chemical, electronic, and pigment uses.

APPENDIX D

A Resource/Reserve Classification for Minerals

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## A Resource/Reserve Classification for Minerals From U.S. Bureau of Mines (1993)

### INTRODUCTION

Through the years, geologists, mining engineers, and others operating in the minerals field have used various terms to describe and classify mineral resources, which as defined herein include energy materials. Some of these terms have gained wide use and acceptance, although they are not always used with precisely the same meaning.

Staff members of the U.S. Bureau of Mines and the U.S. Geological Survey collect information about the quantity and quality of all mineral resources, but from different perspectives and with different purposes. In 1976, a team of staff members from both agencies developed a common classification and nomenclature, which was published as U.S. Geological Survey Bulletin 1450-A-"Principles of the Mineral Resource Classification System of the U.S. Bureau of Mines and U.S. Geological Survey." Experience with this resource classification system showed that some changes were necessary in order to make it more workable in practice and more useful in long-term planning. Therefore, representatives of the U.S. Geological Survey and the U.S. Bureau of Mines collaborated to revise Bulletin 1450-A.

Long-term public and commercial planning must be based on the probability of discovering new deposits, on developing economic extraction processes for currently unworkable deposits, and on knowing which resources are immediately available. Thus, resources must be continuously reassessed in the light of new geologic knowledge, of progress in science and technology, and of shifts in economic and political conditions. To best serve these planning needs, known resources should be classified from two standpoints: (1) purely geologic or physical/chemical characteristics—such as grade, quality tonnage, thickness, and depth—of the material in place; and (2) profitability analyses based on costs of extracting and marketing the material in a given economy at a given time. The former constitutes important objective scientific information of the resource and a relatively unchanging foundation upon which the latter more valuable economic delineation can be based.

The revised classification systems, designed generally for all mineral materials, is shown graphically in figures 1 and 2; its components and their usage are described in the text. The classification of mineral and energy resources is necessarily arbitrary, because definitional criteria do not always coincide with natural boundaries. The system can be used to report the status of mineral and energy-fuel resources for the Nation or for specific areas.

### RESOURCE/RESERVE DEFINITIONS

A dictionary definition of resource, "something in reserve or ready if needed," has been adapted for mineral and energy resources to comprise all materials, including those only surmised to exist, that have present to anticipated future value.

**Resource.**—A concentration of naturally occurring

solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

**Original Resource.**—The amount of a resource before production.

**Identified Resources.**—Resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. Identified resources include economic, marginally economic, and sub-economic components. To reflect varying degrees of geologic certainty, these economic divisions can be subdivided into measured, indicated, and inferred.

**Demonstrated.**—A term for the sum of measured plus indicated.

**Measured.**—Quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and(or) quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurements are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

**Indicated.**—Quantity and grade and(or) quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observation.

**Inferred.**—Estimates are based on an assumed continuity beyond measured and(or) indicated resources, for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

**Reserve Base.**—That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve base is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources). The term "geologic reserve" has been applied by others generally to the reserve-base category, but it also may include the inferred-reserve-base category; it is not a part of this classification system.

**Inferred Reserve Base.**—The in-place part of an identified resource from which inferred reserves are estimated. Quantitative estimates are based

largely on knowledge of the geologic character of a deposit and for which there may be no samples or measurements. The estimates are based on an assumed continuity beyond the reserve base, for which there is geologic evidence.

**Reserves.**-That part of the reserve base which could be economically extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative. Reserves include only recoverable materials; thus, terms such as "extractable reserves" and "recoverable reserves" are redundant and are not a part of this classification system.

**Marginal Reserves.**-That part of the reserve base which, at the time of determination, borders on being economically producible. Its essential characteristic is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technological factors.

**Economic.**-This term implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

**Subeconomic Resources.**-The part of identified resources that does not meet the economic criteria of reserves and marginal reserves.

**Undiscovered Resources.**-Resources, the existence of which are only postulated, comprising deposits that are separate from identified resources. Undiscovered resources may be postulated in deposits of such grade and physical location as to render them economic, marginally economic, or subeconomic. To reflect varying degrees of geologic certainty, undiscovered resources may be divided into two parts.

**Hypothetical Resources.**-Undiscovered resources that are similar to known mineral bodies and that may be reasonably expected to exist in the same producing district or region under analogous geologic conditions. If exploration confirms their existence and reveals enough information about their quality, grade, and quantity, they will be

reclassified as identified resources.

**Speculative Resources.**-Undiscovered resources that may occur either in known types of deposits in favorable geologic settings where mineral discoveries have not been made, or in types of deposits as yet unrecognized for their economic potential. If exploration confirms their existence and reveals enough information about their quantity, grade, and quality, they will be reclassified as identified resources.

**Restricted Resources/Reserves.**-That part of any resource/reserve category that is restricted from extraction by laws or regulations. For example, restricted reserves meet all the requirements of reserves except that they are restricted from extraction by laws or regulations.

**Other Occurrences.**-Materials that are too low grade or for other reasons are not considered potentially economic, in the same sense as the defined resource, may be recognized and their magnitude estimated, but they are not classified as resources.

A separate category, labeled other occurrences, is included in figures 1 and 2. In figure 1, the boundary between subeconomic and other occurrences is limited by the concept of current or potential feasibility of economic production, which is required by the definition of a resource. The boundary is obviously uncertain, but limits may be specified in terms of grade, quality, thickness, depth, percent extractable, or other economic-feasibility variables.

**Cumulative Production.**-The amount of past cumulative production is not, by definition, a part of the resource. Nevertheless, a knowledge of what has been produced is important to an understanding of current resources, in terms of both the amount of past production and the amount of residual or remaining in-place resource. A separate space for cumulative production is shown in figure 1. Residual material left in the ground during current or future extraction should be recorded in the resource category appropriate to its economic-recovery potential.

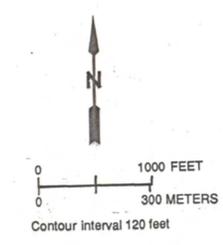
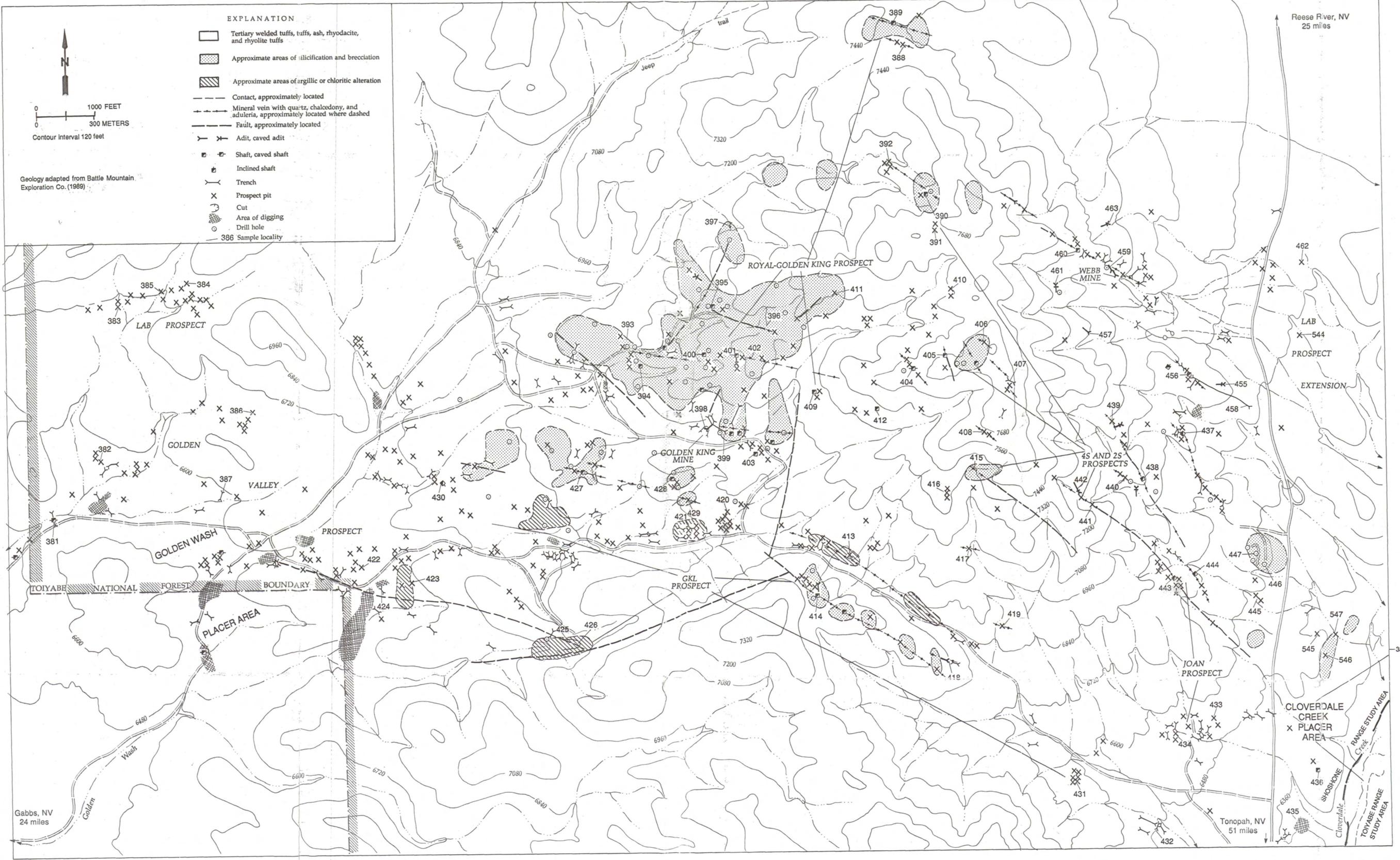
Cumulative production	IDENTIFIED RESOURCES		UNDISCOVERED RESOURCES		
	Demonstrated		Inferred	Probability range	
	Measured	Indicated		Hypothetical	(or) Speculative
ECONOMIC	Reserves		Inferred reserves		
MARGINALLY ECONOMIC	Marginal reserves		Inferred marginal reserves		+
SUB-ECONOMIC	Demonstrated subeconomic resources		Inferred subeconomic resources		+
Other occurrences	Includes nonconventional and low-grade materials				

Figure D-1.--Major elements of mineral-resource classification, excluding reserve base and inferred reserve base.

Cumulative production	IDENTIFIED RESOURCES		UNDISCOVERED RESOURCES		
	Demonstrated		Inferred	Probability range	
	Measured	Indicated		Hypothetical	(or) Speculative
ECONOMIC	Reserve		Inferred		
MARGINALLY ECONOMIC			reserve		+
SUB-ECONOMIC	base		base		+
Other occurrences	Includes nonconventional and low-grade materials				

Figure D-2.--Reserve base and inferred reserve base classification.

117°32'30"



- EXPLANATION**
- Tertiary welded tuffs, tuffs, ash, rhyodacite, and rhyolite tuffs
  - Approximate areas of silicification and brecciation
  - Approximate areas of argillic or chloritic alteration
  - Contact, approximately located
  - Mineral vein with quartz, chalcocite, and adularia, approximately located where dashed
  - Fault, approximately located
  - Adit, caved adit
  - Shaft, caved shaft
  - Inclined shaft
  - Trench
  - Prospect pit
  - Cut
  - Area of digging
  - Drill hole
  - 386 Sample locality

Geology adapted from Battle Mountain Exploration Co. (1989)

Reese River, NV  
 25 miles

Gabbs, NV  
 24 miles

Tonopah, NV  
 51 miles

Plate 5.- Workings, sample sites, and geology of the Cloverdale mining district

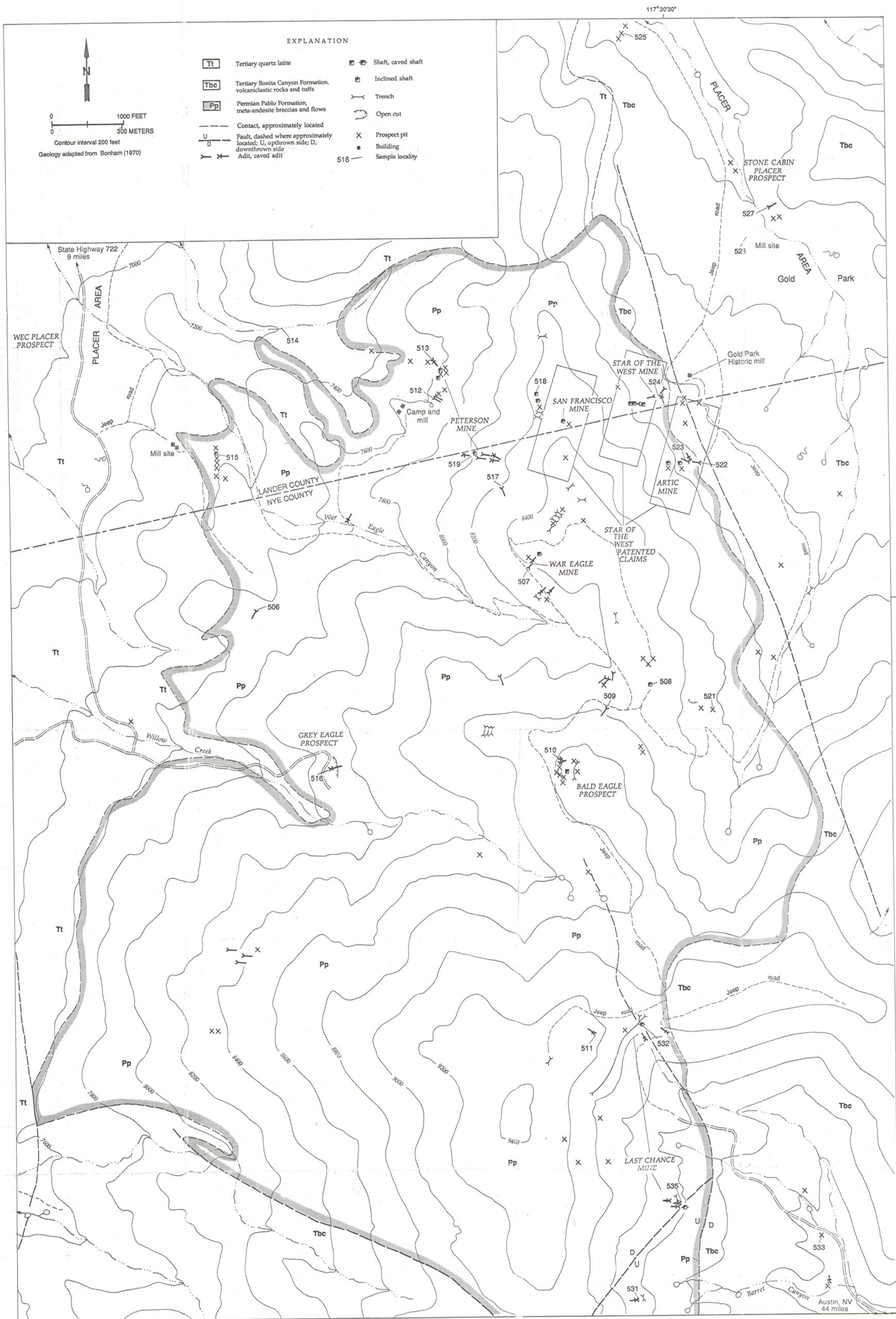


Plate 1.- Workings, sample sites, and geology of the Jackson mining district



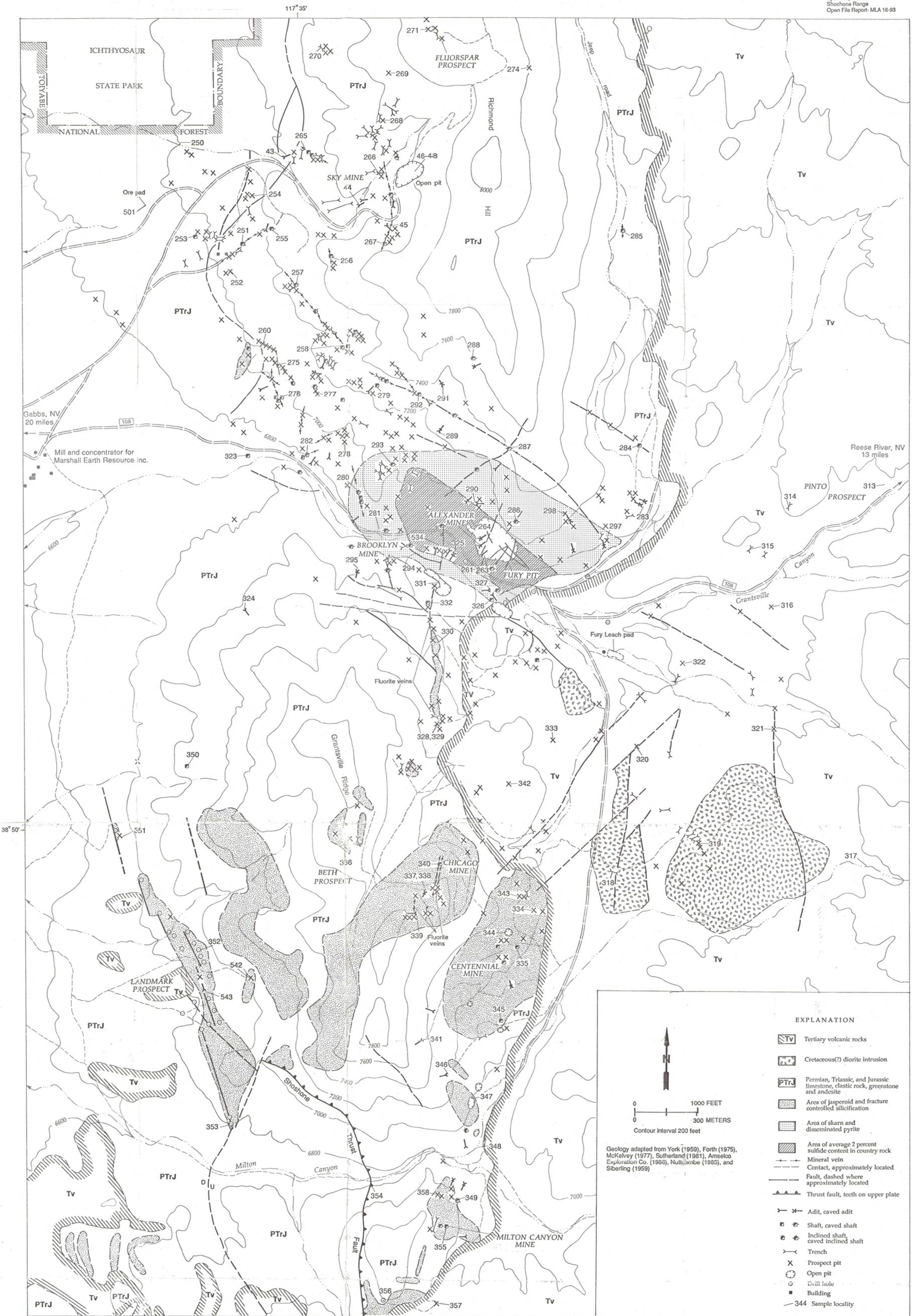


Plate 4.- Workings, sample sites, and geology of the Grantsville mining district

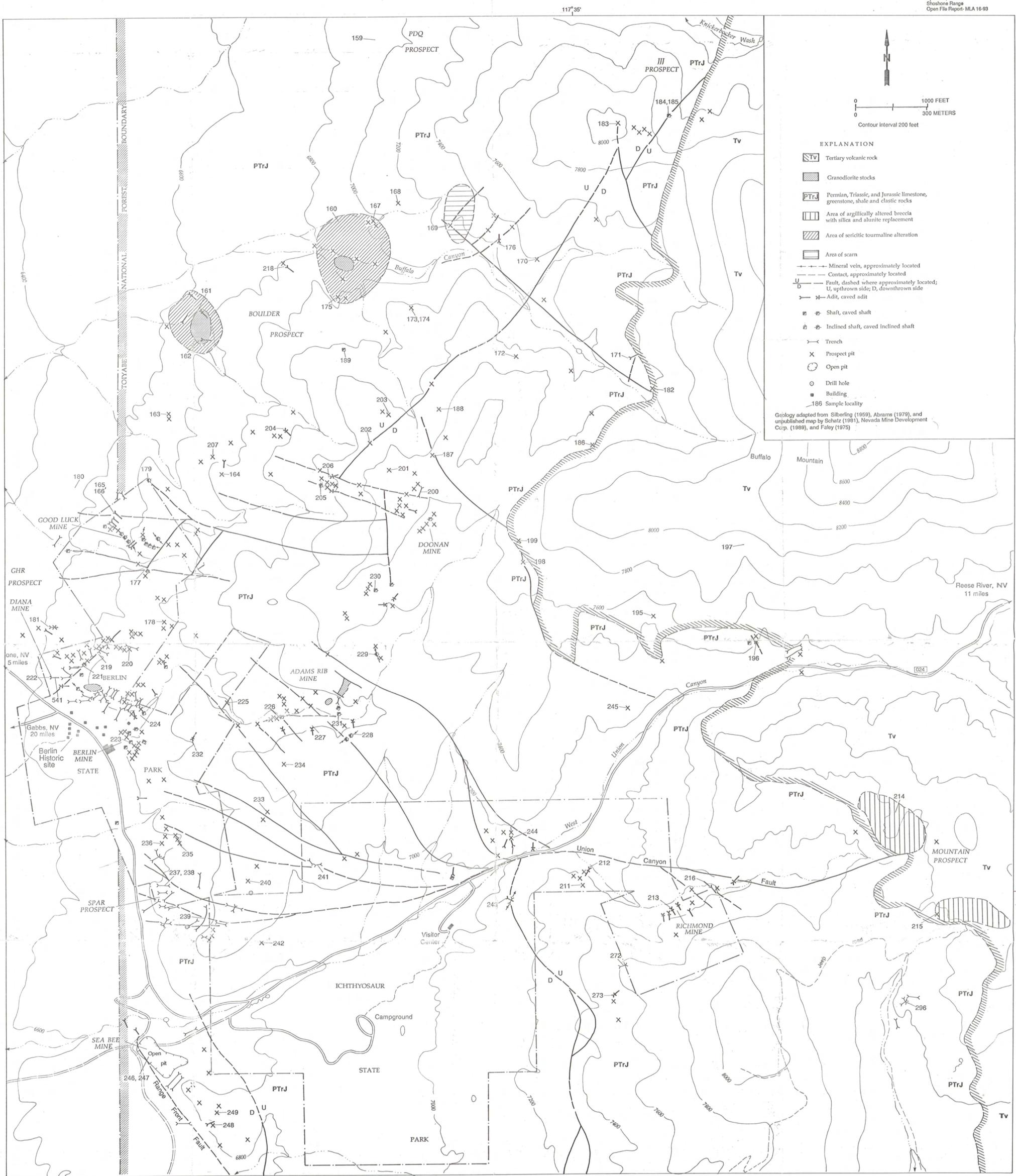
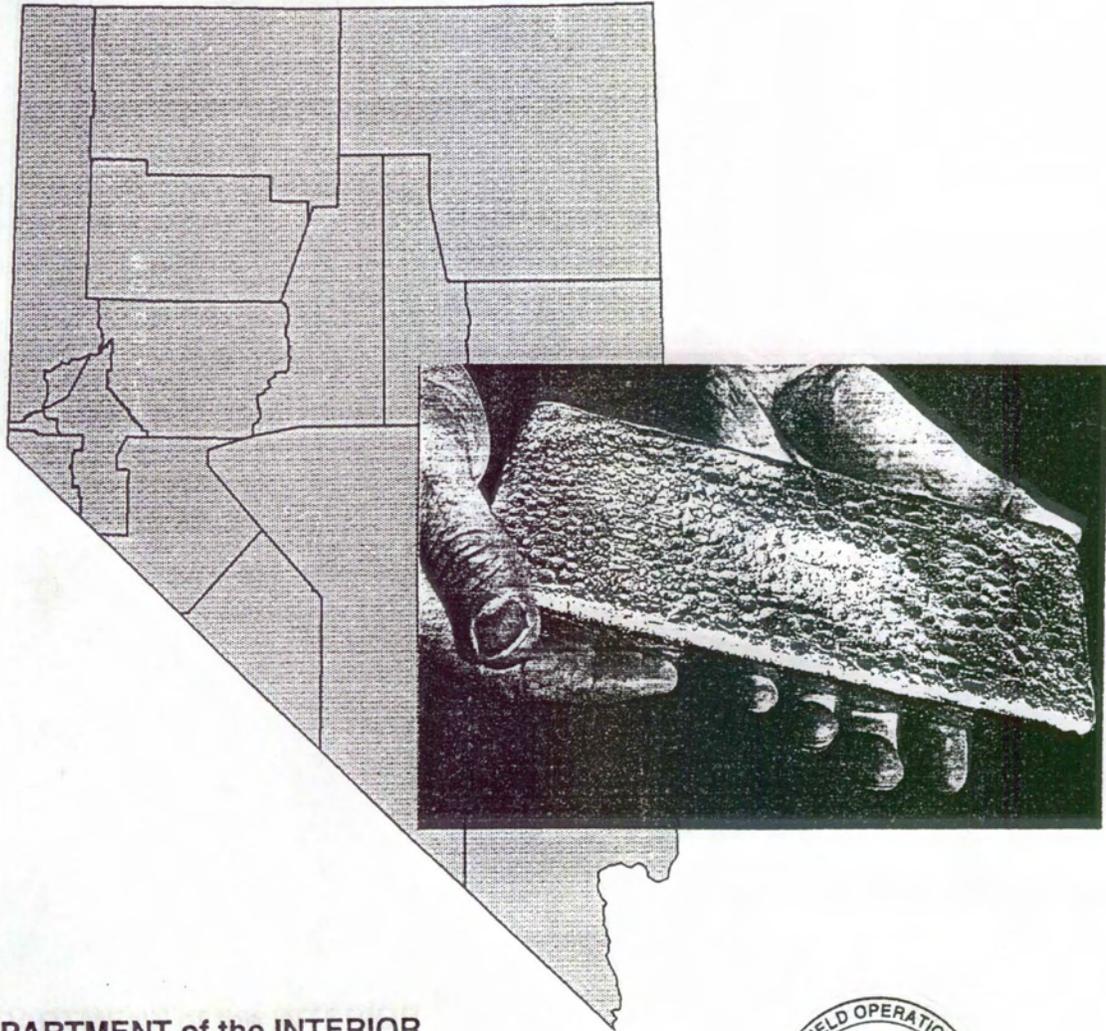


Plate 3.- Workings, sample sites, and geology of the Berlin mining district

*Office Copy*

# ACTIVE OR SIGNIFICANT GOLD DEPOSITS IN NEVADA (1992)



**U.S. DEPARTMENT of the INTERIOR**  
Bruce Babbitt, Secretary

**U. S. BUREAU of MINES**  
Hermann Enzer, Acting Director



OFR16-93

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<p>This open-file map is a quick reference containing location, ownership, and general lithology information on 124 active or significant Nevada gold mines. The map includes all counties, significant towns, and major highways in Nevada to aid in mine location. Several geologic trends with which the mines are associated are also depicted. General ore genesis for each deposit, including sedimentary, volcanic, plutonic, and placer-hosted deposits, are also identified.</p> <p>Gold mines are also listed alphabetically, by mine name, on the map. Each entry includes the appropriate county, percent of company ownership, operating company, and the property status as of May 1992. For additional information, contact Thomas M. Sweeney, U.S. Bureau of Mines, Western Field Operations Center, 360 East Third Avenue, Spokane, WA 99202; telephone (509) 353-2700.</p>			13.
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ACTIVE OR SIGNIFICANT NEVADA GOLD PROPERTIES MAP

(1992)

By

Thomas M. Sweeney

U.S. Department of the Interior  
Bureau of Mines

April 1993

## ACTIVE OR SIGNIFICANT NEVADA GOLD PROPERTIES MAP

(1992)

The attached map is a quick reference presently containing location, ownership, and general lithology information about 124 active or significant Nevada gold mines.

It was conceived as an "office working map" at the U.S. Bureau of Mines, Western Field Operations Center, Spokane, WA, to reference and plot general mine information about the changing Nevada gold industry. The map is continuously evolving as new information about these properties is acquired. Yearly reprints include corrections and additions to insure a reasonably up-to-date product, although some errors and omissions may occur. Notification of any required corrections would be greatly appreciated.

The map shows all counties, several significant towns, and major highways. Many geologic trends associated with the local mines are also depicted. Individual mines are identified using a triangular map symbol, or variations thereof, to indicate different ore genesis. A filled triangle indicates a deposit where gold is hosted by sedimentary rocks, an open triangle denotes a volcanic-hosted deposit, an open triangle with a dot in its center indicates a plutonic-hosted deposit, and a capital "P" indicates a placer deposit.

On the left edge of the map there is an alphabetical listing of gold mines by name. Each entry includes the name of the appropriate county, ownership by company and that company's percent of ownership, operator designation, and the status of the property as of May 1992.

A small inset map of counties is included to enable easier location of the mines. For example, if a user knows a mine name but not its location, they can refer to the property list on the left side of the map to determine which county it is in. They would then locate the general area of interest on the inset map prior to a detailed search on the main map.

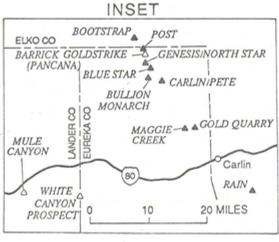
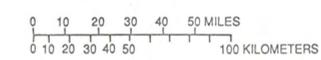
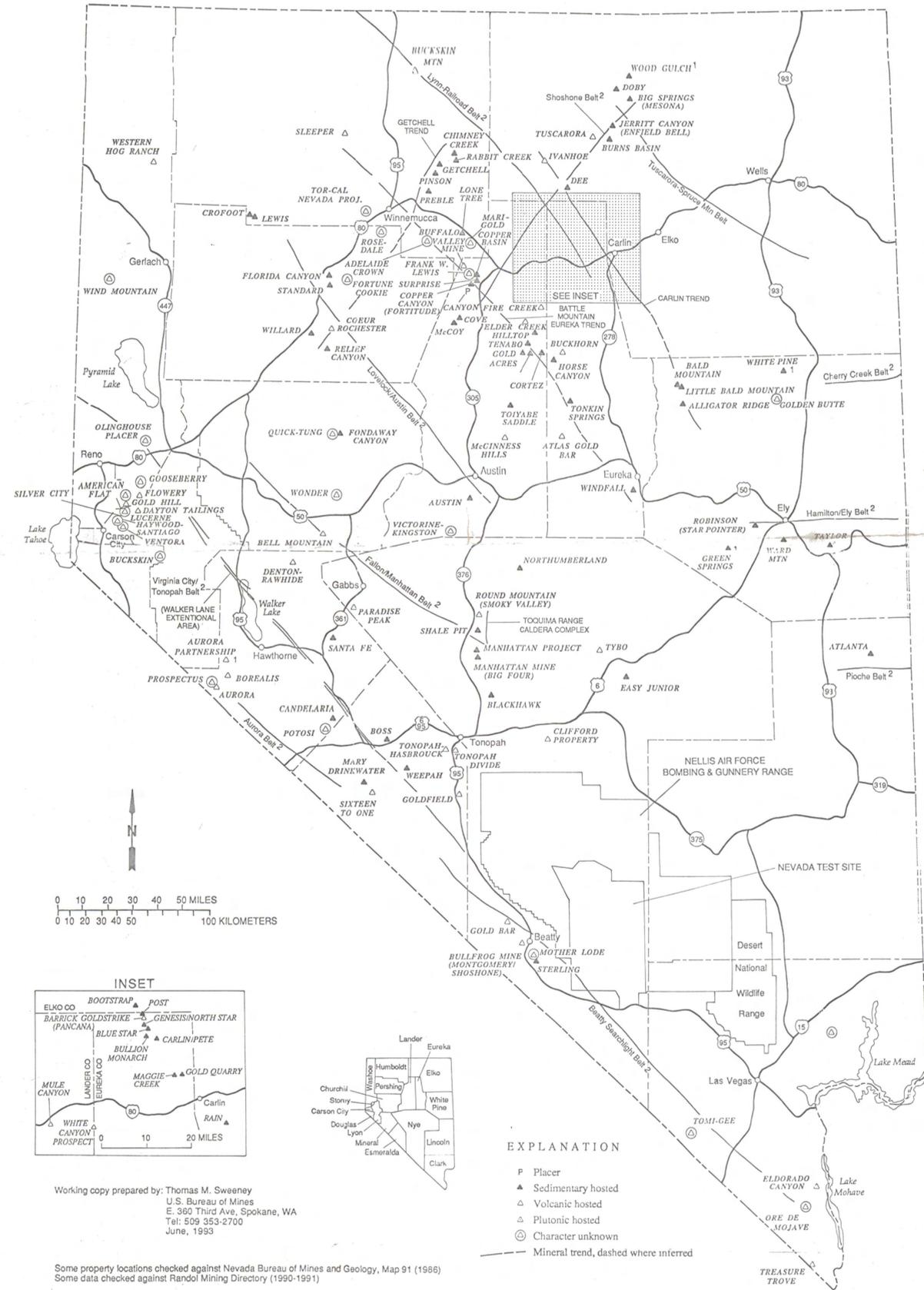
Several sources used during preparation of this product are referenced at the bottom of the map. More detailed information can be obtained by calling the telephone number provided at the bottom of the map.

# ACTIVE OR SIGNIFICANT NEVADA GOLD PROPERTIES

U.S. Bureau of Mines, Western Field Operations Center

## ACTIVE OR SIGNIFICANT NEVADA GOLD PROPERTIES U.S. BUREAU OF MINES WESTERN FIELD OPERATIONS CENTER

NAME (ACT.)	COUNTY	OWNER NAME (PERCENT OF OWNERSHIP)	PROJECT STATUS
ADELAIDE CROWN	HUMBOLDT	GOLD KING MINING, INC. OP	ACTIVE
ALLIGATOR RIDGE	WHITE PINE	USM (100) OP	ACTIVE
AMERICAN FLAT 1(LORRINE)	STOREY	UNITED MINING CO. INC. OP #34	INLE
ATLANTA	LINCOLN	STANDARD SLAG CO. (51)/BACAT PROPERTIES INC. (49) #34	INLE
ATLAS GOLD BAR	EUREKA	ATLAS GOLD MINING INC. (100) OP	ACTIVE
AURORA PARTNERSHIP	MINERAL	MINECO (50) OP/ELECTRA NORTHWEST RESOURCES (50)	ACTIVE
AURORA PROJECT	MINERAL	NEVADA GOLDFIELDS COOP. (100)/AURORA CONSOLIDATED MINES COMPANY OP	CLOSED
AUSTIN VENTURE	LANDER	PLACER DOME U.S. INC. (100) OP	ACTIVE
BALD MOUNTAIN	WHITE PINE	N.A. REBERSTROM (100) OP	BEVELP
BELL MOUNTAIN	CHURCHILL	INDEPENDENCE MINING COMPANY, INC. (100) OP	ACTIVE
BIG SPRINGS (MESONA)	ELKO	CANADIAN RESOURCES LTD. (100) OP #24	ACTIVE
BLACK HAWK	NYE	NEVADATOP GOLD COMPANY (100) OP	ACTIVE
BLUE STAR	EUREKA	NEVADATOP GOLD COMPANY (100) OP	ACTIVE
BOOTSTRAP (CAPSTONE)	ELKO	ECHO BAY MINES LTD. (100) OP	INLE
BORERALS (EAST RIDGE)	MINERAL	ECHO BAY MINES LTD. (100) OP	CLOSED
BOSS	ESMERALDA	E. BEGG (70)/FALCON EXPLORATION	CLOSED
BUCKEEN	EUREKA	CORTICE RESOURCES INTERNATIONAL (74.41)/OP/GENESIS RESOURCES LTD. (25.6)	INLE
BUCKEEN HILL	HUMBOLDT	SODONA MINING CORPORATION (100) OP - LEASE PLANT FOR JIMSTOWN, CA. ORE	EXPLOR
BUCKEEN MTS. (NATIONAL)	HUMBOLDT	QUEENSTAKE RESOURCES INC. (60)/ASARCO (40) #34	ACTIVE
BUFFALO VALLEY	LANDER	HORIZON GOLD SHARES	CLOSED
BULLFROG (MONT. SHOSHONE)	NYE	LAC MINERALS LTD. (100)/LAC BULLFROG INC. OP	ACTIVE
BULLION MONARCH	FURCO	HIGH RESCUT MINERAL RESOURCES OF NEVADA (100)	INLE
BUVUS BASIN	F. CO	INDEPENDENCE MINING COMPANY (70)/FAC CORPORATION (30)	BEVELP
CANDELARIA	MINERAL	MINECO METALS CO. (100) OP	INLE
CANYON PLACER	LANDER	BATTLE MOUNTAIN GOLD COMPANY (100) OP	INLE
CARLIN	EUREKA	NEVADATOP GOLD CO. (100) OP	ACTIVE
CASINO/WHOROCK	CLARK	USM (51) OP/PEASAS GOLD, INC. (49)	ACTIVE
CHIMNEY CREEK	HUMBOLDT	WAGNER MINERAL RESOURCES (100) OP	ACTIVE
CLIFFORD	NYE	TCAN RESOURCES (60)/PETROBRONCO VENTURES (40) #34	ACTIVE
COEUR ROCHESTER	PERKINS	COEUR ROCHESTER MINES (100) OP	ACTIVE
COPPER BASIN (SURPRISE)	LANDER	BATTLE MOUNTAIN GOLD COMPANY (100) OP	ACTIVE
COPPER CANYON (FORTITUDE)	LANDER	(SEE FORTITUDE)	ACTIVE
CORTEZ (HORSE CANYON/GOLD COVE)	LANDER	PLACER DOME U.S. INC. (40)/OP/KEENE/COTT (40)	ACTIVE
CROFOOT	HUMBOLDT	ECHO BAY MINES LTD. (100) OP	ACTIVE
CROFOOT/LEWIS	HUMBOLDT	GRANDES EXPLOITACIONES (47)/MTCOFT RESOURCES AND DEVELOPMENT CORPORATION (53)	ACTIVE
DAYTON TAILINGS	ELKO	ALABAMA MINES (100) OP #34	CLOSED
DEKSTER (VISCARRA)	MINERAL	BATONCE YELLOW KNIFE RES. (44.10)/CARSON COOP. (44.10)/JONAN LIVERMORE (12)	ACTIVE
DEKSTER (VISCARRA)	ELKO	DEKSTER COOP. (87.2) S. PETER (12.8)/TADSON INC. (49.3)/FLEXUS RES. CORP. (49.2) OF EVENTS (50.7)	ACTIVE
DEKSTER (VISCARRA)	ELKO	HORIZON GOLD SHARES (60)/FISCHER-WATT GOLD COMPANY (40)	INLE
DEKSTER (VISCARRA)	ELKO	HOMESTEAD MINING CO. (100) OP	BEVELP
EAST JUNIOR	WHITE PINE	ALTA GOLD (100) OP	INLE
ELDER CREEK	LANDER	ALTA GOLD (100) OP	INLE
ELDORADO CANYON (TECHN.)	CLARK	MOZAYE GOLD INC. (79) #34	ACTIVE
FALCON CO. (TOMPAH DIV)	ESMERALDA	FALCON MINING AND EXPLORATION CO. (1)/TOMPAH DIVIDE MINING CO. (1) OP #24	ACTIVE
FIRE CREEK	LANDER	ELKHOTE MINES LTD. (100) #34	INLE
FLORIDA CANYON	PERKINS	PEASAS GOLD INC. (100) OP	ACTIVE
FLOWERY (SILVER CITY CANYON)	STOREY	MINERAL RESOURCES (40)/AMERICAN EAGLE RESOURCES, INC. (40) OP	INLE
FONDSHAY CANYON	CHURCHILL	TEENECO MINERALS (100) OP	INLE
FORTITUDE (COPPER CANYON)	LANDER	BATTLE MOUNTAIN GOLD COMPANY (100) OP	ACTIVE
FORTUNE COCKIE	PERKINS	PRODUP INC. (100) OP #34	ACTIVE
FRANK W. LEWIS	LANDER	NEVADATOP GOLD COMPANY (100) OP	EXPLOR
GENESIS	EUREKA	NEVADATOP GOLD COMPANY (100) OP	ACTIVE
GETCHELL	HUMBOLDT	FRX MINERALS, INC. (100) OP (FIRST MISSISSIPPI GOLD INC.)	ACTIVE
GOLD ACRES (CORTEZ)	LANDER	PLACER DOME U.S. INC. (40)/OP/KEENE/COTT (40)	ACTIVE
GOLD BAR	NYE	ANGST INC. (100) - WILL CLOSE 9/92	ACTIVE
GOLD HILL	STOREY	FRONTIER ENERGY RESOURCES, INC. #34	ACTIVE
GOLD QUARRY (MAGGIE CR.)	EUREKA	NEVADATOP GOLD COMPANY (100) OP - INCLUDES MAC AND THUS DEPOSITS	ACTIVE
GOLDEN BUTTE	WHITE PINE	ALTA BAY	INLE
GOLDFIELD BLACKHAWK	ESMERALDA	PACIFIC GOLD AND WARDON (25)/NORANDA (25)/SOUTHERN PACIFIC LAND COMPANY (50)/BLACKHAWK MINES	BEVELP
GOLDFIELD (NETZ)	EUREKA	AMERICAN BARRETT RESOURCES CORPORATION (100) OP	ACTIVE
GOOSEBERRY	STOREY	ASAMERA MINERALS INC. (50)/PRIVATE INDIVIDUAL (50)	INLE
GREEN HILL	WASHOE	U.S. MINERALS EXPLORATION - USM (100) OP	CLOSED
GREEN SPRINGS	WHITE PINE	U.S. MINERALS EXPLORATION - USM (100) OP	CLOSED
HAYWOOD (SANTAGO)	ELKO	U.S. MINERALS EXPLORATION - USM (100) OP	INLE
HILLTOP	LANDER	PLACER DOME U.S. INC. (40)/OP/KEENE/COTT (40)	EXPLOR
HORSE CANYON (CORTEZ)	EUREKA	PLACER DOME U.S. INC. (40)/OP/KEENE/COTT (40)	ACTIVE
ILLIPAH	WHITE PINE	ALTA GOLD CORPORATION (100) OP	CLOSED
IVANHOE (LJ/LISTER)	ELKO	CORONADO RESOURCES (50)/NEVADATOP GOLD UP TO (75)	ACTIVE
JERRITT CANYON (ENFIELD BELL)	ELKO	INDEPENDENCE MINING COMPANY, INC. (70)/OP/FC CORPORATION (30)	ACTIVE
KINGSTON (VICTORINE)	LANDER	NEVADA GOLDFIELDS CORPORATION (50)/OP/NEW BEGINNINGS (50)	INLE
LEWIS (CROFOOT)	HUMBOLDT	SEE CROFOOT/LEWIS	ACTIVE
LITTLE BULL MOUNTAIN	WHITE PINE	NEB BYSTON MINES (81)/OP/PCO/PCP RESOURCES (17)/PRIVATE INDIVIDUAL (2)	ACTIVE
LONE TREE	HUMBOLDT	LONE TREE MINING, INC. (100) OP	ACTIVE
LUCERNE (SILVER CITY)	ELKO	WINDMILL 1/2M RESOURCES #34	INLE
MAGGIE CREEK (GOLD QUARRY)	EUREKA	NEVADATOP GOLD CO. (100)	ACTIVE
MANHATTAN (BIG FOUR)	NYE	ECHO BAY MINES (100) OP	INLE
MANHATTAN PROJECT	NYE	CROWN RESOURCES (100) OP	EXPLOR
MARI-GOLD	HUMBOLDT	CORDEX SYNDICATE (70)/SANTA FE MINERALS CORP. (30)/MARI-GOLD MINING CO. OP	ACTIVE
MARY DRINKWATER	LANDER	HOMESTEAD MINERALS (100) OP	ACTIVE
MCCOY (COVE)	LANDER	SEE COVE/MCCOY	ACTIVE
MESONA (BIG SPRINGS)	ELKO	SEE BIG SPRINGS	ACTIVE
MONTGOMERY SHOSHONE (BULL)	NYE	(SEE BULLFROG)	ACTIVE
MOTHER LODE	NYE	GEXA GOLD COOP. (44.10)/SISCON (40)/N.A. REBERSTROM (UP TO 20) OP	ACTIVE
MULE CANYON	LANDER	GOLDFIELDS MINING CORPORATION (100) OP	BEVELP
NORTH STAR	EUREKA	NEVADATOP GOLD COMPANY (100) OP	INLE
NORTHUMBERLAND	NYE	WESTERN STATES MINERALS CORPORATION (100) OP	INLE
OLINGHOUSE PLACER	WASHOE	(SEE ALSO GREEN HILL)	INLE
ORE DE MOJAVE	CLARK	WAGNER MINING AND DEVELOPMENT (100) OP #34	INLE
PARADISE PEAK	NYE	FRX GOLD CORPORATION (100) OP	ACTIVE
PETE	EUREKA	NEVADATOP GOLD COMPANY (100) OP	INLE
PINSON	HUMBOLDT	CORONA CORPORATION, AMER. BARRETT, (UNITED STATES, EACH 4 (26.25)/J.S. LIVERMORE (12)/FSM (9)	ACTIVE
PIPELINE	LANDER	PLACER DOME U.S. INC. (40) OP/KEENE/COTT (40)	EXPLOR
POST	EUREKA	NEVADATOP GOLD COMPANY (100) OP	ACTIVE
POTOSI	MINERAL	NEVADA MINERAL VENTURES #34	INLE
PREBLE	HUMBOLDT	CORONA CORPORATION, AMER. BARRETT, (UNITED STATES, EACH 4 (26.25)/J.S. LIVERMORE (12)/FSM (9)	ACTIVE
PROSPECTUS	MINERAL	NEVADA GOLDFIELDS MINING CORPORATION (100) OP	INLE
QUICK-TUNG (GOLD HILL)	CHURCHILL	FRONTIER ENERGY RESOURCES, INC. #34	ACTIVE
RABBIT CREEK	HUMBOLDT	SANTA FE PACIFIC MINERALS CO. (100) OP	ACTIVE
RAIN	ELKO	NEVADATOP GOLD COMPANY (100) OP	CLOSED
RELIEF CANYON	PERKINS	PEASAS GOLD INC. (100) OP	CLOSED
ROBERTSON	LANDER	AMAT GOLD, INC. (40) OP/CAROL GOLD (40)	EXPLOR
ROBINSON (STAR POINTER)	WHITE PINE	HAGRA COPPER (100) OP	ACTIVE
ROSE-BALE	PERKINS	MINERAL ASSOCIATES INC. (100) OP #34	ACTIVE
ROUND MOUNTAIN (SILVER VAL)	NYE	ECHO BAY MINES (50)/HOMESTEAD (25)/CASE FOREORD & COMPANY INC. (25)	ACTIVE
SANTA FE	MINERAL	CORONA CO. INC. OP/INTERNATIONAL CORONA (100)	ACTIVE
SILVER CITY	WASHOE	?	INLE
SILVERMOUNT	ESMERALDA	ZEPHYR RESOURCES INC. (44.6-47.0)/M3-CONTINENT MINING CO. #34	INLE
SLEEPER	HUMBOLDT	AMAT GOLD INC. (100) OP	ACTIVE
SKOY VALLEY (ROUND MOUNTAIN)	NYE	ECHO BAY MINES (50)/HOMESTEAD (25)/CASE FOREORD & COMPANY INC. (25)	ACTIVE
STANDARD	PERKINS	?	ACTIVE
STAR POINTER (ROBINSON)	WHITE PINE	HAGRA COPPER (100) OP	ACTIVE
STERLING	NYE	CATHERAL GOLD COOP. (52)/SAGA EXPLORATION (30)/OP/GENEX (10)	ACTIVE
SURTECH (SEE KINGSTON)	LANDER	BATTLE MOUNTAIN GOLD COMPANY (100) OP	INLE
SURPRISE (COPPER BASIN)	LANDER	ALTA GOLD (100) OP	ACTIVE
TALON	WHITE PINE	FIRST INTERNATIONAL METALS (100) OP	INLE
TENABO	LANDER	INLAND GOLD AND SILVER COOP. (100) OP	ACTIVE
TOIYABE SADDLE (TOIYABE)	LANDER	?	ACTIVE
TOMI-GEE	CLARK	?	ACTIVE
TONKIN SPRINGS	EUREKA	HOMESTEAD MINING CO. (51) OP/U.S. GOLD CORP. (49)	EXPLOR
TOMPAH DIVIDE	ESMERALDA	CROWN RESOURCES CORP. #34	EXPLOR
TOMPAH HASBROUCK	ESMERALDA	CORDEX EXPLORATION COMPANY (100) OP	EXPLOR
TOR-CAL NEVADA PROJECT	HUMBOLDT	TREASURY TRAVEL MINING INC. (100) OP #34	ACTIVE
TREASURY TROVE	CLARK	HORIZON GOLD SHARES (82)/OP/FISCHER-WATT MINING CO. (18)	ACTIVE
TUSCARORA GOLD (DEKSTER)	ELKO	ALTA GOLD CORPORATION (100) #34	BEVELP
TYBO	NYE	TECK RESOURCES (65) (100) OP #34	ACTIVE
VENTORA	CARSON CITY	NEVADA GOLDFIELDS COOP. (50)/OP/NEW BEGINNINGS (50)	ACTIVE
VICTORINE (KINGSTON)	LANDER	ALTA GOLD CORPORATION (100) OP	INLE
WARD MOUNTAIN	WHITE PINE	SUNSHINE MINING COMPANY (100)/LEASED TO HOMESTEAD MINERALS, INC. OP	INLE
WEEPAP	ESMERALDA	WESTERN MINING CORPORATION HOLDINGS LTD (100)/WESTERN HOG RANCH COMPANY OP	ACTIVE
WESTERN HOG RANCH	WASHOE	?	ACTIVE
WHITE CANYON	LANDER	?	ACTIVE
WHITE PINE	WHITE PINE	WESTERN STATES MINERALS CORP. (100) OP	ACTIVE
WILLARD (PERSONAL)	PERKINS	WESTERN STATES MINERALS CORP. (100) OP	INLE
WIND MOUNTAIN	WASHOE	AMAT GOLD INC. (100) OP	CLOSED
WINDFALL (HORSE WINDFALL)	EUREKA	WESTERN MINING SERVICES LTD. (100) #34	INLE
WONDER	CHURCHILL	BELMONT RESOURCES (U.S.) INC. (100) #34	INLE
WOOD GULCH	ELKO	HOMESTEAD MINING COMPANY (100) OP	CLOSED



Working copy prepared by: Thomas M. Sweeney  
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June, 1993

Some property locations checked against Nevada Bureau of Mines and Geology, Map 91 (1986)  
Some data checked against Randol Mining Directory (1990-1991)

- Property location is approximate
  - Belt locations from AIME Gold Exploration Seminar
  - Ownership data not confirmed (See list)
- Note: OP= Operator
- This is a working map only and may contain errors or omissions

**EXPLANATION**

- △ Placer
- Sedimentary hosted
- Volcanic hosted
- Plutonic hosted
- Character unknown
- - - Mineral trend, dashed where inferred