UNIVERSITY OF NEVADA-RENO

Nevada Bureau of Mines and Geology

20 Aug 86

NBMG OPEN FILE REPORT 86-14

A MINERAL INVENTORY OF THE
TONOPAH RESOURCE AREA
BATTLE MOUNTAIN DISTRICT, NEVADA

J. V. Tingley and J. Quade

Prepared for:
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
TONOPAH OFFICE
TONOPAH, NEVADA 89049

Under Contract #YA-553-CT1-1058

J. V. Tingley, Principal Investigator
J. Quade, Research Associate

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

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NEVADA BUREAU OF MINES AND GEOLOGY
University of Nevada-Reno, Reno, Nevada

John Schilling, Director/State Geologist

August, 1986

Summary of Work Performed
Mineral Inventory Tonopah Resource Area,
Contract #YA-553 CT1-1058
U.S. Bureau of Land Management

Work was completed on the Tonopah Resource Area Mineral Resource Inventory in two complementary stages. First, search of the literature was made, and data on mineral occurrences within the project area were compiled on short form Nevada MRDS (Mineral Resource Data Set) forms. All of the information was plotted on maps for field use. Folios were then prepared for each mining district, which included the MRDS forms, notes on mining claims, and pertinent references. This material provided the basis for planning the second stage of the inventory, the field examinations.

During the field stage of the project, mining districts within the resource area were visited and selected properties were examined. Important properties as well as outlying prospects were examined and described in order to provide more complete and accurate information on the occurrences beyond that provided in the literature. During the examination, emphasis was placed on collecting geologic information on the mineral occurrences and on noting current activity.

Photos were taken in each area to document activity, type of mine workings, and geologic relationships. In addition, samples showing typical mineralization were collected from most of the visited properties. All of the samples were high-graded and usually taken from dumps, ore piles, or outcrops.

The samples were prepared for analysis by the Nevada Analytical Laboratory, UNR, Reno, and analyzed for 31 elements (semi-quantitative spectrographic technique) by the Branch of Exploration Geochemistry, U.S. Geological Survey, Denver, Colorado. The analytical work was done through a cooperative agreement between the Branch of Exploration Geochemistry and the Nevada Bureau of Mines and Geology.

The information collected during the course of the Tonopah project has been compiled and is presented in this report in the following form:

1) Summary report organized by mining district: includes location, history, field observations, and current mining status of each district. A list of selected references follows each individual district write-up. Sample description sheets and results of geochemical analysis are included in the appendix of the report.

2) Mining District folios:

   a) Prospect forms describing each mine property examined in the field. Sample descriptions accompany forms of sampled properties.

b) MRDS forms containing location and brief description of mine properties as gathered from literature sources and field information.

c) Slides of properties and sample sites.

3) Maps

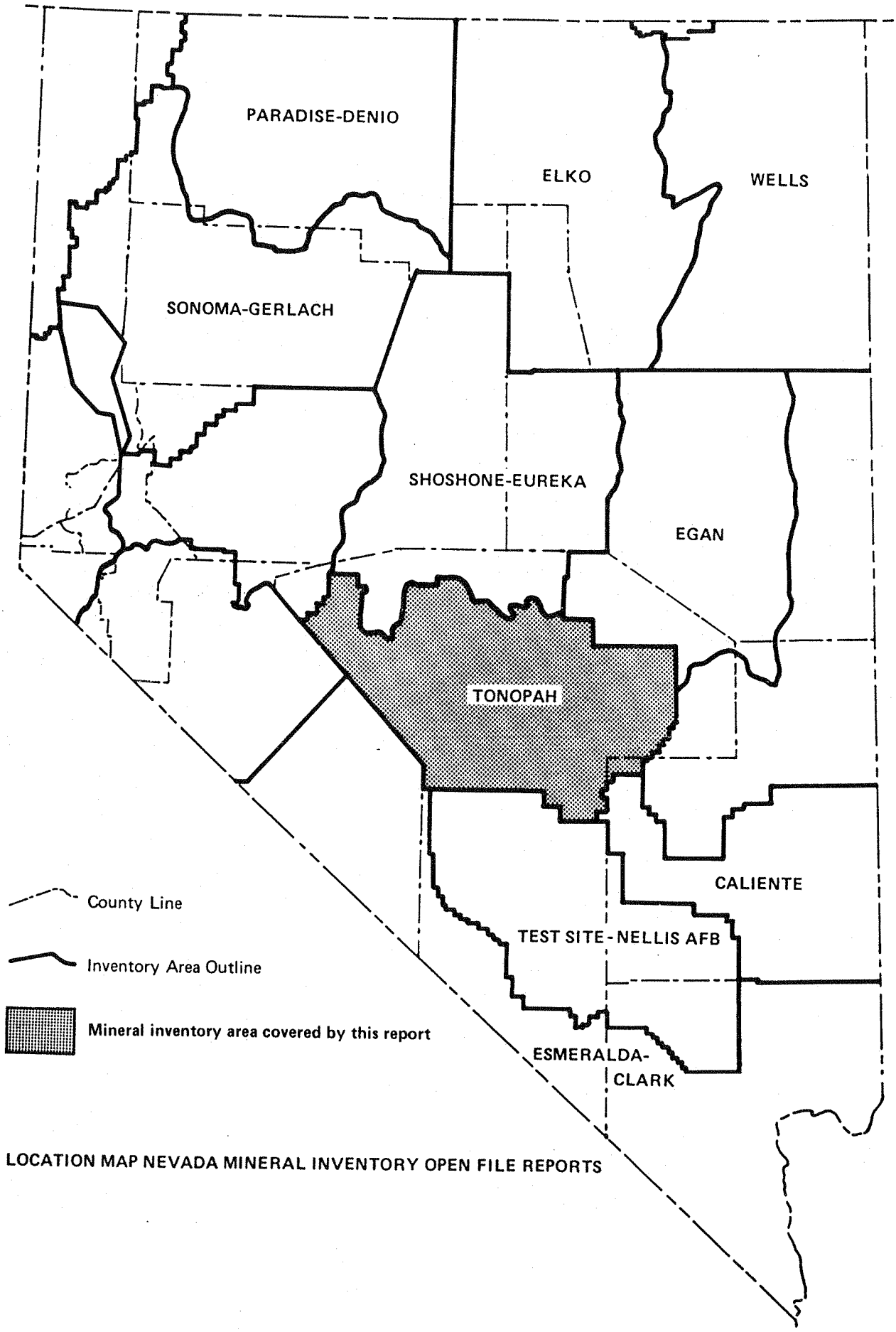
a) Planimetric maps, 30' series, showing location of mining districts, and sample locations.

b) USGS 7 1/2' and 15' topographic maps showing sample locations and prospect names.

In addition to this information, topographic field sheets and field notes are on file at the Nevada Bureau of Mines and Geology. Also, splits of all the samples taken as well as selected hand specimens have been retained at the Nevada Bureau of Mines and Geology. This material may be useful for additional studies in selected areas.

In reporting on this project, no attempt has been made to compile detailed geologic information on the districts. Since this project was a mineral inventory, our efforts were confined to acquiring new information on prospects, and no time was available to collect new regional geologic data. Local or regional geologic interpretations were derived from published geologic maps or other pertinent literature sources.

The literature search and compilation of MRDS data for this project was done mainly by Daphne D. LaPointe. Field work was carried out by J. Quade, and J. V. Tingley during the summer and fall of 1985 and the spring and summer of 1986. Work on the few mining districts located on the boundaries of the Tonopah resource area was done as part of earlier resource area studies. Reports prepared for these studies have been updated and included in this report.



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ARROWHEAD DISTRICT

LOCATION

The Arrowhead district is located on the north end of the Reveille Range, immediately north of the Reveille mining district in Township 3 North, Ranges 51-1/2 and 52 East, Nye County.

HISTORY

The district was formed about 1919 and the two major companies in the district were incorporated in that year (Lincoln, 1923). The district was most active in the early 1920's as ten companies were organized for work in the district during 1919-1922 (Kral, 1951). Kleinhampl and Ziony (1984) credit the district with about $13,000 in production for the years 1920-1932 and 1939. According to Kleinhampl and Ziony (1984), the district was first named the Needles district, although no used of this name continues today. There was no activity noted in the district when it was visited in the fall of 1985.

GEOLOGIC SETTING

The district is underlain by Tertiary volcanic rocks which are complexly faulted. Most of the mines and prostects of the district are confined to a narrow, north-trending zone of altered welded tuff and intrusive rhyodacite. In this zone, altered Miocene welded tuffs form the upper plate of a thrust sheet that overlies a thick Oligocene welded tuff unit. The Oligocene unit, the Monotony Tuff, is interpreted to be an intracaldera unit within a fault-disrupted block of a large caldera (Ekren, Rogers, and Dixon, 1973). The Arrowhead district is on the western margin of this caldera feature. Kleinhampl and Ziony (1984) noted altered Paleozoic rocks to be present on the dump of the Arrowhead shaft and suggested that the shaft may have penetrated the thrust fault and entered the underlying Paleozoic rocks. A preferred alternative is that the altered sedimentary rocks encountered in the deep workings represent blocks of Paleozoic rock within a megabreccia related to the rim of the inferred caldera.

ORE DEPOSITS

The two main mines of the district were the Arrowhead and the Arrowhead Extension, located northwest and southeast of the old town of Arrowhead. Both deposits are within propylitized, silicified welded tuff that contain disseminated pyrite. At the Arrowhead Mine, silver mineralization occurred in two ore shoots that formed along a vein cutting the altered rocks. Vein material present on the mine dump contains calcite and minor amounts of an unidentified gray sulfide along with pyrite.

There has been no activity in this district for some time, and no activity was noted in 1985.

GEOCHEMICAL ASSOCIATIONS

Two ore samples, one taken from each of the major mine dumps in the district, reported silver values of 0.7 and 20 ppm, gold values of nil and 0.1 ppm, arsenic 100 and 980 ppm, and antimony 85 and 45 ppm. Barium was moderately

anomalous in both samples and base metal contents were very low.

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ATHENS DISTRICT

LOCATION

The Athens district is located in the southern Pactolus Hills, western Nye County. The district includes the old camps of Athens and Pactolus and extends from the Nye-Mineral County line north for 10 miles along the Pactolus Hills. The mines of the district are grouped in two general areas, one around the Warrior Mine in the southern part of Township 9 North, Range 37 East, and another around Pactolus camp in the northern part of that township and the southern portion of Township 10 North, Range 37 East.

HISTORY

According to Kral (1951) the earliest work in the district was done at Pactolus where high-grade gold ore was discovered about 1903. Activity in this area continued only to about 1907. The Warrior property, in the southern part of the district, was discovered in about 1912 and some work was done there in 1915. Most of the activity at the Warrior property, however, was during the period 1934-1946 when ore shipments were made to the Dayton Consolidated custom mill at Silver City (Kral, 1951). Total recorded production from the district is $71,635 (Kleinhampl and Ziony, 1984).

There has been considerable exploration in this district in the past few years. Amoung others, Utah International worked in the Pactolus area in the mid-1970's and Cominco American was drilling there in early 1986. Other companies were active in the Warrior Mine area in 1986, and recent claim staking was in evidence there.

GEOLOGIC SETTING

Triassic limestone of the Luning Formation and Mesozoic granitic crop out in the area south of the Warrior Mine in the southern edge of the district. The Luning Formation has been contact metamorphosed near the granite-contacts. These older rocks are faulted against and unconformably lapped by Tertiary volcanic rocks on the north (Kleinhampl and Ziony, 1984). The Teritary volcanic rocks consist of silicic welded tuffs, andesitic to basaltic lavas, and some lacustrine deposits.

Steep normal faults trending northwest to north-northwest cut all of the units present in the district, but are more frequent in the welded tuff and older rocks.

ORE DEPOSITS

Mine workings at the Warrior Mine explore a northwest-trending shear zone that cuts bleached welded tuff. Samples of vein material from the mine dump were highly oxidized, but were reported to contain visible flecks of galena (Kleinhampl and Ziony, 1984). To the south of the Warrior Mine, workings reportedly for both gold and mercury were developed in the same welded tuff unit as at the Warrior. These workings are along silicified shear zones which cut argillicaly altered welded tuff. Stockworks quartz veins are exposed along the zones along with some quartz-sulfide breccia.

At Pactolus, gold-bearing quartz veins occupy northeast-trending shear zones in argillized, silicified rhyolitic welded tuff. Gougy shear zones contain limonitic patches and seams and quartz veins. The veins commonly are parallel, are up to two feet thick, and display open centers and comby, banded quartz (Kleinhampl and Ziony, 1984). Other than linonite-stained quartz, no other minerals were noted. Gold reportedly occurs as free gold in these deposits.

GEOCHEMICAL RELATIONSHIPS

Samples taken at Pactolus, in the northern part of the district, contained low to moderate silver values, no detectable gold, and high arsenic and antimony. Samples from the Warrior Mine area, to the south, contained only trace silver, no gold, no antimony, and very low to moderate arsenic. Base metal values were very low in both areas.

SELECTED REFERENCES

Kleinhampl, F. J., and Ziony, J. I. (1984) Mineral resources of northern Nye County, Nevada: NBMG Bull. 99B.

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BARCELONA DISTRICT

LOCATION

The Barcelona mining district is located high in the central Toquima Range, about 6 miles northwest of the town of Belmont, Nye County. The district lies on the southeastern side of Shoshone Mountain and includes the area at the head of Silver Creek, all of Antone Canyon, and extends east to include the Corcoran Canyon area. The major workings on Silver Creek are within the northeastern part of Township 9 North, Range 44 East and the northwestern part of Township 9 North, Range 45 East. Antone Canyon extends into the southern part of Township 10 North, Range 45 East and the Corcoran Canyon prospect is in Township 10 North, Range 46 East.

HISTORY

According to Thompson and West (1881), the first silver discoveries at Barcelona were made in 1867 by Emanuel San Pedro. San Pedro led a prospecting party into the area, established a base camp at Spanish Springs in the southern Toquima Range, and explored the surrounding area for gold and silver. This group developed the Barcelona, South Barcelona, and Liguira silver mines and, in two seasons of work, mined about $60,000 from the deposits (Kleinhampl and Ziony, 1984). The mines were first included in the Philadelphia (Belmont) district but, in 1875, the separate Spanish Belt district was formed (Thompson and West, 1881). The town of Barcelona was started in 1876 but the mines ceased work and the town was deserted by 1877. Some work again started in 1879 on the Barcelona and adjacent mines and continued at least until 1889 (Kleinhampl and Ziony, 1984). The district is now commonly referred to as Barcelona rather than Spanish Belt and, again, is sometimes included in the Belmont district.

Mercury was reported to be present in mines at Spanish Belt in 1876 (Whitehill, 1877), but no production is reported from this early discovery. The Flower mercury mine in Antone Canyon was discovered in 1908 and the Van Ness mercury mine, west of the Barcelona Mine was discovered in 1928. Mercury was produced at the Van Ness Mine through 1943.

Production figures for the district are incomplete; Couch and Carpenter (1943) credit the Barcelona Mine with $165,000 through 1940. Kleinhampl and Ziony (1984) credit the district with at least $133,000 in mercury alone, giving a total of $298,000.

Very little mining has taken place in the district in recent years. Several major companies, however, have conducted exploration for both base and precious metals in the Barcelona area. In the late 1960's, Kerr-McGee Corporation drilled near the old silver properties for porphyry molybdenum. Freeport Exploration Co., in 1986, was reported to be exploring in the Antone Canyon area, presumably for precious metals. Copper Range Exploration is actively exploring a silver-gold occurrence near the mouth of Corcoran Canyon. The results of these programs are unknown.

GEOLOGIC SETTING

The major portion of the Barcelona district is within a wedge-shaped septum of metamorphosed lower Paleozoic strata between the granitic Belmont and Round Mountain plutons. The sedimentary rocks are chiefly shales, siltstones, and quartzites of the Cambrian Carrara Formation and Ordovician Palmetto Formation (Kleinhampl and Ziony, 1984). Most of the sedimentary rocks adjacent to the granitic rocks are metamorphosed to hornfels or skarn. Tertiary rhyolitic welded tuffs lap the older rocks on the east side of the district. The Corcoran Canyon area is entirely underlain by welded tuffs whose source is probably a caldera complex lying east of Meadow Creek (Boden, 1986).

ORE DEPOSITS

Silver was the main metal mined in the Barcelona district, although some lead and gold were recovered from the silver ores. The silver deposits, located at the head of Silver Creek in the central part of the district, are the historic deposits reportedly discovered in 1867 by San Pedro and his Mexican prospecting party. Mining at the Barcelona and San Pedro mines was along quartz-veined, silicified ledges confined to a northeast-trending fault zone between schist and limestone. The two mines are on separate but parallel veins and the workings are interconnected. Minerals visible in ore samples collected from the mine dumps include pyrite, tetrahedrite, galena, cinnabar, and molybdenite in a gangue of quartz. Some of the vein material is brecciated and recemented with later quartz.

In the area explored by Kerr-McGee for molybdenum, near the San Pedro workings, disseminated molybdenite, chalcopyrite, and other sulfides occur in a skarn zone.

At the Van Ness mercury mine, west of the Barcelona and San Pedro Mines, cinnabar veinlets occur with quartz and kaolinite in tabular bodies in a silicified limestone. The mineralized zone ranges from 2-30 feet wide and extends for about 1400 feet along strike (Kleinhampl and Ziony, 1984). At the Flower mercury mine, east of Barcelona, cinnabar occurs with barite and stibnite along a thrust fault cutting limestone and siltstone of the Carrara Formation.

At the Silver Reef prospect in Corcoran Canyon, silver mineralization occurs associated with quartz veins in a silicified ash-flow tuff. The host ash-flow tuff is the Upper Tuff of Corcoran Canyon which originated from a caldera lying to the southeast of Corcoran Canyon, one of a series of nested calderas of the Toquima caldera complex (Boden, 1986). Silver mineralization is in the hanging wall of the northeast-striking, northwest-dipping fault zone. The original work at the prospect was on a pyrargyrite-bearing quartz vein within the fault zone. At least four generations of hydrothermal breccias can be seen within the mineralized area. Pyrite and minor silver sulfides are present as disseminations and streaks in breccia filling and with quartz in microveinlets. An alteration sequence of propylization, sericitization, silicification is present in the mineralized zone. Exploration is presently (1986) in progress at this property for a bulk-minable silver deposit.

GEOCHEMICAL RELATIONSHIPS

Samples from the Barcelona and San Pedro Mines contained high silver values and trace gold associated with anomalous arsenic, antimony, copper, lead, zinc, and molybdenum. Similar associations were found at the Perkins prospect to the west, but samples from there also contained tungsten and higher molybdenum values. Samples from the Flower antimony and mercury prospects in Antone Canyon reported high antimony and arsenic values, very low base metals, and very high boron.

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BELLEHELEN DISTRICT

LOCATION

The Bellehelen district is located in the northern Kawich Range, about 50 miles east of Tonopah. The mines of the district are located to the southeast of the old town of Bellehelen, in Bellehelen Canyon on the west side of the range and at the head of Neversweat Canyon on the east side of the range.

HISTORY

Gold was discovered in this district in 1904 and the camp was most active during the years 1909-10 (Paher, 1970). One operator is said to have produced $500,000 from mines of the district after 1910, but this figure cannot be confirmed (Paher, 1970). During the 1917-1921 period, Pacific States Mining and Milling Company reported production of $117,000 from Bellehelen (Kral, 1951). The only recorded production from the district, however, is $29,473 for 1917 (Couch and Carpenter, 1943). A 50-ton cyanide mill was built in 1922 and operated intermittently until 1927 but no production is recorded for any of those years (Kleinhampl and Ziony, 1984). There was no activity in the district in the fall of 1985, but an area nort and west of the Ben Hur Mine has been drilled within the last few years.

GEOLOGIC SETTING

The northern Kawich Range in the vicinity of Bellehelen is underlain by multiple ash-flow sheets of Oligocene-Miocene age. The source for this tuff is the Kawich caldera which lies in the northern portion of the range, just south of Bellehelen Canyon (Gardner and others, 1980). A major lineament passes northwesterly through the Kawich Range at Bellehelen. This structure, known as the Bellehelen lineament or Bellehelen fault zone (Gardner and others, 1980), or the Kawich-Toiyabe lineament (Snyder and Healey, 1983), apparently controls the location of the mines of the district.

ORE DEPOSITS

All of the known ore deposits of the Bellehelen district lie within the confines of the northwest-trending Bellehelen fault zone which forms the northeastern boundary of the Kawich caldera (Gardner and others, 1980). The ash-flow tuffs which form the host rocks for the ore deposits are commonly slicified and argillized in the vicinity of the mine workings. Although all of the mines and prospects of the district are aligned along the major northwest trend, orebodies at the individual deposits occur along silicified east-west trending fissures. At the Ajax Mine on the northwest margin of the district, pyrite and unidentified gray sulfides occur along a north-dipping, east-west striking silicified zone. At the Ben Hur Mine, in the central part of the district, mineralization occurs along a northwest-trending structure where it is cut by east-west trending fissures. Both sets of structures are silicified. At the Merger Mine, at the head of Neversweat Canyon on the east side of the district, cerargyrite and native gold occur along spaced northeast-trending shear zones. Vein-like silicified zones along the east-west fissures vary from a few inches up to several feet thick and contain wispy gray streaks of sulfides in a siliceous matrix.

GEOCHEMICAL RELATIONSHIPS

Ore samples from the Bellehelen district contained high silver values and moderate to high gold values associated with moderately anomalous arsenic and low to moderate antimony values. Molybdenum values in all samples are higher than would be expected for the type of mineralization present at Bellehelen, and one sample contained 300 ppm molybdenum. Other base metal values were very low in all samples.

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BELMONT DISTRICT

LOCATION

The Belmont mining district is located north and south of the town of Belmont, Nye County. The district is located mainly along a north-south trending range of low hills that extend between the Toquima Range and the Monitor Range, and form the division line between Ralston and Monitor Valleys. The mines and prospects of the district are within the southern half of Township 9 North, Range 45 East and the northern half of Township 8 North, Range 45 East. The principal mines are located about one mile southeast of the old town of Belmont but mines in Hillen Canyon northwest of Belmont, at the mouth of Silver Creek west of Belmont, and at Monarch, south of Belmont, are included in this district.

HISTORY

The first locations at Belmont were made in October 1865, and a district called Philadelphia was organized. In 1866, the name was changed to Silver Bend, but was changed back to the original name within the year (Thompson and Wset, 1881). A ten-stamp mill was built in 1866, a twenty-stamp mill was constructed in 1867, and a forty-stamp mill was constructed in 1868. These mills had all ceased operating by 1876, but other smaller mills operated up to about 1895 when most activity at Belmont came to an end (thompson and West, 1881; Lincoln, 1923). Most of the production came in the early years, and by 1885 the combination of declining silver prices and increased costs of pumping water finally forced closure of the mines. Ore mined prior to 1885 had an average value of about $80 per ton and ranged in value from about $25 to $250 per ton (Nash and others, 1985).

In 1915, electric power was brought in from Manhattan, the mines were dewatered, and an attempt to reactivate them was made. Insufficient silver ore was located to support new mining operations, and the district has been largely idle since that time. In the late 1960's and early 1970's, mining interests financed by Howard Hughes (Summa Corp.) acquired most of the Belmont Mines and conducted exploration; these efforts were apparently unsuccessful. More recently, a heap-leach operation was commenced at the site of the Highbridge mill to treat old dumps from the adjacent mines. This facility was inactive at the time of our examination, and appears to have been abandoned.

Very little information is available on the Monarch camp area south of Belmont. Paher (1970) dismisses the camp as strictly a land promotion active about 1906. Lincoln (1923), however, mentions that turquoise was discovered in the district in 1909. This is probably the time of discovery of the turquoise at Monarch descirbed by Kral (1951). There is no activity at Monarch at the present time.

GEOLOGIC SETTING

The Belmont distirct straddles a contact zone between a Late Cretaceous granitic pluton and Cambrian and Ordovician quartzite, siltstone, mudstone, shale and carbonate strata. In the vicinity of the major mines on Highbridge Hill, the exposed strata are commonly dark-gray shale, mudstone, and siltstone that have undergone mild metamorphism to phyllitic shale, argillite, and slate

(Kleinhampl and Ziony, 1984). Granite of the Belmont pluton crop out west of the town of Belmont and underlie most of the western part of the district. A broad contact zone several hundred feet wide surrounds the granite. Aplitic dikes and sills, and sills of granitic porphyry are commonly present within the contact zone of the granite and within the marginal zone of the intrusive as well (Kleinhampl and Ziony, 1984).

Small outcrops of diabase, serpentinite, and peridotite crop out just south of Monarch. These rocks are inferred to be Paleozoic or early Mesozoic age by Kleinhampl and Ziony (1984).

Total production of the Belmont district is shown as about $3.8 million, 1866-1951 (Kleinhampl and Ziony, 1984). Lincoln (1923), however, credits the district with about $15 in production.

ORE DEPOSITS

According to observations made by S. F. Emmons in 1868 (reported in Hague, 1870), two main vein systems or ledges were mined at Belmont in the 1860's. An eastern vein, called the Highbridge and Transylvania ledges, was in limestone and slate. To the west about 1000 feet was a vein in quartzite called the Arizona-El Dorado. As reported by Emmons, the veins are generally conformable with bedding of the enclosing host rocks; the dip of both sedimentary rocks and veins is about 40 degrees to the east. The veins mined in the old Belmont workings were 3 to 12 feet wide and consisted of massive white quartz with bunches or disseminated particles of silver minerals. The pay zone tended to be along the ganging wall of the vein. Silver minerals present were reported to be silver chloride and stetefeldite (possibly a mixture of pyrargyrite and tetrahedrite). Samples collected from the dumps of the Arizona and Highbridge Mines contained visible cerargyrite and galena as well as molybdenite. Most of the high-grade ore mined in the early period of the district came from the upper 500 feet of the veins. At least one of the mines, however, contained rich ore down to the 1000 foot level (Kleinhampl and Ziony, 1984).

Northwest of Belmont, along the south side of Hillen Canyon, two separate clusters of old workings explore quartz vein systems which cut Ordovician limestone. The workings in both areas are quite extensive, but neither area is described in literature on the district.

At the northernmost workings, located about one and one half miles northwest of Belmont, five deep shafts were sunk along a North 30 degree East, near-vertical vein which occupies a fault zone in thin-bedded limestone. The limestone is silicified along the zone. Vein quartz collected from dumps here contained pyrite, galena, stibnite, and tetrahedrite.

About one half mile northwest of Belmont, seven shallow inclines and numerous cuts expose a northwest-striking brecciated quartz vein system formed along bedding planes in a dark gray limestone. In 1983, Phelps Dodge Corp. staked this area but it is not known if they are active at this time.

Tungsten occurs at two separate localities in the southern and western parts of the district. Wolframite-huebnerite bearing quartz veins occur at the Falcon prospect near the mouth of Silver Creek, about 4 miles west of Belmont

and a thin quartz vein, also containing worlframite-huebnerite, was prospected at the Old Windlass property two miles south of Belmont. About 37 tons or ore is reported to have been shipped from the Falcon prospect, no production is reported from the Old Windlass property (Stager and Tingley, in prep.).

The turquoise property at Monarch occurs within a silicified shear zone which cuts serpentinite. This area has been recently staked by U. S. Minerals Exploration Co., Arvada, CO.

GEOCHEMICAL RELATIONSHIPS

A detailed study of the geochemical relationships present in the Belmont silver ores has been done by the U.S. Geological Survey (Nash and others, 1985). That work was, however, confined to the central district, southwest of the town of Belmont. Our sampling, while not as intense as that done by the U.S.G.S., was more extensive.

Ore samples collected by us from the central Belmont Mines contained high silver values, but no detectable gold, associated with anomalous arsenic, antimony, lead, zinc, and copper. Molybdenum values were anomalous in all samples and one value greater than 2000 ppm was obtained. In contrast, samples collected from the vein deposits northwest of Belmont contained detectable gold values along with high silver. Samples from this area were low in molybdenum. Arsenic, antimony, lead, zinc, and copper were all anomalous in the northern area, but all values, except for zinc, were much lower than found southwest of Belmont. Zinc was the only element, except gold, that increased in value at the northern mines.

The sample taken from the "turquoise" prospect at Monarch was relatively low in copper content but reported high chrome and nickel present. Much of the green mineral present at this prospect must be the nickel mineral garniertie.

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BLACK HAWK DISTRICT

LOCATION

The Black Hawk or Queen City mining district is located in the low hills on the southwest end of the Quinn Canyon range in the vicinity of Queen City summit. The mines and prospects of the district are located mainly north of State Route 375 in portions of Townships 2 and 3 South, Ranges 53 and 54 East, Nye County.

HISTORY

Mercury was discovered in this area in 1929 by J. Mellon, and about 70 flasks of mercury were produced from the Black Hawk Mine between 1930-1935 (Holmes, 1959). Sporadic activity was reported from the district during 1936-1943 and 1955-1957, but no additional production has been recorded. At the time of our examination (Fall 1983) a large portion of the district had been recently staked and drilled. U.S. Minerals Exploration, Arvada, Colorado, is the claim holder, and exploration is, no doubt, for gold.

GEOLOGIC SETTING

Paleozoic sedimentary rocks crop out on the west side of Queen City summit, and underlay the western portion of the district. Limestone of the Cambrian Nopah Formation is overlain on the east, near the summit, by a quartzitic sandstone. East of these Paleozoic outcrops, the remainder of the district is underlain by rhyolitic ash-flow tuffs of Pliocene age (Cornwall, 1972).

ORE DEPOSITS

There is some confusion as to the location and geologic setting of the Black Hawk Mine. Bailey and Phoenix (1944) describe the Black Hawk occurrence as cinnabar found in botryoidal masses along the contact between sandstone and limestone. All other writers (Kral, 1951; Holmes, 1959; and our field crew, 1983) describe the Black Hawk occurrence as cinnabar found along shears in highly silicified volcanic rocks. Obviously there are two separate occurrences; Bailey and Phoenix saw one, all others saw the second. Kral, who was most familiar with local mine owners, placed the Black Hawk name on the occurrence in the tuffs, we will continue this useage. At the Black Hawk deposit, cinnabar occurs as blebs and veinlets in quartz and as coatings in vugs in silicified rhyolite tuff. Chalcedonic silica, jarosite, and fine-grained barite crystals were noted in the silicified rocks.

GEOCHEMICAL RELATIONSHIPS

The one ore sample from this district contained, along with visible cinnabar, high arsenic, barium, and moderate antimony. This association is similar to that found in many other epithermal precious metal deposits.

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CLIFFORD DISTRICT

LOCATION

The Clifford district is confined to a small area surrounding the Clifford Mine in the northeast quarter of Section 3, Township 3 North, Range 49 East, Nye County. The district includes a small hill which lies at the edge of Stone Cabin Valley about two miles northwest of the margin of the northern Kawich Range. Workings of the Clifford Mine cover most of the hill; the workings are about one and three quarters miles south of U.S. Highway 6 and can easily be seen from the highway.

HISTORY

Silver was discovered at Clifford in December 1905. There was considerable activity in the camp during 1906 and 1907 and the population peaked in 1908 (Paher, 1970). The camp declined after that date. Western Gold Corporation acquired the Clifford properties in 1925 and the mines were operated intermittently by the company and by lessees until 1946 (Kral, 1951). The district is credited with slightly over $500,000 n production (Kleinhampl and Ziony, 1984). There has been some exploration activity at Clifford in the past few years and new claim staking was noted in the district in October 1985.

GEOLOGIC SETTING

Much of the bedrock in the Clifford district is concealed by alluvium and gravel derived from the Kawich Range. Outcrops are Tertiary volcanic rocks, chiefly rhyolitic pyroclastic rocks and andesite. The pyroclastic material is chiefly ash-flow tuff and breccia (Kleinhampl and Ziony, 1984). The district lies along a major fault that bounds the resurged Kawich caldera as shown by Ekren and others (1976). Mapping in the area by Gardner and others (1980), however, places the Clifford district well to the north and outside of the caldera.

ORE DEPOSITS

The account by Ferguson (1916) remains the best description of the Clifford deposit, and it is summarized below.

Most of the work in the district was done on oxidized ores near surface. The hill at Clifford is covered with small shafts and irregular inclines where rich streaks were followed for short distances. A 200-foot shaft on the western point of the hill reached the sulfide zone, but is reported to have disclosed no definite orebodies. The ore of the shallow workings consists of heavily iron-stained tuff cut by small quartz veins that contain small irregular masses of limonite. The richer ore contains cerargyrite and some minute threads of native silver; some cerargyrite occurs in minute veinlets of light-brown jarosite. Rare specks of a silver sulfide mineral and pyrite occur in some oxidized ore and free gold can be obtained by panning the richer ore.

Sulfide ore, exposed by the shaft mentioned by Ferguson (1916), occurs along a sheared fault contact between andesite and rhyolitic agglomerate. The andesite is highly pyritized along the contact but most of the ore was within the agglomerate. The richer ore consisted of agglomerate with less pyrite but cut by small drusy quartz veins, the vugs of these veins contained small crystals of stephanite, pyrargyrite, and proustite Ferguson, (1916). The wall rocks at the mines are highly silicified.

GEOCHEMICAL RELATIONSHIPS

Ore samples collected from the Clifford Mine dumps contained moderate to high silver values (50 and 1000 ppm) and high gold values (5.2 and 16 ppm) associated with anomalous arsenic and moderately anomalous barium. Antimony values were low (14 and 40 ppm) and all other base metal values were low. The gold values obtained, equivalent to 0.15 and 0.47 ounces per ton gold, were very high and corroborate Ferguson's observation that the richer ores contained free gold.

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CLOVERDALE DISTRICT

LOCATION

The Cloverdale mining district includes the southern portions of the Toiyabe and Shoshone ranges and extends from Peavine Creek on the east to north of Cloverdale Ranch on the west. Mines and prospects in Secret Basin, the old camps of East Golden and West Golden, and the few scattered mines south of Mount Ardivey are included within the Cloverdale district. The district is largely within the Toiyabe National Forest, in portions of Townships 8 and 9 North, Ranges 39, 40, 41, and 42 East, northern Nye County. An area in the northern Royston Hills, southwest of Cloverdale Ranch, included by others in the Cloverdale district (Kral, 1951) is within the Republic mining district and is described in that section of this report.

HISTORY

Cloverdale Ranch and an associated stage station were established about 1872 and a post office was located there for a short period of time in the 1880's (Paher, 1970). Mining activity in the area dates from about 1902 when gold was discovered in East Golden (Kral, 1951). In 1906 placer gold was discovered in Cloverdale Creek below East Golden (Vanderburg, 1936). Most of the lode mining in the district has been centered around East and West Golden, and intermittent activity was reported from small mines there in 1907-1910, in the 1920's and in the 1940's. Fluorite was discovered in Secret Basin in 1940 but apparently nothing has been produced from the deposits (Papke, 1979). Prospecting for precious metals was renewed in the district in the 1960's, and an active exploration project was underway in East and West Golden when the district was examined in October, 1985.

GEOLOGIC SETTING

Outcrops of Permian Pablo Formation and Jurassic Dunlap Formation occur south of the mouth of Cottonwood Canyon on the flanks of Rainier Mountain. The remainder of the area is underlain by Tertiary volcanic rocks, mainly ash-flow tuffs. A west-northwest trending fault separating the pre-Tertiary rocks from the Tertiary rocks on Rainier Mountain is interpreted by Stewart and Carlson (1976), to be related to margin structures of the Peavine caldera. This postulated caldera is centered somewhat to the north of Peavine Creek and lies mostly outside of the district. Most of the ash-flow tuffs exposed in the Cloverdale district would be within the southwestern portion of the caldera; and the mineralized areas on the Rainier Mountain, Secret Basin, and East Golden, fall on or near the ring fracture zone of the caldera.

ORE DEPOSITS

Mines and prospects in the Cloverdale district are clustered in two general areas, Rainier Mountain south of Cottonwood Canyon, and East and West Golden. The fluorite prospects in Secret Basin lie about half way between the two main areas, and a few deposits are located west of Mount Ardivey in the north part of the district. All of the mineralized areas within the Cloverdale district are located along a general northwest trend which parallels the southwestern margin of the Peavine caldera (Snyder and Healey, 1983). The mining ares lie

outside of the defined caldera margin, but mineralization is postulated to occur along structures related to the ring fracture zone of the caldera.

There is no production recorded from the Cloverdale district. It is obvious, however, from the extent of dumps at the mines in East and West Golden that there has been some gold and silver produced from the district.

At the deposits on Rainier Mountain, copper mineralization occurs in epidotized argillite and siltstone of the Pablo Formation. The deposits occur in a major northwest-trending shear zone which separates volcanic rocks on the north from the pre-Tertiary rocks on the south. Malachite and azurite, along with abundant iron oxides, coat fractures and are disseminated in the shear zone.

The fluorite prospects in Secret Basin are within a northwest-trending shear zone in quartz latite. The fluorite occurs as veins and as matrix material in breccias along the shear zone. Prospects in the northwest portion of the basin occur near the margin of a small, obsidian-rich plug which cuts the volcanic section.

The precious metal mines and prospects at East and West Golden occur in quartz-cemented breccias which follow northwest-trending shear zones in welded ash-flow tuffs. The welded tuff wall rocks are kaolinized and silicified although alteration is generally confined to vein margins. Adularia is present coating some fracture surfaces. At the East Golden Mine, the vein system can be traced for about 2000 feet along strike.

GEOCHEMICAL RELATIONSHIPS

Samples taken from East Golden contained high silver values along with gold values that ranges 0.50 to 12 ppm. Other trace element contents, however, were very low. Moderate values for barium were found, arsenic and antimony were detected in two samples, but values were low. Individual samples from West Golden contained higher antimony and arsenic values in individual samples, but values were not consistent. Samples from the fluorite prospects were found to contain no metallic trace elements.

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DANVILLE DISTRICT

LOCATION

The Danville mining district is located in the central part of the Monitor Range, Nye County approximately 60 miles southwest of Eureka. The district is located on the east side of the mountain range; the workings are in middle and upper Paleozoic rocks exposed in the lower portions of the range. Most of the mines and prospects are located in Danville and Green Monster Canyons.

HISTORY

The district was discovered in 1866 and has had several periods of activity since that time (Kleinhampl and Ziony, 1984). The recorded production is only $31,212, but there was probably significant additional but unreported production (Kleinhampl and Ziony, 1984; Kral, 1951).

ORE DEPOSITS

Mineralization in the main mining area near Danville consists of oxidized lead-zinc-silver irregular replacement bodies and veins in dolomites. The veins and mineralized zones usually trend northerly or northeasterly and contain some quartz gangue as well as silicified wall rock and oxidized lead-zinc-silver minerals. A thin phosphate-rich shale bed of no commercial importance is also present in Danville Canyon. Argillized rhyolite porphyry is associated with jasperoid at one prospect. Silicification is a common wall-rock alteration associated with the lead-zinc-silver veins in the Danville district.

Mineralization in the vicinity of Green Monster Canyon consists of stibnite-bearing veins and replacements with quartz and barite gangue. Iron-oxide minerals (possibly after pyrite) are also present, and the mineralization appears to be associated with jasperiod zones. They were prospected for disseminated gold deposits in the mid-1970's (Kleinhampl and Ziony, 1984), and exploration was again underway for this type of deposit in 1981.

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EDEN DISTRICT

LOCATION

The Eden mining district is located on the east side of the northern Kawich Range about 70 miles east of Tonopah. The district lies southeast of Kawich Peak along what Ball (1907) refers to as Little Mill Creek Canyon (now known as Eden Creek). Mines and prospects are located in the northwest quarter of Township 1 North, Range 49 East, Nye County.

HISTORY

Ball (1907) recounts that the first locations in the district were made in February 1905. Lessors were reportedly working near the mouth of Eden Creek in 1906 and 1907, and the presence of stamp mill remains there indicates early mining activity (Kral, 1951). Exploration was done in the district in 1923-24 and 1926-34, but no production resulted from that activity. There is no recorded production from the district and Kral (1951) assumes a total district production of less than $10,000.

When this district was visited in the Spring of 1986, new roads were in evidence to a new mill site at the Southern Gold Mining property near the head of Eden Creek. Mill equipment had been installed and appeared ready for use. Drilling equipment was present on new drill pads prepared east of the mill site and appeared to be awaiting the spring thaw to commmence work for the year.

GEOLOGIC SETTING

The Eden district is entirely underlain by rhyolitic ash-flow tuff sheets of Oligocene-Miocene age which originated from the Kawich caldera. This caldera, which was the source for most of the tuff exposed in the norhtern Kawich Range, is centered to the northwest of the Eden district. The caldera margin is posutulated to pass in a north-south direction across Eden Creek near its mouth, then turn to the southwest, cross the range, and pass through the Silver Bow mining district on the west (Gardner and others, 1980). The Eden district is just within the southeastern margin of the caldera. Regional geologic mapping by Gardner and others (1980) shows the district to be cut by two major structural trends. A northwest-trending system of faults, parallel to the Bellehelen lineament, passes through the district. North-trending faults southwest of Eden Creek generally follow the curving margin of the caldera and may be related to the caldera ring fracture zone.

ORE DEPOSITS

Gold-silver mineralization at Eden occurs along steeply dipping, silicified shear zones in rhyolitic ash-flow tuff. In places, the rhyolite wall rock is intensely silicified parallel to the mineralized zones. The silicified zones stand out from unsilicified rock, and were called "dikes" by the early miners (Ball, 1907). Mineralized zones at the mines vary in width from veins of quartz 3 feet wide to bands of silicified rhyolite 8 feet wide intensely netted with quartz stringers. Much of the quartz is crustified and iron stained, and unoxidized quartz sometimes has a blue tinge due to the presence of fine-grained pyrite. Bladed quartz, suggestive of replacement of earlier

calcite, is also present (Ball, 1907). In ore samples collected from the district, only pyrite was seen associated with quartz. Ball (1907), however, reports pyrargyrite, cerargyrite, and native silver to be present.

GEOCHEMICAL RELATIONSHIPS

Samples taken of ores from the Eden district were very low in all metallic elements. Silver values ranges from 2 to only 70 ppm while gold values were all below our limits of detection. One sample was anomalous in arsenic, another in antimony; in all other samples these elements were below the detection limit. All base metal values were very low except molybdenum. Molybdenum values ranged from 15 to 200 ppm.

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ELLENDALE DISTRICT

LOCATION

The Ellendale mining district is located in the south end of the Monitor Range, in the small portion of the range lying to the south of U.S. Highway 6 about 31 miles east of Tonopah. The mining area is in the southeastern tip of the range, toward Stone Cabin Valley, and is largely within the east half of Township 3 North, Range 46 East, the west half of Township 3 North, Range 47 East, and the northwest portion of Township 2 North, Range 47 East, Nye County.

HISTORY

High-grade float was discovered in the area on April, 1909 and shipments of rich ore were made from the district in 1910 and 1911 (Kral, 1951). The Ellendale Mine operated between 1909 and 1915 and its dumps were re-treated in 1938-39. When discovered in 1909, Ellendale was described as another Goldfield. Paher (1970), however, found evidence in newspaper articles of late summer, 1909, that implied that the camp was "another swindle". For whatever reason, the camp declined after about 1915. Barite was discovered about 1931 as deposits in the south end of the district and barite has been produced intermittently since that time. Total metal production from the district is about $166,000 (Kleinhampl and Ziony, 1984) although locally the district is credited with up to one million dollars in production (Kral, 1951). Barite production has been about $120,000 through 1960 (Kleinhampl and Ziony, 1984).

Exploration was done in the late 1960's for disseminated gold in the southern part of the district and some drilling ahs been done south of the Ellendale Mine within the past three years. Road building and drilling was done within the past year in the eastern part of the district, north of the Jumbo barite mine.

GEOLOGIC SETTING

The northern half of the Ellendale district is underlain by Tertiary volcanic rocks which include rhyolitic to basaltic andesite flows, dikes, and plugs and rhyolitic to rhyodacitic welded tuffs, tuffs, and tuffaceous sedimentary rocks (Kleinhampl and Ziony, 1984). The host rocks for the gold deposits at the Ellendale Mine are rhyolite plugs and domes, irregular masses and dikes of probable early to middle Miocene age.

In the southern part of the district, south of the Ellendale Mine, complexly faulted blocks of Paleozoic rocks crop out. The Paleozoic rocks include Cambrian phyllitic shale, quartzite, limestone, and shale, Silurian Roberts Mountains Formation, and undifferentiated Devonian-Silurian carbonate rocks. Large areas of metamorphosed Paleozoic rocks of undetermined age crop out near the Jumbo barite deposit. These rocks include hornfels, marmorized beds and tactite zones. Several outcrops of Tertiary quartz diorite and Tertiary or Cretaceous hornblende diorite occur along a northwest band that crosses the district from north of the Jumbo barite mine to south of the Ellendale gold mine (Kleinhampl and Ziony, 1984).

The Ellendale district does not lie within or adjacent to any presently defined caldera systems. The Big Ten Peak caldera lies about ten miles to the north in the Monitor Range and the Kawich caldera lies about ten miles to the east in the northern Kawich Range. Ekren and others (1976 depict an older caldera in the southen Monitor Range which is cut by the Big Ten Peak caldera. The southern boundary of this feature is just to the north of the Ellendale district, roughly along the trace of U.S. Highway 6.

ORE DEPOSITS

In the northern part of the district, site of the original gold discoveries in 1909, most of the workings are in intrusive rhyolite near the contact with andesite porphyry. The rhyolite in the mineralized area is silicified and to a lessor degree sericitized and pyritized. Numerous fissures filled with iron-stained quartz cut the rhyolite and, in the mineralized zone, the rhyolite shows numerous rusty brown specks composed partly of jarosite (Ferguson, 1916). At the Ellendale Mine, the rhyolite is sheared and fissured along planes striking northeast. The fault and fissure zones range from several inches up to a few feet thick and contain up to several feet of gougy material along them (Kleinhampl and Ziony, 1984). Other than iron oxides and sulfates, no other minerals were noted on the Ellendale Mine dumps. Nearby properties, however contained pyrite, copper oxides, and some galena.

In the eastern part of the district, prospects expose quartz veins cutting diorite near its contact with sedimentary rocks. Coper oxides and sulfides are visible on the dumps here.

The Jumbo barite mine, on the south end of the district, is a bedded deposit of barite within chert, argillite, and limestone of early Paleozoic age. The barite body is pod-like in form, and is only partly concordant with the enclosing sedimentary bedding. The rocks in the area are brecciated and stained with iron oxides (Papke, 1984).

GEOCHEMICAL RELATIONSHIPS

Samples of ore taken from dumps of the Ellendale Mine and adjacent workings all contained gold, one sample contained 150 ppm--over four ounces per ton, but only trace amounts of silver. Both arsenic and antimony values were very low in these samples; base metal values were also low. MOlybdenum values, while low, appear to be slightly anomalous. Two samples taken from prospects about one half mile northwest of the Ellendale Mine contained high silver associated with high lead, zinc, and copper. One of these samples contained high bismuth, antimony, and molybdenum; neither contained arsenic.

Samples taken in the southeastern part of the district, including one taken at the barite mine, were high to very high in barium. The barite mine sample contained no anomalous metal values, however. Other samples in this area were anomalous in copper, lead, zinc, and antimony. Silver values ranged from 1.5 to 700 ppm, and one sample reported 20 ppm gold.

Sampling in this district seems to indicate that thee are two separate and distinct types of mineralization present: one associated with the diorite and

quartz diorite intrusive bodies and their contact zones; and another probably younger period of mineralization associated with the rhyolite intrusive bodies and their contact zones. The former is a base-metal silver association, the latter gold with little else except possibly molybdenum.

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ELLSWORTH DISTRICT

LOCATION

The Ellsworth mining district is located in the northern Paradise Range about 10 miles northeast of the town of Gabbs. The district includes Germany and Marble Falls canyons on the west side of the Paradise Range and extends to the east to include the area of Ellsworth and Flagstaff canyons in the central and eastern parts of the range. The mines and prospects of the district are within the eastern part of Township 13 North, Range 37 East, and the western part of Township 13 North, Range 38 East, Nye County.

HISTORY

Ore was discovered in the Ellsworth district in 1863 and the area was organized as the Mammoth district in 1864. There was only minor activity in the district until 1870 when a 10-stamp mill was constructed (Thompson and West, 1881). The mill operated intermittently up to about 1881 when operations ceased (Kral, 1951). Tailings from the early operations were reworked in the district during the early 1920's and from 1933-45. Tungsten was mined from small deposits during the early 1900's and again in the 1950's. The tungsten mineral, huebnerite, was first described int he United States from occurrences at Ellsworth (Kleinhampl and Ziony, 1984). The date of this discovery is not clear, but the earliest reference to it found was dated 1891.

At the time of our examination (March 1986), there was evidence of mining activity in several parts of the district. A new headframe was in place at the Big Springs Mine north of Ellsworth and underground work has been done within the past year. Road building had been done northwest of the Return Mine and in Marble Canyon. Cominco American had staked claims adjacent ot the Return Mine in 1982, and a block of claims in the Lime Dyke area had been staked in February 1986 by Placer U.S. Inc.

GEOLOGIC SETTING

Limestone and siliceous clastic rocks of the Permian Pablo Formation underlie most of the western part of the Ellsworth district. The southeastern part of the district is underlain by Tertiary volcanic rocks, mainly rhyolitic ash-fall tuffs of the Toiyabe Quartz Latite. Ellsworth Canyon, which divides the district in a northeast-southwest direction, forms the division between the two rock types; Permian rocks lie generally northwest of Ellsworth Canyon and Tertiary volcanic rocks crop out to the south of the canyon. A body of Cretaceous granodiorite is shown by Kleinhampl and Ziony (1984) near the mouth of Ellsworth Canyon. The Permian rocks are strongly deformed into a series of tight folds aligned along a northwest trend (Kleinhampl and Ziony, 1984).

ORE DEPOSITS

Mineral properties Ellsworth fall into four general groups within the distirct. Properties around the Esta Buena and Eagle Mines, near the townsite of Ellsowrth on the east side of the district, may be the oldest workings in the area. These properties include the Esta Buena, Flagstaff, Grandview or Eagle, and the Easter Sunday Mines. Workings at these mines occur near the contact of Permian rocks and a Cretaceous intrusive.

Mineralization occurs in quartz veins which cut greenstones, carbonate rocks, and the intrusive itself. At the Esta Buena Mine, silver mineralization was found in a quartz vein in a thrust fault between limestone and granodiorite. Skarn mineralization is present at the Grand View and Easter Sunday properties and wolframite was seen in samples from the Grand View Mine.

The Big Spring, about one mile north of Ellsworth, is similar to those near the town. Oxidized quartz vein material from this deposit contains copper oxide minerals and possibly tetrahedrite. Garnet and epidote are also present.

At the Lime Dyke Mine in Marble Falls Canyon, and at the German and Japan Claims in Germany Canyon, workings expose quartz veins which cut meta-andesite and carbonate rocks. Galena is present along with pyrite at the Lime Dyke Mine, no metallic minerals were seen at the German and Japan property.

The Return Mine and nearby Vindicator Mine and Clinton Baird property are all located in Ellsworth Canyon about two miles southwest of the old town. Workings at these mines were developed along vein-like altered shear zones in Tertiary volcanic rocks. The shear zones strike to the northwest and display very little visible mineralization except quartz and iron-oxide staining. At the Return Mine, pyrite and tetrahedrite were found in samples collected from the mine dumps. Wall rocks near the shear zones are argillized and weakly silicified.

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FAIRPLAY DISTRICT

LOCATION

The Fairplay district is located on the southwestern flank of the Paradise Range and extends from the old camps of Atwood and Goldyke west to the Mineral County line. The mines and prospects of this district are concentrated in two areas. One encompasses the Goldyke-Atwood Mines in the southeast part of Township 11 North, Range 36 East, the east half of Township 10 North, Range 36 East, and the west half of Township 10 North, Range 37 East; the second area is located mainly west of Pole Line Road in parts of Townships 10 and 11 North, Ranges 35 and 36 East.

HISTORY

Gold was discovered in this area in 1901, and the Atwood mining district was organized that year (Kral, 1951). Apparently little came of the first discoveries and the area was organized as the Fairplay district in 1903. The major mine near Atwood, the Butler Mine, closed in 1906 and the town quickly faded away (Hall, 1981). Discoveries near Goldyke (Tom Burns Camp), about one mile southwest of Atwood, were made in 1906 and mines in that area were active until about 1910 (Hall, 1981). No production is recorded from the Fairplay district through 1984, but Kral (1951) notes that intermittent small production came from mines there between 1907 and 1930.

In the fall of 1982, FMC Corporation discovered a large gold orebody in the western part of the Fairplay district. This discovery, originally named the Goose deposit, is now in production as the Paradise Peak Mine. This mine has a projected 10 year life and a planned production of 100,000 ounces of gold and 3.5 million ounces of silver annually.

GEOLOGIC SETTING

The oldest rocks exposed within the Fairplay mining district consist of greenstones of the Permian Pablo Formation which crop out in the northeastern part of the district, north of Atwood, and three separate patches of metasedimentary and metavolcanic rocks of Triassic Excelsior Formation found in the northwestern part of the district, near the Mineral County line. The remainder of the district is underlain by Tertiary volcanic rocks. The volcanic rocks consist of silicic to intermediate lavas and tuffs and welded ash-flow tuffs in the area of Goldyke, dacitic to basaltic lavas to the west of Goldyke, and rhyolitic ash-flow tuffs in the northern and far western parts of the district (Kleinhampl and Ziony, 1984).

ORE DEPOSITS

Mines and prospects of this district are grouped into three areas; the original discovery site and related deposits at Atwood-Goldyke, a cluster of workings between State Highway 361 and Pole Line Road in the northwestern part of the district, and the somewhat isolated Paradise Peak gold mine in the western part of the district.

The Butler Mine, principal mine of the old Atwood district, and the Okey Davis and Goldyke Reef properties at Goldyke display similar geologic settings and ore controls. The Butler Mine was developed along a northeast-striking fault zone at the contact of Permian greenstones (meta-andesite) with a rhyolite dike. Gold and silver mineralization is present in oxidized quartz vein material formed along the fault. The Okey Davis mine to the south is in a similar setting except the rhyolite dike here cuts Tertiary andesite. The andesite is proplized and silicified. At the Goldyke Reef Mine, ore occurred in bunches along a northwest-trending vein which cuts silicified andesite and dacite. Other properties nearby show similar characteristics; iron-stained quartz veins with minor pyrite and galena which cut silicified meta-andesite or andesite. The wall rocks are propylized, silicified, and stained with iron oxides. Most of the veins follow fault zones along contact of rhyolite dikes and the older rocks. The structural trends followed by dike-vein contacts are northwest and northeast.

In the northern part of the district at the Sullivan Mine, northwest-trending quartz veins cut silicified metavolcanic rocks. Copper oxide and sulfide minerals are present in brecciated, pod-like quartz veins. Workings at the nearby Gold Ledge Mine explore narrow iron-stained quartz veins and veinlets which occur along a metasedimentary-metavolcanic rock contact. The veining follows a northeast-trending fault zone.

At the present time, most of the activity in the Fairplay district is centered about the new FMC gold mine in the southwestern part of the district. The Paradise Peak gold mine is located on a small isolated rhyolite hill just west of Pole Line Road. This location is at the site of an old mercury workings, the Nody prospect, and a small production of mercury is credited to the property for 1936 and 1969 (Bailey and others, 1984). Claims over the mercury prospect had been abandoned before the gold discovery was made and the property was staked by agents for FMC Corporation in late 1982. The mine is currently operating at a rate of 4000 tons per day and is one of the largest gold mines in the state.

The ore deposit at Paradise Peak Mine occurs in felsic tuffs and flows that overlie a thick section of dacite flows. The altered and mineralized rocks are apparently overlain by a younger sequence of unaltered andesite flows. Gold-silver-mercury mineralization occurs within a restricted envelope of quartz-alunite alteration which lies within a larger area of advanced argillic alteration. These zones grade out into argillic then propylitic alteration zones. Central zones of quartz-alunite or quartz locally overlie areas of opaline silica flooding. The quartz-alunite zones contain cinnabar, barite, native sulfur, native gold, silver haloids, and, locally, pyrite. The top of the ore zone is capped by a 20- to 30-foot-thick zone of hydrothermal breccia which probably represents the upper expression of one of the main mineralizing conduits. The orebody occurs in a down-dropped fault block and the boundaries of the ore zone are therefore sharp. Several hundred feet of propylitized dacite flows underlie the ore zone.

GEOCHEMICAL RELATIONSHIPS

All ore samples collected within the eastern (Goldyke-Atwood) portion of the Fairplay district were found to contain gold; values ranged from the detection

limit of 0.05 ppm up to 6.1 ppm. Silver values were variable, ranging from 1 ppm up to 1000 ppm and do not correlate well with gold values. Arsenic and antimony values were low to moderate in these samples; copper, lead, and zinc were anomalous in all of them.

Very high gold values were found in the samples taken at the Sullivan and Gold Ledge Mines on the north edge of the area. Values of 18 and 76 pp. gold, both associated with high aresenic, were obtained. The Sullivan Mine sample contained 700 ppm silver and very high copper, lead, and antimony; the Gold Ledge sample contained only low values for these elements.

At the Paradise Peak Mine, samples contained gold (1.05 and 1.5 ppm) and silver (30 and 50 ppm) associated with low arsenic values and high antimony and mercury values. Base metal values were also low in samples from this deposit.

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GABBS DISTRICT

LOCATION

The Gabbs district covers the western portion of the Paradise Range and lies between Downeyville on the north and the Cottonwood Canyon area on the south, and extends from the western front of the range near Gabbs east to include prospects near Craig Station in the eastern part of the range. The mining district lies mostly within Township 12 North, Ranges 36 and 37 East, Nye County.

HISTORY

Paher (1970), sets the date of discovery of silver-lead deposits at Downeyville, in the northern part of the district, as May 1877. However, production records for the Downeyville mines show production for the years 1875-1887 (Couch and Carpenter, 1943), indicating that the district must have been discovered sometime prior to 1875. A lead smelter was built at Downeyville shortly after 1881, but activity at the mines had ceased by about 1901 (Paher, 1970). The Phelps-Stokes iron deposit, northeast of Gabbs, was discovered in 1902 and produced a significant amount of iron ore in 1951-52 (Kleinhampl and Ziony, 1984). Several small copper properties have been explored in the area extending from Craig Station northwest to the Big Chief Mine. Copper exploration and production apparently took place between 1912-15. Tungsten was discovered at the Betty O'Neal prospect sometime following World War I and other tungsten occurrences just southeast of the town of Gabbs were discovered in 1931 (Stager and Tingley, in prep.). The largest production from the Gabbs district has come from the non-metallic mineral deposits, deposits of magnesite and brucite which occur north of Cottonwood Canyon near the old Betty O'Neal tungsten property. Brucite was discovered near the town of Gabbs in 1927 (Kral, 1951). Large amounts of magnesite were mined during Wrold War II as a source of magnesium metal, and large tonnages of both brucite and magnesite have been mined from the deposit up to the present time for use in the refractory industry.

GEOLOGIC SETTING

Pre-Tertiary sedimentary rocks of the district are distributed in three north-northwest trending belts, with one belt of folded Triassic and Jurassic rocks sandwiched between a thrust plate of Late Triassic strata on the west and Permian rocks on the east (Kleinhampl and Ziony, 1984). The Permian rocks, mapped as Pablo Formation, include mainly metavolcanic silicic and mafic rocks with lessor amounts of clastic rocks and, in one area, a quartzite unit mapped separately as the Dunlap Formation. The central belt of rocks includes parts of the Mesozoic Luning, Gabbs, and Sunrise Formations consisting of fine-grained clastic and carbonate beds. The westernmost belt of strata is a thrust plate of largely recrystallized dolomite of the upper member of the Late Triassic Luning Formation which has been intruded by the Cottonwood Stock.

The Cottonwood Stock, the largest plutonic body in the district, has intruded the Luning Formation in the central part of the district; it is spatially associated with the brucite deposits which lie along its contact. An older

granite forms smaller scattered outcrops in the southwestern and southeastern parts of the district. In addition to the plutonic rocks, northwest-trending dike swarms cut many of the Mesozoic rocks. The dikes include andesite, lamprophyre, rhyolite, and aplite, and are concentrated mainly in the western part of the district, near the granite and the Cottonwood granodiortie stock. The plutonic rocks were interpreted to be Early Jurassic age or younger by Vitaliano and Callaghan (1963), and to be Cretaceous by Schilling (1968). The rhyolite dikes have been inferred by some to be the youngest of the pre-Tertiary rocks (Vitaliano and others, 1957), and by others to be Tertiary (Callaghan, 1933).

ORE DEPOSITS

Mineral deposits in the Gabbs district are grouped into three general areas. Deposits of magnesite and brucite are confined to the contact aureol of the Cottonwood Stock. Small contact-metamorphic tungsten deposits also occur near the margin of the stock. The magnesite-brucite deposits account for the largest portion of the mineral production form the Gabbs district. Since considerable information is available on these deposits, we did not examines them as part of this study. Articles by Vitaliano and Callaghan (1956), and Krall (1951), can be consulted for descriptions of the magnesite-brucite deposits.

Deposits of silver-lead-zinc at Downeyville are all clustered within a one square mile area in the low hills northeast of the town of Gabbs. Ore occurs in replacement bodies in altered limestone of the Luning Formation. From what can be seen from surface exposures, mining was done along pipes and chutes that followed bedding plane-fracture intersections in the host limestone. The limestone outcrops display a mottled appearance with bleached marble zones occurring both along bedding and as random patches in the rock. The ore deposits are oxidized at surface, and outcrop as limonite-, hematite- rich gossans. The gossans contain lenses of jasperoid. Vugs commonly contain clear quartz crystals, barite crystals, hemimorphite crystals, and cerussite. Wulfenite is also present. Specimens of sulfide ore, from deeper in the mine workings, seen on the Downeyville Mine dump consisted of massive galena, sphalerite, and pyrite. Silver, and some gold, occurred with the lead-zinc minerals. A small patch of altered intrusive rock crops out just northwest of the main shaft of the old Downeyville Mine. The alteration in the limestone at Downeyville, as well as the silver-base metal mineralization, could be related to a body of intrusive rock which may underlie this portion of the district.

The third general grouping of mineral deposits in the Gabbs district consists of several small copper-silver occurrences located north and south of Craig Station along the eastern border of the mining district. These deposits fall along a northwest-southeast trend which extends from the area of the Big Chief Mine on the northwest to the prospects near Fowler spring on the southeast. At the Big Chief and Chuckar properties, oxide and sulfide copper minerals occur along shear zones cutting silicified limestone. Prospects northwest of Craig Station explore quartz veins containing copper mineralization which cut meta-andesite. Further southeast, prospects near Fowler Spring expose northwest-trending quartz veins in shear zones in meta-andesite. These prospects contain tetrahedrite.

Other properties which do not fall into any of the three areas described include the Phelps-Stokes iron mine at the mouth of Bell Canyon and the Chestnut Mine at the head of Bell Canyon, in the southeast portion of the mining district. The Phelps-Stokes deposit is a replacement body of magnetite and hematite associated with a small body of porphyritic granite which cuts dolomite of the Luning Formation. At the Chestnut Mine, gold-silver mineralization occurs along shear zones cutting altered meta-andesite.

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GOLDEN ARROW DISTRICT

LOCATION

The Golden Arrow mining district is located on the western side of the northen Kawich Range about 40 miles southeast of Tonopah. The district covers the lower flanks of the range along the edge of Cactus Flat and includes the old camp of Golden Arrow as well as Blake's Camp three miles to the northwest. The mines of the district are located in Sections 27, 28, 29, 32, and 33, Township 2 North, Range 48 East and in Sections 3, 10, and 11, Township 1 North, Range 48 East, Nye County. This district is only 5 miles north of the northern boundary of Nellis Air Force Range.

HISTORY

Discoveries in this district were made at two separate locations within a period of about eight months. A small ledge of rich gold ore was discovered at the original site of Golden Arrow in October 1904 (Paher, 1970). This discovery would have been at one of the properties in the southeast part of the district, in Township 1 North, Range 48 East. In June 1905, gold was discovered in veins at Blake's Camp, located about 3 miles to the northwest of the original Golden Arrow discoveries (Ball, 1907). Somehow, in the years since the first activity in the camp, the name Golden Arrow has been transferred north to the site of mines at the foot of Confidence Mountain, northeast of Blake's Camp.

Most of the work in this district was done prior to 1916, although small shipments of ore from the district are recorded for 1941 and 1946-50 (Cornwall, 1972). Total estimated production is about $4200 (Kral, 1951).

There has been considerable activity at Golden Arrow in the past few years. Drilling and trenching around Dead Horse Hill (Blake's Camp) appears to have been done recently. About a mile and one half south of the present site of Golden Arrow, a large open-pit mine was developed and then apparently abandoned. Ore from this mine was transported a few hundred feet down slope to the northwest of the pit and placed on leach pads. There is no evidence that the leach operation ever operated and it was not active in May 1986.

Evidence of recent drilling was also noted in the area of the Jeep claims, at the original site of Golden Arrow.

GEOLOGIC SETTING

All of the Golden Arrow district is underlain by Tertiary volcanic rocks. Most of the rocks are rhyolitic welded ash-flow tuffs and tuff breccias (Tuff of Kawich caldera, Gardner and others, 1980). Near the site of Blake's Camp, these rocks are overlain by the Andesite of Golden Arrow (Gardner and others, 1980). The Kawich caldera lies in the northern Kawich Range ot the northeast of Golden Arrow; the district is outside the western margin of the caldera. The Page fault, a major ore control for the mines at Blake's Camp (Ferguson, 1916) is roughly parallel to the caldera margin and, although about 3 miles apart, the two may be structurally related.

ORE DEPOSITS

At what is presumed to be the site of the 1904 Golden Arrow discovery, the present Jeep Group area in Section 3, Township 2 North, Range 48 East, three inclines expose a northwest-striking quartz stringer zone in altered rhyolite. Pyrite and wispy streaks of gray sulfides occur in the quartz.

Workings in Sections 32 and 33, Townhsip 2 North, Range 48 East (the Golden Arrow Mine of Ferguson, 1916), follow the northeast-trending Page fault (Ferguson, 1916). A series of ten or more shafts were sunk along the fault to explore mineralized zones formed along it. Vein mineralization described by Ferguson (1916) occurred in rhyolite and consisted of small quartz-filled fissures carrying a few specks of sulfides. The wall rock close to the fissures is silicified. Pyrite is the principal sulfide present. Lamellar quartz-after-calcite was noted by Ferguson in some areas of the vein, and small crystals of second generation quartz were reported to line the faces of larger quartz crystals in vugs.

At what is presently called the Golden Arrow Mine in Section 28, Township 2 North, Range 48 East (the Cotter Mine, Desert and Gold Bar Shafts of Ferguson, 1916), a line of inclines follows a northwest-trending shear zone in rhyolite. The zone is up to 4 feet wide and can be traces for 500-600 feet along strike. Closely-spaced quartz veinlets follow the shear zone; pyrite and fine-grained gray sulfides can be seen in brecciated vein material. Wall rock near the veins is argillized and silicified. Ferguson (1916) noted that the veins at the Cotter prospects branched out at right angles from the Page fault and, in 1916, had not continued any great distance from that structure.

In the north central part of Section 32, Township 2 North, Range 48 East, a line of shafts follows a northwest-trending, brecciated quartz vein which follows a shear zone in rhyolite. These workings, not mentioned in Ferguson's 1916 description of the district, are near what appears to be the contact of the rhyolite plug with rhyolitic welded tuff.

GEOCHEMICAL RELATIONSHIPS

Ore samples taken from the Cotter mines (now Golden Arrow Mine) contained high silver values, very high gold values in association with high arsenic and antimony. Lead was moderately high in one sample from this area, and molybdenum was also moderately high in this sample. All other metals were low.

Samples from all other mines in the district were generally lacking in any metallic values. High silver values were detected from samples taken from the workings northwest of the Golden Arrow shaft of Ferguson (1916); one of these also contained anomalous arsenic and two samples from this location were anomalous in beryllium. Anomalous beryllium values were also detected in samples from the Jeep Group area near the original Golden Arrow townsite.

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HANNAPAH DISTRICT

LOCATION

The Hannapah district is located in low hills along the west flank of the southern Monitor Range about 20 miles east of Tonopah, Nye County. Most of the mines on the district are located near the old Hannapah townsite north of McKinney Tanks in Township 3 North, Range 45 East but the district also includes workings along the northeast side of Thunder Mountain in Township 4 North, Range 44 East.

HISTORY

The Hannapah district is credited with production of one ton of ore worth $146 for 1871 (Couch and Carpenter, 1943). This information must be dismissed as in error, however, as there is no reference to any mining activity in this part of Nye County prior to about 1900. The date of discovery at Hannapah is not known, but Spurr (1902) visited the area in the fall of 1902 and described the showings "...very young and so little developed that not much could be seen." By 1905 a small camp had formed, and a townsite was platted in 1906. In 1907, after only limited mining the district and townsite were abandoned (Hall, 1981). In 1915, a short boom followed silver discoveries in the southern part of the district. A settlement of Volcano started there, but the boom died the same year when a revival at the Hannapah again drew attention to that part of the district. Intermittent activity by the Mohawk Company, the Silverzone Company, and others occurred during 1919 and 1920 but, by 1921, the district was dead. The last record of activity in the district was in 1922-35 when $15,900 was shipped from the Richardson Mnie (Kral, 1951). Kleinhampl and Ziony (1984) credit the district with $329,837in production, 1871-1935 (including the presumedly incorrect $146 in 1871).

When this district was examined in 1986, evidence of recent exploration activity was seen in the western and southern parts of the district. New claims and drill sites were seen on the Sam Jack calims, east of Thunder Mountain, and in an area south of U.S. Highway 6, near the old building stone quarry.

GEOLOGIC SETTING

The Hannapah district is almost completely underlain by altered Tertiary volcanic rocks. These rocks are subdivided into two informal map units; the tuffs of Hannapah and a peripheral younger sequence, and the tuffs of McKinney Tanks. The tuffs of Hannapah include quartz latite and rhyolite welded tuffs; these rocks are believed to be the main host rock for the ore deposits at Hannapah. The tuffs of McKinney tanks are composed of air-fall and welded ash-flow tuffs and some tuffaceous sedimentary strata (Kleinhampl and Ziony, 1984). Basalt caps Thunder Mountain in the western part of the district. Large blocks of pre-Tertiary rocks crop out in several places in the district. These rocks are interpreted by Kleinhampl and Ziony (1984) to be exotic blocks of sedimentary rocks caught up in the ash-flow tuffs, or possibly meggabreccia blocks related to the caldera margin of the postulated Hannapah caldera. This feature, as shown by Ekren and others (1976) lies to the northeast of Hannapah and the inferred ring fracture zone of the caldera passes westerly through

Hannapah, then turns north to pass between Thunder Mountain and the main Monitor Range. Bonham and Garside (1979), however, believe the caldera margin to be much further to the east. Kleinhampl and Ziony (1984) map a major lineament, the Hannapah fault, passing through the center of the district. Most of the mines of the district are aligned along this northwest-striking shear zone.

ORE DEPOSITS

In the southern part of the district, in what is named the Quarry area, a large area of hydrothermal alteration has een recenmtly prospected by drilling and trenching. Rocks in the area are silicified and stained with iron oxides. Silica veinlets lace the rock but, other than iron oxides, no mineralization was seen.

To the north, at Hannapah, mines and prospects follow the major northwest-trending Hannapah shear zone. Large areas of bleached, argillized, and silicified rock occur along the structure. Silicified zones and quartz veins along the shear contain gold-silver mineralization. The main ore mineral was polybasite; the ores are brecciated and contain fine-grained pyrite. Drusy quartz and jasper are commonly seen on the dumps in the main part of the district.

In the Thunder Mountain area, mineralization at the Bannock Mine is exposed in a northwest-trending vein within a knob of silicified volcanic rock. Gold-silver values are reported to be present with pyrite in the vuggy quartz vein. Highly silicified breccia from dumps here contains fine-gray sulfides in the breccia matrix. North of the Bannock Mine, at the Sam Jack claims, workings follow a strong, N5°W quartz vein which cuts silicified rhyolite. The vein is about 3 feet wide, is strongly iron stained, contains pyrite, jarosite, and yellow-green oxide minerals. Prospects in the Silver Ace area, immediately west of the Sam Jack, are located on silicified zones in rhyolite tuff. Numerous silicified fracture zones occur here, and the area is inferred to represent the upper part of the epithermal vein system; the mineralized fractures could develop into well-defined veins in flows and breccias that underlie the rhyolite tuffs exposed at surface (Bonham and Garside, 1979).

GEOTHERMAL RELATIONSHIPS

Every sample of ore taken in this district reported gold present. Gold values were low, ranging from just detectable (at 0.05 ppm) to 1.4 ppm, but definitely anomalous. Silver values were mainly high, ranging from 5 to 1500 ppm. Arsenic values ranged from moderate to high, antimony from low to moderate in all samples. Lead values were high in only three samples, zinc and copper were very low in all samples. Two molybdenum values were slightly anomalous at 50 and 100 ppm. Barium values, however, seem lower than usual for mineralized samples. Mos barium values were less than 1000 ppm.

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JEFFERSON CANYON DISTRICT

LOCATION

The Jefferson Canyon mining district is located south of Mount Jefferson on the west side of the central Toquima Range. The mines and prospects of the district are located along the sides of Jefferson Canyon about 6 miles northeast of the town of Round Mountain, Nye County. The old town of Jefferson is in the center of the district and the principal mines of the district are located within a mile square area around Jefferson.

HISTORY

The district was discovered in 1866 (Whitehill, 1873), but no details of the early history are known. Mining began in 1871 when a test lot of ore was sent to Austin for milling (Lincoln, 1923). Originally organized as the Green Isle district in 1873, the name was soon changed to Jefferson. The town of Jefferson started in 1874 and reached its peak in 1876 with a population of 600 (Paher, 1970). The principal mines were the Prussian and the Jefferson, located on the ridge above Berlin Canyon, southwest of Jefferson, and the Kanrohat or Sierra Nevada, located just southeast of Jefferson townsite in Jefferson Canyon. Ten-stamp mills were installed on both the Prussian and Jefferson mines in 1874, and most of the recorded production of the district came from these mines in the period 1874-78 (Kleinhampl and Ziony, 1984). The Kanrohat Mine, discovered in 1873, was active in 1873, 1909, 1917-18 and again in 1927-28, but no production is recorded from this property. Numerous old workings, some of them quite extensive, can be seen at the Silver Shield property on the north side of Jefferson Creek north of the Kanrohat Mine. Carper (1920) mentions the presence of an old smelting furnace, "used by the Spanish and Indians", somewhere on this property. These workings may be the oldest int he district, possibly dating to 1866-67 when Emanual San Pedro and his party were prospecting in the mountains to the southeast of Mount Jefferson.

Lincoln (1923) credits the district with $1 million in production but Kleinhampl and Ziony (1984) show a recorded production of $534,945 during the period 1869-1957.

GEOLOGIC SETTING

The Jefferson Canyon district is situated on the southern boundary of the Mount Jefferson caldera, one of three large, nested calderas which make up the Toquima caldera complex of Boden (1986). The caldera margin at Jefferson is marked by a major fault which forms the ore control for most of the mines of the district. A sequence of Tertiary welded ash-flow tuffs lie within the caldera, extending from the Jefferson mines north to the summit of Mount Jefferson. South of the boundary fault, a thin lens of Cambrian and Ordovician metasedimentary rocks crops out between the mine area and granite of the Toquima pluton to the south. The ash-flow tuff that forms the host rock for mineralization at Jefferson was described by Kleinhampl and Ziony (1984) as the porphyry of Kanrohat which they believe intrudes the older tuff of Mount Jefferson. Boden (1986) does not describe this intrusive relationship and concluded that the ash-flow tuffs exposed at Jefferson are one of the upper units of the thick tuff of Mount Jefferson.

ORE DEPOSITS

The bulk of the production from the Jefferson Canyon district came from the Prussian-Jefferson vein system. The two major mines, the Prussian and Jefferson developed mineralized vein quartz which formed along a N40°W, 60°E fault contact which separates welded tuff on the northeast from shaly limestones on the southwest. The fault structure is interpreted to be along the ring fracture zone of the Mount Jefferson caldera. At surface, the vein varies between 2 and 5 feet in thickness and consists of manganese-stained quartz with clots of tetrahedrite, silver sulfides, galena, and minor pyrite. Ferguston and Cathcart (1954) describes the veins as irregular quartz veinlets and silicified rock which formed along the major shear zone. Two distinct veins, about 90 feet apart, are described: the western vein corresponds to the main Prussian-Jefferson vein and the eastern vein is the Sierra Nevada or Kanrohat vein. At depth, these veins are said to have been 10 to 15 feet in width. Packard (1909) reported that the early production came from oxidized ores from the upper parts of the veins and that these ores changed to sulfides and sulfantimonides at water level. During examination of the area, specimens of skarn ore were found in the dump of an adit west fo the upper Kanrohat portal. This material consisted of silicated rock with garnet, chlorite, and flecks of molybdenite. The source of this rock is unknown but its presence may indicate that deeper workings of the Kanrohat mine penetrated the granite-sedimentary rock contact which crops out south of the mine area.

The Silver Shield, Sailor Boy, Seever workings on the north side of Jefferson Canyon explored mineralized fracture zones in silicified ash-flow tuff. Black calcite, manganese-stained quartz veinletes and manganese oxide-rich gossan occur along low-angle structures which alternately steepen and flatten down dip. Lacy stockworks of quartz veins occur in the footwall of the major low-angle structures, and pale, blue-green copper oxide minerals occur in the soft, layered manganese oxide-rich gossan along the structures. Extensive workings occur for aoub 1500 to 2000 feet along the canyon here, and several old hoist foundations can be seen along the trace of the minealized outcrops.

Two major exploration projects have been active at Jefferson Canyon in the past few years. Drilling on the Silver Shield property and surrounding area has reportedly encountered a large area of low-grade silver mineralization. Copper Range Exporation is exploring the area along the south side of Jefferson Canyon, east of the Sierra Nevada Mine, for bulk-mineable silver-gold ore. No announcements have been made of the results of either of these programs.

GEOCHEMICAL RELATIONSHIPS

Geochemical results of samples from Jefferson Canyon show two distinct groupings of ores. Samples taken from the Prussian-Jefferson and Kanrohat (Sierra Nevada) veing system south of Jeffersn Canyon show high gold and silver values in association with high manganese, copper, lead, antimony, and zinc. Arsenic values were low to moderate, ranging from 80 to 430 ppm. Samples taken from the north side of Jefferson Canyon, from the Silver Shield area, all contained gold and silver, but values were lower than to the south. These samples were high in manganese but low in copper, lead, antimony, and zinc. Arsenic values were variable, ranging from not detected to more than 2000 ppm.

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JETT DISTRICT

LOCATION

The Jett mining district is located in the southeastern Toiyabe Range and includes the area between Broad Creek and Peavine Canyon, southeast of Arc Dome. The mines and prospects of the district are scattered in Townships 9, 10, and 11 North, Range 42 East, Nye County. This is the area commonly included within the Jett district (Kral, 1951), and not the much larger area of Kleinhampl and Ziony (1984), that incorrectly included portions of the adjacent Twin River district.

HISTORY

Ore was discovered in the district in 1875 by John Davenport. The district was organized the following year but active operations did not begin until 1880. (Thompson and West, 1881). These first operations were probably in the northern part of the district, near the mouth of Jett Canyon. Other discoveries were made in 1876 in what Thompson and West (1881) refer to as the Toiyabe District. These later discoveries were probably in the Wall Canyon or the Boyd Canyon areas in the southern part of the district. There is no recorded production from this early activity, the ores were reported to have been shipped to Eureka, Austin, and Jefferson, and the production was no doubt credited to those districts. Some mining was done in the 1920's on silver-base metal deposits at the mouth of Jett Canyon. Antimony was discovered near the head of Wall Canyon in 1915, and small amount of the metal were produced from the deposit in 1915-1918, 1936-1943, 1947-1953, and 1957-1958. The Horse Canyon mercury deposit was discovered in 1937, and mercury was mined from it in periods of high mercury prices up to the 1960's. Total production from the Jett district, through 1965, is in excess of $100,000 (Kleinhampl and Ziony, 1984).

Both Kral (1951) and Kleinhampl and Ziony (1984), relate that the Jett district was discovered in 1865 and state that it was then known as the Argentore or Silver Point district. Silver Point is in the Toquima Range, across Smoky Valley to the east of Jett, and is in the Round Mountain district.

GEOLOGIC SETTING

The Jett mining district is located within a triangular-shaped block of Paleozoic sedimentary rocks which are bordered on the north and west by Teritary volcanic rocks and on the east by alluvium. The northern border of the Paleozoic rock outcrop is formed by the margin of a caldera roughly centered on Arc Dome, the western border falls along the margin of the inferred Peavine caldera which lies west of the Jett district, and the eastern border is formed by the range-front fault which separates the Toiyabe Range from Great Smoky Valley. The volcanic rocks fill the central portions of the calderas and some extra-caldera flows cover the pre-Tertiary rocks in parts of the district.

The Paleozoic rocks are shale, slate, and limestone of the Gatecliff Formation and Masket Shale; calcareous shale, calcareous siltsonte, and limestone of the

Gold Hill Formation; and calcareous siltstone and quartzite of the Pablo Formation. Small bodies of serpentinite, spatially associated with the late Paleozoic clastic rock, crop out in the area of Pablo Canyon and Horse Canyon. Small outcrops of granite porphyry and quartz monzonite are scattered in the district. Perhaps the most prominent of these is the large dike that crosses Jett Canyon near its mouth. This dike contains mineralized quartz veins and is parallel to the margin of the large caldera which forms the northern edge of the district. The volcanic rocks bordering the district to the north and west are rhyolitic to rhyodacitic welded ash flow tuffs of the Toiyabe Quartz Latite and some younger rhyolite flows.

ORE DEPOSITS

There are four major mining areas within the Jett district. Two of these, the Gibraltar Mine at the mouth of Jett Creek and the Last Chance Mine at the head of Wall Canyon, lie along a southeast-trending arc that parallels the ring-fracture zone of the Arc Dome/Toiyabe Dome caldera. The third area is near the mouth of Boyd Canyon and the fourth is at the head of Horse Canyon.

The Gibralter silver-lead-zinc mine is the probable location of the Centennial, Seventy-six and Idelwild properties mentioned in Thompson and West (1881), the site of the earliest work in the district. Workings are along a wide, silicified shear zone that cross-cuts at a slight angle the large quartz latite dike that extends northeast along the range front near the mouth of Jeff Canyon. The shear zone is 40-50 feet wide and contains clots and disseminations of galena, sphalerite, and pyrite with quartz.

At the Last Chance or Wall Canyon antimony mine, stibnite occurs with white quartz and calcite along a northeast-trending vein in carbonaceous shale and limestone. Small serpentinite lenses outcrop in the mine area. The serpentinite contains small amounts of the nickel mineral garnierite which occurs as pale green streaks and disseminations though the rock.

The Dollar antimony-silver mine, near the mouth of Boyd Canyon shows evidence of pre-1900 activity, and may be the site of the Toiyabe district discoveries described by Thompson and West (1881). At this property, stibnite, and possibly tetrahedrite, occur with quartz along a northeast-trending shear zone which forms the contact between a silicified limestone and shale.

The Horse Canyon mercury mines is at the head of Horse Canyon in the southern part of the range. At the mine, cinnabar occurs as clots and fracture coatings on silified rocks in a wide breccia zone along a northwest-trending shear structure that generally separates Tertiary welded tuffs, on the southwest, from Paleozoic sedimentary rocks, on the northeast. The sedimentary rocks are brecciated and silicified and pipe-like breccias cut through exposures seen on pit faces. The wide shear zone is inferred to be a caldera-margin structure of the Peavine Caldera which is centered to the southwest of the Jett district. Recent exploration in this area was probably for precious metals associated with the mercury mineralization.

Other, smaller mineral occurrences in the district include the Valley Claims, a silver-antimony property located in the side canyon south of the dam in Jett Canyon, and a tungsten prospect (not found) located in this same general area.

GEOCHEMICAL RELATIONSHIPS

At the Gibraltar property, silver and trace amounts of gold occur with very high amounts of lead, zinc, cadmium, and bismuth; very low antimony; and no detectable arsenic. Ore from the other major property in this part of the district, the Valley Claim, contained silver, gold, lead, zinc, and cadmium in similiar amounts, but contained high antimony and arsenic also. Two of the samples from the Last Chance antimony mine contained detectable gold as well as antimony. Silver and arsenic values were low in these samples, and they contained no cadmium or bismuth. Samples of serpentinite from Last Chance contained anomalous chrome and nickel values. Mercury ore from the Horse Canyon Mine was found to contain trace amounts of silver, but no gold, antimony, or arsenic were detected.

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LODI DISTRICT

LOCATION

The Lodi mining district is located in the Lodi Hills, northwestern Nye County. The district is restricted to that portion of the Lodi Hills in the southern three-quarters of Township 13 North, Range 36 East. Prospects on the northern tip of the Lodi Hills are included in the Quartz Mountain district north of Lodi; the mines at Ellsworth, in the Paradise Range across Lodi Valley to the east of the Lodi Hills, are in the distrinctly separate Ellsworth district.

HISTORY

Silver-lead ore was discovered at the site of the Illinois Mine, eastern Lodi Hills, in 1874. The district was organized in 1875, and a ten-ton smelter was erected by 1878. By 1880, when the first period of operation ended, about $400,000 had been produced (Paher, 1970).

Operations resumed in 1905 and the camp was then known as Marble. A new 100-ton smelter was completed in 1909 and work on the property continued until 1914 but the smelter apparently never produced metal as no production is credited to the Illinois Mine after 1890. Some underground development work was done around 1919 by Goldfield Consolidated Mines Co., but no production resulted from that activity. Paher (1970) mentions that some ore was produced from the Illinois Mine in 1940, but there has been no activity since that time.

Tungsten was discovered in the district about 1944, and during the period from 1951 to 1963, the mines of the district hae yielded more than $7 million in tungsten (Stager and Tingley, in prep.). The major producers have been the Victory, El Capitan, and Kay Cooper Mines.

GEOLOGIC SETTING

The Lodi Hills are primarily composed of Mesozoic metasedimentary and metavolcanic rocks which have been intruded by a large granitic mass. The oldest exposed rocks are greenstones, pelitic mudstone, and siltstone with minor quartzite, dolomitic sandstone, and sandy dolomite of the Triassic Excelsior Formation. These rocks occur mainly in the northern Lodi Hills, north of the Lodi mining district. Most of the sedimentary rocks in the southern Lodi Hills are carbonate strata, with some shale and siltstone, of the Late Triassic Luning Formation (Kleinhampl and Ziony, 1984).

Plutonic rocks ranging in composition from granite to diorite crop out in the southern Lodi Hills. The largest pluton, the Illinois stock, is spatially and genetically related to the tungsten deposits of the district. The contact of the Illinois stock with the sedimentary rocks is interpreted to be a low-angle fault on the west side of the district near the Victory tungsten mine (Humphrey and Wyatt, 1958). The east side of the contact, near the Illinois mine, may be a normal intrusive contact although it could be an extension of the low-angle thrust (Dougan thrust) forming the western contact (Kleinhampl and Ziony, 1984).

ORE DEPOSITS

Metallic ore deposits in the Lodi district are concentrated in two areas, silver-lead occurrences on the east side of the Illinois mine, and tungsten occurrences along the west and south side of the district in the area between the Victory and El Capitan Mines. In addition, small amounts of talc have been shipped from a deposit (Huntley Mine) on he northeast side of the district.

At the Illinois Mine property, three steep northwest-striking veins, the Illinois, Welch, and East veins occur within a shear zone that cuts limestone and shaley limestone of the Luning Formation. The zone is up to 150 feet wide and is traceable for about one mile along strike. Most of the mine production was from the Illinois and Welch veins; they vary from 2 to 20 feet in width and are usually not over 20 feet apart. Mining has been done from surface to a depth of 700 feet (Kral, 1951). The veins, on outcrop, are expressed as lenses and fracture coatings of manganese and iron oxides which occur along parallel fault zones. In some areas, the limestone wall rock is webbed with silica veinlets. The ore minerals were cerussite, anglesite, and hemimorphite in the near-surface material, and galena in the deeper ores.

The tungsten deposits of the Lodi Hills, although not discovered until the early 1940's, have accounted for the bulk of the metal production of the district. Tungsten deposits occur mainly as disseminated scheelite in crushed and sheared granodiorite of the Illinois stock and in tactite along the contacts of the stock with limestones of the Luning Formation.

The bulk of the tungsten production in the district came from the Victory Mine near the southwest end of the Lodi Hills. Scheelite at the Victory Mine occurs as disseminations in the outer zone of the Illinois stock. The principal orebody was 2 to 4 feet wide and was enclosed in a feldspathized zone 10 to 40 feet thick that formed along a shear zone in the stock. (Stager and Tingley, in prep.). Some scheelite occurred west of the Victory, along the contact of the stock with limestone, but the major production came from the granitic-hosted orebody. The nearby Kay Cooper and El Capitan Mines are similar but much smaller tungsten occurrences.

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LONGSTREET DISTRICT

LOCATION

The Longstreet mining district covers a large area in the southern Monitor Range in the vicinity of Big Ten Peak. The district extends from McCann Canyon on the north to Saulsbury Basin on the south and from Stone Cabin Valley on the east to Ralston Valley on the west. The few mines and prospects of the district are widely scattered but the major deposits are near Windy Canyon in Township 6 North, Range 47 East, and southwest of Georges Canyon in Townships 5 and 6 North, Ranges 46 and 47 East. Other prospects flank Big Ten Peak in Townships 6 and 7 North, Ranges 45 and 46 East.

HISTORY

The first mineral locations in this district were made in the area of Georges Canyon in 1903. This part of the district was originally known as the Fresno district (Kral, 1951) and includes the Clipper Mine and Kellys Mine. The Longstreet Mine, in Windy Canyon the northeast side of the district, produced $10,000 during 1930 (Kral, 1951) but its date of discovery is not known. Other properties in the district were being worked in the 1920's and minor production is reported for the late 1920's and for 1938. The total district production is reported to be less than $25,000 (Kleinhampl and Ziony, 1984). Exploration activity appeas to be at a high level in the district at present. Road building and recent drilling was noted on the south side of Kellys Mine Canyon and large blocks of new mining claims have been staked east of Georges Canyon Rim on the east side of the district and in the area southwest of Georges Canyon at the edge of Fourmile Basin.

GEOLOGIC SETTING

Tertiary volcanic rocks undrlie most of the central and southern Monitor Range in the area covered by the Longstreet mining district. The district is entirely within the margins of the Big Ten Peak caldera and the volcanic rocks ar mainly intracaldera rhyolitic to dacitic welded ash-flow tuffs. Large blocks of Paleozoic sedimentary rocks are mapped by Kleinhampl and Ziony (1984) within the volcanic rock outcrop area. These blocks, some up to one mile long by one third mile wide, are interpreted by Bonham and Garside (1979) to be landslide blocks within caldera collapse breccias.

ORE DEPOSITS

At the Clipper Mine, the original 1903 discovery site in the Longstreet district, workings explore a northwest-striking quartz vein that cuts argillically altered rhyolite tuff. Pyrite along with fine-grained gray sulfides are present in the vein quartz. The vein follows a shear zone that can be traced for over 400 feet along strike. Kellys Mine, about one half mile to the north of the Clipper, follows a quartz vein in a similar northwest-trending fault structure. The Kellys Mine vein is about 4 feet wide and can be traced for several hundred feet on surface. Vein material from this deposit contains pyrite, tetrahedrite, and copper oxide minerals.

Stockworks quartz veining occurs in argillitized, silicified rhyolite tuff at the Longstreet Mine about 6 miles northeast of Kellys Mine. Gold and silver values are reported to occur with quartz, pyrite, and other fine-grained black sulfides in a pipe-like zone within the altered tuff.

High on the eastern slope of Big Ten Peak, on the western side of the district, dozer cuts at the 29 Pines Mine expose a quartz stockworks area in silicified rhyolitic ash-flow tuff. The silicified tuff is brecciated; the breccia matrix consists of silica with fine-grained, dark sulfides within it. About one mile to the southeast of the 29 Pines Mine, a large adit was driven on a buggy, iron-stained quartz vein cutting argillically-altered granite. This granite is interpreted to be an exotic block within intracaldera ash-flow tuff.

Other prospects on the west side of Big Ten Peak, including the Balck Hawk Mine (Last Chance Mine) and the White Gold claims were also developed within large exotic blocks, rootless blocks of Paleozoic metasediments, floating in the ash-flow tuffs. At the Blackhawk Mine, brecciated quartz vein material containing pyrite, sphalerite, and galena occur in silicified, brecciated limestone. Drilling in this area proved the limestone to be a slide block within Tertiary mineralized Paleozoic Outcrops.

Recent activity was noted in the area of Kellys Mine, the Longstreet Mine, the 29 Pines Mine, and two unnamed areas along the east side of the district. Atlas Minerals has a large claim area surrounding the warm spring east of Georges Canyon Rim where drill roads have been cut in an altered ash-flow tuff. At the Lince claims, on the edte of Fourmile Basin south of Georges Canyon, Alhambra Mines Co. has staked an area of quartz veining in highly silicified rhyolite. The outcrop of silicified rock is about three-quarters of a mile long and displays local areas of iron-oxide staining and brecciation. Drilling has been done here, but the results are not known.

GEOCHEMICAL RELATIONSHIPS

Ore samples from the Clipper Mine - Kellys Mine area contained low gold and high silver associated with anomalous antimony and molybdenum values. Base metal values for all samples from this area were very low. Samples from the Longstreet Mine were similar, gold and silver associated with moderately anomalous molybdenum and very low base metal values. High antimony occurred withy low arsenic in one Longstreet Mine sample; the second sample from the mine area contained low antimony with high arsenic.

Samples from prospects on the west side of Big Ten Peak, from occurrences within the Paleozoic exotic blocks, reported low arsenic, antimony, gold, and silver but high lead and zinc values. Two samples were moderately anomalous in bismuth an cadmium; one contained anomalous tungsten.

All other samples taken from the district showed very low values for all elements.

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MANHATTAN DISTRICT

LOCATION

Manhattan is in the southern part of the Toquima Range, about 45 miles north of Tonopah. The main Manhattan district lies along Manhattan Gulch, a northwest-trending drainage on the west side of the range. Numerous other small mining areas located in the southern Toquima Range south of the Belmont and Round Mountain districts are included in the Manhattan district. The Manhattan lode and placer mines are located in Township 8 North, Ranges 43 and 44 East. Other mines in the district are located near Pipe Spring in Township 8 North, Ranges 44 and 45 East, at Spanish Spring in the central part of Township 7 North, Range 44 East, near Willow Spring along the western side and near Baxter Spring on the eastern side of Township 7 North, Range 43 East.

HISTORY

Silver ore was discovered in the Manhattan district in 1866 and the district was organized the following year (Thompson and West, 1881). The Thompson and West account of the district related that the principal mines were the Mohawk and the Black Hawk and described the deposits as veins containing copper but no trace of gold which occurred between limestone and porphyry. Raymond (1868) described the ores as "antimonial sulphurets... with their decompositions such as chloride of silver, etc." A few shipments of silver ore were made to the mill at Belmont, but the district was abandoned in 1869 (Paher, 1970). The location of the early silver discoveries is not exactly known, Ferguson (1921) mentions old silver mines worked in 1866 located about 4 miles south of the town of Manhattan, and these may be the original silver workings. Their location would be either near Pipe Spring or Spanish Spring in the southeastern part of the present Manhattan district.

The district was inactive until 1905 when, on April 1, ore rich in free gold was discovered only about 100 feet from the stage road from Belmont to Cloverdale (Ferguson, 1924). The district boomed in early 1906 but enjoyed a fairly short life; the San Francisco earthquake and fire of April 1906 triggered a financial panic which dampened activity at Manhattan as well as many other mining camps in Nevada. Some activity resumed in the fall of 1906 and the summer of 1907 (Paher, 1970) but the district did not fully recover until 1909 when mining of placer gold deposits began in Manhattan Gulch below the town. A rich strike at the White Caps gold mine in 1912 brought additional life to the camp, and activity continued at a fairly constant level until the mid- 1920's when operations subsided (Paher, 1970). Lode gold production continued at variable levels until 1940 when operations ceased during the war. Minor lode production is recorded between 1944 and 1950 (Kleinhampl and Ziony, 1984). Placer gold production was more or less continuous in the district from 1906 until 1950 and a large gold dredge operated at Manhattan between 1938 and 1946. Total production from Manhattan, 1906 to 1967, has been about $11 million (Kleinhampl and Ziony, 1984). In the mid-1970's, Summa Corporation obtained control of the major mining properties at Manhattan and began exploration. Summa reportedly produced nearly $500,000 in gold from its properties before selling them to Houston Oil and Minerals in 1977. Tenneco Minerals purchased Houston's Manhattan properties in 1983 and are currently producing gold at an announced production rate of 27,000 ounces

per year from an open-pit mine. Published reserves at this mine are 5 million tons of 0.036 oz gold per ton (Bonham, 1985).

GEOLOGIC SETTING

The southern Toquima Range consists of Paleozoic sedimentary and metamorphic rocks intruded by a large Cretaceous granite pluton and intruded or overlain by Tertiary hypabyssal and volcanic rocks (Shawe and others, 1986). The Palozoic rocks are marine sedimentary rocks: quartzite, silty argillite, silty argillite, and limestone of Cambrian age; and argillite, lime argillite, limestone, dolomite, chert, and quartzite of Ordovician age (Ferguson, 1924). A small patch of serpentinite of the Permian Pablo Formation crops out southwest of Manhattan in the Willow Spring area. Cretaceous granite crops out south of Pipe Spring and extends along the southeast margin of the district to the area southwest of Spanish Spring. Locally, Paleozoic argillite has been metamorphosed to phyllite; near granite contacts, it consists of knotted schist and muscovite-biotite schist. In places near the granite contact, limestone has been metamorphosed to skarn. South of Manhattan, epidote, diopside, and garnet are common in the metamorphosed limestone; potassium feldspar locally floods these rocks or forms thin veins that cut the limestone, and sulfides are present in places (Shawe and others, 1986). Tertiary volcanic rocks cover a large area of the district north of Manhattan Gulch. These rocks are largely silicic ash-flow tuffs originating from and now filling the Manhattan caldera. The caldera is centered around Bald Mountain and Diamond King Hill, north of Manhattan; the southern caldera margin passes roughly in a west-northwest direction along East Manhattan Wash and Manhattan Gulch (Shawe, 1981).

ORE DEPOSITS

The geology of the gold deposits of the Manhattan district has been very well described by Ferguson (1924); his work should be consulted for details of the deposits. The summary presented here has been taken largely from Shawe and others (1986).

The lode gold deposits of the Manhattan district are of a variety of types, although they occur together in a coherent belt, about 3000 feet wide, which follows the south margin of the Manhattan caldera for about 6 miles. The most productive deposits formed in shear zones in phyllitic argillite, silty argillite, and quartzite of the Gold Hill Formation. At deposits on Gold Hill, numerous thin veinlets of quartz, adularia, pyrite, and gold form a generally north-south trending stockworks zone. This is the area now being mined by Tenneco Minerals Co. At the White Caps Mine, on the east end of the district, gold ore occurred as replacement bodies in limestone of the Gold Hill Formation. Ore was mined along north-trending fault zones where gold occurred with pyrite, stibnite, realgar, orpiment and cinnabar in a ganque of calcite and quartz with minor fluorite. At the April Fool Mine, lying midway between the White Caps and Gold Hill deposits, gold mineralization took place in vuggy veins in a limestone layer in the Gold Hill Formation. The veins contain quartz, adularia, fluorite, minor pyrite, and free gold. At the Wall, or Summit, and Keystone mines near Summit Hill south of Manhattan, mineralized breccia on a fault contact between Gold Hill Formation and Ordovician limestone contains fluorite, finely crystalline quartz, free gold, and silver.

Away from the central Manhattan mines, mines and prospects can be found at North Manhattan, East Manhattan, near Pipe Springs, Spanish Spring, at Baxter Spring, and near Willow Spring. About 4 miles north of Manhattan, prospects at North Manhattan along Bald Mountain Gulch expose quartz veins which cut welded ash-flow tuff. The veins are vuggy and display iron-oxide staining. Mines at East Manhattan, along East Manhattan Wash, are near the contact of Tertiary rhyolitic ash-flow tuff and Ordovician limestone. Mine workings expose an east-west trending quartz vein; vein material is vuggy and iron-oxide stained. Workings seen near Pipe Springs did not display visible mineralization, although a strong northwest- trending vein is exposed there. At Spanish Springs, narrow huebnerite-bearing quartz veins cut Cretaceous granite. The veins range from a few inches up to 2 feet thick and follow a north-south strike. Tetrahedrite is reported to occur in these veins (Kleinhampl and Ziony, 1984), and either the Spanish Spring or Pipe Spring occurrences could be the site of the 1866 Manhattan silver discoveries. In the area of Baxter Spring, old workings expose silicified shear zones cutting thin-bedded shale and limestone. The shear structures roughly follow bedding and strike north-south. Drusy quartz stringers, stained with iron and manganese oxides, follow fractures in the zone. At the Willow Spring prospects, on the southern margin of the district, a zone of nickel mineralization in highly silicified serpentinite extends along the western face of the Toquima Range for about 3 miles. Garnierite and niccolite occur in the altered untramafic rock and several groups have explored the area for nickel. The best areas reportedly have grades of 0.35% nickel with traces of cobalt (Kleinhampl and Ziony, 1984).

GEOCHEMICAL RELATIONSHIPS

Ores from the central Manhattan district were found to be very high in gold, low in silver, and associated with high arsenic and antimony. Base metal values were very low and barium values were low. To the north, in North Manhattan, high gold and low silver values were obtained, but arsenic and antimony values were low, barium was moderate, and one sample was anomalous in molybdenum. Base metal values were also low. To the south, in the Keystone-Wall mine area, gold values were high, but silver values were also high, associated with very low arsenic, moderate antimony and lead, and low copper and zinc. Samples from Baxter Spring reported high gold and low silver associated with moderate arsenic values and low antimony values. Other base metal values at Baxter Spring were low. The nickel-rich deposits at Willow Spring were found to contain anomalous chrome as well as nickel.

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MOORES CREEK AREA

LOCATION

Moores Creek is on the northwest slope of Mount Jefferson in the central Toquima Range about ten miles north of the town of Round Mountain. The only known prospects in the area are located on the second drainage south of Moores Creek in Sections 1 and 2, Township 11 North, Range 44 East, and Section 35, Township 12 North, Range 44 East.

HISTORY

Little is known of the history of this area, it has no recorded production and there is no activity in the area at the present time. Old workings in the area may date to the late 1800's or early 1900's (Kleinhampl and Ziony, 1984). The area has been included with either the Northumberland district to the north, or the Round Mountain district to the south, and only Kleinhampl and Ziony (1984) have described it as a separate mining area.

GEOLOGIC SETTING

The Moores Creek area lies on the lower northwestern flank of the Mount Jefferson early Miocene volcanic massif, in a sequence of altered, rhyolitic ash-flow tuffs that originated in the Moores Creek caldera, the oldest of three nested calderas that make up the Toquima caldera complex of Boden (1986). The tuff of Moores Creek is characterized by light colored, porphyritic fiamme, and the unit forms light-colored slopes underlying the cliff-forming brown rhyolitic to quartz latitic tuffs of Mount Jefferson (Boden, 1986; Kleinhampl and Ziony, 1984). The prospects in the district are located within the intracaldera tuffs of Moores Creek, but the mining area is adjacent to the northern margin of the younger Mount Jefferson caldera. The Mount Jefferson caldera is to the south and nested within the larger Moores Creek caldera (Boden, 1986).

ORE DEPOSITS

Several shallow inclined shafts, two adits, and about a half-dozen prospect pits are located about two miles south of Moores Creek, just east of the Toiyabe National Forest boundary. The workings are in a light gray, lithic-rich ash-flow tuff and are concentrated along a N10-15W, 55NE fault zone. Rock along the fault zone is iron- and manganese-oxide stained, brecciated, and cemented with drusy quartz. Less than one mile to the west, in Section 2, native sulphur was noted in bleached, argillitized tuff exposed in a road cut. This area (in both Sections 1 and 2) has been drilled within the past 5 years for bulk-mineable precious metal deposits. Work was reportedly done by Louisiana Land Co.

GEOCHEMICAL RELATIONSHIPS

Samples of mineralized material from dumps in Section 1 contained high gold (1.5-1.7 ppm), and high silver (200-300 ppm), associated with anomalous arsenic and molybdenum. Antimony values were only moderate (82-92 ppm).

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MOREY DISTRICT

LOCATION

The Morey mining district is located on the east flank of the central Hot Creek Range in northeastern Nye County. The major mines of the district are located within Section 5, Township 9 North, Range 51 East, but there are scattered prospects to the northwest and southeast.

HISTORY

Ore was discovered in Morey Canyon in 1865, the district was organized in 1866. A stamp mill was constructed to treat district ores in 1873. Intermittent production is reported from the district beginning in 1866 and extending to 1965. The most productive years were between 1866-1891 and 1937-1947. Total recorded production for the district is at least 6,511 tons of ore with a value of at least $475,523 (Kleinhampl and Ziony, 1984). In more recent years (1970-present), International Minerals and Chemical Corp., Superior Oil Co., and Billiton Exploration have conducted exploratory drilling in the central and western part of the district.

GEOLOGIC SETTING

The Morey district is underlain by as much as 7,000 feet of Tertiary pyroclastic rocks. These rocks have been divided into a number of rhyodacitic to quartz latitic intracaldera ash-flow tuff units which are associated with the Oligocene Morey Peak caldron, complex. The high morey Peak massif probably represents the resurgent part of a caldera, and the mining district may be low on the northern flank of the resurged dome within the caldera and partly within a complexly faulted moat zone between the dome and the caldera margin.

ORE DEPOSITS

The ore deposits at Morey are high-grade, silver-bearing, epithermal fissure veins hosted by rhyodacitic to quartz-lattitic ash-flow tuffs of the Oligocene Williams ridge and Morey Peak Formations (Ekren and others, 1974). The veins strike east-west, are vertical or dip steeply to the south, and are oxidized in their upper portions. The mineralogy of the veins is complex. The main ore minerals are diaphorite, owyheeite, andorite, pyrargyrite, and stephanite (Williams, 1968). These minerals occur in the veins along with a rare and unusual mineral assemblage which includes sphalerite, galena, stibnite, jamesonite, cassiterite, pyrite, and arsenopyrite (Kleinhampl and Ziony, 1984). Most of the vein material observed on the dumps was composed of alternating bands of quartz and rhodochrosite containing clots and stringers of ruby silver (pyrargyrite).

One-half mile southwest of the base of Morey Canyon, a major northwest-striking fault displaces the productive veins. On the northeast side of the fault, in the vicinity of the main workings, the upper oxidized portions of the veins are exposed adjacent to propyllitically altered tuffs. Southwest of the fault, the tuffs show quartz-sericite alteration.

The most recent exploration work in the district has been to the west of the central mine area where anomalous lead, silver, molybdenum, and tin values were found with disseminated sulfides in sericitically altered tuffs.

GEOCHEMICAL RELATIONSHIPS

Ore samples taken from the district showed high silver values, with trace gold, in association with very high arsenic, antimony, cadmium, lead, and zinc. Copper values are high, but not in the same range as lead and zinc. Tin was very high in the samples taken, but only very low molybdenum was present.

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NORTHUMBERLAND DISTRICT

LOCATION

The Northumberland district covers that portion of the northern Toquima Range which extends from Northumberland Canyon north to the general vicinity of the Lander-Nye County line. All of the district is within the Toiyabe National Forest, most of the mines are within Townships 12 and 13 North, Ranges 45 and 46 East, Nye County.

HISTORY

Silver was discovered in the district in 1866, and ores from the Monitor and Blue Bell Mines were treated at a 10-stamp mill located at a spring in West Northumberland Canyon (Kral, 1951). Stone ruins mark the site of the old mill in the canyon and more stone foundations can be seen at the site of the original mine camp just east of the summit at Northumberland Pass. The silver mining activity was intermittent, and apparently stopped about 1891. Gold was discovered slightly east of the old silver prospects in 1936, and by 1939 the Northumberland Mining Company was in operation. Gold mining continued until 1942 when operations ceased due to the wartime closure order. Gold exploration resumed in the late 1960's, and in 1981, mining began on low-grade gold ore developed in the area of the old mines. Barite was discovered in the late 1960's and significant production of this material was made from several deposits.

Total production of the district, through 1962, is given as about $1.2 million (Kleinhampl and Ziony, 1984). Considerable barite has been produced since then, however, and the Cyprus Gold Mine has contributed significantly to production from the district.

GEOLOGIC SETTING

According to Kleinhampl and Ziony (1984), Paleozoic strata and Mesozoic plutons underlie about two-thirds of the district, and Tertiary volcanic and sedimentary rocks underlie the remainder. The Paleozoic rocks have been cut and moved along thrust faults, and segments of eastern facies carbonate rocks, transition facies carbonates and siliceous rocks, and western facies detrital and volcanic rocks are present in the district.

The largest plutonic body in the district, Clipper Gap pluton, lies north of West Northumberland Canyon. Several small intrusives, ranging from granite to quartz diorite in composition, crop out in the heart of the district. These smaller intrusives are surrounded by a well-developed metamorphic aureole (Kleinhampl and Ziony, 1984).

Oligocene and Miocene welded tuffs and tuffaceous sediments lie discordantly on the older rocks, and megabreccia units are exposed west of Northumberland Pass and north of West Northumberland Canyon. These formation are related to a large collapsed caldera, the Northumberland caldera, which occupies the north-central part of the Toquima Range.

ORE DEPOSITS

Most of the mineral occurrences are located along East and West Northumberland Canyons, and the Northumberland Gold Mine is at the pass where both canyons meet at the range crest. Barite occurrences are being mined in both canyons, but the major deposits are near the mouth of East Northumberland Canyon. Small copper, gold, and turquoise prospects occur in the area surrounding the Clipper Gap pluton northwest of the central part of the district, and uranium has been reported in altered tuffs in Willow Canyon, north of West Northumberland Canyon.

The early mined silver ores at Northumberland were in veins which were in plutonic rocks. The ores contained ruby silver and cerargyrite with some malachite and azurite (Raymond, 1869). The Northumberland Gold Mine is a disseminated deposit which occurs primarily in silicified, argillaceous and carbonaceous limestone of the Ordovician Pogonip Group. Silicified horizons of the Pogonip have been extensively fractured. Economic gold mineralization occurs in microfracture fillings of quartz and barite within the silicified horizons (Goldstein, 1973). The silicified, mineralized zones are generally associated with the margins of a monzonite intrusive (Kral, 1951).

Barite cements silicified breccia in the vicinity of the gold mines, and the earliest-explored barite occurrences were in the gold-silver part of the district. The major barite reserves, however, occur as thick sections of bedded barite near the mouth of East Northumberland Canyon.

Outside of the central Northumberland district in East Northumberland Canyon, only limited mining activity has occurred. Small quartz vein occurrences of gold-silver bearing pyrite-chalcopyrite were prospected in the Clipper Gap area, and small turquoise showings were prospected south of Pete's Canyon. At the Rifle prospect in Willow Canyon, the uranium mineral, coffinite, has been reported from spring deposits.

Large areas of the Northumberland caldera were claimed by Noranda Mines in 1981 and some drilling for uranium was done on their claim block. There is activity at the present in this area.

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PARADISE PEAK DISTRICT

LOCATION

The Paradise Peak district is located in the southern Paradise Range, south of Paradise Peak. The mines of the district extend from the southeast slope of Paradise Peak to B and C Spring on the east, then west to the southwestern flank of the range. All of the mines and prospects included in this district are in the southern half of Township 11 north, Range 37 East, Nye County. Both Kral (1951) and Kleinhampl and Ziony (1984) included this district within the adjoining Fairplay district. Schilling (1976), however, recognized Paradise Peak as a separate district.

HISTORY

The first record of activity within the boundary of the present Paradise Peak district is the discovery of the Scheebar mercury mine in 1929 (Bailey and Phoenix, 1944). An article in the Mines Handbook for 1931 (Rand and Sturgis 1931) mentions that the Paradise Peak Mining Company was incorporated in 1929 to develop an older copper, gold, silver property at Paradise Peak, but no accurate location information is given. There are numerous, small prosepcts on copper-bearing gossans in the area north of B and C Spring on the east side of the district. These workings are old, the style of timber used and the presence of purple glass and cut nails indicates work predating the turn of the century, and it is possible that this is the area referred to in the Mines Handbook article.

The Scheebar Mine produced mercury through 1943, and was again explored in the mide 1960's. Tungsten, in the form of scheelite, was discovered at the property in 1943 and a small quantity of tungsten was produced from the Scheebar Mine in 1954 (Stager and Tingley, in prep.). The Baxter tungsten property was discovered on the west side of the district in the early 1950's, and over 16,000 units of WO_3 were produced from the property through 1956. Exploration on a large porphyry molybdenum deposit in the area near B and C Spring began about 1970, and discovery of a body of porphyry molybdenum, silver, copper ore was announced in 1978. Due to the present depressed state of the molybdenum-copper market, however, there is now no activity in this area.

GEOLOGIC SETTING

Paradise Peak is underlain by limestone and siltstone of the Jurassic-Triassic Sunrise, Gabbs, and Luning Formations, undivided (Kleinhampl and Ziony, 1984). Outcrops of Permian Pablo Formation occur as the upper plate of a thrust sheet which covers the Jurassic-Triassic rocks along the southeast and southwest flank of Paradise Peak. Tertiary volcanic rocks cover the older rocks from the area of B and C Spring to the south and east. Two small outcrops of Cretaceous granite occur in the western part of the district where they intrude both Jurassic-Triassic and Perwmian sedimentary rocks. Large areas of hornfels outcrops northeast of B and C Spring may indicate that intrusive rock may underlie that area also.

ORE DEPOSITS

Mines and prospects in this district are confined to the areas of pre-Tertiary rock outcrops and, with the exception of the Scheebar Mine, are located along the southern flanks of Paradise Peak.

At the Scheebar Mine, workings expose a wide zone of quartz-carbonate veining along a shear zone in recrystallized limestone. The banded quartz-carbonate veins have strings of crystalline cinnabar along them and are reported to locally contain both scheelite and fluorite.

The U. V. Industries molybdenum property, north of B and C Spring, is in the area of several old shafts and adits that were driven on copper-bearing gossans and jasperoid zones in silicated limestone and hornfels. Stockworks quartz veining is exposed in several road cuts and trenches, the veins contain chalcocite as well as blue and green oxide copper minerals. Silicified, quartz-veined porphyry was found on dumps in this area.

On the western side of the district, on the lower western slopes of Paradise Peak, scheelite-bearing quartz veins and skarns have been mined at the Baxter-Hancock and Big Dike mines. At the Baxter-Hancock, scheelite occurs in quartz seams and stringers that cut silicated limestone adjacent to a major fault zone. A hematite-bearing garnet, epidote skarn zone which formed along a limestone-dike contact is exposed at the Big Dike Mine.

To the southeast of the Baxter-Hancock area, old workings in the Mildred Mine area were probably originally worked for gold and silver. Kleinhampl and Ziony (1984) attribute more recent dozer work and trenching in this area to exploration for tungsten during the 1950's.

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REPUBLIC DISTRICT

LOCATION

The Republic district is located in the northern Roysten Hills, a low northwest-trending group of hills along the western boundary of Nye County about 40 miles northwest of Tonopah. The district includes three general mining areas: the camp of Republic, near the Orizaba Mine, in the southwest quarter of Township 8 North, Range 39 East, Cole Springs Camp, about one mile to the southwest in the northeast quarter of Township 7 North, Range 39 East, and a third area about 3 miles to the south in the south central part of Township 7 North, Range 39 East.

Both Lincoln (1923) and Kral (1951) included the mines of the Republic district in the Cloverdale district. Cloverdale is north of the Royston Hills, in the southern Toiyabe Range, and the mines are in a completely different geologic setting. Kleinhampl and Ziony (1984) restricted the district to the Republic camp area of the Royston Hills but identified it as the Royston Hills Area, a name which confuses the district with the main Royston district to the south in Esmeralda County.

HISTORY

In 1906-1907, several shallow shafts were sunk in the Republic Camp area, and a few ore shipments were sent to Millers and to Hazen for treatment. Report of a high-grade strike in the spring of 1913 caused a short-lived boom; some shallow prospecting was done at this time, but the excitement was soon over and all work ceased. In the fall of 1913, there were less than a dozen people in the entire district (Sirdevan, 1913). The principal mine in this part of the district, the Orizaba, has a recorded production of about $127,980 produced between 1913-1918 (Kral, 1951). Mines in the Cole Springs Camp area are reported to have had minor production, but no records of this exist. A small mill is currently in operation at Cole Springs, but it receives ore from a variety of sources, mainly outside of the Republic district. Signs of recent exploration activity were in evidence in the district when it was visited in the Spring of 1986. Drilling has been done around the Orizaba Mine, and dumps at the Farris property have been removed.

GEOLOGIC SETTING

The oldest rocks exposed in the Republic district are calcareous and dolomitic siltstone, sandstone, and conglomerate of the Late Triassic Luning Formation (Kleinhampl and Ziony, 1984). These units are folded into a major east-striking syncline and are mildly to intensely deformed. Contact metasomatization has locally bleached the formations, and hornfels has formed in some areas. Highly deformed Tertiary volcanic rocks overlie the Luning and are composed chiefly of altered and sheared welded tuff (Kleinhampl and Ziony, 1984). These older rocks are overlain by relatively undeformed volcanic flows of intermediate composition which are in turn overlain by gently dipping tuffaceous sedimentary strata, andesitic lavas, and younger andesitic and basaltic rocks. Near the Blue Gem Mine in the southern part of the district, deformed metachert, quartzite, and greenstone, assigned to the Permian Pablo Formation, crop out (Kleinhampl and Ziony, 1984).

ORE DEPOSITS

The mines and prospects of the Republic district are grouped into three areas. Mines related to the old camp of Republic are on the north edge of the district and extend from the Orizaba Mine on the east to the Hyland and Farris properties on the west. About one mile to the south, a second group of workings is scattered in the hills surrounding Cole Springs camp. The third area includes prospects around the Blue Gem turquoise mine about 3 miles south of the Orizaba.

At the Orizaba Mine, workings followed a northwest-striking, southwest-dipping quartz vein in bleached limestone near an intrusive contact. The vein contains bunches of argentite, galena, and sphalerite in a gangue of quartz and calcite. Inclines at the Hyland property, east of the Orizaba, expose a N40°W, southwest-dipping shear zone in a bleached, altered volcanic rock near the contact with limestone of the Luning Formation. Vein quartz along the shear zone contains streaks of a gray, wispy sulfide, possibly silver. Mineralization at the Flossie claims, northeast of the Hyland, and at the Farris property, west of the Hyland, occurs in quartz veins in andesite and meta-andesite. Veins at the Flossie strike N15°E and N40°W and contain pyrite and some base metal sulfides in quartz gangue. Both vein systems have been exposed by prospects and incline shafts. At the Farris property, workings follow a N40°E, vertical quartz vein which contains minor galena.

Shafts and prospect pits near Cole Springs camp follow quartz veins which strike N40°W and cut altered lavas and intrusive bodies of dacitic to rhyolitic composition. Vein quartz from dumps in the area displays brecciation and iron-oxide staining.

At the Blue Gem Turquoise Mine, workings follow thin turquoise veinlets in altered shear zones in a fine-grained white quartzite. The rock is almost completely argillized near the shear zones, and is silicified along the mineralized fractures.

GEOCHEMICAL RELATIONSHIPS

Of the eleven high-grade dump samples collected in this district for geochemical analysis, only three did not contain detectable gold; values ranged from 0.45 ppm to 7.7 ppm with silver values of 3 ppm to 3000 ppm. Arsenic values were very high in samples from the Blue Gem area and were very low to the north. Antimony values were high in the south near the Blue Gem and near the northwest part of the district and low at the Orizaba Mine. Base metal values were generally high throughout the district, and cadmium was moderately high in some samples, mainly those on the northwest side of the district. Samples from the Cole Camp area were slightly high in molybdenum.

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REVEILLE DISTRICT

LOCATION

The Reveille mining district is located in the northern Reveille Range about 15 miles southeast of Warm Springs, a point at the junction of US Highway 6 and State Route 375 about 50 miles east of Tonopah, Nye County. The mines and prospects of the district are located at the crest and on the west side of the range in Township 2 North, Range 51 1/2 East.

HISTORY

Ore was discovered here in August, 1866, and the district was immediately organized and named in honor of the Reese River Reveille, the newspaper in Austin, Nevada (Thompson and West, 1881). In 1869, stamp mills to treat ore from the mines were built near water in Reveille Valley, 12 miles to the west. These mills ran for only a short time before failing. In 1875, the larger mill, a ten-stamp operation, resumed operations and continued to run at intervals for the next four years. This operation is credited with $1.5 million in bullion (Thompson and West, 1881). The camp was abandoned in 1880. New Reveille, a camp in the district located about 2 miles south of the original mines, was discovered in the late 1880's and operated in the 1890's, in 1904-1906 or 1907, and at times over the years from 1911 to 1950 (Kral, 1951). Kleinhampl and Ziony (1984) credit most of the pre-1904 production of the district to the old Reveille mines and the post-1904 production to mines at New Reveille. They credit the district with $741,274 in production, 1866-1963.

In the mid-1970's, the major properties in the Reveille district came under the control of Gold Creek Mining Co. That company embarked on a mining venture which involved open-pit mining of the surface area surrounding the old underground mines and moving the rock to heap leach pads constructed at the foot of the range to the west. This operation was not successful, and the camp is again deserted.

GEOLOGIC SETTING

The north half of the Reveille Range consists essentially of a gently west-tilted core block of Paleozoic strata broken into faulted moisaic blocks. These blocks are bounded on all sides by faults that separate the core from generally less intensely but complexly faulted Tertiary rocks.

The exposed Paleozoic section consists of carbonate assemblages of Lower Paleozoic Antelope Valley Limestone, Pogonip Group, and Eleana Formation and of coarse to fine clastic rocks of Permian or Pennsylvanian age (Kleinhampl and Ziony, 1984). Tertiary volcanic rocks lie unconformably on and are faulted against the Paleozoic rocks. They consist of welded ash-flow tuffs and lavas and include some dikes and sills that cut exposed Paleozoic strata. The thickest tuff unit mapped in the district, the Monotony Tuff, covers most of the east flank of the Reveille Range (Ekren and others, 1973). The source of this tuff is a large, disrupted caldera which lies mainly to the east of the range in Railroad Valley. Gravity anomalies indicate that the western edge of the caldera nearly coincides with the eastern frontal scarp of the

range and is immediately adjacent to the substantial section of Paleozoic rocks to the west (Snyder and Healey, 1983). The mines of the district are located in the faulted Paleozoic rocks along the margin of the described caldera.

ORE DEPOSITS

The Reveille district was originally prospected for gold and silver, and major silver production came chiefly from two mines, the Gila at old Reveille camp and the New Reveille Mine at New Reveille camp. Early reports noted that near-surface ore at both the Gila and New Reveille mines was oxidized and consisted mainly of cerargyrite and cerussite with some galena, malachite, and azurite in a gangue of quartz and gyspum (Ball, 1907). Ball noted that the ore occurred in quartz veins and stringers ramifying through brecciated zones in the Paleozoic rocks near their contact with rhyolite. The deposits were described as podiform occurrences which were found within several tens of feet of the surface and were associated chiefly with irregularly silicified zones rather than well-developed veins.

All of the deposits in the Reveille district occur where lower Paleozoic quartzite (Eureka Quartzite of the Pogonip Group) is in fault contact with the oldest welded tuffs. Ore-bearing solutions apparently moved upward and laterally in and adjacent to the highly fractured quartzite and were trapped by the overlying impermeable tuff. The tuff nearly everywhere appears to be in low-angle fault contact with the underlying Paleozoic rocks (Ekren and others, 1973). Open-pit operations at the mines in the old Reveille part of the district have destroyed evidence of the old workings and it is difficult to identify exact locations of old shafts and other landmarks. At the Amazon, Fisherman, Knicherbocker property, southwest of the Gila Mine, new cuts and pits explore a wide shear zone in carbonate rocks near contact with a Tertiary dike. Pods of iron-oxide stained, silicified rock up to thirty feet in diameter are exposed along the zone. At the Antimonial Mine, on the east side of the district, a vuggy, silicified zone from 2 to 24 inches wide is exposed along the quartzite-rhyolite contact. The New Reveille Mine has been spared the recent attempt at open-pit mining, and workings there are intact. The ore zone is highly iron-oxide stained at surface and follows a quartzite-rhyolite contact. Ore samples from this mine contained ceragyrite, cerrussite, galena, sphalerite in brecciated, vuggy quartz.

GEOCHEMICAL RELATIONSHIPS

Gold was detected in several samples from the district but the values were low, the highest value obtained was 0.35 ppm from the New Reveille Mine. Silver values were high, ranging from 100 to 1500 ppm in samples from the western parts of the district; samples from the Gila Mine and Antimonial Mine contained only 15 ppm silver. Antimony was highly anomalous in all samples. Arsenic was anomalous in all samples, but very high in samples from New Reveille. Molybdenum was moderately anomalous in samples from New Reveille and the Kietzke mine area. Barium was high only in samples from the Kietzke Mine.

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ROUND MOUNTAIN DISTRICT

LOCATION

The Round Mountain mining district is located on the western slopes of the central Toquima Range about 45 miles north of the town of Tonopah, Nye County. The district extends from the general area of Willow Creek on the north to Mariposa Canyon on the south, and from the crest of the Toquima Range near Spanish Peak on the east to the floor of Smoky Valley on the west. Most of the gold mines of the ditrict are at Round Mountain on the west side of the district; tungsten, mercury, and uranium mines and prospects are located in the foothills immediately east of the town of Round Mountain.

HISTORY

The Round Mountain district may have been prospected as early as the 1870's when the nearby camp of Jefferson was active. The first record of activity, however, is in 1891 when claims were located in the area of the later Round Mountain gold discoveries. The main activity at Round Mountain dates from 1906 when lode and placer gold deposits were located on the lower slopes of Round Mountain and Stebbins Hill (Tingley and Berger, 1985). Lode and placer gold mines were active at Round Mountain between 1906 and 1916, and from 1919 into the 1920's; activity declined sharply in the 1930's. Placer mining was done at deposits on the western flanks of Round Mountain in the 1940's and 1950's. The last placer mining ceased in 1959 (Kleinhampl and Ziony, 1984. In 1969, Copper Range Co. entered the district and conducted exploration on both the placer and lode deposits. Lode exploration was successful, large-scale openpit operations began at the new Smoky Valley Mine in 1977, and gold mining has been continuous on the property since that date.

Huebnerite-bearing quartz veins were discovered in the area of Shoshone Creek, east of Round Mountain, about 1907 and a small amount of tungsten concentrates was produced in that year. Tungsten prospecting continued in the area up to about 1912, but there has been no significant activity since that time. Uranium has been reported present in some of the old tungsten mine workings, but there has been no uranium production (Garside, 1973).

Mercury has been produced from the Senator, or Red Bird, mercury mine near Spanish Peak at the crest of the Toquima Range east of Round Mountain. This property was discovered sometime between 1925 and 1928 (Bailey and Phoenix, 1944) and is credited with between 100 and 200 flasks of mercury produced up to 1965 (Kral, 1951; and Kleinhampl and Ziony, 1984). This property is sometimes included in the adjacent Belmont district rather than Round Mountain.

GEOLOGIC SETTING

Pre-Tertiary rocks cropping out in the Round Mountain mining district include principally Cambrian and Ordovician siliceous shale, siltstone, chert, and minor limestone. Cretaceous granitic rocks of the Round Mountain pluton cut the sedimentary rocks on the southeast, and northeast-striking Tertiary rhyolite dikes cut both sedimentary and granitic rocks in a zone along the west boundary of the pluton (Kleinhampl and Ziony, 1984). Tertiary ash-flow

tuffs cover the north, west, and south parts of the mining district. The southwestern margin of the Mount Jefferson caldera lies to the northeast of the Round Mountain district, the Manhattan caldera lies to the south of the district. Ash-flow tuffs at Round Mountain, host rocks for the gold mineralization there, are interpreted to be intracaldera tuffs which pre-date the Tuffs of Mount Jefferson. These tuffs may fill an older caldera structure which now li°es mainly buried beneath gravels in Smoky Valley (Tingley and Berger, 1985).

ORE DEPOSITS

The gold deposits at Round Mountain and at the Gold Hill Mine north of Round Mountain are the most important mineral deposits within the Round Mountain district.

The Round Mountain lode gold deposits occur near the margin of a large caldera complex. Host rock for the gold deposits is a 1400-foot thick rhyolite ash-flow tuff unite that is composed of a 400- to 500-foot thick nonwelded base, a densely welded central portion about 800 feet thick, and a less densely welded vapor-phase altered top that is 75 to 100 feet thick. The lode gold mineralization is controlled by the dispositon of high-angle regional stress fractures, in particular a northwest-trending set. Where the narrow fractures cut the lower nonwelded portion of the tuff, mineralization occurs as thin quartz veinlets and as disseminations throughout the pumiceous tuff. In the welded portion of the tuff, the mineralization occurs wholly as veins along the high-angle fractures or along hydrothermally dilated low-angle joints. Circular, somewhat pipelike masses of brecciated rock exposed along some of the fracture zones are interpreted to be centers of hydrothermal explosions directly related to the formation of the gold mineralization. (Tingley and Berger, 1985). The gold ores, as presently exposed, are oxidized and are characterized by hematitic and limonitic stain. Samples of deep ores reveal the mineralogy to be primarily native gold and pyrite. Realgar has been reported present and fluorite is present in the brecciated zones. Adularia from veins on Round Mountain has been dated at about 25 m.y. Alunite from surface and near-surface vein localities at Round Mountain has been dated at about 10 m.y., recording an early Pliocene period of supergene alteration (Tingley and Berger, 1985).

The gold placer deposits at Round Mountain formed from the vein deposits and are located down-slope from the vein outcrops. A problem with the placer deposits that plagued early operators and that still faces any potential operator is the presence of a large part of the gold values as "contained gold". This is gold not freed from its rock matrix; standard placer gold recovery methods do not collect this gold and it is lost to tailings.

At the tungsten occurrences east and south of Round Mountain, small huebnerite-bearing quartz veins occur in and near the Cretaceous Round Mountain pluton. The veins are short, lenticular, and strike mostly northeast and northwest. In addition to quartz and huebnerite, the veins contain muscovite, fluorite and barite (Shawe and others, 1984). Mine workings at these occurrences are very small, and only very little tungsten ore could have been produced from them. Samples of ore from the old dumps show veins of only a few inches in thickness although clots of huebnerite up to several inches across were seen within some vein material.

Ore at the Senator mercury deposit occurs as cinnabar and metacinnabar in thin quartz-barite veins that occupy a shear zone cutting granite. The shear zone is about 100 feet wide at its widest exposure, and can be traced for almost 1,000 feet along strike. The mine camp at the property has been abandonded since about 1968, but evidence of recent dozer work on the north end of the vein system was seen when the property was examined (Spring 1986).

GEOCHEMICAL ASSOCIATIONS

At the Round Mountain lode gold deposit, areas enriched in gold and silver are also anomalous in the pathfinder elements arsenic, antimony, thallium, mercury, fluorine, molybdenum, and tungsten. The gold deposits are not characteristically enriched in copper, zinc, and lead, although locally anomalous amounts of these metals occur (Tingley and Berger, 1985).

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ROYSTON DISTRICT

LOCATION

The Royston district is located in the central Royston Hills, astride the Nye County - Esmeralda County line about 25 miles northwest of Tonopah. The mines of the district are located in the northwest quarter of Township 5 North, Range 40 East and the southwest quarter of Township 6 North, Range 40 East. The county line bisects the district along a northwest-southeast line and the largest properties are in Esmeralda County. In Esmeralda County, the area is known as the Crow Springs district.

HISTORY

The first recorded activity in the Royston (Crow Springs) district was in 1902 when mining began on the Royal Blue Mine, located just west of the county line in Esmeralda County. From 1902 to 1915, the mine is credited with production of about $5 million (Morrissey, 1968) in turquoise. Intermittant mining activity has taken place in the district to the present time, but there is no record of the dollar amount produced. Production in the district has been coincident with the rise of gem prices. A high-grade deposit of silver was discovered on the Foy-Betts Lease in 1921 and about $20,000 worth of ore was produced from a shallow shaft on that property in six weeks' time (Paher, 1970). Apparently little came of the silver strike, and the boom quickly subsided.

The district and the surrounding areas were heavily prospected in the 1960's and 1970's for copper-molybdenum porphyry deposits and, at the present time, the central part of the district is being explored for precious metals by a Canadian firm.

GEOLOGIC SETTING

The Royston hills are underlain by metavolcanic rocks (greenstone) and metachert assigned to the Permian Pablo Formation (Kleinhampl and Ziony, 1984). At Royston, the Pablo Formation is locally bleached and exhibits a well-developed fracture cleavage. A minor outcrop of granitic rock is located in the main part of the district. Tertiary volcanic rocks, consisting of welded ash-flow tuffs and basalt overlie the older rocks.

ORE DEPOSITS

Turquoise occurs principally in veinlets and seams in intensely deformed and altered metavolcanic rocks of the Pablo Formation near the contact with intrusive quartz porphyry. Minor lenses and nodules of turquoise ranging from a fraction of an inch to more than an inch in thickness occur in the altered host rock and as cementing material in fault breccias; the rocks were locally silicified after the turquoise was emplaced (Morrissey, 1968). Turquoise from the district ranges from pale blue to dark sky blue.

At the Royston Coalition Mine, within the Nye County part of the district, workings follow a north-trending shear zone in bleached, altered quartzite of

the Pablo Formation. An iron- oxide stained, brecciated quartz vein containing galena, sphalerite, and pyrite follows the shear zone. Turquoise occurs in the oxidized portions of the vein system and has been mined in some of the workings on this property. One of the shafts at this mine, located on the north end of the common line of Sections 6 and 6, T5N, R40E, is the Foy-Betts Lease, source of the silver ore responsible for the short rush to the district in 1921.

GEOCHEMICAL RELATIONSHIPS

Samples of ores from the district were anomalous in gold and contained high silver associated with high arsenic, antimony and base metals. Boron values were high, one sample contained over 2000 ppm boron.

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SAN ANTONE DISTRICT

LOCATION

The San Antone district covers the northwest portion of the San Antonio Mountains east of Big Smoky Valley about 25 miles north of Tonopah. The district includes the old camp of Cimarron in Township 6 North, Range 42 East on the north end of the range and the Liberty camp in the northwest portion of Township 5 North, Range 42 East along the west side of the mountains. At present, access to the district is difficult. Cimarron camp can be reached by very poor roads from the east but dune sand in Smoky Valley and restrictions by Arco security guards at the Hall Mine prevent access to any of the mines or prospects on the west side of the range.

HISTORY

Springs at the site of the San Antonio stage stop in Smoky Valley north of the San Antone district were visited by John Fremont in 1845 (Hall, 1981), and Kral (1951) relates that diggings south of Liberty were worked by Mexicans in 1854. Thompson and West (1881), however, give the discovery date of the district as 1863. They also credit the discovery to Mexicans. The early discoveries were all in the vicinity of the Liberty Mine, on the west side of the district. In 1865 a 10-stamp mill was built at San Antonio station to treat ores from the district; it ran for only a short time and was replaced by a 4-stamp which also ran only a short time (Kral, 1951). Production of $116,301 is credited to the district for 1867-88 (Couch and Carpenter, 1943), and Kral (1951) credits the Liberty Mine with $500,000 between 1910 and 1912. Beginning in about the mid-1930's exploration in the district has been concentrated at the Hall property, about one mile north of the Liberty area on the west edge of the district. Copper-molybdenum mineralization there attracted the attention of several large mining companies for its low-grade, open-pit potential. U.S. Vanadium Corporation worked the area in 1935-38, and Freeport Sulfur Company held the property in 1940. In 1942, as part of its strategic metals investigations, the U.S. Bureau of Mines studied the deposit. In 1957, the Anaconda Company acquired the ground and began a long period of exploration and study of the porphyry molybdenum deposit. In 1981 Anaconda, then a subsidiary of Atlantic Richfield Co., placed the Hall Mine in production. The $200 million molybdenum mine and mill began production with an estimated mine life of 20 years on a 40 million ton orebody. In 1983, drastic reductions in the price of molybdenum caused the mine to be closed. The mine remains closed, the plant is still in place but Arco hopes to sell and it is doubtful that the mine will reopen.

GEOLOGIC SETTING

The oldest rocks in the San Antone district consist of dark gray to black volcanic siltstone and some interbedded greenstone of the Permian Pablo Formation. At the Hall Mine, quartzite and quartz-mica schist of possible Triassic or Jurassic age are intruded by a Cretaceous quartz monzonite stock. Tertiary volcanic rocks, consisting of rhyolitic welded ash-flow tuffs, dacite flows, and basalt flows cover most of the San Antonio Mountains north and east of Liberty camp. Rhyolite and andesite dikes are common in the district and are generally altered. Andesite dikes intrude Tertiary welded tuffs at

Cimarron camp and are inferred to be associated with the precious metal mineralization there (Kleinhampl and Ziony, 1984).

ORE DEPOSITS

Ore deposits in the San Antone district consist of precious- metal deposits in beccia zones in the Cimarron area and base- metal silver and gold veins and porphyry copper-molybdenum deposits in the Liberty area.

At the Cimarron Mine, in the eastern part of Cimmaron camp, a shaft and several adits were driven on a N25°W, 65°SW shear zone in bleached, argillized rhyolite. Brecciated vein material from the shear zone contains fine crystals of black sulfides, possibly silver. This area has been recently drilled; drilling was confined to an arcuate vein system which follows the western and northern margins of a rhyolite plug.

At the San Antonio Mine, about three quarters of a mile west of the Cimarron Mine, major workings follow a N70°W, 45°SW fissure vein along a fault in rhyolite. The vein is several feet wide and is composed almost entirely of brecciated rhyolite, bleached white, stained with iron oxides and cemented with silica. In places the breccia is open and appears merely glued together, in others, the space is completly filled with silica matrix. Jarosite and fine- grained pyrite are present within the breccia.

In the Liberty area, silver was recovered from oxidized veins containing cerargyrite, embolite, native silver, and argentite which cut rocks of the Permian Pablo Formation (Kleinhampl and Ziony, 1984). At Liberty, veins are reported to strike northwest and range in width from about 2 to 12 feet.

The porphyry molybdenum deposit at the Hall property is related to a quartz monzonite stock which locally intrudes quartz-mica schist, sericitic quartzite, and limestone. Ore minerals, which include molybdenite, pyrite, and minor chalcopyrite are disseminated chiefly in a massively developed irregular zone of quartz veins, a stockworks, that envelops the marginal zone of the pluton and some of the bordering country rocks. An irregular, hydrothermally altered halo around the deposit is sericitized, silicified, and argillized, and a limestone unit is massively silicified. The deposit has a maximum lateral dimension of 4000 feet and extends to at least 2000 in depth (Kleinhampl and Ziony, 1984). Prior to the beginning of open-pit mining, Anaconda outlined at least 5-10 million tons of material containing 0.25% to 0.35% MoS_2 per ton.

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SILVER BOW DISTRICT

LOCATION

Silver Bow is situated in the canyon of Breen Creek, on the west side of the central Kawich Range about 50 miles west of Tonopah, Nye County. Mines and prospects are located in the south half of Township 1 North, Range 49 East, and in the northern tier of sections of Township 1 South, Range 49 East. The district lies on the northern boundary of the Nellis Bombing Range and those properties in Township 1 South are within the bombing range.

HISTORY

The first locations at Silver Bow were made in November 1904 (Ball, 1907). By the summer of 1905, several hundred men were in the district, a townsite had been platted, and a number of shallow prospect holes had been sunk. The first shipments were made from the district in 1906 (Lincoln, 1923). Paher (1970) states that the district declined rapidly and had joined the ranks of dead towns by mid-year, 1906. Mining activity continued on an intermittent basis, however, as a 2-stamp mill was built in 1913, another mill was active in 1920-21 and, in 1929, a 50-ton flotation mill was built in the district (Lincoln, 1923; Kral, 1951). Ore was shipped from the district in 1941 (Kral, 1951) and there was activity by the Tickabo Mining and Milling Co. in 1964. The most recent activity in the district appears to be a large claim block staked by Amoco in June 1984. No evidence of work on this block of claims was seen in 1986. Total production of the district is estimated at between 100,000 and 1,000,000 ounces silver and between 1000 and 10,000 ounces gold (Cornwall, 1972).

GEOLOGIC SETTING

The entire Silver Bow district is underlain by Tertiary volcanic rocks, mainly welded ash-flow tuffs and rhyolite intrusions, related to the Kawich caldera. This caldera, which is centered in the Kawich Range north of the Silver Bow district, was the source for most of the tuff exposed in the northern part of the range. The center of the caldera is delimited by intracaldron tuffs and of crystal-rich rhyodacite domes and lava flows, surrounded by younger, ring fracture, rhyolitic intrusive bodies (Gardner and others, 1980). The southern margin of the Kawich caldera passes through the Silver Bow district.

ORE DEPOSITS

Silver-gold mineralization at Silver Bow occurs in silicified shear zones which cut welded ash-flow tuffs and in quartz veinlets which cut small rhyolite intrusive bodies. The trend of the mineralized zones, east-northeast, and east-west, generally parallels the Kawich caldera margin which is inferred to pass through the district.

The wall rocks are intensely silicified and kaolinized in the vicinity of the deposits. Veins and silicified zones within the shear zones range from a few inches up to a few feet in width and some veins can be traced in outcrop for several hundred feet along strike length. The veins are vuggy, brecciated,

and stained with iron oxides. Ball (1907) observed some of the high-grade ore and described it as containing zonally grown crystals of quartz with finely divided silver sulfides dusting some of the bands of growth. Ore minerals included stephanite, ruby silver, silver chloride, and free gold. The only metallic minerals today visible in dump samples are pyrite and an unidentified gray sulfide.

GEOCHEMICAL RELATIONSHIPS

Geochemical results from ore samples collected in this district were very uniform. Gold values were high in some samples (up to 15 ppm) and silver values were all high (ranging from 15 to 3000 ppm). Arsenic was highly anomalous in all but four samples, antimony was anomolous in half of the samples taken. Barium values were low and all base metal values were low. Molybdenum was moderately high in six of the eleven deposits sampled.

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SILVERTON DISTRICT

LOCATION

The Silverton district is located in the central Pancake Range north of Black Rock Summit on U.S. Highway 6 about 85 miles northeast of Tonopah. The mines in the district are confined to a small area on the southeastern flank of the range in the southeastern part of Township 8 North, Range 54 East. This is a much more restricted definition of the district than used by Kral (1951) who included Silverton with the Currant district, centered on the White Pine-Nye County line some 40 miles to the east, or by Kleinhampl and Ziony (1984) who grouped Silverton and the entire Pancake Range for 40 miles to the north into one mining area which they called the Pancake Range mining area.

HISTORY

Silver was discovered in this district in about 1921 by Hale C. Tognoni, a company was immediately organized, a shaft was sunk, high-grade stringers were mined, and the ore was shipped to Tonopah (Kral, 1951). Small amounts of silver ore were produced from the district in 1930-37, and in 1953 (Kleinhampl and Ziony, 1984). When the district was visited in early 1986, evidence of recent road building and drilling were seen.

GEOLOGIC SETTING

The Silverton mining area is underlain by Paleozoic sedimentary rocks and Tertiary volcanic rocks which outcrop as numerous slivers and discontinous blocks and plates bounded by both steep and low-angle faults (Kleinhampl and Ziony, 1984). Ekren and others (1976) show the Silverton area to be within and near the eastern boundary of their Williams Ridge-Hot Creek Valley caldron complex. The district falls inside of the eastern margin of the large complex and outside of the eastern margin of the Lunar Lake caldera which lies southwest of Silverton. The complex outcrop pattern of the Paleozoic and Tertiary rocks in the mining district can be perhaps explained by what Kleinhampl and Ziony (1984) refer to as caldron-margin tectonics; blocks of caldera wall have slid under gravity into the collapsed interior moat area of the caldera to form imbricated masses of Paleozoic and Tertiary strata. Silicic dikes and sills were than injected along the weak zones of the caldera margin. Locally, welded tuffs, dikes, and fault zones in the Paleozoic rocks are bleached, jasperized, and argillized.

ORE DEPOSITS

At the Silverton Mine, the major property in the district, argentite, cerargyrite, and native silver occurs in small veinlets in Devonian carbonate strata near a major north- south trending fault (Kleinhampl and Ziony, 1984). The vein material, consisting of quartz and calcite, is highly oxidized and is coated with argillic gouge. At the Blackbird antimony prospect, about one mile northeast of the Silverton Mine, minor stibnite and barite occur in a 2 to 3 foot thick quartz vein cutting silicified rhyolite. A few hundred feet to the southwest, a thinner vein (4 inches to 16 inches thick) in rhyolite contains solid stibnite in places.

GEOCHEMICAL RELATIONSHIPS

No gold was detected in ore samples taken from this district. Silver was very high in samples from the Silverton Mine and was associated low barium and moderately high antimony. Arsenic was not detected in the Silverton Mine samples and all base metal values in those samples were low. Samples taken from prospects to the northeast of the Silverton Mine, including those at the Blackbird antimony prospects, were low in silver, high in arsenic, mostly very high in antimony, generally high in barium, and low in base metals. In contrast to volcanic-hosted ores in other nearby mining districts located in caldera settings, the Silverton district ores were all low in molybdenum.

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TONOPAH DISTRICT
(by L. J. Garside)

LOCATION

The Tonopah mining district is centered on the town of Tonopah, in Townships 2 and 3 North, Ranges 42 and 43 East, Nye and Esmeralda Counties. The main productive part of the district is located in Nye County, just outside the Esmeralda Resource Area (in Sections 35, 36, Township 3 North, Range 42 East). The workings in the district consist of many thousands of feet of underground drifts and crosscuts, with vertical shafts to the surface, Bonham and Garside (1979, fig. 73) show the location of the principal shafts.

HISTORY

The district was discovered by Jim Butler in 1900, and was worked by lessees in the first few years. Tonopah had steady production until 1930, and sporadic production until the late 1940's. There has been no recorded production since 1961. Hughes Tool Co. (Summa Corp.) purchased mining claims that comprise a substantial part of the district in 1969. Houston International Minerals Co. purchased these in 1977, and has done considerable exploration drilling, underground sampling, and mapping in the district in the search for new orebodies or extensions of ones previously mined. No commercial discoveries have been announced to date. Cordex Exploration Co. drilled low-grade disseminated gold-silver mineralization at the Three Hills property about 2 miles west of Tonopah in the late 1970's. The company has not announced a discovery, and the property was inactive in 1982.

The Tonopah district has produced 1,861,200 oz/gold and 174,152,628 oz/silver from epithermal bonanza precious-metal veins in volcanic host rocks.

GEOLOGIC SETTING

The geology and ore deposits of the district have been described by numerous workers; these studies are cited in Bonham and Garside (1979). The underground geology is described in detail by Nolan (1935). The most recent work in the district was done by Fahley (1981).

ORE DEPOSITS

The ore in the Tonopah district occurs in veins which cut Tertiary volcanic rocks ranging in composition from dacite to rhyolite. The veins are composed largely of quartz but also contain varying amounts of K-mica, adularia, pyrite, and rhodochrosite.

High-grade, primary metallization in the veins consists of argentite, polybasite, pyrargyrite, electrum, sphalerite, galena, and chalcopyrite. The volcanic rocks adjacent to the veins are altered to quartz, K-mica, and adularia. This zone of potassium-silicate alteration grades outward into an intermediate argillic zone consisting of kaolinite, halloysite, K-mica, and montmorillonite which in turn grades outward into propylitized rocks.

The orebodies in the Tonopah district occur in a zone approximately 650 feet thick, which is elongated in an east-west direction. This zone reaches its highest altitude in the central part of the district, which is the only place that orebodies are exposed at the surface. The zone is controlled by several sets of pre-ore faults, which are both high and low angle. The exposed orebodies are oxidized to an average depth of about 100 feet, although some deeper oxidation occurs locally along faults, which cut the ore. Supergene enrichment was not a significant factor in the Tonopah district. Silver-gold ratios in oxidized ore were essentially the same as those in unoxidized ore, which indicates that relatively little supergene migration of silver or gold occurred. Most of the silver in the oxidized ore occurred as silver haloids.

The age of the bonanza silver-gold mineralization described above is well defined by K-Ar age dating of pre- and post-ore rocks and hydrothermal vein minerals (Bonham and Garside, 1979, p. 111-112) as 18-19 m.y.

In addition to the silver-gold deposits described above, younger low-grade gold-silver mineralization and hydrothermal alteration occur in intrusive rhyolite (Oddie Rhyolite) and tuffaceous sediments (Siebert Formation). These mineralized units are younger than the main-stage Tonopah mineralization.

Very little ore has been produced to date in the district from rocks mineralized in this later period of hydrothermal activity. Generally, the mineralization is distinctly lower grade than in the earlier phase and has a higher gold/silver ratio. Mineralized veins of this later period occur on Mount Oddie and Ararat Mountain. Disseminated, low-grade, gold-silver mineralization also occurs in silicified, tuffaceous sediments of the Siebert Formation and Oddie Rhyolite of the Three Hills property about 1/2 mile northwest of Siebert Mountain.

Because unaltered rocks of the Brougher Rhyolite unconformably overlie hydrothermally altered rocks of the Siebert Formation, the age of the Brougher Rhyolite places a lower limit on this later period of mineralization in the Tonopah district. The Brougher Rhyolite in the Tonopah district has K-Ar ages of 16.1 and 16.3 m.y. The available evidence indicates that this second period of mineralization in the Tonopah district is the same age as the mineralization in the nearby Divide district and is probably genetically related to it, as adularia and adularized whole rock from mineralized lodes in the Divide district were dated by the K-Ar method at 16.3 and 16.4 m.y.

GEOCHEMICAL RELATIONSHIPS

Anomalous Au, Ag, As, Sb, Zn, Ba, Mn, and other metals are reported from vein and wall-rock samples in the Tonopah district. The details of the geochemical anomalies are reported in Bonham and Garside (1982).

Olson (1964, p. 188) reports a clay deposit in the Tertiary Siebert Formation a few miles northwest of Tonopah. Also, the Tonopah Summit Member of the Fraction Tuff is extensively altered to zeolite minerals (predominantly mordenite) over a considerable area south of Tonopah (Papke, 1973; Bonham and Garside, 1979, p. 50).

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TROY DISTRICT

LOCATION

The Troy mining district is located east of Railroad Valley on the western slopes of the southern Grant Range in northeastern Nye County. Mining areas within the district extend from Grant Canyon on the northeast to Troy Canyon on the southwest. Most of the mines are within the boundary of the Humboldt National Forest but the Terrell and Nye Mines southwest of Mud Spring Basin are on BLM administered lands west of the National Forest boundary. The district is located mainly within Townships 6 and 7 North, Range 57 East and includes all of the historic Grant, Seymour, Irwin Canyon, Central City, and Troy mining districts.

HISTORY

Ore was discovered in 1867 at the Troy Mine in the southern part of the district, and the district was organized soon after. A town was laid out about two miles east of the mouth of Troy Canyon in 1869, and, in 1871, a 20-stamp mill with a smelting furnace was built. Work ceased after only 6 months operation, and the town was deserted (Thompson and West, 1881). The Grant district, in Grant Canyon on the north edge of the district, was organized in October 1869. Thompson and West (1881) reported that some ore was shipped to Austin from the district, but that little work had been done there up to 1881. Discoveries were made in Irwin Canyon, in the central part of the district, in 1905 (Kral, 1951), but no production is credited to properties there. Minor silver production is credited to the district for 1916-1928, 1948-1951, and 1963 (Kleinhampl and Ziony, 1984). Tungsten mineralization was discovered in the area between Grant and Irwin Canyons in the early 1950's, and tungsten production between 1954 and 1961 is estimated at $100,000 to $250,000 (Kleinhampl and Ziony, 1984). Total production from the old precious metals mines of the district, 1873-1963, is given as only about $32,000.

When this district was examined in April 1986, a watchman was guarding the Troy Mine and reported that it was scheduled to open in the summer of 1986. Claim staking, road building, trenching, and sampling had been done during 1983-1984 near the Haller and Vanderhof properties in Irwin Canyon, and some small-scale mining and milling had been done at the Irwin Mine within the past six months.

GEOLOGIC SETTING

The Grant Range in the vicinity of the Troy district is underlain by a thick sequence of Early Cambrian through Pennsylvanian sedimentary rocks which have been intruded, along the western front of the range, by a large Tertiary granitic body. The sedimentary rocks include Lower Cambrian Prospect Mountain Quartzite and Eldorado Limestone, and Ordovician shaly limestones and dolomites. The intrusion, the Troy pluton, is a quartz monzonite that includes minor granite and granodiorite. The stock has metamorphosed the country rocks to approximately the kyanite zone of medium grade (Kleinhampl and Ziony, 1984). Major low-angle faults cut all of the rocks of the district, including the pluton. In general, the thrusts emplace relatively thin sheets of younger strata over older, with minimum displacement probably

measurable in miles (Kleinhampl and Ziony, 1984). Younger, high-angle faults cut all the rocks as well as the low-angle structures.

ORE DEPOSITS

The ore deposits of the Troy district are well described in Hill (1916) and Kleinhampl and Ziony (1984), and these references should be consulted for details of the occurrences.

The ore deposits of the Troy district are spatially and most likely genetically related to the Troy pluton. Silver-gold deposits in the district occur in quartz veins which cut carbonate rocks. Oxidation is mild and the deposits commonly contain sphalerite, galena, pyrite and some chalcopyrite and arsenopyrite in a quartz gangue. Minerals in the oxide zone include silver-bearing cerussite, anglesite, malachite, azurite, and iron oxides. In some properties, the mineralization extended beyond the quartz lenses and formed small pods of replacement ore in the carbonate wall rock. At the Locke Mine in Troy Canyon and at the Mayolli claims and the Vanderhoef property in Irwin Canyon, mineralization formed along a fault contact between the Troy pluton and limestone and shaly limestone. Mineralization, consisting of quartz stringers containing galena and pyrite, occurred in sheared and crushed portions of the contact zone.

Tungsten mineralization at both the Terrell and Nye Mines occurs in a contact zone between the Troy pluton and a limestone-shale member of the Prospect Mountain Quartzite. At the Terrell Mine, a tactite zone formed along the contact is about 15 feet wide and can be traced several hundred feet in outcrop. The zone consists of dark garnet, quartz, diopside, chlorite, and epidote with disseminated scheelite crystals. Some sphalerite, chalcopyrite, and bornite is present with the quartz. Tungsten ore mined from this deposit was fairly high grade, and scheelite crystals up to an inch across have been found in the ore.

GEOCHEMICAL RELATIONSHIPS

Ore samples from the mines in Grant Canyon contained essentially no gold and only low silver, associated with very high lead and zinc, low copper, and low to moderate antimony. Cadmium and bismuth values from this area were low to moderate.

Ore from the Terrell Mine contained tungsten associated with high zinc, cadmium, bismuth, and manganese. Ore from the Nye tungsten mine contained no bismuth or cadmium, low zinc, and high antimony. Both ores contained low but anomalous tin values.

Samples taken from the Irwin Mine were extremely high in gold (3.8 ppm and 7.5 ppm) and contained moderate to high silver (100 ppm and 1000 ppm) associated with high lead, zinc, and bismuth. One sample contained high arsenic, the other none.

All ore samples from the Locke mine and vicinity were very high in gold (1.4 ppm to 12 ppm) and low in silver (10 ppm to 150 ppm). All the samples contained high arsenic, moderate to high lead, and moderate zinc. Only one

sample contained antimony (150 ppm). Bismuth values were anomalous but not as high as values obtained in the northern part of the Troy district.

Barium values were low for the entire district, molybdenum values were low and were detected in only two samples from the district.

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TWIN RIVER DISTRICT

LOCATION

The Twin River district covers the arcuate eastern slope of the central Toiyabe Range and extends from South Twin River north to the Nye-Lander County border. The district is restricted largely to the east slope of the Toiyabes and includes areas or sub-districts sometimes referred to as Twin River, North Twin River, Clear Creek, Ophir, and Millett. In this segment of the Toiyabe Range, almost every canyon contains small mines and prospects which could be described separately. None of these areas, however, produced such significant amounts of ore that they can stand as separate districts.

HISTORY

The first activity in the district followed discovery in 1863 of silver ores at the Murphy (Ophir) Mine in Ophir Canyon. This property is credited with the major production (as much as $750,000 total) from the entire district. Other producing mines were the Giant in Park Canyon, and the Buckeye in Summit Canyon. The districts total production, through 1969, is given as $759,678 (Kleinhampl and Ziony, 1984).

Major production from Twin River has been in gold, silver, and tungsten along with minor amounts of lead, zinc and copper. Barite has been produced from Summit Canyon. Mercury and fluorite are reported present, but no production has been recorded for these commodities. Sodium chloride was mined from a salt marsh on the edge of Smoky Valley near Bowman Ranch sometime prior to 1900. The salt was used in early gold-silver milling operations, but none has been mined recently.

GEOLOGIC SETTING

The eastern portion of the Toiyabe Range, essentially from its crest to the eastern range front, is composed of complex thrust slices of Paleozoic sediments which have been intruded by a linear belt of granitic intrusives. The intrusives form prominent, rugged outcrops in the lower portion of the eastern range front, and the Paleozoic rocks are metamorphosed near the granitic contacts. The complex of Paleozoic sediment-intrusive rocks are overlain to the south and west by large outcrops of Tertiary volcanic rocks, largely welded tuffs.

According to Ferguson and Cathcart (1954), the pre-Tertiary sedimentary rocks of the Twin River district are composed of the Cambrian Gold Hill Formation, disconformably overlain by the Ordovician Palmetto Formation and unconformably overlain by two Permian Formations (Diablo and Pablo Formations). Willden (1982, verbal commun.) feels that pre-Cambrian rocks may be exposed in one outcrop near the mouth of Ophir Canyon where the Cambrian Gold Hill Formation overlies metamorphic rocks. If these are of pre-Cambrian age, they would be the oldest rocks in the Toiyabe Range. All of the pre-Tertiary Formations are metamorphosed, due both to regional deformation and to local plutonism.

There are four major granitic plutons exposed in the district. The largest, the Aiken Creek pluton, is slightly to the north of the district. A smaller

granodiorite mass crops out in Ophir Canyon and even smaller exposures occur in Broad and Park Canyons. The granitic plutons are all considered to be Jurassic(?) or younger. The Ophir pluton has been dated at about 54 m.y., the dike at Broad Canyon has been dated at about 30 m.y. (Kleinhampl and Ziony, 1984). Small bodies of serpentinite crop out throughout the area. They are lensoid and irregular, all are fault bounded and may be serpentinized ultramafics (Kleinhampl and Ziony, 1984).

Tertiary rocks in the Twin River district consist of thick sections of volcanic rocks which overlie the older rocks. The thick Darrough Felsite crops out between South and North Twin River, but most of the formation lies to the south of the district where it is inferred to fill the cauldron from which it erupted (Kleinhampl and Ziony, 1984).

Two younger sequences of Tertiary volcanics crop out on the western crest of the range north of North Twin River. The youngest of these, the Toiyabe Quartz Latite, is generally unaltered but the oldest, termed the middle volcanic sequence by Kleinhampl and Ziony (1984), is usually altered and serves as host to some orebodies in parts of the district.

ORE DEPOSITS

Metallic mineral deposits in the Twin River district include tungsten in skarn deposits near the granitic contacts, base metal-silver deposits as sulfide replacements along veins, usually also near intrusive contacts, and gold-silver occurrences in pyrite-bearing quartz veins, again usually in areas near granitic bodies. Barite has been mined from a small, lenticular pod in sedimentary rocks in Summit Canyon. Mercury and fluorite have been reported from location s within the district, but neither have been produced.

The major tungsten activity has been at the Warfield-New Year-Bottom properties located near the mouth of Ophir Canyon. Scheelite at the Warfield occurs in irregular pods in quartz with some molybdenum and traces of beryllium in calcareous schist near a granodiorite contact (Kleinhampl and Ziony, 1984). Other small occurrences of tungsten were seen near the mouth of Summit Canyon, where scheelite occurs in a narrow zone in meta-limestone, and at small prospects along the range front between Summit Canyon and Timblin Creek which explore poorly developed skarn zones.

The largest of the base metal-silver deposits in the district, the Murphy or Ophir Mine in Ophir Canyon, was not active in 1981, and has not produced for many years (produced mainly between 1866-68, and between 1935-37). The ore at the Murphy consists chiefly of tetrahedrite, galena, sphalerite with stibnite and pyrite which occurs in a quartz vein. The vein strikes north, dips about 45°E, and is in shale. The mine has been developed to a depth of 360 feet, with several levels of mining about that. At another base metal-silver deposit, in Park Canyon at the Giant Patent (Nevada Silver Producers, Park Canyon Mine), mine development was in progress during 1981. In the past, mining was done here on sulfide replacement ore (sphalerite, galena, pyrite) which occurs along bedding in a limestone. Some mining was done along a cross fault which cuts the main replacement lens. The replacement orebodies occur in the limestone just south of a limestone-granite contact.

The Buckeye Mine, at the mouth of Summit Canyon on the north side of the creek is similar to the Murphy property, but has less extensive workings. Old workings at the Buckeye explore a N40°E quartz vein which follows a shear zone in phyllite. Vein material on the dump contained clots of sphalerite with minor galena and pyrite.

Small quartz-pyrite veins, presumably carrying gold values, were examined at the Gold Pocket (Millett) Mine north of Park Canyon, and at an unnamed mine high on the range front south of Park Canyon. At both properties, N55°E-trending veins follow shear zones in granodiorite.

About four miles up South Twin River canyon, workings of the A-1 gold mine expose quartz-calcite veins which cut a lithic welded tuff. The veins contain gold- and silver-bearing pyrite. Molybdenite is reported to be present in one of the upper adits on the south end of the property.

At the Tom Cat claims, south of South Twin River, spotty sulfide mineralization (pyrite, galena) occurs in a silicified shear zone which occurs along a contact between a rhyolite dike and metamorphics (phyllite, greenstone). The dike is sericitized, and the larger quartz grains can be seen, in thin section, to contain euhedral tourmaline crystals.

At the head of Ophir Canyon, and extending to the west, a large area of alteration occurs in older metavolcanic rocks. The rocks are locally iron stained, fractured, silicified and show some kaolinization especially along shear and breccia zones. Specimens found on dumps in this area showed stockworks silica veining, with pyrite, chalcopyrite, galena, barite, and some zoned fluorite. There is evidence here of past exploration, mainly trenching and surface sampling, but the area was not active when visited in 1981.

Most of the prospects and mines visited in the Twin River district were posted with recent claim markers, but the only activity noted was in Park Canyon (Giant Mine), Summit Canyon (Republic Resources Barite) and recent roadwork at Ophir.

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TYBO DISTRICT

LOCATION

The Tybo district includes the entire southern Hot Creek Range in eastern Nye County and extends from Warm Springs on the south to Hot Creek Canyon on the north. The mines are located in four widely separated areas along the range that, early in the area's history, were considered separate districts. The Hot Creek section of the district is located on both sides of Hot Creek Canyon in the vicinity of Page Springs. To the south, a string of mines and prospects extends from Mountain View Canyon south through the head of Old Dominion Canyon and on south to Keystone Canyon, a distance of about four miles. To the south another five miles are located the mines at Tybo itself in Tybo Canyon. The fourth area is in the vicinity of M & M Canyon, north of Milk Spring on the south end of the range.

HISTORY

Thompson and West (1881) describe four separate mining districts within what is now known as the Tybo district. The Hot Creek district, organized in 1866, covered mines from Hot Creek south to Old Dominion Canyon. The Empire district, discovered in 1866, extended from Old Dominion south to the town of Tybo. Tybo district, organized in 1870, took in the southeast portion of the older Empire district. Milk Spring district, adjoining Tybo on the south, was organized in 1867. Stamp mills were constructed at Hot Creek in 1867 and mining continued there until 1868 and then declined. A short period of mining about 1880 produced about $1 million in ore (Kleinhampl and Ziony, 1984). Mining has been intermittent in this part of the district and production has been very small since the end of the 1880 activity.

Tybo proper was discovered in either 1869 or 1870, the first smelter there was erected in 1874, and, by 1877, Tybo was the second largest producer of lead (next to Eureka, Nevada) in the United States (Kleinhampl and Ziony, 1984). The mine failed in 1879 due to smelting difficulties, and operations ceased. Intermittent mining continued until 1888 or 1891 and attempts were made to reactivate the district in the early 1900's, 1918-1920, and 1925. In 1929, a flotation mill and sulfide smelter were built and the camp operated for the next eight years. After the mill closed in 1937, small-scale leasing operations continued at Tybo until about 1944. Attempts to reopen Tybo were made in the early 1960's and in the 1970's. Total production of the Tybo district is about $10 million, 1867-1966.

Silver King Mines of Ely, Nevada, have been working at Tybo for the past several years. They have brought electric power into the old camp, and are conducting both underground and surface exploration.

Present activity in the Tybo district, outside of the Tybo mine area, consists of claim staking and drilling in the area of the Break and M & M mercury mines in the south end of the district and operations at the Warm Springs turquoise mine.

Within the last few years, drilling and mining of copper sulfide-bearing skarn ore was done at the Keystone Mine, Keystone Canyon. A large tonnage of what

appears to be fair grade copper ore has been mined and placed on a leach pad at the mouth of the canyon. The purpose of this venture is not entirely clear since copper sulfide ore is not readily treatable by leaching.

GEOLOGIC SETTING

The geology of the Tybo district is well described in reports by Ferguson (1933) and Kleinhampl and Ziony (1984). These references should be consulted for details on the areal geology. The following description is abstracted from Kleinhampl and Ziony (1984).

A thick sequence of Paleozoic sedimentary rocks is exposed along the east flank of the Hot Creek Range which includes the Tybo district. These rocks, which host the main silver-bearing ores of the district, are unconformably overlain by Tertiary volcanic rocks on the west and on the south. Carbonate rocks representing almost the entire Paleozoic section from Middle Cambrian to Permian are present in the Tybo district. These carbonate rocks, consisting of about 85% limestone and 15% dolomite make up about three-quarters of the section; shale, argillite, and some quartzite make up the remainder.

Tertiary volcanic and sedimentary rocks lie unconformably on the deformed and tilted Paleozoic strata. The oldest Tertiary rocks are Eocene or Oligocene lavas and welded tuffs, and the youngest are Miocene tuffs and welded tuffs. The rhyodacite dikes (quartz latite dikes of Ferguson, 1933), that host the silver-lead deposits, are Miocene or Oligocene.

The Paleozoic beds in the northern part of the district were folded into a broad, north-trending arch that breaks up into a series of smaller, tighter folds in the vicinity of the Tybo Mine. Ferguson (1933) related north-trending folds at Tybo to the major 2 G fault, the locus of the major silver-lead mineralization in the district.

ORE DEPOSITS

Ferguson (1933) described in detail the deposits at the Tybo Mine. Kleinhampl and Ziony (1984) abstracted Ferguson's work and added information on other occurrences in the district. These references should be consulted for details on the deposits; the following summary is taken from them.

At Tybo proper, silver with some gold occurs in an argentiferous lead-zinc sulfide ore that forms tabular veinlike bodies along faults. The ore replaces quartz latite dikes to a large extent and to a lesser extent, limestone (Ferguson, 1933). Silver with tetrahedrite and no gold occurs in the Keystone area, north of Tybo.

At the Tybo Mine, nearly all of the ore was mined from orebodies formed along the north-south trending 2 G fault. Oxidized ores extended to the 300 level and were mined early in the history of the mine. Thereafter, sulfides consisting of pyrite, sphalerite, galena, chalcopyrite, pyrrhotite, and arsenopyrite made up the mineralization. Galena and sphalerite were the only "ore" minerals. The outcropping gossan zones of these deposits are high in manganese oxides.

At the Keystone Mine, at the mouth of Keystone Canyon, little can be seen of the original mine workings as a large open pit has obliterated the surface. Rocks exposed in the pit are thin-bedded limestones and shales that have been fractured and altered at their contact with a granite intrusive body. Replacement ores in a skarn have formed at the contact; massive chalcopyrite, bornite, pyrite, sphalerite, and some galena occur with epidote, quartz, garnite, and diopside in the skarn.

Mineralization at the Mountain View area, south of Mountain View Canyon, consists of very fine grained black sulfides, possibly tetrahedrite, in a silicified breccia which formed along a northwest-trending shear zone in bleached limestone. The old workings here are extensive; they obviously supplied ore first to the arrastre then to the mill-smelter located in the canyon below. This area is mentioned by name only in Thompson and West (1881) but no information on its production or time of operation is known.

To the north of Mountain View, at the eastern mouth of Hot Creek Canyon, open-pit mining was in evidence at the Uncle Sam claim area. Jasperoid with copper oxides, pyrite, and possibly tetrahedrite occurs here along a silicified shear zone in limestone.

At the Page Mine, on the west end of Hot Creek Canyon, antimony mineralization occurs in silicified pods and quartz stringers in argillically altered rhyolite flows and tuffs. The vein system, consisting of parallel veins ranging from 1 inch to 3 feet in thickness, can be traced along strike for more than 1000 feet. Bladed stibnite, with red and yellow antimony oxides, occurs in the quartz stringers.

On the south end of the Hot Creek Range, in the M & M Canyon area, mercury mineralization occurs in highly altered Tertiary welded tuff. At the M & M Mine, orebodies were localized along and beneath an east-west trending low angle structure in the basal portion of the tuff. Mercury mineralization occurred as veinlets and disseminations along the structures. About one mile south of the mercury mines in M & M Canyon, an area has been recently staked for precious metals exploration. Narrow quartz veins occur here in bleached, argillically altered rhyolite.

GEOCHEMICAL RELATIONSHIPS

Ore samples taken from mines and prospects in Hot Creek Canyon (Uncle Sam claims and Page Mine area) contained low but anomalous gold values. The Uncle Sam sample contained high silver, the Page Mines samples were very low in silver. All contained high arsenic and antimony and low base metal values.

Samples from Mountain View contained no gold, moderate to high silver, and only moderately anomalous arsenic and antimony. Base metal values were low to moderate. One sample contained low but anomalous cadmium and tin values.

Ore samples taken along the line of mines and prospects extending from Old Dominion Canyon south to Keystone Canyon were generally similiar. Little to no gold was found in these samples, silver values were generally high associated with high arsenic, antimony, lead, and copper. Zinc was high in only three samples from this area and highest in a sample of skarn ore from

the Keystone pit. Several samples were moderately to highly anomalous in cadmium; the highest cadmium values came from samples in two localities in Old Dominion Canyon. Anomalous tin values were reported in several samples; the highest was 200 ppm in a skarn sample from Keystone.

Tybo Mine area samples were very similiar to those from the Keystone-Old Dominion area with the exception that all Tybo samples contained gold. Gold values ranged from 0.15 ppm to 6.1 ppm with silver values of 70 ppm to 1000 ppm. Arsenic and antimony values were moderate to very high in these samples, as were values for lead and zinc. Copper values were only moderately anomalous. Cadmium values were very high in all but one sample from Tybo and tin values were anomalous in all samples.

Samples from M & M Canyon area on the south end of the district contained no detectable gold, low silver, and low to moderate arsenic and antimony. Copper values were low, lead moderate, and zinc low. Two samples from the area of recent staking to the south of the mercury mines area contained no gold or silver but were higher in arsenic and antimony. Base metal values were low. All samples from this end of the district were moderately high in barium.

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UNION DISTRICT

LOCATION

The Union mining district is located on the west flank of the southern Shoshone Mountains in Nye County, in Townships 11 and 12 North, Range 39 East. The district is geographically separated into two more or less distinct mining centers, the Berlin-Ione area and the Grantsville area. The district is accessible along good roads from Nevada Highway 25, 50 miles south from U.S. Highway 50 and 55 miles from Austin. The district is partially located in the Berlin-Ichthyosaur State Park and the Toiyabe National Forest.

HISTORY

The Union district was organized and the towns of Ione and Grantsville established in 1863 after ore was discovered by P. A. Haven. In 1864 Nye County was formed from Esmeralda County, and Ione became the first county seat. The county seat was moved from Ione to Belmont in 1867 and by 1869 mining activity in the district had begun to decline. The district boomed briefly from 1878-1885, but thereafter enjoyed only minor periods of activity up to World War II. Berlin was founded in the 1890's and became the site of mining activity until 1909. The tailings were milled from 1911-1914 and production in the area was sporadic. Mercury was discovered at the Quicksilver property near Ione in 1907 and became the chief commodity from the district up to 1920, with over 10,000 flasks produced for the period. Afterwards the annual production until 1944 was 50 flasks (Bailey and Phoenix 1944). There were small production figures for fluorite in the 1950's and for tungsten in 1960. More recently the Standard Slag Company drilled the district in 1971. The district has had nearly continuous activity since its organization producing over $4 million (Kleinhampl and Ziony, 1984), principally from mercury, gold (lode and placer), and silver, with minor amounts of antimony, fluorite and tungsten.

GEOLOGIC SETTING

The southern Shoshone Mountains are a narrow, north-northeast trending range on the west side of the Reese River Valley. Silberling (1959) suggests that the rocks underlying the Union district are a window of north-striking, east-dipping Permian, Triassic, and Jurassic meta-andesite, clastics and calcareous bedded sediments. Most of the workings are in the Triassic Luning and Grantsville Formations. The sediments are flanked by Tertiary lavas and pyroclastics. Locally the sediments are intruded by Tertiary aplite and rhyolite porphyry dikes and a granodiorite stock intrudes near Ione. Quaternary black lavas cap the volcanic sequence. Locally the sediments are in thrust contact and overturned to the east. The area was deformed in the early Middle Jurassic prior to the emplacement of the Late Mesozoic or early Tertiary granitic intrusions. Localized fold and thrust faults developed, possible related to the Jurassic Nevada orogeny (Silberling, 1959). East-west transverse faults cut the north-northeast trending normal faults which shape the Shoshone Range. Tingley (1971) suggests that the sediments north and south of Grantsville Canyon are folded into a north trending, south plunging anticline.

ORE DEPOSITS

The mineral occurrences for the district are as follows: The gold and silver ore lodes occur as replacement deposits in brecciated limestone which are associated with the normal fault zones, in fissure quartz vein deposits, and in shear seams in Tertiary rhyolites (Kral, 1951; Kleinhampl and Ziony, 1984). Ore minerals include argentiferous galena, sphalerite, pyrite, and tetrahedrite. The tungsten minerals are located in the contact metamorphic zone associated with the intrusions. The antimony ore fills fissure veins in the north trending, steeply dipping fractured fault zone in the Luning Formation. Associated with the stibnite is pyrite, copper carbonates, silver and selenium (Kleinhampl and Ziony, 1984). Copper ore (sulfide and carbonate) was mined from east-west shear zones in Triassic metasediments (Kral, 1951). Cinnabar deposits are found at shallow depth in the Triassic clastics following fractures, near gouge zones, as painty films on fracture surfaces, and locally as replacement and disseminated deposits. Cinnabar is also found in Tertiary agglomerates, and in rhyolitic and andesitic tuffs (Kral, 1951). The fluorite ore is scattered throughout the district and is associated with the north- and west-trending fault zones. The ore occurs as small irregular masses in replacement bodies in silicified zones adjacent to the faults. The 1971 drilling by Standard Slag indicated a shallow ore deposit with reserves of over 400,000 tons of 18.5% CaF_2 at shallow depth (Papke, 1979).

Union Carbide Corporation held property in the Grantsville part of the district for several years, and explored the silver, base metal, and tungsten potential of the area. They developed a small tonnage of silver ore at the old Grantsville Mine, but the reserves and grade were too low to continue with development.

During the field examination of the district (1981), work was in progress at the Mercury Mining Company Mine, where the previously undergroung operation was being converted to an open pit. A mill was nearing completion and it appeared that it would soon be in operation.

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WILLOW CREEK DISTRICT

LOCATION

The largest portion of the Willow Creek district is within the Tonopah Resource Area but the southern foothills of the Quinn Canyon Range lie within Lincoln County and are within the Caliente Resource Area. For the purposes of this study, however, we have included most of the Quinn Canyon fluorite district within our area of interest. The area covered in reconnaissance fashion extends from the vicinity of Section 1, Township 2 North, Range 54 East on the Lincoln-Nye County line northeast along the Quinn Canyon Range to just northeast of Adaven. A good portion of this area is within the Humboldt National Forest.

HISTORY

Kral (1951) credits the first discoveries in the Willow Creek district to Charles Sampson and David Jenkins who located the Rustler claim east of Nyala on an arsenical gold-silver deposit. Other small deposits containing gold and silver were discovered nearby, and shipments were made from some during the periods 1917-1926, and 1938-1939, and in 1948. No production is recorded but Kral (1951) estimates metallic production of not over $100,000.

Fluorite was discovered in the northeast part of the district in 1934 and other deposits were discovered to the west near Quinn Canyon in 1941 (Papke, 1979). Fluorite deposits in the Lincoln County part of the district were not staked until 1952-1953. While only about 29,5000 tons of fluorspar have been produced from this district, it contains the largest concentration of fluorspar deposits in Nevada (Papke, 1979). There has been no activity related to fluorspar production in the Quinn Canyon area for many years. There was, however, considerable activity related to precious metal exploration taking place in the district in 1984. Several major mining companies, including Superior Oil, Cominco American, and Amoco Minerals had large claim blocks within the district at that time.

GEOLOGIC SETTING

The southern part of the Quinn Canyon Range consists mainly of volcanic rocks through which several isolated blocks of Paleozoic carbonate rocks are exposed. A rhyolite plug cuts the volcanic rocks in Cottonwood Creek, southeast of Adaven. The carbonate rocks range in age from Cambrian Windfall Formation through Devonian Guilmette Formation. These rocks are complexly faulted. The volcanic rocks consist mainly of thick sections of welded ash-flow tuff and both Paleozoic carbonates and the tuffs have been cut by rhyolite plugs and east-northeast trending rhyolite dikes. The occurrence of thick ash flows in the domed central part of the Quinn Canyon Range and the occurrence of numerous rhyolite plugs and flows on the southwest and south flanks all strongly suggest that the range is, in part, a resurged caldron. The rocks are intensely fractured and faulted and hydrothermal alteration is locally intense (Stainsbury and Kleinhampl, 1969).

ORE DEPOSITS

The fluorite deposits in this district are thoroughly described by Papke (1979) and his work should be consulted for details concerning the various mines and prospects. Our reconnaissance work was designed to investigate the potential for metallic mineralization in the district and our descriptions and sampling reflects this emphasis.

Generally, two types of fluorite deposits are described by Papke (1979), deposits associated with large masses of jasperoid in carbonate rocks, and deposits associated with breccia zones in altered volcanic rocks. The jasperoid bodies as well as the breccia zones and related fluorite deposits generally are aligned along north-northeast directions parallel to rhyolite dikes which cut the older rocks in the district. An impressive feature of the district which is not emphasized in the literature is the size and extent of some of the jasperoid masses. These, and the rhyolite dikes, stand out in topographic relief and can be visually traced for great distance along strike. The structural control for the fluorite deposits, the jasperoid-filled structures and the dikes may be related to the resurged caldron. The fluorite deposits themselves may be just one manifestation of a much larger mineralized system.

GEOCHEMICAL RELATIONSHIPS

Samples taken in this study were not specifically of high-grade fluorite, rather they were taken from silicified breccias and jasperoid at or near the fluorite occurrences. Gold was found to be present, in small amounts, in 17 of the 22 samples taken in the area. Arsenic and antimony values were generally low, but high values were obtained from two known precious metal occurrences on the north side of the district. The presence of gold in association with fluorite occurring along major structures marked with jasperoid and silicification makes the Quinn Canyon area an obvious target for precious metal exploration.

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A P P E N D I X A

Sample Description

Sample Number	Location	Description
288	Quad: Carvers NW Sec: 23 T: 12N R: 42E UTM: 4303320 N 0479820 E	Dump, grab rhyolite porphyry dike, rounded qtz. phenocrysts, dissem. sulfides.
289	Quad: Carvers NW Sec: 26 T: 12N R: 42E UTM: 4303180 N 047960 E	Dump, select, vein quartz, silicified porphyry, clots galena, sooty black (Ag?) coatings, MnO, Feox.
290	Quad: Carvers NW Sec: 26 T: 12N R: 42E UTM: 4303170 N 0479610 E	Dump, silect, breccia, qtz. cemented, MnO, Feox, cerrussite.
291	Quad: Toiyabe Peak 7 1/2' Sec: Uns. T: 13N R: 42E UTM: 4314620 N 0475940 E	Crab, dump from open cut. Milkey-white vein qtz. cinnabar limonite in vugs (barite pit?)
292	Quad: Toiyabe Peak Sec: Uns. T: 13N R: 42E UTM: 4313770 N 0477640 E	Dump, select marbelized ls. white vein quartz with scheelite.
293	Quad: Toiyabe Peak Sec: Uns. T: 13N R: 42E UTM: 4313950 N 0477610 E	Select dump, white vein quartz with clots fine grain sphalerite, MnO.
	Quad: Sec: T: R: UTM: N E	
298	Quad: Carvers NW Sec: 23 T: 13N R: 43E UTM: 4314550 N 0480540 E	Dump grab, massive qtz-epidote-garnet skarn, Fn-gr, pulverent WO_3 clots in cellular gossan-like areas in skarn.
299	Quad: Carvers NW Sec: 14 T: 13N R: 42E UTM: 4315180 N 0480550 E	Dump, grab, banded garnet-epidote-pyroxene tactite, clots scheelite along some fractures.

Sample Description

Sample Number	Location	Description
425	Quad: Green Monster Canyon 7 1/2 Sec: Uns. T: 10N R: 48E UTM: 4286490 N 0538350 E	Breccia in siltstone(?) cemented with stibnite, and barite, stibiconite hematite, country rock probably silt or mud stone, butt brown.
426	Quad: Danville 7 1/2 Sec: 23 (?) T: 11N R: 48E UTM: 4291550 N 0541615 E	White rhyolitic porphry, dike feOx stained quartz eye. 1-5mm silicic matrix, feldspars weathered out.
427	Quad: Danville 7 1/2 Sec: 24 (?) T: 11N R: 48E UTM: 4291480 N 0540630 E	Jasperoid(?) brownish-red stain with MnOz(?) stains. White radiating Uug-filled mineral.
	Quad: Sec: T: R: UTM: N E	
441	Quad: Tonopah 7 1/2' Sec: 34 T: 3N R 42E UTM: 4213640 N 0478610 E	White to medium gray, sacchroidal quartz vein material with disseminated blebs of pyrite, yellow oxides coat surfaces, drusy quartz coats vugs & fractures FeOx stained.
	Quad: Sec: T: R: UTM: N E	
529	Quad: Jet Spring 7 1/2' Sec: 14 T: 13N R: 45E UTM: 4313220 N 0510420 E P & S Mine Northumberland District	Bedded bartie.
530	Quad: Northumberland Pass 7 1/2' Sec: Uns. T: 12N R: 46E UTM: 4305800 N 0515650 E All Minerals Property Northumberland District	Bedded barite
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
601	Quad: Mt. Jefferson 7 1/2 Sec: 1 T: 11N R: 44E UTM: 4298650 N 0500566 E	Lithic quartz rich as flow tuff(?) moderately weathered, crystalline qtz. vein, FeOx stained drusy quatz., some silification, vesicular. No apparent mineralization.
602	Quad: Mt. Jefferson 7 1/2' Sec: T: R: UTM: N E	Lithic and crystal rich ash flow tuff(?) some breccia cemented w/crystilline (fine to coasrs) qtz. Lithics up to 2cm appear to be dk. gray silicified Ls, FeOx stained. No apparent mineralization.
603	Quad: Jet Spring 7 1/2' Sec: 6 T: 12N R: 45E UTM: 4308550 N 0501790 E	White crystalline, clear to light gray qtz vein material euhedral azurite, malachite oxidized pyrite disseminated galena(?), gossany areas, tetahedrite Mn staining, crystalline galena material occur coating surface, filling vugs, and finely disseminated throughout qtz.
	Quad: Sec: T: R: UTM: N E	
605	Quad: Northumberland Pass 7 1/2 Sec: Uns. T: 12N R: 46E UTM: 4306975 N 0515390 E	Med. to dk. gray silt/mudstone, minor FeOx stained, brecciated, cemented w/ barite. Barite also disseminated throughout ore.
606	Quad: Northumberland Pass 7 1/2 Sec: Uns. T: 12N R: 46E UTM: 4307280 N 0514925 E	Silicified mudstone/shale fractured, limonite stained. No apparent mineral-ization.
607	Quad: Northumberland Pass 7 1/2 Sec: Uns. T: 13N R: 46E UTM: 4307575 N 0514550 E	Greenish gray, equigranular slightly porphryrite intrusive granodiorite qtz eyes up to 1 cm., Minor hornblend. Muscauite mostly plag. No apparent Mineralization.
608	Quad: Jet Spring Sec: Uns T: 12N R: 45E UTM: 4308900 N 0510200 E	Light gray to muddy gray mudstone highly fractured, almost shear material FeOx stained chalk-like substance fillin veins. No apparent mineralization
609	Quad: Jet Spring Sec: Uns. T: 13N R: UTM: 4310710 N 0510090 E	Drill Cuttings

Sample Description

Sample Number	Location	Description
630	Quad: Northumberland Pass Sec: Uns. T: 13N R: 46E UTM: 4312525 N 0515490 E	Drill cuttings, iron-gray friable mud-stone/shale FeOx staining.
631	Quad: Northumberland Sec: T: 13N R: 46E UTM: 4311475 N 0413650 E	Dark gray, carbonaceous, calcareous shale, drill cuttings. (No Rep. samples)
	Quad: Sec: T: R: UTM: N E	
774	Quad: Toiyabe Peak 7 1/2 Sec: Uns. T: 13N R: 42E UTM: 4312460 N 0470560 E	Greenish gray to dark reddish brown fine grained, dense highly fractured rock with sulfide in sprays and disseminated breccia, siderite, barite some silicification, FeOx stained.
775	Quad: Toiyabe Peak 7 1/2 Sec: Uns. T: 13N R: 42E UTM: 4312200 N 0470320 E	Same as 774 with addition of sphalerite minor veinlets.
776	Quad: Toiyabe Peak 7 1/2 Sec: T: R: UTM: N E	Sample composed of 3 rock types-silicic volcanic, quartzite and white quartz vein material, euhedral exidized pyrite crystal and ghosts gossan, highly fractured galena(?), volcanic is micaceous,
	Quad: Sec: T: R: UTM: N E	fluorite crystals coating surface breccia.
777	Quad: Toiyabe Peak 7 1/2 Sec: T: R: UTM: N E	Highly fractured, milky white quartz vein material with sulfides in filling spaces, FeOx stains slicks. Galena pyrite, chalcopyrite, fluorite, malachite, azurite, galena in strinters
	Quad: Sec: T: R: UTM: N E	and pods, volcanic quartz biotite, equigranguilar, k-spars. Malachite infilling between other crystals. Both rock type cut with micro veinlets of quartz, barite(?) Separated into 2 sampl
		A) Quartz vein B) Volcanic

Sample Description

Sample Number	Location	Description
778	Quad. Toiyabe Peak 7 1/2 Sec: Uns. T: 13N R: 42E UTM: 4310450 N 0475760 E	Med gray limestone breccia cemented with white milky quartz bearing crystalline and massive pyrite, yellowish coating oxide, hematite oxide.
	Quad. Sec: T: R: UTM: N E	
849	Quad: Morey Peak 7 1/2' Sec: 5 T: 9W R: 51E UTM: 4280120 N 0564930 E Morey District	Altered tuff + qtz veins w/bands of rhodochosite, sphalerite + sulfides. Clots of Ruby Ag also present.
850	Quad: Morey Peak 7 1/2 Sec: 5 T: 9W R: 51E UTM: 4280150 N 0564680 E	Pyrite bearing vein material w/ sphalerite, rhodochosite + qtz.
851	Quad: Morey Peak 7 1/2 Sec: 5 T: 9W R: 51E UTM: 4280150 N 0564680 E	Same as 850 except w/chalcopyrite + Jamesonite?
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
1101	Quad: Ione 15" Sec: 19 T: 12N R: 38E UTM: 4304050 N 0436050 E Brunto Pass Union	Dk grey LS breccia cemented w/cinnabar bearing, vuggy, crystalline calcite vugs filled w/white chalky material.
1102	Quad: Paradise Peak 15' Sec: 19 T: 13N R: 38E UTM: 4313800 N 0435725 E Grand View Mammoth(?)	Sugary qtz & crystalline calcite vein material carrying tetrahedrite altering to malachite & azurite, limonite stains, rx highly fractured, minor barite(?) dendritic MnO_2 stains, minor gossan.
	Quad: Sec: T: R: UTM: N E	
1103	Quad: Paradise Peak 15' Sec: 30 T: 13N R: 38E UTM: 4313000 N 0435725 E Esta Buena, Esta Wanda Mammoth	White crystalline (massive to sugary) qtz veins carry fine crystalline blobs, and disseminated sulfide, FeOx-MnO_2 stains, brecciated, minor cu minerals coating surfaces.
1104	Quad: Ione 15' Sec: 2 T: 12N R: 39E UTM: 4309325 N 0452400 E Mercury Mining Corp. Mini Union	Hihgly altered Fe-mn stained volcanic (rhyolite?), vuggy, some mudstone/shale, crystalline calcite coats fractures and fills fissures.
1105	Quad: Ione 15' Sec: 15 T: 12N R: 39E UTM: 4310200 N 0451000 E Shamrock Mine	White crystalline, vuggy qtz and material w/fresh & oxidized sulfide cu mineral fill vugs. Tetrahedrite limonite stained.
1106	Quad: Ione 15' Sec: 14 T: 12N R: 39E UTM: 4307200 N 0452000 E NV Cinnabar Co./Shoshone Quicksilver Mine. Union	Fresh and altered ashfall tuff w/ cinnabar covering surface, some pumice fragments, FeOx stained.
1107	Quad: Ione 15' Sec: 15 T: 12N R: 39E UTM: 4306650 N o45o400 E	White crystalline calcite, vein, MnO_2 stains. Gossany pods, intergrown barite.
1108	Quad: Ione 15' Sec: 15' T: 12N R: 39E UTM: 4307500 N 0449450 E Union	White crystalline qtz vein/breccia material, country rx altered completely to gossan, heavily FeMn stained, oxidized sulfides.

Sample Description

Sample Number	Location	Description
1109	Quad: Ione 15' Sec: 29 T: 12N R: 39E UTM: 4303625 N 0447510 E Berlin Mine Union	White massive qtz vein/gouge material, bearing crystalline, fresh & oxidized pyrite and other sulfides, highly fractured, FeOx-MnO_2 stained crystalline calcite veining.
1110	Quad: Ione 15' Sec: 3 T: 11N R: 39E UTM: 4299550 N 0450430 E Grantsville Mine? Union	Sulfide bearing qtz vein gouge cutting fine-grained siliceous rx, minor calcite veins, rx heavy, dense, almost hornfelsic, some ls breccias, pyrite oxidized, FeOx stain.
1111	Quad: Ione 15' Sec: 10 T: 11N R: 39E UTM: 4297600 N 0450550 E	Sugary qtz gouge material, Fe-Mn-Cu stained, highly fractured/brecciated, slightly vuggy, slightly gossany.
	Quad: Sec: T: R: UTM: N E	
1230	Quad: Outlaw Springs 7 1/2' Sec: T: R: UTM: N E	Porphyritic argillic volcanic, fracture filled & coated with turquoise yellow oxides and limonite coat survaces.
	Quad: Sec: T: R: UTM: N E	
1281	Quad: Outlaw Springs SE 7 1/2' Sec: T: R: UTM: N E	Limonitic stained mud/siltstone, chert gouge/fracture material cut/pods-stringers, veinlets blue-green turquoise.
	Quad: Sec: T: R: UTM: N E	
1471	Quad: Caliente 2° Sec: 13, 24 T: 2S R: 53E UTM: 4180000 (est.) N 0591500 E OCR Claims Black Hawk District	Silicified, bleached rhyolitic, sugary quartz vein, argillically altered, surface coatings of crystalline cinnabar and meta-cinnabar also discrete grains, very finely disseminated pyrite and other sulfides (too small to identify in pods, veinlets, clots, crystalline barit

line vugs, garosite(?), several stages silica flooding, abundant drusy quartz, heavil
Fe-Mn oxide stained rocks highly fractured, abundant vugs, (looks like fold rock)

Sample Description

Sample Number	Location	Description
1472	Quad: Granny Goose Well 7 1/2' Sec: Unsurv. T: 10N R: 36E UTM: 4289190 N 0415720 E Granny Goose(FMC) Gold Fairplay District	Brecciated, silicified rhyolite, native sulfide in vugs, colloform alunite, jarosite coating surfaces, in places rock is mass of white, micro-crystalline quartz.
1473	Quad: Granny Goose Well 7 1/2' Sec: Unsurv. T: 10N R: 36E UTM: 4289160 N 0415820 E Granny Goose(FMC)Gold Fairplay District	Brecciated, silicified rhyolite, silicified fragments laced with silica veinlets, jarosite, Feox, alunite.
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
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Sample Description

Sample Number	Location	Description
1768	Quad: Quinn Canyon Range 1:100,000 Sec: 34 T: 3N R: 55E UTM: 4213800 N 0609000 E Nyco Mine Quinn Canyon District	Chipped from vein 150' into upper adit-fluorite is small crystals & vuggy masses with quartz. The country rock is quartz latite.
1769	Quad: Quinn Canyon Range 1:100,000 Sec: SW 1/4 34 T: 3N R: 55E UTM: 42136000 N 0607800 E Precious Metal Prospect(?) Quinn Canyon District	From minor prospect-brecciated Fe-stained quartz vein in quartz latite.
1770	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 29 T: 2N R: 56E UTM: 4207800 N 0614200 E Blue Bell Prospect Quinn Canyon District	Bench exposed E-W vein of purple-green fluorite which is brecciated and silicified in a vuggy quartz.
1771	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/2 29 T: 2N R: 56E UTM: 4207500 N 0613600 E Shannon Queen Prospect Quinn Canyon District	Sample is from outcrop of Fe-oxide stained/brecciated and silicified greenish white fluorite.
1772	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 30 T: 2N R: 56E UTM: 4207300 N 0612600 E Emerald Prospect Quinn Canyon District	Fluorite vein material in prospect pits, lowgrade-mixed with iron, manganese vuggy quartz are coarse green crystals of fluorspar.
1773	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 30 T: 2N R: 56E UTM: 4207400 N 0614400 E Near Blue Bell Prospect Quinn Canyon District	Vein exposed in road-cut 300 ft. east of Blue Bell Prospect-the North striking vein is a highly silicified breccia in quartz latite.
1774	Quad: Quinn Canyon Range 1:100,000 Sec: SW 1/4 18 T: 2N R: 56E UTM: 4207400 N 0614400 E Sunbeam Prospect Quinn Canyon District	Prospect -pits had low-grade fluorite in a vuggy, brecciated and silicified volcanic.
1775	Quad: Quinn Canyon Range 1:100,000 Sec: NE 1/4 16 T: 3N R: 56E UTM: 4220700 N 0615700 E Horseshoe Mine Quinn Canyon District	Chipped sample from So. open-pit irregular shaped replacement body of fluorite mixed with quartz in a limestone. Some calcite and vuggy open-spaced breccia.
1776	Quad: Quinn Canyon Range 1:100,000 Sec: NE 1/4 16 T: 3N R: 56E UTM: 4220600 N 0615800 E Horseshoe Mine Quinn Canyon District	Northern open-pit, fluorite is a replacement body in limestone with calcite. Some ore is black and gray ore called "coontail" fluorite.

Sample Description

Sample Number	Location	Description
1777	Quad: Quinn Canyon Range 1:100,000 Sec: NE 1/4 16 T 3N R 56E UTM: 4220800 N 0615800 E Northern Horseshoe Prospect Quinn Canyon District	Minor Fluorite in a vein of silicified breccia crosscutting a jasperoid which forms a ridge maker of NE trending jasperoids.
1778	Quad: Quinn Canyon Range 1:100,000 Sec: 10 T: 3N R: 56E UTM: 4223600 N 0616600 E Spar Mine Quinn Canyon District	Fluorite vein (pod) is along a N25E structure which has been bulldozed-fluorite is massive banded purple and gray/country rock is very bleached dolomite.
1779	Quad: Quinn Canyon Range 1:100,000 Sec: SW 1/4 10 T: 3N R: 56E UTM: 4221400 N 0616300 E Big Jim Prospect Quinn Canyon District	From a small adit in side of jasperoid/a body of fluorite which has jasperoid inclusions in the matrix.
1780	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 2 T: 3N R: 56E UTM: 4223200 N 0618000 E Mammoth Prospect Quinn Canyon District	Several pits-trenchs expose fluorite as a matrix with limestone and jasperoid as breccia fragments.
1781	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 9 T: 3N R: 57E UTM: 4222500 N 0625500 E Bonanza Claims Quinn Canyon District	Chipped from outcrops and dozer-cuts. Silicified breccia and jasperoid.
1782	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 10 T: 3N R: 57E UTM: 4222000 N 0625500 E Liberty Bell Claims Quinn Canyon District	Chip samples from outcrops of silicified breccia and jasperoids.
1783	Quad: Quinn Canyon Range 1:100,000 Sec: NE 1/4 9 T: 4N R: 56E UTM: 4230700 N 0621380 E Pathfinder Mining & Exploration Quinn Canyon District	Gossan-like iron-stained in limestone. From dump sulfides of Pb/Zn Ag(?)
1784	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 18 T: 4N R: 56E UTM: 4229400 N 0611600 E Hangen Claims(?) Quinn Canyon District	Gossan-like veins in granodiorite and limestone pyrite, sphalerite, Ag(?)
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
1996	Quad: Quinn Canyon Range 1:100,000 Sec: SW 1/4 1 T: 2N R: 54E UTM: 4359600 N 0498300 E Rainbow Mine Quinn Canyon District	Fluorspar occurs as veins in green amygdale/quartz latite tuff. Narrow veins were pale green aggregates trending N20E along a bulldozed fault structure.
1997	Quad: Quinn Canyon Range 1:100,000 Sec: SW 1/4 1 T: 2N R: 54E UTM: 4213000 N 0600700 E Rainbow Claims Quinn Canyon District	Vertical vein bearing, N15W was stoped 20' deep x 35' long. The 1'-3' vein is in quartz latite tuff along a fault structure. The massive fluorspar is white to green.
1998	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 1 T: 2N R: 54E UTM: 41213100 N 0600500 E Bruno Prospect Quinn Canyon District	Shallow shaft in dark reddish brown volcanic breccia. Grey and green fluorspar in pod shaped orebody that trends N25E.
1999	Quad: Quinn Canyon Range 1:100,000 Sec: NW 1/4 2 T: 2N R: 54E UTM: 421400 N 0599500 E Red Bluff Claims Quinn Canyon District	Minor prospect pits along N80E fault structure, fluorspar is contained in a vuggy quartz breccia as white/light green crystals.
2000	Quad: Quinn Canyon Range 1:100,000 Sec: 34 T: 3N R: 55E UTM: 4213900 N 0608000 E Nyco Mine Quinn Canyon District	Chipped from footwall vein 50' into lower adit. Vein includes gouge, iron staining, brecciated vuggy fluorspar.
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
2012	Quad: Arc Dome 7½' Sec: Unsurvyed T 11N R 42E UTM: 4300280 N 0476720 E A-1 Mine Twin River District	Selected from dump, silca rich vein material bleached white with pyrite, calcite, Cu sulfides, Ag, Au (?)..from upper adit, Si banding, cockade structures
2013	Quad: Arc Dome 7½' Sec: Unsurvyed T: 11N R: 42E UTM: 4300270 N 0476710 E A-1 Mine Twin River District	Selected from dumps, vein materia Pyrite, calcite and unidentified sulfides..possible gold/silver
2014	Quad: Arc Dome 7½' Sec: Unsurv. T 11N R 42E UTM: 4300490 N 0476700 E A-1 Mine Twin River Distrcit	Selected from large recenty Rehab large adit.. silica rich vein material bleached white..minor unidentified sulfides and possibl gold/silver mineraliazation
2015	Quad: Arc Dome 7½' Sec: Unsurv. T: 11N R 42E UTM: 4301000 N 0476500 E A-1 Mine Millsite Twin River District	Vein material from millsite of A-1 Mine Visable sulfides in qtz vein material and breccia
2016	Quad: Carvers 7½' Sec: Unsurv. T: 11N R: 42E UTM: 4289940 N 0481385 E Monitor Rescue Mine (?) Jett District	Selected from prospect pit..qtz vein material from a exposed iron stained vein.
2017	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4284860 N 0501425 E Prussian Mine Jefferson Canyon District	Selected from dump near shaft.. manganse rich vein material with minor pyrite and unidentified silver sulfides
2018	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4284655 N 0501680 E Jefferson Mine Jefferson Canyon District	Selected from dumps..hydrothermal breccia..manganse rich quartz.. galena, minor pyrite..possible agentite and or hessite
2019	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4284500 N 0502025 E Sierra Nevada Mine Jefferson Canyon District	Selected from dumps..manganese-rich quartz veins with minor Fe-oxides, silver sulfides, Cu Ox.. Rhodenite..large north facing adi
2020	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4284685 N 0502075 E Sierra Nevada Mine Jefferson Canyon District	Selected from dumps..manganese-rich vein material with pyrite, chalcopyrite, silver sulfides from large lower adit

Sample Description

Sample Number	Location	Description
2021	Quad: Jefferson 7½' Sec: Unsur. T: 10N R 44E UTM: 4285020 N 0501955 E Unnamed workings Jefferson Canyon District	Chipped from vein in adit..old workings along SW facing canyon in tuff..consisting of manganese-rich silver ore.
2022	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4285640 N 0501955 E Seever Property Prosp. #7 Jefferson Canyon District	Chipped from vein in open adit.. silicified horizon in moderately welded tuff..gray unidentified sulfides
2023	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4285600 N 0502220 E Unidentified Adits Jefferson Canyon District	Selected from dumps by old north facing adits in highly altered volcanics..dark gray streaks of unidentified sulfides.. some brecciation
2024	Quad: Jefferson 7½' Sec: Unsurv. T: 10N R: 44E UTM: 4285050 N 0502300 E Silvershield (?) Jefferson Canyon District	Vein materials from dump and exposed scoraceous and partly brecciated fe-manganese silver antimony quartz vein.
2025	Quad: Jefferson 7½' Sec: Unsurv. T: 9N R: 44E UTM: 4277100 N 0501900 E Van Ness Barcelona District	Selected from open-pit..argillic vein material with cinnabar, meta cinnabar (?) and antimony (?) highly altered zone in granite near older sediments
2026	Quad: Jefferson 7½' Sec: W¼ 6 T: 9N R: 45E UTM: 4277680 N 0503160 E Warren Prospect Barcelona District	Selected from dumps..white quartz galena, tetrahedrite, flourite, pyrite, sphalerite and Ag (?)
2027	Quad: Jefferson 7½' Sec: W¼ 6 T: 9N R: 45E UTM: 4277740 N 0503250 E Perkins or Washington Mine Barcelona District	Selected from dump..qtz vein materail..fe-oxides, pyrite molybdenum, CuOx, tetrahedrite, lead/silver, galena..from caved upper workings
2028	Quad: Jefferson 7½' Sec: NW¼ 7 T: 9N R: 45E UTM: 4277050 N 0503535 E Barcelona Mine Barcelona District	Selected from upper dumps..qtz material some breccia..strongly silicified with secondary qtz.. pyrite, cinnabar, tetrahedrite
2029	Quad: Jefferson 7½' Sec: 6 T: 9N R: 45E UTM: 4277580 N 0503565 E San Pedro Mine Barcelona District	Selected from dump by main shaft qtz vein material with galena, tetrahedrite and possible silver sulfides

Sample Description

Sample Number	Location	Description
2030	Quad: Jefferson 7½' Sec: 6 T: 9N R: 45E UTM: 4277960 N 0503990 E Warren Prospect Barcelona District	From contact zone..epidote, garnet, calcite..tungsten, molybdenum in basal member of Carra formation
2031	Quad: Jefferson 7½' Sec: 5 T: 9N R: 45E UTM: 4278250 N 0504735 E Hooper Mine Barcelona District	From dump near prospect..qtz vei calcite with silver sulfides (?) small shaft on fault near recent drilling
2032	Quad: Jefferson 7½' Sec: 32 T: 8N R: 45E UTM: 4278750 N 0505095 E War Eagle Mine Barcelona District	Selected from dumps..quartz vein material in shear zone..calcite fe-oxides possible gold/silver mineralization
2033	Quad: Jefferson 7½' Sec: 3 T: 8N R: 45E UTM: 4279800 N 0506340 E Warren Gold Mine Barcelona District	Selected from dump..vuggy, qtz with strong hydrothermal breccia strong iron staining..pyrite, possible gold (?).
2034	Quad: Jefferson 7½' Sec: 33 T: 8N R: 45E UTM: 4279200 N 0507420 E Flower Quicksilver Mine Barcelona District	Selected from open workings along fault in altered Carra Strong argillic alteration with visable cinnabar and possible antimony.
2035	Quad: Jefferson 7½' Sec: 33 T: 8N R: 45E UTM: 4279520 N 0507465 E Flower Antimony Mien Barcelona District	Selected from dump destroyed by drilling pad.. vein and gouge consisting of antimmony and sulfides from a vein fault system.
2036	Quad: Belmont East 7½' Sec: 36 T: 9N R: 45E UTM: 4269740 N 0512270 E Arizona Mine Belmon District	Ore from dumps associated with the Transylvania fault and vein Yellow and green oxides..copper lead, and silver sulfides.
2037	Quad: Belmont East 7½' Sec: 36 T: 9N R: 45E UTM: 4270200 N 0512145 E Combination Mine Belmont District	Composite sample from dumps along the Highbridge vein system yellow and green oxides on silve copper, lead and anitmongy sulfides..massive and breccias
2038	Quad: Belmont East 7½' Sec: 36 T: 9N R: 45E UTM: 4269460 N 0512200 E So. transylvania vein Belmont District	Selected along the vein which is commonly brecciated and strongly silicified..with Pb, Ag, Sb and Cu..oxides and sulfides

Sample Description

Sample Number	Location	Description
2039	Quad: Belmont East 7½' Sec: 36 T: 9N R: 45E UTM: 4269500 N 0511820 E Five inclines on Southend Belmont District	Samples collected from exposed veins along and in the inclines consisting of bull qtz..Copper oxides and sulfides, tetrahedrite and other sulfides.
2040	Quad: Belmont East 7½' Sec: 36 T: 9N R: 45E UTM: 4270300 N 0511700 E Old workings along ridge Belmont District	Older workings along NW portion of the ridge...a series of inclin with extensive qtz veining, CuOx and possible gold/silver minerals
2041	Quad: Belmont West 7½' Sec: 22 T: 8N R: 45E UTM: 4264345 N 0509000 E Monarch Star Mine East Manhattan District	Selected from dumps..gossan-like extensive iron staining without apparent mineralization
2042	Quad: Belmont West 7½' Sec: 25 T: 8N R: 44E UTM: 4263855 N 0501160 E Paulette Lode Claim East Manhattan District	Chipped from fault vein system and selected from dumps..argillic altered fault..calcite and Ag (?)
2043	Quad: Manhattan 7½' Sec: SE¼ 15 T: 8N R: 44E UTM: 4266060 N 0497720 E Unnamed Mine Manhattan District	Selected from dumps and exposed quartz vein and gouge..including secondry qtz, breccia and vuggy cockade structures..possible Au?
2044	Quad: Manhattan 7½' Sec: NW¼ 22 T: 8N R: 44E UTM: 4265780 N 0496905 E Unnamed shaft Manhattan District	Selected from dump a highly iron stained lithic tuff.. Very little visable mineralizatio possible Au?
2045	Quad: Manhattan 7 ½' Sec: 21 T: 8N R: 44E UTM: 4264580 N 0495775 E White Caps Mine Manhattan District	Selected from dumps..replacement ore consisting of realgar-orpimen Antimony, calcite, silver sulfide
2046	Quad: Manhattan 7½' Sec: SW¼ 21 T: 8N R: 44E UTM: 4264600 N 0495340 E Manhattan Consolidated Manhattan District	Selected from open workings and dumps..calcite vein material with minor silver and pyrite.
2047	Quad: Manhattan 7½' Sec: 20 T: 8N R: 44E UTM: 4264725 N 0494995 E Earl Mine Manhattan District	Selected from dump and exposed vein..iron-stained qtz with unidentified sulfides.

Sample Description

Sample Number	Location	Description
2048	Quad: Carver SE 7½ Sec: NW¼ 33 T: 11N R: 44E UTM: 4291340 N 0495120E Gold Hill Mine Round Mountain District	Selected from workings..a highly altered and silicified volcanic with extensive pyrite and report gold mineralization.
2049	Quad: Carvers SE 7½' Sec: NW¼ 33 T: 11N R: 44E UTM: 4291325 N 0495450E Gold Hill Mine Round Mountain District	Chipped from vein in shear..a vuggy chalcedonic vein with reported but not visable Au/Ag mineralization.
2050	Quad: Toiyabe Peak 7½' Sec: Unsurv. T: 11N R: 42E UTM: 4305000 N 0477260E Golden Wall Mine Twin River District	Selected from dump and replace-ore body..qtz vein and altered limestone..sphalerite, galena, bornite, and possible silver
2051	Quad: Toiyabe Peak 7½' Sec: Unsurv. T: 11N R: 42E UTM: 4305000 N 0477125E Golden Wall Mine Twin River	Chipped from vein west of adit qtz and replacement ore with Pb, Cu, Sb, AG, with yellow and green oxides..possible tetrhedrit
2052	Quad: Toiyabe Peak 7½' Sec: Unsurv. T: 11N R 42E UTM: 4305000 N 0477340E Golden Wall Mine (Prospect) Twin River District	From dump along an exposed vein and shaft..in granite..qtz vein with minor sulfides.
2053	Quad: Round Mountain 7½' Sec: 31 T: 10N R: 44E UTM: 4280800 N 0492820E Steigmeyer Property Round Mountain District	Selected from open-pit, vein and dike material..qtz-calcite, argillic alteration..Ag/Au mineralization
2054	Quad: Round Mountain 7½' Sec: SW¼ 31 T: 10N R 44E UTM: 4280060 N 0492165E Green Top Claims Round Mountain District	Selected from open workings in old workings qtz-calcite vein material along faultvein system . Cu, Ag, Au(?), tetrahedrite, brecciation.
2055	Quad: Manhattan 7½' Sec: 5 T: 8N R: 44E UTM: 4270000 N 0494250E Unnamed Prospect Mahattan District	Small Prospect on E-W structure in altered volcanics..strongly silicified.. Ag, Au(?)
2056	Quad: Manhattan 7½' Sec: 31 T: 8N R: 44E UTM: 4271495 N 0494525E Unnamed Shaft Manhattan District	Selected from dumps in altered volcanic tuff strong vein highl; silicified along white bleached zone fe-oxides..possible Ag, Au.

Sample Description

Sample Number	Location	Description
2057	Quad: Manhattan 7½' Sec: 31 T: 8N R: 44E UTM: 4271120 N 0494315 E Unnamed Adit Manhattan District	Selected from dump..vuggy qtz vein in volcanics, minor fe-ox and possible gold/silver minerals
2058	Quad: Seyler Peak 7½' Sec: NW¼ 28 T: 8N R: 43E UTM: 4264020 N 0486020 E Unnamed Shaft Manhattan District	Selected from dump near shaft in gray thin platy shale..minor qtz iron stained.
2059	Quad: Seyler Peak 7½' Sec: NW¼ 34 T: 8N R: 43E UTM: 4262700 N 0487100 E Chance #1 Manhattan District	Selected from dump..vuggy qtz, iron-stained with minor sulfides.
2060	Quad: Seyler Peak 7½' Sec: NW¼ 34 T: 8N R: 43E UTM: 4262750 N 0487300 E Unnamed Adit Manhattan District	From vein in adit..vuggy iron stained..extensive hydolthermal alteration..possible Au/Ag.
2061	Quad: Seyler Peak 7½' Sec: 33 T: 8N R 43E UTM. 4261790 N 0486125 E Unnamed Stopes Manhattan District	Chipped from veins in open-stopes very old workings..vein contains sulfides with olive green oxides arsenides(?) in brecciated matrix
2062	Quad: Baxter Spring 15' Sec: SW¼ 4 T: 7N R: 43E UTM: 4259755 N 0486705 E Unnamed Shaft Manhattan District	Very old workings on crest of peak..strong iron-staine qtz vein with little visable mineralizatio
2063	Quad: Baxter Spring 15' Sec: 4 T: 7N R: 43E UTM: 4260010 N 0486600 E Two unnamed prospects Manhattan District	Chipped from outcrop..of vuggy iron stained qtz vein.
2064	Quad: Baxter Spring 15' Sec: 7 T: 7N R: 43E UTM: 4258000 N 0482750 E Willow Spring Area Prospect Manhattan District	Selected from pospect..limonite stained vein material stronly silicified with green nicolite (niAs)
2065	Quad: Baxter Spring 15' Sec: 17 T: 7N R: 43E UTM: 4257000 N 0484015 E Willow Spring prospect Manhattan District	Selected from dump near large old shaft..limonite stained, high silication minor copper and nicolite (?)

Sample Description

Sample Number	Location	Description
2066	Quad: Baxter Spring 15' Sec: 26 T: 7N R: 43E UTM: 4254000 N 0489900 E Baxter Spr. Area adits Manhatten District	Selected from dump..highly silic ified, partly vuggy, iron-staine vein material from an adit.. apparent precious metal target.
2067	Quad: Baxter Spring 15' Sec: NW¼ 26 T: 7N R: 42E UTM: 4254350 N 0489000 E Baxter Spring Area Manhattan District	Seleceted from dump..silicified limestone and shales..strongly oxidized, minor sulfides
2068	Quad: Baxter Spring 15' Sec: SW¼ 15 T: 7N R: 42E UTM: 4256650 N 0498000 E Spanish Spring Mines Manhatten District	Selected from dump..qtz vein material including apalite dike possible sulfides and reported free-gold.
2069	Quad: Manhattan 7½' Sec: 29 T: 8N R: 44E UTM: 4262675 N 0494440 E Jumbo Mine Manhattan District	Chipped from exposed veins in open-pit silcified zones in olde seds..argillic alteration, calc-ite..fe oxides and silver sulf-ides.
2070	Quad: Manhattan 7½' Sec: NE¼ 32 T: 8N R: 44E UTM: 4262360 N 0494960 E Keystone Mine Manhattan District	Selected from vein in adit.. hydrothermal breccia, in alter-argillitized seds..Flourite, and precious metals (?)
2071	Quad: Manhattan 7½' Sec: 32 T: 8N R: 44E UTM: 4262300 N 0494800 E Keystone or Wall Mine (?) Manhattan District	Selected from dumps..highly silicified and bleached rhyolite with minor fe-oxides a gray wispy streaks of unidentified sulfides.
2072	Quad: Manhattan 7½' Sec: 32 T: 8N R: 44E UTM: 4262370 N 0494950 E Keystone Mine Manhattan District	Selected from working along the westside of Summit Hill..ore appears to be a breccia with flourite, mercury and gold/silve along the flanks of the rhyolite
2073	Quad: Belmont West 7½' Sec: NE¼ 31 T: 9N R: 45E UTM: 4270575 N 0504560 E Unnamed prospects Belmont District	Qtz veins and dike materials associated with older workings in granite fe-oxides, minor Pb, Chalcopyrite...
2074	Quad: Belmont West 7½' Sec: 2 T: 8N R: 45E UTM: 4268425 N 0510050 E Old Windlass #1 Mine Belmont District	Chipped from exposed vein in granite with wolframite and huebnerite (?)..also known as Wolframite Mine.

Sample Description

Sample Number	Location	Description
2075	Quad: Belmont West 7½' Sec: 23 T: 9N R: 45E UTM: 4274150 N 0510320 E Unnamed prospect Belmont District	Selected from vein fault system qtz, gouge in kaolinized structure with Ag/Au (?).
2076	Quad: Belmont West 7½' Sec: SW¼ 14 T: 9N R: 45E UTM: 4273900 N 0509680 E Unnamed shafts Belmont District	Selected from dumps..and exposed veins in limestone..qtz and jasperoid..calicification..yellow ox, minor sulfides and possibele Ag, Au (?).
2077	Quad: Belmont West 7½' Sec: 23 T: 9N R: 45E UTM: 4273845 N 0509600 E Unnamed Shaft Belmont District	From dumps near large shaft.. jasperoid with yellow oxides.
2078	Quad: Belmont West 7½' Sec: 23 T: 9N R: 45E UTM: 4272300 N 0510680 E Unnamed Inclines Belmont District	From open workings associtated with eight inclines along a N40W structure that includes a qtz breccia with antimony and possible lead/silver.
2079	Quad: Belmont East 7½' Sec: 1 T: 9N R: 45E UTM: 4268020 N 0511410 E Unnamed Incline Belmont District	Selected from dump and exposed vein..yellow oxides on a lead-silver-antimony mineralization.
2080	Quad: Belmont East 7½' Sec: 12 T: 8N R: 45E UTM: 4266740 N 0511280 E Westend Consl. Mining Co. Belmont	Chipped from seds in prospect near the head frame..altered seds consisting of thin bedded shales portion of which are iron stained with possible Au (?) Ag (?).
2081	Quad: Jet Spring 7½' Sec: 1 T: 12N R: 44E UTM: 4308435 N 0501560 E Hilltop Group (Blue Jay) Northumberland District	From a shaft in vent of gossan-like deposit..highly silicified iron-stained limestone some copper oxides and sulfides.
2082	Quad: Jet Spring 7½' Sec: 6 T: 12N R: 45E UTM: 4308665 N 0501800 E Hilltop Group (Blue Jay) Northumberland District	Selected from prospects, dumps along qtz veins in limestone.. Cu oxides and sulfides with Ag? strong oxidation and silication
2083	Quad: Mount Jefferson 7½' Sec: 1 T: 11N R: 44E UTM: 4298880 N 0500510 E J. J. Claims Moores Creek District	From dump near northern most shaft..strongly altered and silicified tuff..cockade structures with reported but not visable Au..possible Ag sulfides.

Sample Description

Sample Number	Location	Description
2084	Quad: Mount Jefferson 7½' Sec: 1 T: 11N R: 44E UTM: 4298600 N 0500560 E J. J. Claims Moores Creek District	From dumps and exposed structures in a vein fault system in altered tuff..silicification..iron-stain minor sulfide and possible gold.
2085	Quad: Carver SE 7½' Sec: 35 T: 12N R: 44E UTM: 4300120 N 0499000 E Road Cut Moores Creek District	Chipped from exposure in road-cut of altered tuff..bleached, argillic alteration with visable sulphur..
2086	Quad: Tonopah 15' Sec: 31 T: 5N R: 44E UTM: 4232750 N 0492105 E Midway Mine Tonopah District	Chipped from exposed veins in sediments consisting of qtz. Cu, and minor sulfides.
2087	Quad: Tonopah 15' Sec: 31 T: 5N R: 44E UTM: 4232800 N 0492800 E Midway Mines Tonopah District	Selected from dumps with qtz fault gouge and silicified vein material copper oxides and minor sulfides possible gold/silver
2088	Quad: Baxter Spring 15' Sec: 30 T: 5N R: 44E UTM: 4233600 N 0493150 E Unnamed Shaft Midway area Tonopah District	Vein in large incline..strong limonite and silica..brecciation minor copper infered Ag/Au (?)
2089	Quad: Paradise Peak 15' Sec: 30 T: 11N R: 36E UTM: 4293450 N 0416000 E Gold Ledge Mine Fairplay District	Selected from dump..silicified vein material with strong fe-ox, Some unidentified sulfides and reported gold.
2090	Quad: Paradise Peak 15' Sec: 29-32 T: 11N R: 36E UTM: 42992750 N 0417750 E Sullivan Mine Fairplay District	Chipped from veins in prospect in the central camp..Strongly silicified qtz vein some breccia Cu oxides and sulfiedes
2091	Quad: Granny Goose Well 7½' Sec: Unsurv. T: 10N R: 36E UTM: 4286620 N 0420600 E Unnamed Shaft Fairplay District	Selected from dump..silicified and altered tuff..qtz vein with minor copper and undidentified sulfides.
2092	Quad: Goldyke 7½' Sec: Unsurv. T: 10N R: 37E UTM: 4286785 N 0424400 E Goldyke Reef Mine Fairplay District	Selected from main dump..highly silicified and altered vol-tuff strong hyrothermal bleaching iron--stain..breccia some pyrite possiblle gold/silver

Sample Description

Sample Number	Location	Description
2093	Quad: Goldyke 7½' Sec: Unsurv. T 10N R 37E UTM: 4288675 N 0424700 E Laura Group Fairpaly District	Sampled from main dump..qtz vein and altered vein with secondary silica..epithermal..Veins are hard, brecciated and vuggy with pyrite and silver sulfides
2094	Quad: Paradise Peak 15' Sec: 32 T: 10N R: 37E UTM: 4292100 N 0427250 E Unnamed shaft Fairplay District	Selected from dump and skarn zone.Tungsten, galena, sphalerit pyrite.
2095	Quad: Paradise Peak 15' Sec: 33 T: 10N R: 37E UTM: 4291650 N 0427600 E Bigdyke Mine Fairplay District	Selected from open-dozer-cuts skarn..epidote, replacement ore with pyrite, hematite, CuOx's lead and tungsten.
2096	Quad: Granny Goose Well 7½' Sec: Unsurv. T: 10N R: 36E UTM: 4286700 N 0421585 E West Goldyke (Patend 4010) Fairplay District	Selected from vein fault system silicified, bleache white..iron stained.
2097	Quad: Granny Goose Well 7½' Sec: Unsurv. T: 10N R: 36E UTM: 4288600 N 0420520 E Everett Mine Fairplay District	Selected from dump and prospect Qtz vein with pyrite, galena, cinnabar, and possible Silver.
2098	Quad: Warm Springs NW 7½' Sec: 3 T: 3N R: 49E UTM: 4221295 N 0545500 E Cliffford Mine Clifford District	Selected from dumps..silicified rhyolite..hydrothermally bleache Pyrite, and other sulfides
2099	Quad: Warm Springs NW 7½' Sec: 3 T: 3N R: 49E UTM: 4221200 N 0545660 E Clifford Mine Clifford District	Selected from ore-bin near large shaft..silicfied rhyolite,brecci pyrite and tetrahedrite, CuO.
2100	Quad: Bellehelen 7½' Sec: 1 T: 2N R: 49E UTM: 4211360 N 0549100 E Ben Hur Mine Bellehelen District.	Selected from dumps..veins in hydrothermally altered tuffs pyrite, azurite, copper sulfides
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
2207	Quad: Paradise Peak 15' Sec: Unsurv. T: 13N R: 36E UTM: 4316350 N 0423400 E White Pine Extension Adit Lodi District	Vein quartz, gossan, clots MnO, galena shalerite, hemimorphite, cerussite.
	Quad: Sec: T: R: UTM: N E	
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Sample Description

Sample Number	Location	Description
2208	Quad: Paradise Peak 15' Sec: Unsurv T 13N R 36E UTM: 4316300 N 0423650 E North Shaft, Illinois Mine Lodi District	Cellular gossan, vein quartz, limonite, hematite, calcite veinlets in marblized ls.
2209	Quad: Paradise Peak 15' Sec: Unsurv T 13N R 36E UTM: 4313650 N 0420600 E Kay Cooper Mine Lodi District	Granular, silicated ls.with sulfides, some garnet, dark green phlogopite.
2210	Quad: Paradise Peak 15' Sec: Unsurv T 13N R 36E UTM: 4313550 N 0420950 E Kay Cooper Mine Lodi District	Fine-gr. white, silicated ls and feldspar-rich intrusive rock, Feox, MnO, scheelite.
2211	Quad: Paradise Peak 15' Sec: Unsurv T: 13N R. 36E UTM: 4313250 N 0422200 E Lodi District	Vein quartz, brecciated and recemented with quartz, clots chalcopyrite, malachite, chrysocolla.
2212	Quad: Paradise Peak 15' Sec: Unsurv T: 13N R: 36E UTM: 4311600 N 0422870 E El Capitan Mine Lodi District	Skarn, massive, fn-gr. garnet tr. pyrite, tr. scheelite, some endoskarn, MnO points.
2213	Quad: Paradise Peak 15' Sec: Unsurv T: 13N R: 36E UTM: 4316050 N 0423900 E Illinois Mine Lodi District	Massive hematite/limonite gossan, vugs lined with cerussite crystals, hemimorphite crystals, some anglesite.
2214	Quad: Paradise Peak 15' Sec: 11 T: 12N R 36E UTM: 4307500 N 0422360 E Gabbs District	Gossan, jasperoid, silicated dolomite, hemimorphite crystals in vugs.
2215	Quad: Paradise Peak 15' Sec: 11 T: 12N R: 36E UTM: 4307400 N 0422650 E Gabbs District	Silicified shale, limestone, quartzite in breccia, clear quartz crystals in vugs, yellow- and cinn.-brown limonite frac. coatings.
2216	Quad: Paradise Peak 15' Sec: 11 T: 12N R: 36E UTM: 4307250 N 0422350 E Downeyville Mine Gabbs District	Dense, brick-red and yellow-brown jasperoid, vugs lined with clear and white, euthedraul barite crystals, radiating hemimorphite xls.

Sample Description

Sample Number	Location	Description
2226	Quad: Paradise Peak 15' Sec: 6 T: 12N R: 37E UTM: 4309850 N 0425800 E Gabbs District	Clots of chalcocite with green and blue Cuox rims and staining, in white quartz-calcite vein.
2227	Quad: Paradise Peak 15' Sec: 5 T: 12N R: 37E UTM: 4309450 N 0427270 E Big Chief Mine Gabbs District	Malachite and azurite clots in silicified limestone, some chalcocite.
2228	Quad: Paradise Peak 15' Sec: 5 T: 12N R: 37E UTM: 4309800 N 0427600 E Gabbs District	Clear vuggy vein quartz, malachite and azurite clots, gossan with boxworks.
2229	Quad: Paradise Peak 15' Sec: 28 T: 12N R: 37E UTM: 4303450 N 0429020 E Chestnut Mine Gabbs District	Thin, white quartz veins in kaolinized andesite, hematite-after-pyrite in both vein material and wall rock, jarosite in vugs.
2230	Quad: Paradise Peak 15' Sec: 21 T: 11N R: 37E UTM: 4295800 N 0429000 E Scheebar Mine Fairplay District	White quartz-calcite vein with clots and strings of crystalline cinnabar along banding, dark red-brown euhedral crystals(garnet?)
2231	Quad: Paradise Peak 15' Sec: 16 T: 11N R: 37E UTM: 4295850 N 0428850 E Scheebar Mine Fairplay District	White vein quartz with sericite, Cuox minerasls, hematite-red jasperoid pod along cinnabar-bearing vein.
2232	Quad: Paradise Peak 15' Sec: 27 T: 11N R: 37E UTM: 4293000 N 0430600 E Fiarplay District	Silicified hornfels and skarn cut by stockworks of quartz veins, gossan clots, Cuox, chalcocite in veins
2233	Quad: Paradise Peak 15' Sec: 27 T: 11N R: 37E UTM: 4293100 N 0430450 E Fairplay District	Jasperoid breccia, some vein quartz, clots green Cuox mienrals.
2234	Quad: Paradise Peak 15' Sec: 27 T: 11N R: 37E UTM: 4292800 N 0430550 E Fiarplay District	Massive gossan, mostly hematite and limonite

Sample Description

Sample Number	Location	Description
2217	Quad: Paradise Peak 15' Sec: 11 T: 12N R: 36E UTM: 4307100 N 0422100 E Downeyville Mine Gabbs District	Cellular, siliceous gossan, hematite and limonite, clear quartz crystals and bladed wulfenite crystals in vugs.
2218	Quad: Paradise Peak 15' Sec: 11 T: 12N R: 36E UTM: 4307100 N 0422100 E Downeyville Mine Gabbs District	Massive sulfide ore, mainly pyrite, some sphalerite.
2219	Quad: Paradise Peak 15' Sec: 9 T: 12N R: 37E UTM: 4308200 N 0428450 E Gabbs District	Buff, Feox-stained brecciated quartzite, vuggy, some jsp., jarosite, sericite
2220	Quad: Paradise Peak 15' Sec: 4 T: 12N R: 37E UTM: 4309200 N 0429300 E Craig Station Prospect Gabbs District	White vein quartz, clots lammellar quartz-after-calcite, yellow Feox stain.
2221	Quad: Paradise Peak 15' Sec: 4 T: 12N R: 37E UTM: 4309150 N 0429100 E Craig Station Prospect	Massive and cellular gossan and white vein quartz, pods chalcopyrite, bornite, some green Cuox.
2222	Quad: Paradise Peak 15' Sec: 3 T: 11N R: 36E UTM: 4299100 N 0419750 E Gabbs Tungsten Gabbs District	White vein quartz, clots calcite, muscovite on vein walls, minor Feox and MnO staining, some scheelite.
2223	Quad: Paradise Peak 15' Sec: 9 T: 12N R: 37E UTM: 4307300 N 0428850 E Fowler Spring Prospect Gabbs District	White vein quartz, clots green and blue Cu oxides, possible tetrahedrite, some hematite-after-pyrite in both vein and wall rock.
2224	Quad: Paradise Peak 15' Sec: 21 T: 12N R: 37E UTM: 4304400 N 0428200 E Phelps-Stokes Iron Mine Gabbs District	Massive hematite-magnetite iron ore, some pyrite.
2225	Quad: Paradise Peak 15' Sec: 13 T: 12N R: 36E UTM: 4306000 N 0423600 E Gabbs District	Siliceous, hematite-limonite gossan.

Sample Description

Sample Number	Location	Description
2235	Quad: Paradise Peak 15' Sec: 33 T: 11N R: 37E UTM: 4291035 N 0427960 E Big Dike Mine Fiarplay District	Massive garnet-epidote skarn, specular hematite, some Cuox minerals, trace scheelite.
2236	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
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Sample Description

Sample Number	Location	Description
2774	Quad: Stinking Spring 15' Sec: 32 T: 1N R: 49E UTM: 4194200 N 0542700 E Prospect Silverbow District	From open workings a silicified rhyolite breccia, vuggy, bleache iron stained..pyrite and reporte Au, Ag.
2775	Quad: Stinking Spring 15' Sec: 29 T: 1N R: 49E UTM: 4195175 N 0542750 E Prospect Adit Silverbow District	Chipped from silicified zone in rhyolite, approximtely twenty fe into adit, some unidentified gra streaks.
2776	Quad: Kawich Peak 15' Sec: 27 T: 1N R: 49E UTM: 4196010 N 0546410 E Unnamed Adit and Shaft Silverbow District	Unnamed adit and shaft in silci-rhyolite..strong alteration near veining..no visable mineralazati
2777	Quad: Kawich Peak 15' Sec: 35 T: 1N R: 49E UTM: 4193800 N 0547010 E Unnamed Crosscut and Shaft Silverbow District	Chipped from vein in adit, qtz rich bleached shear zone, some gray unidentified sulides with pyrite.
2778	Quad: Kawich Peak 15' Sec: 2 T: 1S R: 49E UTM: 4192800 N 0547000 E Large unnamed shaft Silverbow District	Silicified zones with qtz, pyrit in shear zones..eastern end of structure in rhyolite..
2779	Quad: Kawich Peak 15' Sec: 2 T: 1S R: 49E UTM: 4193750 N 0547000 E Unnamed Inclines Silverbow District	Collected from dump and exposed vein 2-4 ft qtz vein in rhyolite pyrite and unidentified sulfides
2780	Quad: Kawich Peak 15' Sec: 2 T: 1S R: 49E UTM: 4193850 N 0546600 E Unnamed Incline Silverbow District	Chipped from shear zone, quartz stringers and gouge in rhyolite strongly bleached along shear pyrite and gray unidentified sulfides with possible Ag, Au.
2781	Quad: Kawich Peak 15' Sec: 36 T: 1N R: 49E UTM: 4194350 N 0548400 E Large Crosscutting Adit Silverbow District	Silicified vein material in rhyolite from large crosscutting adit. pyrite and unidentified sulfides
2782	Quad: Kawich Peak 15' Sec: 35 T: 1N R: 49E UTM: 4194300 N 0547650 E Unnamed Inclines Silverbow District	Selected from exposed 3-4 foot vein in shear..with argillic white alteration..some pyrite and gray silver sulfides

Sample Description

Sample Number	Location	Description
2393	Quad: Mount Ardivey 7½' Sec: Unsur. T: R: UTM: 4276290 N 0452780 E Silver's Gold Claim Cloverdale District	Silicified vein, breccia, limonite fracture coatings. Quartz cement, fine-grained black sulfide, some native silver.
2394	Quad: Mount Ardivey 7½' Sec: Unsurv. T: R: UTM: 4277100 N 0452380 E Golden King III Claim Cloverdale District	Brecciated quartz vein, FeOx fracture coatings, adularia crystals overgrown by quartz, Jarosite crystals over quartz some dark sulfide points.
2395	Quad: Mount Ardivey 7 1/2' Sec: Unsurv. T: R: UTM: 4277720 N 0452290 E Golden King III Claim Cloverdale District	Brecciated, silicified, rhyolite tuff, drusy quartz crystals and limonite fracture coatings.
2396	Quad: Secret Basin 7 1/2' Sec: Unsurv. T: R: UTM: 4272120 N 0459960 E Prince Albert Group Cloverdale District	Sericitized rhyolite tuff, purple to red hematite staining on fractures, pale, greenish fluorite in groundmass of altered rock.
2397	Quad: Paradise Peak 15' Sec: 6 T: 12N R: 37E UTM: 4301000 N 0425750 E Gabbs District	Clots of steely chalcocite, malachite, azurite in white quartz and calcite vein, vuggy, with quartz crystals in vugs.
2398	Quad: Quartz Mtn 71'2' Sec: Unsur T: R: UTM: 4318360 N 0418120 E H and M Mine Lodi District	Pale green silicated limestone, skarn, minor limonite, MnO clots, sugary calcite, amber quartz.
2399	Quad: Paradise Peak 15' Sec: Unsur T: R: UTM: 4313650 N 0420850 E Victory Mine Lodi District	Silicated limestone, quartzflooded intrusive rock, clots pyrite.
2400	Quad: Paradise Peak 15' Sec: 14 T: 13N R: 36E UTM: 4316300N N 0422750 E Smuggler Mine Lodi District	Vein quartz, clear, black streaks, pale yellow Feox and Pbox stains, jarosite in vugs.
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
2576	Quad: Gabbs Mtn. 7 1/2' Sec: Unsurv. T: 10N R: UTM: 4286360 N 0411800 E Rex Claims Fairplay District	Dump sample, grab, brecciated rock, silicified,HgS, native sulfur
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
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	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
2684	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 10N R: 42E UTM: 4286870 N 0479200 E Valley Claim Jett District	Oxidized vein material, clots quartz, galena, sphalerite, pyrite in cellular gossan, yellow and orange oxides, possibly from antimony.
2685	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 10N R: 42E UTM: 4286620 N 0480420 E Jett District	Pyrite, iron sulfates, gray-black sulfide (stibnite), some chlorite.
2686	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 10N R: 42E UTM: 4286850 N 0482400 E Gibralter Property Jett District	Clots of galena and pale amber sphalerite in sugary white quartz vein, some clear, crystalline quartz.
2687	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 10N R: 42E UTM: 4283980 N 0481260 E Millett Property Jett District	Iron and manganese oxide gossan clots in quartz vein, jarosite crystals coating vugs.
2688	Quad: Toms Canyon 7 1/2' Sec: Unsurv. T: R: UTM: 4283100 N 0475120 E Last Chance Mine Jett District	Quartz and calcite with cinn-brown oxides, streaks and clots pale blue-green mineral(?), some disseminated, tetrahedrite.
2689	Quad: Toms Canyon 7 1/2' Sec: Unsurv. T: R: UTM: 4285160 N 0475000 E Last Chance Mine Jett District	White quartz and calcite with streaks carbonaceous wall rock, clots massive pyrite, fine-grained and massive stibnite.
2690	Quad: Toms Canyon 7 1/2' Sec: Unsurv. T: R: UTM: 4285360 N 0474680 E Big Horn #7 Claim Jett District	White quartz and calcite with clots and dissemination of stibnite, pale blue-green mineral staining quartz.
2691	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 9N R: 42E UTM: 4276320 N 0479600 E Dollar Mine Jett District	White quartz and calcite, sprays stibnite, some pyrite.
2692	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 9N R: 42E UTM: 4276620 N 0479540 E Dollar Mine Jett District	White quartz and calcite with clots and dissemination of stibnite, some tetrahedrite.

Sample Description

Sample Number	Location	Description
2693	Quad: Toms Canyon 7 1/2' Sec: Unsurv. T: R: UTM: 4279130 N 0477780 E Warmarc Claim Jett District	White quartz vein, vuggy, yellow oxide coatings, tract stibnite.
2694	Quad: Pablo Canyon Ranch 7 1/2' Sec: Unsurv. T: 9N R: 42E UTM: 4277870 N 0478360 E Jett District	Massive white vein quartz, cinn-brown gossan clots, some fine-grained stibnite.
2695	Quad: Tom's Canyon 7 1/2' Sec: Unsurv. T: R: UTM: 4277900 N 0475340 E Horse Canyon Mine Jett District	Silicified, limey sandstone with cinnabar and white calcite fracture coatings, FeOx staining.
2696	Quad: Dry Canyon 7 1/2' Sec: 36 T: 8N R: 42E UTM: 4261400 N 0471940 E Cloverdale District	Fractured, Feox-stained rhyolite tuff, silicified but no obvious mineralization.
2697	Quad: Secret Basin 7 1/2 Sec: Unsurv. T: R: UTM: 4271970 N 0461800 E Colton Prospect Cloverdale District	Pale white, green, and purple fluorite vein and breccia cementing material, Feox stained.
2698	Quad: Mount Ardivey 7 1/2' Sec: Unsurv. T: R: UTM: 4277820 N 0454320 E	Feox-stained, quartz-cemented breccia, vugs lined with clear quartz crystals.
2699	Quad: Mount Ardivey 7 1/2' Sec: Unsurv. T: R: UTM: 4277860 N 0454300 E East Golden Mine Cloverdale District	Silicified hydrothermal breccia, quartz and adularia crystals on fracture surfaces, minor manganese oxide.
2700	Quad: Mount Ardivey 7 1/2' Sec: Unsurv. T: R: UTM: 4275250 N 0455940 E Cloverdale District	Silicified rhyolite tuff with hairline quartz veinlets, adularia crystals on fractures.
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
2729	Quad: Bellehelen 7½' Sec: 8 T: 2N R: 50E UTM: 4210700 N 0551425 E Prospect #8 (Silver Disc.) Bellehelen District	From vein in adit..silicified rhyolite..strong hydrothermal alteration..yellow oxides on unidentified sulfides.
2730	Quad: Bellehelen 7½' Sec: 7 T: 2N R: 50E UTM: 4210285 N 0550600 E Merger Mine (Ruby Claim) Bellehelen District	From dump near millsite near large cross-cut adit..Qtz vein material..silver haloids, Pyrite
2731	Quad: Bellehelen 7½' Sec: 7 T: 2N R: 50E UTM: 4210320 N 0550525 E Merger Mine Bellehelen District	Chipped from discovery vein by to upper shafts..large qtz vein with wispy streaks of silver, and other sulfides
2732	Quad: Bellehelen 7½' Sec: 34 T: 3N R: 49E UTM: Ajax Mine N E Bellehelen District	Seleceted from dump qtz rich zone in rhyolite..strong hydro-thermal alteration ..bleahed white..pyrite and possible Au/Ag
2733	Quad: Bellehelen 7½' Sec: 35 T: 3N R: 49E UTM: 4213340 N 0546460 E Unnamed shaft Bellehelen District	Selected from dumps near old shsft in silicified rhyolite Pyrite and other sulfides
2734	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4207840 N 0571420 E Silvermonial Mine Reveille District	Selected from open-pit..qtz vein and secondary qtz..brecciation Malachite, azurite, anitmony lead/silver
2735	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4207950 N 0571420 E Silvermonial Reveille District	Seleceted from western open-pit, exposed veins included qtz brec-cia with copper and wispy gray streaks of sulfides in second-ary qtz.
2736	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4209000 N 0570260 E Kietzke Mine Reveille District	Chipped from vein fault system in open-pit..sulfides of copper azurite,malachite, barite and fluorite.
2737	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4208850 N 0570280 E Kietzke Mine Reveille District	From exposed vein in and dump gossan-like mineralization witn Copper oxides and sulfides.

Sample Description

Sample Number	Location	Description
2738	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4209085 N 0570900 E Fisherman, Amazon ect prop. Reveille District	Chipped from exposed vein in hydrothermally altered volcanics seconday qtz copper and pyrite.
2739	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4209800 N 0571685 E Gila Mine Reveille District	Chipped from vein in adit qtz.. in quartzite..vuggy with copper, antimony and probable tetrahedrit
2740	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4209965 N 0572360 E Antimonal Mine Reveille District	Chipped from exposed veins and sampled from ore-bin..strong iron oxides with pyrite, stibnite and tetrahedrite.
2741	Quad: Reveille 7½' Sec: Unsurv. T: 3N R: 51½E UTM: 4214780 N 0572900 E Arrowhead Extension Arrowhead District	Selected from dump in propylitized..dark pruple andesite tuff pyrite, and silver sulfides (?)
2742	Quad: Reveille 7½' Sec: Unsurv. T: 3N R: 51½E UTM: 4215395 N 0572550 E Arrowhead Mine Arrowhead District	Selected from dumps..propylitiized and bleached tuff..lots pyrite and silver and minor gold gold reported.
2743	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4206345 N 0571280 E New Reveille Mine Reveille District	Selected from dump..strongly oxidized, iron stained vein system with qtz breccia..vuggy Ag, Pb, Sb, yellow oxides..primary zinc.
2744	Quad: Reveille 7½' Sec: Unsurv. T: 2½N R: 51½E UTM: 4206460 N 0570285 E New Reveille Mine Reveille District	Selected from dump near upper adit and exposed workings..comby qtz..breccia, with yellow oxides of Pb, Sb...Cu, and prooble Ag.
2745	Quad: Tybo 7½' Sec: Unsurv. T: 5N R: 49E UTM: 4233700 N 0546460 E A & B Mine Tybo District	From open-pits and dozer-cuts bleached white..hydrothermally altered tuffs with Mercury and sulphur and minor sulfides
2746	Quad: Tybo 7½' Sec: Unsurv. T: 5N R: 49E UTM: 4233750 N 0547600 E M & M Mine Tybo District	From outcrops and dozer-cuts in hydrothermally altered tuffs bleached white..silicified..argllic alateration..mercury, pyrite and minor sulfides

Sample Description

Sample Number	Location	Description
2747	Quad: Tybo 7½' Sec: Unsurv. T: 5N R: 49E UTM: 4233650 N 0548200 E Break Mine Tybo District	Selected from dozer-cuts in white highly altered argillic tuffs...mercury as cinnabar and possible metacinnabar.
2748	Quad: Tybo 7½' Sec: Unsurv. T: 6N R: 49½E UTM: 4246750 N 0552480 E Tybo Mine (Adit) Tybo District	From massive dump..replacement ore in limestone consisting of Lead/zinc/silver..pyrite.
2749	Quad: Tybo 7½' Sec: Unsurv. T: 6N R: 49½E UTM: 4246680 N 0552220 E Tybo Mine (Main Shaft) Tybo District	Massive replacement ore of lead/zinc/silver in limestone
2750	Quad: Tybo 7½' Sec: Unsurv. T: 6N R: 49½E UTM: 4247000 N 0551700 E Bunker Hill Mine Tybo District	Mostly from vein fault system exposed near the the two shafts ore at surface is strongly oxidized iron stained and free of visable mineralization
2751	Quad: Tybo 7½' Sec: Unsurv. T: 6N R: 49½E UTM: 4246585 N 0551700 E Gilmore Mine (?) Tybo District	Selected from massive dumps.. qtz breccia and replacement ore oxidized..in limestone gouge zone with pyrite..tetrahedrite(?
2752	Quad: Tonopah 1:250,000 Sec: 19 T: 3N R: 47E UTM: 4216400 N 0520200 E Ellendale Mine Ellendale District	From fault vein system in open-stope.. sample from vein consist intrusive material in hydrothermally altered rhyolite..Gold/Ag.
2753	Quad: Tonopah 1:250,000 Sec: 19 T: 3N R: 47E UTM: 4216400 N 0520300 E Ellendale Mine Ellendale District	From dump and narrow vein in adit..altered rhyolite..lots pyritization and reported gold.
2754	Quad: Tonopah 1:250,00 Sec: 19 T: 3N R: 47E UTM: 4216400 N 0520200 E Ellendale Mine Ellendale District	From vein in and along western adit..highly altered rhyolite strongly silicified..iron-staine with visable sulfides (?) Cu. pyrite..Ag, Au
2755	Quad: Tonopah 1:250,000 Sec: 19 T: 3N R: 47E UTM: 4216000 N 0520900 E Prospect east Ellendale Min Ellendale District	From vein in shaft..qtz..fe Ox, with minor sulfides in altered purple rhyolite.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	1110	1111		1230		1281		1471	
Fe % (.05)	3	.7		3		5		3	
Mg % (.02)	.2	1.5		.5		.07		.1	
Ca % (.05)	7	3		.1		1		.1	
Ti % (.002)	.07	.03		.2		.2		.2	
Mn (10)	3000	300		70		100		50	
Ag (.5)	1000	200		2		3		1	
As (200)	1000	1500		L		500		1500	
Au (10)	N	N		N		N		N	
B (10)	N	10		200		150		20	
Ba (20)	150	70		1000		1000		1500	
Be (1)	10	L		2		2		2	
Bi (10)	G1000	300		N		N		N	
Cd (20)	G500	150		N		N		N	
Co (5)	15	N		N		N		N	
Cr (10)	20	20		20		300		N	
Cu (5)	1000	7000		1000		2000		15	
La (20)	L	L		50		30		50	
Mo (5)	20	15		30		15		L	
Nb (20)	N	N		N		N		20	
Ni (5)	15	10		N		10		N	
Pb (10)	20000	2000		20		10000		50	
Sb (100)	150	1000		N		N		100	
Sc (5)	5	L		20		10		5	
Sn (10)	10	N		N		N		N	
Sr (100)	300	N		300		300		2000	
V (10)	150	30		100		200		70	
W (50)	300	N		N		N		N	
Y (10)	15	N		10		20		10	
Zn (200)	G10000	700		N		700		L	
Zr (10)	20	10		70		70		200	
Th (100)	N	N		N		N		N	

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Sample Description

Sample Number	Location	Description
2756	Quad: Yellow Cone 7½' Sec: T: 3N R: 46E UTM: 4217050 N 0520180 E Northwest of Ellendale Mine Ellendale district	Silicified vein material and gouge from vein, open spaces, manganese staining with copper sulfides and oxides, pyrite with some quartz.
2757	Quad: Yellow Cone 7½' Sec: T: 3N R: 46E UTM: 4216990 N 0519440 E Northwest of Ellendale Mine Ellendale district	Chipped from vuggy qtz vein, stained by fe-oxides and manganes galena and unidentified sulfides
2758	Quad: Stone Cabin Ranch SW 7½' Sec: 26-27 T: 3N R: 46E UTM: 4215120 N 0524760 E Unnamed shafts Ellendale district	Selected from dumps, vuggy qtz vein material iwth minor Cu, and silver sulfides
2759	Quad: Stone Cabin Ranch 7½' Sec: T: 3N R: 46E UTM: 4215010 N 0525385 E Unnamed inclines Ellendale district	Selected from dumps and prospects qtz vein material with Cu oxides sulfides in a matrix of dirorite
2760	Quad: Stone Cabin Ranch 7½' Sec: T: 3N R: 46E UTM: 4214380 N 0524380 E Unnamed shaft Ellendale district	From exposed vein..silicified strongly bleached volcanic with cockade structures, no visable mineralization
2761	Quad: Stone Cabin Ranch 7½' Sec: 34 T: 3N R: 47E UTM: 4212000 N 0525680 E Jumbo Mine Ellendale district	Chipped from outcrop..strongly altered hydrothermal system some silication..shaft in barite pit.
2762	Quad: Stone Cabin Ranch 7½' Sec: T: 3N R: 47E UTM: 4212200 N 0523445 E Unnamed prospect incline Ellendale district	Chipped from vein and selected from dump..green and yellow arsenides, Cu oxides, and Ag sulfides
2763	Quad: Yellow Cone 7½' Sec: T: 3N R: 47E UTM: 4212880 N 0520780 E Unnamed incline	Chipped from vuggy, partly calcified vein in platy, shaley, limestones.
2764	Quad: Yellow Cone 7½' Sec: T: 3N R: 47E UTM: 4218320 N 0521580 E Prospect (incline) Ellendale district	Small prospect incline on northside of rhyolite plug..strong iron staining and hydrothermal alteration.

Sample Description

Sample Number	Location	Description
2765	Quad: Stinking Springs 15' Sec: 27 T: 2N R 48E UTM: 4205300 N 0534800 E Eastern most shaft Golden Arrow	Selected from dump..qtz vein silicified breccia and micro breccia, some bleaching near shears
2766	Quad: Stinking Springs 15' Sec: 27 T: 2N R: 48E UTM: 4205175 N 0535150 E Blewett-Watson Golden Arrow district	Chipped from vein and selected from dump, rhyolite breccia, gouge and qtz stringers
2767	Quad: Stinking Springs 15' Sec: 28 T: 2N R: 48E UTM: 4205020 N 0535000 E Golden Arrow Mine Golden Arrow district	From open stopes and dumps, fault vein, breccia, strong hydrotherma alteration near vein..pyrite, Ag, and probable gold.
2768	Quad: Stinking Spring 15' Sec: 28 T: 2N R: 48E UTM: 4205200 N 0534800 E Golden Arrow Mine Golden Arrow district	Chipped from vein and from dumps brecciated rhyolite, bleached and iron stained..minor pyrite.
2769	Quad: Stinking Spring 15' Sec: 3 T: 1N R: 48E UTM: 4201350 N 0536500E Jeep Group Golden Arrow district	Chipped from vein and dump silicified fault vein rhyolite bleached, brecciated, unident-ified sulfides and oxides, some silver.
2770	Quad: Stinking Spring 15' Sec: 33 T: 2N R: 48E UTM: 4203750 N 0534200 E Large unnamed incline Golden Arrow district	Selected from dump..silicified and partly brecciated vein mater-ial in shear. Au, Ag, (?)
2771	Quad: Stinking Spring 15' Sec: 33 T: 2N R: 48E UTM: 4203250 N 0533700 E Unnamed incline Golden Arrow district	Selected from dumps, silicified rhyolite breccia..pronable gold-silver.. one of 10 shafts along the same vein in rhyolite
2772	Quad: Stinking Spring 15' Sec: 32 T: 2N R: 48E UTM: 4203650 N 0533400 E Unnamed prospect Golden Arrow district	Selected from dump..qtz rich rhyolite breccia, vuggy, fe-oxide highly silicified.
2773	Quad: Stinking Spring 15' Sec: 32 T: 2N R: 48E UTM: 42044000 N 0533150 E Shaft in adit Golden Arrow district	Selected from dump and chipped from vein..qtz vein in rhyolite hydrothermal alteration near contact

Sample Description

Sample Number	Location	Description
2783	Quad: Kawich Peak 15' Sec: 35 T: 1N R: 49E UTM: 4194350 N 0547300 E Unidentified Incline Silverbow District	Bleached white shear zone with silicified vein material..selected from dump and vein..strong pyrite with possible Au/Ag.
2784	Quad: Kawich Peak 15' Sec: 33 T: 1N R: 49E UTM: 4193650 N 0544500 E Clark, Newton, Zigler, Prop. Silverbow District	Selected from dumps..silicified vein material in pinkish-gray rhyolite with strong bleaching near veins..possible Au/Ag.
2785	Quad: Kawich Peak 15' Sec: 5 T: 1N R: 50E UTM: 4201750 N 0551800 E Eden Mine Eden District	Quartz vein material selected dumps includes strong pyrite and minor gray streaks of sulfides.
2786	Quad: Kawich Peak 15' Sec: 8 T: 1N R: 50E UTM: 4199650 N 0551300 E Southern Gold Mining Co. Eden District	Iron stained tuff with minor silication and no visable minaral ization, was being mined from along a shear zone and treated ir a nearby mill.
2787	Quad: Kawich Peak 15' Sec: 17 T: 1N R: 50E UTM: 4199250 N 0551250 E Southern Gold Mining Co. Eden District	Chipped from outcrop (discovery ledge)? above and east of mill. highly silicified iron stained material in rhyolite country rx.
2788	Quad: Kawich Peak 15' Sec: 7 T: 1N R: 50E UTM: 4200150 N 0551150 E Prospect Eden District	Chipped from exposed vein in a a prospect..iron stained qtz veir approximately 3-4 feet wide.
2789	Quad: Kawich Peak 15' Sec: 4 T: 1N R: 50E UTM: 4202650 N 0552150 E Prospect adits and shaft Eden District	Selected from dumps..qtz vein and silicified rholite from a prospect shaft and two adits pyrite and unidentified sulfides
2790	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4264000 N 0598280 E Main Silverton Mine Shaft Silverton District	Selected from dumps..qtz-calcite stringers in limestone..minor sulfide mineralization.
2791	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4264010 N 0598200 E Incline and Prospects Silverton District	Selected from dumps and prospects west of main shaft..qtz-calcite veins with minor visable sulfide mineralization

Sample Description

Sample Number	Location	Description
2792	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4264300 N 0598260 E Unnamed Adit Silverton District	Chipped from shear zone in adit near contact between limestone and quartzite..highly argillitize some silica minor sulfides.
2793	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4264800 N 0598365 E Prospect Silverton District	Chipped from hydrothermally altered shear an gossan like mineralization in limestone rx.
2794	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4265200 N 0599285 E Blackbird Prospects Silverton District	Chipped from vein in prospect, stringers of silica-rich vein in rhyolite with visable stibnite and other sulfides.
2795	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4265160 N 0599285 E Blackbird Prospect Silverton District	Chipped from parallel vein system to the south of site 2794..silca rich ryholite shear with visable stibnite and other sulfides.
2796	Quad: Lockes 7½' Sec: 26 T: 8N R: 54E UTM: 4265160 N 0599285 E Blackbird Prospects Silverton District	Chipped from 3rd parallel vein to the south of site 2795 silicified shear zone with 16" vein.. drusy qtz..vugs with barite xtls stibnite and other sulfides
2797	Quad: Georges Canyon Rim 7½' Sec: T: 5N R: 47E UTM: 4241180 N 0522090 E Prospect Adit Longstreet District	Chipped from vein in adit..that was strongly altered..gouge and silica..some sulfides
2798	Quad: Saulsbury Basin 7½' Sec: 36 T: 6N R: 46E UTM: 4242310 N 0519780 E Kelly Mine Longstreet District	Selected from dumps, vein material, some breccia, gouge, pyrite, copper oxides, silver sulfides (? and possible gold.
2799	Quad: Saulsbury Basin 7½' Sec: 36 T: 6N R: 46E UTM: 4241785 N 0519900 E Clipper Mine Longstreet District	Selected from dump at lower adit qtz vein material, argillic alteration, in rhyolite, with pyrite and reported Ag/Au.
2800	Quad: Saulsbury Basin 7½' Sec: 36 T: 6N R: 46E UTM: 4241680 N 0519810 E Clipper Mine Longstreet District	From vein and dumps..qtz vein material..argillic alteration in shear zone..pyrite, and silver sulfides.

Sample Description

Sample Number	Location	Description
3066	Quad: Georges Canyon Rim 7½' Sec: ____ T: 5N R: 47E UTM: 4238350 N 0522680 E Prospect Longstreet District	Chipped from vein..consisting of highly silicified breccia with fe-oxides alteration.
3067	Quad: Georges Canyon Rim 7½' Sec: ____ T: 5N R: 47E UTM: 4236700 N 0523580 E Lince Claims Longstreet District	Chipped from dozer-cuts..highly silicified outcrops with local zones of strong hydrothermal alteration and iron staining.
3068	Quad: McCann Canyon 7½' Sec: ____ T: 6N R: 47E UTM: 4247700 N 0525400 E Longstreet Mine Longstreet District	Selected from dumps near lower adit..strong hydrothermal alteration silicifed material very little qtz..black specs, gray streaks, pyrite, micro breccia.
3069	Quad: McCann Canyon 7½' Sec: ____ T: 6N R: 47E UTM: 4247700 N 0525400 E Longstreet Mine Longstreet District	From dozer-cuts near upper adit highly silicified breccia, vuggy drusy qtz..fe-stained, pyrite.
3070	Quad: Georges Canyon Rim 7½' Sec: 25 T: 6N R: 47E UTM: 4243370 N 0529520 E Warm Spring Longstreet District	From prospect-pits, highly altered ash tuff with incrustations of hot water deposits.
3071	Quad: Mc Kinney Tanks 7½' Sec: ____ T: 3N R: 45E UTM: 4218920 N 0508040 E Silver Star Mine Hannapah District	Selected from dumps, highly bleached and argillitized, iron stained, silicified material wit pyrite, wispy gray streaks of sulfides.
3072	Quad: Hannapah 7½' Sec: ____ T: 3N R: 45E UTM: 4219560 N 0507800 E Hannapah Silver Star Hannapah District	Selected from dumps near big shaft quartz vein material, micro-breccia, argillic alteration, pyrite, gray-black sulfides.
3073	Quad: Hannapah 7½' Sec: ____ T: 3N R: 45E UTM: 4219740 N 0507340 E Richardson Mine (Silver Leaf) Hannapah District	Selected from dumps near shaft Argillitized and silicified vein material with pyrite and unidentified sulfides
3074	Quad: Hannapah 7½' Sec: ____ T: 3N R: 45E UTM: 4220150 N 0506715 E Hannapah Mine Hannapah District	Selected from dumps near shaft silcified and argillitized vein material with pyrite and other sulfides.

Sample Description

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3075	Quad: Hannapah 7½' Sec: ____ T: 4N R: 44E UTM: 4225720 N 0500985 E Sam Jack Group Hannapah District	Selected from dumps near shafts silicified vein material with some breccia, jarosite, pyrite, argillic alteration and reported gold
3076	Quad: Hannapah 7½' Sec: ____ T: 4N R: 44E UTM: 4222920 N 0500915 E Bannock Mine (Tough Nut Clms) Hannapah District	Selected from dumps near the big incline..highly silicified breccia some pyrite and sulfieds in matrix of the breccia
3077	Quad: Hannapah 7½' Sec: ____ T: 4N R: 44E UTM: 4222630 N 0500820 E Bannock Mine (Tough Nut Clms) Hannapah District	Selected from dumps silcified.. iron stained vein material with pyrite and other sulfides
3078	Quad: Tonopah 15' Sec: 23 T: 4N R: 44E UTM: 4225800 N 0499800 E Unnamed Shaft Hannapah District	Selected from dumps..quartz vein strong secondary silica..pyrite
3079	Quad: Tonopah 15' Sec: 4 T: 4N R: 44E UTM: 4228550 N 0498850 E Unnanmed Shaft Hannapah District	Selected from dumps and vein in shear..manganese staining possible Au/Ag mineralization..from a silicified volcanic outcrop.
3080	Quad: Mc Kinney Tanks 7½' Sec: ____ T: 2N R: 45E UTM: 4211890 N 0510075 E Prospects Hannapah District	From dozer-cuts..silicified seds strong hydrothermal alteration drilled recently for gold.
3081	Quad: Mc Kinney Tanks 7½' Sec: ____ T: 2N R: 45E UTM: 4211080 N 0510000 E Quarry Area Hannapah District	From quarry area, highly altered and silicified volcanics and sediments.
3082	Quad: Hannapah 7½' Sec: ____ T: 3N R: 45E UTM: 4222000 N 0508700 E Unnamed Shaft Hannapah District	Selected from dumps..silicified vein material..some brecciation argillic alteration, pyrite and possible lead-silver minerals.
3083	Quad: Flagstaff Mtn 7½' Sec: ____ T: ____ R: 50E UTM: 4255500 N 0553725 E Keystone Group Tybo District	Selected from veins in open-pit replacement ore, chalcopyrite, pyrite, galena, tetrahedrite epidote, calcite

Sample Description

Sample Number	Location	Description
3084	Quad: Flagstaff Mtn 7½' Sec: T: R: 50E UTM: 4256600 N 0554110 E Unnamed adits and shaft Tybo District	Quartz vein material from dumps associated with adits..fe-oxides copper oxides, galena, tetrahedrite.
3085	Quad: Flagstaff Mtn 7½' Sec: T: R: 50E UTM: 4256600 N 0554000 E Unnamed adits and shaft Tybo District	Chipped from quartz vein material and gouge..limonite, pyrite, CuO tetrahedrite
3086	Quad: Flagstaff Mtn 7½' Sec: T: R: 50E UTM: 4255325 N 0553640 E Ophir & Dexter Claims Tybo District	Quartz vein material from dumps near old old shafts, CuOx, galena, tetrahedrite
3087	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4255675 N 0551780 E Unnamed Adit Tybo District	Quartz vein material..fe-oxides and reported gold.
3088	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4257480 N 0551550 E Unnamed Adit and Shaft Tybo District	Selected from dumps, silcified vein material..iron staining with copper oxides and tetrahedrite.
3089	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4259660 N 0551600 E Banner Lode Claim Tybo District	Selected from dumps..vein material that is strongly hydrothermally altered, manganese breccia CuOx, possible tetrahedrite
3090	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4260360 N 0551000 E Star #1 Claim Tybo District	Manganese stained quartz vein material with minor copper and possible tetrahedrite
3091	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4258800 N 0551600 E Small prospect Tybo District	Sample from pit, silicified iron stained with copper oxides and sulfides.
3092	Quad: Flagstaff Mtn 7½' Sec: T: R: 49E UTM: 4259375 N 0551860 E Unnamed Adit Tybo District	From dumps, silicified zones in limestone with strong iron staining. Au/Ag (?)

Sample Description

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3093	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4261775 N 0552190 E Mountain View Lode Claims Tybo District	Chipped from upper shaft and selected from dumps, breccia with strong siliciation in limestone matrix of breccia has sulfides.
3094	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4261850 N 0552190 E Mountain View Lode Claims Tybo District	Chipped from breccia pipe(?) gray sulfides within the matrix of the breccia in limestone
3095	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4262010 N 0551825 E Unnamed Shaft and Adit Tybo District	Selected from dump near shaft and chipped from exposed vein in lower adit..strong iron staining possible Au/Ag
3096	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4261780 N 0551650 E Milling ore at mill site. Tybo District	Limonite stained milling ore at mill site..strong iron staining and calcite-limestone and vein gouge.
3097	Quad: Flagstaff Mtn 7½' Sec: T: 7N R: 50E UTM: 4255250 N 0553400 E Dominion Group Tybo (Keystone Area)	Selected from dumps near old shaft..both silicified and calcit veins with galena, pyrite, CuOx, chalcopyrite and possible tetrahedrite.
3098	Quad: Little Fish Lake 7½' Sec: T: 8N R: 50E UTM: 4264450 N 0554840 E Uncle Sam Claims Tybo (Hot Creek) District	Jasperiod and quartz veins with Copper oxides and sulfides, pyrite, and possibe tetrahedrite.
3099	Quad: Little Fish Lake 7½' Sec: 21 T: 8N R: 49E UTM: 4266280 N 0547670 E Unnamed Prospect Tybo (Hot Creek) District	Chipped from vein in open-trench bleached and argillic alteration bladed antimony and other sulfide
3100	Quad: Little Fish Lake 7½' Sec: 15 T: 8N R: 49E UTM: 4266510 N 0547915 E Unnamed prospect Tybo (Hot Creek) District	Chipped from vein in open-trench strong iron staining, bleaching argillic alteration..antimony mineralization.
3101	Quad: Little Fish Lake 7½' Sec: 15 T: 8N R: 49E UTM: 4267010 N 0547915 E Page Mine Tybo (Hot Creek) District	Strong 3 foot vein in volcanics sample chips included antimony and silver mineralization.

Sample Description

Sample Number	Location	Description
3102	Quad: Little Fish Lake 7½' Sec: 22 T: 8N R: 49E UTM: 4266150 N 0549000 E Unnamed Prospect Tybo (Hot Creek) District	Chipped from contact of a gossan like strongly altered area in limestone..with manganese..highly oxidized zone exposed by shallow adit.
3103	Quad: Troy 15' Sec: T: 6N R: 57E UTM: 4251200 N 0630750 E North Star Mine Troy District	Also Mothers Day Claims(?) chip sample from exposed ledge, with pyrite, galena, Au/Ag(?)
3104	Quad: Troy 15' Sec: T: 6N R: 57E UTM: 4251150 N 0630750 E North Star Mine Troy District	Or Mothers Day Claims(?) chip sample from vuggy quartz vein cockade structures..pyrite, galena.
3105	Quad: Troy 15' Sec: T: 6N R: 57E UTM: 4251700 N 0628150 E Unnamed prospect Troy District	Chipped from exposed bull quartz vein in shallow prospect, galena and possible silver minerals
3106	Quad: Troy 15' Sec: 34 T: 7N R: 57E UTM: 4252600 N 0627000 E Terrel Mine Troy District	Selected from dumps skarn material with garnet, epidote, quartz tungsten, bornite.
3107	Quad: Troy 15' Sec: T: 6N R: 57E UTM: 4251600 N 0626150 E Nye Mine Troy District	Selected from dumps assoicated with the large adit..contact skarn material with calcite, epidote, Tungsten, Cu sulfides pyrite
3108	Quad: Troy 15' Sec: 15 T: 6N R: 57E UTM: 4249150 N 0626350 E Irwin Mine Troy District	Selected from dumps associated with upper dumps in granite..qtz veins with strong limonite, Pb sphalerite and possible gold.
3109	Quad: Troy 15' Sec: 10 T: 6N R: 57E UTM: 4249400 N 0626600 E Mayolli Claims Troy District	Chipped from vein..vuggy and in places brecciated, iron oxides manganese, galena, pyrite
3110	Quad: Troy 15' Sec: 23 T: 6N R: 57E UTM: 4247600 N 0628130 E Rowheo #18 Vanderholl Clms Troy District	Chipped from vein..strong iron oxides, galena..possible Au/Ag.

Sample Description

Sample Number	Location	Description
3111	Quad: Troy 15' Sec: ____ T: 6N R: 57E UTM: 4247950 N 0627400 E Roweho #16 Haller Claim Troy District	Selected from dumps..quartz vein with minor oxides of iron, galena and unidentified sulfides.
3112	Quad: Troy 15' Sec: 33 T: 5N R: 57E UTM: 4244450 N 0624300 E Locke Mine Troy District	Selected from dumps associated with the big adit..strong iron staining on quartz without visablw mineralization. reported Au.
3113	Quad: Troy 15' Sec: 33 T: 6N R: 57E UTM: 4244450 N 0624350 E First Strike Prospect Troy District	Selected from dumps associated with the incline, quartz vein material with no visable minerals
3114	Quad: Troy 15' Sec: 32 T: 6N R: 57E UTM: 4244550 N 0624000 E Unnamed Adit Troy District	Chipped from vein in contact with limestone..highly silicified and and iron stained Au/Ag(?)
3115	Quad: Troy 15' Sec: 29 T: 6N R: 57E UTM: 4244700 N 0622800 E Leadhill Claims Troy District	Selected from dumps..qtz vein with galena, and lead oxides and probable silver.
3116	Quad: Nyala 7½' Sec: ____ T: 4N R: 56E UTM: 4227090 N 0613750 E Unnamed Adit Willow Creek District	Quartz vein material selected from dumps associated with an adit..area mined for gold.
3117	Quad: Nyala 7½' Sec: ____ T: 4N R: 56E UTM: 4227900 N 0613500 E Goodman Mine (?) Willow Creek District	Quartz veins in limestone with iron staining but without visable minerals.
3118	Quad: Nyala 7½' Sec: ____ T: 4N R: 56E UTM: 4228110 N 0613110 E Unnamed prospect shaft Willow Creek District	Chipped from vein in limestone some calcite and silication iron staining but no visable minerals.
3119	Quad: Nyala 7½' Sec: ____ T: 4N R: 56E UTM: 4228240 N 0613910 E Line of small prospects Willow Creek District	Chipped from quartz veins in fault vein system. strong iron oxides but without other mineral

Sample Description

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3120	Quad: Nyala 7½' Sec: T: 4N R: 56E UTM: 4228390 N 0612400 E Colorado Group(?) Willow Creek District	Selected from dumps near large adit..quartz vein with pyrite, arsenopyrite..Au/Ag?
3121	Quad: Nyala 7½' Sec: T: 4N R: 56E UTM: 4228550 N 0612620 E Large cross-cutting adit Willow Creek District	Quartz breccia, selected from dumps, iron oxides and some calcite no visable mineralizatior
3122	Quad: Nyala 7½' Sec: T: 4N R: 56E UTM: 4228850 N 0612160 E Small unnamed adit Willow Creek District	Chipped from vein of quartz with iron staining..in limestone and reported gold production.
3123	Quad: Wadsworth Ranch 7½' Sec: T: 3N R: 57E UTM: 4219675 N 0626500 E Combined Metals ~~Prod~~ Red. Mine Willow Creek (Sharp) Distr.	Quartz vein and replacement ore in limestone. includes galena tetrahedrite, and copper sulfides
3124	Quad: Wadsworth Ranch 7½' Sec: T: 3N R: 57E UTM: 4219680 N 0626270 E Combined Metals ~~Prod~~ Red. Inc Willow Creek (Sharp) Distr.	Gossan-like with strong oxidatior yellow and red lead oxides and possible silver.
3125	Quad: Wadsworth Ranch 7½' Sec: T: 3N R: 57E UTM: 4217725 N 0626900 E Red Bird Mine Willow Creek (Sharp) Distr.	Selected from dump..strong iron oxides in silicified vein somewhat gossan-like..galena and copper oxides.
3126	Quad: Wadsworth Ranch 7½' Sec: T: 3N R: 57E UTM: 4217300 N 0626285 E Iron Cap Mine Willow Creek (Sharp) Distr.	Selected from gossan-like vein system, manganese and galena.
3127	Quad: Warm Springs NW 7½' Sec: T: 4N R: 49E UTM: 4231910 N 0549310 E Prospect Tybo District (Warm Spring)	Chipped from small vuggy quartz vein in highly argillic, bleaches white volcanic tuff. Area mined for gold.
3128	Quad: Warm Springs NW 7½' Sec: T: 4N R: 49E UTM: 4231730 N 0549175 E Unnamed Prospect Tybo (Warm Springs) District	Chipped from vein in narrow trnch like prospect..with pyrite and possible Au/Ag mineralizatior

Sample Description

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3129	Quad: Tonopah 15' Sec: 25 T: 3N R: 42E UTM: 4215300 N 0480700 E King Tonopah Mine Tonopah District	Selected from dump near main shaft..quartz vein material adularia, argillic..pyrite with reported gold and silver.
3130	Quad: Big Ten Peak West 7½' Sec: T: 7N R: 45E UTM: 4247980 N 0507000 E Last Chance or Blackhawk Longstreet District	Selected from dumps and chipped from vein in adit..qtz vein and qtz breccia, pyrite and reported silver.
3131	Quad: Big Ten Peak West 7½' Sec: T: 7N R: 45E UTM: 4247900 N 0506940 E Last Chance Mine (Blackhawk) Longstreet District	Selected from dumps near main shaft..qtz vein and qtz breccia Pyrite, galena, sphalerite, and reported silver.
3132	Quad: Big Ten Peak West 7½' Sec: T: 7N R: 45E UTM: 4249850 N 0509070 E White Gold Group Longstreet District	Chipped from contact material includes epidote, garnet, CuOx, Tungsten(?)
3133	Quad: Big Ten Peak West 7½' Sec: T: 7N R: 45E UTM: 4250080 N 0509050 E Unnamed prospect Longstreet District	Chipped from quartz vein in granite host some adjacent contact material including garnet and sulfides.
3134	Quad: Big Ten Peak East 7½' Sec: T: 7N R: 45E UTM: 4248470 N 0513800 E 29 Pines Mine Longstreet District	Chipped from exposed veins in dozer-cuts a rhyolite breccia with strong hydrothermal alteration...matrix of breccia is partly a gray sulfide mass
3135	Quad: Big Ten Peak East 7½' Sec: T: 7N R: 45E UTM: 4248400 N 0512920 E 29 Pines Mine Longstreet District	Chipped from exposed rhyolite breccia with bleahing and argillic alteration..Some silver mineralization in the matrix of breccia.
3136	Quad: Big Ten Peak East 7½' Sec: T: 7N R: 45E UTM: 4247920 N 0511650 E Unnamed Adit Longstreet District	Selected from dump in front of white bleached argillically altered lithic tuff.. some pyrite and only minor qtz vein material pyrite and other sulfides.
3137	Quad: Outlaw Spring SW 7½' Sec: .6 T: 5N R: 40E UTM: 4241425 N 0454830 E Royston Coalition Mine Royston District	Qtz vein from dump and vein fe-oxides argillic alteration some brecciation galena, pyrite and reported gold/silver minerals

Sample Description

Sample Number	Location	Description
3138	Quad: Outlaw Spring SE 7½' Sec: 6 T: 5N R: 40E UTM: 4241500 N 0454830 E Royston Coalition Mine Co. Royston District	Vuggy quartz vein material selected from dums with argillic alteration, galena, sphalerite, and reported gold/silver mineralization.
3139	Quad: Outlaw Spring SE 7½' Sec: 5 T: 5N R: 40E UTM: 424190 N 0455050 E Royston Coalition Mine Co. Royston District	Selected from dumps, breccia, qtz vein and altered quartzite, fe-Ox argillic alteration galena, sphallerite and reported silver.
3140	Quad: Outlaw Spring NE 7½' Sec: 34 T: 7N R: 39E UTM: 4253175 N 0450000 E Ingie Claims Royston District	Selected from dumps, iron stained quartz breccia from veins in quartzite reported Au mineralization
3141	Quad: Outlaw Spring NE 7½' Sec: 35 T: 7N R: 39E UTM: 4253325 N 0550080 E Ingie Claims Royston Claims	Vuggy narrow quartz veins in quartzite with pyrite and reported gold mineralization
3142	Quad: Outlaw Spring NE 7½' Sec: 27 T: 7N R: 39E UTM: 4254780 N 0449720 E Blue Gem Turquoise Mine Royston District	Highly bleached, argillic alteration with visable copper oxides and sulfides. some turquoise.
3143	Quad: Cloverdale Ranch 7½' Sec: T: 8N R: 39E UTM: 4262405 N 0446300 E Orizaba Mine Cloverdale District	Selected from dumps both calcite and quartz veins, with galena, and probable gold.
3144	Quad: Cloverdale Ranch 7½' Sec: T: 8N R: 39E UTM: 4262520 N 0446140 E West of Orizaba Mine Cloverdale District	Selected from dumps qtz and calcite veins..and tetrahedrite?
3145	Quad: Cole Spring 7½' Sec: 8 T: 7N R: 39E UTM: 4259700 N 0445300 E Cole Spring Mine Cole Spring District	Selected from dumps and vein silicified matereal, breccia and vuggy iron stained quartz area has produced gold.
3146	Quad: Cole Spring 7½' Sec: 8 T: 7N R: 39E UTM: 4259600 N 0445340 E Cole Spring Mine Cole Spring District	Selected from dumps associated with inclince..vuggy silicified vein material.

Sample Description

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3147	Quad: Black Spring 7½' Sec: 31 T: 8N R: 39E UTM: 4264410 N 0445215 E Flossie Claims Republic District	Selected from dumps and chipped from exposed quartz veins, iron oxides, some of the quartz is as stingers within a shear, pyrite and reported gold.
3148	Quad: Black Spring 7½' Sec: 30 T: 8N R: 39E UTM: 4263400 N 0444720 E Hyland Property Republic District	Selected from dumps some qtz and silicifed vein material..strong bleaching and argillic alteration Gray wispy stringers of sulfide
3149	Quad: Black Spring 7½' Sec: 30 T: 8N R: 39E UTM: 4263580 N 0444500 E Hyland Property Republic District	Selected from open stopes and dumps on the western end of the vein system in a fault system Lots of gray wispy sulfides that are reported to carry silver.
3150	Quad: Black Spring 7½' Sec: 36 T: 8N R: 38E UTM: 4262900 N 0443540 E Farris Property Republic District	Sugary quartz veins with galena and reported silver values.
3151	Quad: Goldyke 7½' Sec: T: 9N R: 37E UTM: 4280200 N 0430140 E Pactolus Site Athens District	Almost complatly white bleached volcanic with silicified zones that are reported to carry gold values
3152	Quad: Goldyke 7½' Sec: T: 9N R: 37E UTM: 4280000 N 0430140 E Pactolus Camp Athens District	Qtz vein and altered tuff with strong bleaching and argillic alteration, reported to carry gold values.
3153	Quad: Simon 7½' Sec: T: 9N R: 37E UTM: 4273275 N 0427700 E Unnamed Incline Athens District	Selected from dump in association with incline and recently drilled hole..quartz vein breccia with strong argillic alteration
3154	Quad: Simon 7½' Sec: T: 9N R: 37E UTM: 4273525 N 0427900 E Unnamed Incline Athens District	Quartz vein material and gouge strongly argillized with possible mercury and reported gold.
3155	Quad: Simon 7½' Sec: T: 9N R: 37E UTM: 4274200 N 0427625 E Warrior Mine Athens District	Quartz vein material with strong argillic alteration reported to carry Au/Ag mineralization

Sample Description

Sample Number	Location	Description
3156	Quad: Tonopah 7½' Sec: 35 T: 3N R: 42E UTM: 4214000 N 0479360 E Golden Anchor (Tonopah Mine Co.) Tonopah District	Selected from dumps, quartz breccia and quartz vein material with manganese, pyrite and CuO, tetrahedrite(?) Argentite
3157	Quad: Tonopah 7½' Sec: 35 T: 3N R: 42E UTM: 4213400 N 0480475 E Desert Queen (Belmont Dev. Co.) Tonopah District	Selected from dumps, quartz vein material, breccia and tuff with manganese staining, strong pyrite and probable silver sulfides in an argillic alteration
3158	Quad: Tonopah 7½' Sec: 36 T: 3N R: 42E UTM: 4213440 N 0481000 E Belmont Mine Tonopah District	Selected from dumps near big shaft, quartz vein material, breccia stained by manganese, pyrite and possible Au/Ag.
3159	Quad: Baxter Spring 15' Sec: 35 T: 6N R: 42E UTM: 4242300 N 0479100 E Cimarron Mine San Antonio District	Selected from dumps a rhyolite breccia that contains sulfides in the matrix of the breccia all of which is strongly argillitized The ore is within the breccia.
3160	Quad: Baxter Spring 15' Sec: 35 T: 6N R: 42E UTM: 4242500 N 0478900 E West of Cimarron Mine San Antonio District	Chipped from shear and selected from lower adit dump..rhyolite breccia..with strong argillic alteration.
3161	Quad: Baxter Spring 15' Sec: 34 T: 6N R: 42E UTM: 4242500 N 0478500 E Cimarron Fraction #1 San Antonio District	Selected from dumps, rhyolite breccia surrounded by strong argillic alteration. Most of if not all the brecciation is associated with shears.
3162	Quad: San Antonio 15' Sec: 34 T: 6N R: 42E UTM: 4243600 N 0478000 E San Antonio Mine Santonio District	Adit and shaft along a shear that is strongly argillitized, iron-stained and brecciated.
3163	Quad: Paradise Peak 15' Sec: 18 T: 13N R: 38E UTM: 4315800 N 0434450 E Big Spring Mine Ellsworth District	Selected from dump associated with new wood headframe at the bottom of mountain..from dumps quartz vein with Cu, Ag/Au? and contact mineralization.
3164	Quad: Paradise Peak 15' Sec: 18 T: 13N R: 38E UTM: 4315400 N 0434350 E Big Spring Mine Ellsworth District	From dumps associated with old workings..vuggy quartz veins strongly iron stained..minor copper and tetrahedrite(?)

Sample Description

Sample Number	Location	Description
3165	Quad: Paradise Peak 15' Sec: 24 T: 13N R: 37E UTM: 4314250 N 0433150 E Flagstaff Mine Ellsworth District	Chipped from vein, silicified stringers, fault gouge, breccia, fe-oxides, with minor cu, and reported Au/Ag.
3166	Quad: Paradise Peak 15' Sec: 25 T: 13N R: 37E UTM: 4313500 N 0433000 E Easter Sunday Group Ellsworth District	Chipped from exposed quartz vein in trenches next to caved shaft vein near contact with sediments
3167	Quad: Paradise Peak 15' Sec: 26 T: 13N R: 37E UTM: 4312200 N 0431500 E Return Mine Ellsworth District	Selected from the dump, quartz vein in a white bleached and completly argillized volcanic tuff, with pyrite, argentite? and tetrahedrite.
3168	Quad: Paradise Peak 15' Sec: 27 T: 13N R: 37E UTM: 4312250 N 0430850 E Nut Pine Prospect Ellsworth District	Selected from dumps, quartz vein, quartz breccia and jasp-eroid with very little alter-except silication.
3169	Quad: Paradise Peak 15' Sec: 35 T: 13N R: 37E UTM: 4311800 N 0432150 E Clinton Baird Property Ellsworth District	Selected from dumps associated with the main shaft and prospect vuggy vein quartz, limonite, hosted in a bleached white argillically altered volcanic.
3170	Quad: Paradise Peak 15' Sec: 35 T: 13N R: 37E UTM: 4310800 N 0431900 E Vindicator Mine Ellsworth District	Chipped from a quartz vein and quartz stringers in a shear that is hosted in a volcanic that is completly altered to a white argillite.
3171	Quad: Paradise Peak 15' Sec: 11 T: 12N R: 37E UTM: 4307250 N 0431750 E Keyflower Mine Area Ellsworth District	Selected from dumps near an abandoned and caved incline, a silicified material, quartz with chalcopyrite, galena, CuO, pyrite, tetrahedrite
3172	Quad: Paradise Peak 15' Sec: 21 T: 12N R: 37E UTM: 4305000 N 0428500 E Phelps Stokes Mine Ellsworth District	Selected from open-pit massive replacement ore including: iron oxides, hematite, pyrite chalcopyrite.
3173	Quad: Pardise Peak 15" Sec: 11 T: 12N R: 37E UTM: 4307500 N 0422000 E Downeyville Mine Ellsworth District	Replacement ore from dumps near the big shaft included; pyrite, chalcopyrite, galena, sphalerite tetrahedrite and probable Ag sulfides.

Sample Description

Sample Number	Location	Description
3174	Quad: Paradise Peak 15' Sec: 16 T: 13N R: 37E UTM: 4315100 N 0428750 E Unnamed Adits Ellsworth District	Selected from dumps and exposed quartz vein and silicified stringers..some iron oxides, pyrite, and Ag/Au?
3175	Quad: Paradise Peak 15' Sec: 21 T: 13N R: 37E UTM: 4314010 N 0429000 E Lime Dyke Claims Ellsworth District	Selected from dumps..quartz veins and replacement ore with galena, pyrite, tetrahedrite? and reported gold.
3176	Quad: Paradise Peak 15' Sec: 21 T: 13N R: 37E UTM: 4314150 N 0428750 E Lime Dyke Claims Ellsworth District	Very vuggy quartz vein in dusty limonite, with galena and reported to carry gold-silver values.
3177	Quad: Paradise Peak 15' Sec: 21 T: 13N R: 37E UTM: 4313800 N 0428300 E German & Japan Claims Ellsworth District	Collected from dumps associated with adits along the lower west side of range..quartz vein material the best of which was not very impressive.
3178	Quad: Corcoran Canyon 7½' Sec: T: 10N R: 46E UTM: 4282260 N 0515660 E Silver Reef Claims Barcelona District	Chipped from a vein.. silcifie breccia with a matrix of fine grained silica and pyrite with reported silver, antimony, and minor gold..hanging wall vein.
3179	Quad: Tonopah 15' Sec: T: 4N R: 42E UTM: 4227350 N 0479350 E Rays Camp Tonopah District	Selected from dumps near big shaft..vein in shear consist of quartz stringers with gray sulfides and yellow oxides.
3180	Quad: Tonopah 15' Sec: T: 4N R: 42E UTM: 4227560 N 0479750 E Rays Camp Tonopah District	Selected from dump, vuggy qtz stringers, highly oxidized with manganese staining and reported gold.
3181	Quad: Tonopah 7½' Sec: 36 T: 3N R: 42E UTM: 4213440 N 0481000 E Belmont Mine Tonopah District	Selected from dumps..quartz vein material with galena, pyrite and silver sulfides.
3182	Quad: Tonopah 7½' Sec: 25 T: 3N R: 42E UTM: 4215300 N 0480700 E King Tonopah Mine Tonopah District	Selected from dumps..quartz vein material with visable ruby silver, pyrite, with sercite and argillic alteratior

Sample Description

Sample Number	Location	Description
3183	Quad: Belmont West 7½' Sec: 23 T: 9N R: 45E UTM: 4273845 N 0509600 E Unnamed shaft Belmont District	Selected from dumps..quartz vein material with galena, antimony, silver sulfides and pyrite.
3184	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4262010 N 0551825 E Mountain Veiw Mines Tybo (Hot Creek) District	Selected from dump in prospect near upper shaft..vein material with minor copper and tetrahedrite(?) and purplish-blue bloom oxide coating the vein.
3185	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4261995 N 0551625 E Mountain Veiw Mill Site Tybo (Hot Creek) District	Selected from ore in pile near similar to material seen on Mtn. near sample site 3184.
3186	Quad: Little Fish Lake 7½' Sec: 36 T: 8N R: 49E UTM: 4262900 N 0551800 E Arrasta Ruin Tybo (Hot Creek) District	Ore similar to the that seen at the mill and on the mountain.. ore oxidized with coating of bluish-purple silver sulfide(?)
3187	Quad: Corcoran Canyon 7½' Sec: T: 10N R: 46E UTM: 4282250 N 0515730 E Silver Reef Claims Barcelona District	Quartz vein material with visable ruby silver in narrow quartz vein near small adit in hanging wall of highly altered volcanic tuff.
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	
	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
3201	Quad: Paradise Peak 15' Sec: 33 T: 11N R: 37E UTM: 4291060 N 0428140 E Baxter Mine Fairplay District	Pale garnet-epidote skarn, sugary texture with quartz and calcite, MnO spots, some Cuox staining, no scheelite seen in sample
3202	Quad: Round Mountain 7 1/2' Sec: Unsurveyed T: 10N R: 44E UTM: 4282960 N 0497270 E Stevenson's and Schuppey's Claims	Iron stained, vuggy, white vein quartz sericitized granodiorite wall rock, possible fluorite.
3203	Quad: Round Mountain 7 1/2' Sec: Unsurv. T: 10N R: 44E UTM: 4282350 N 0497550 E Unnamed Tungsten Prospect Round Mountain District	White quartz vein some pegmatitic vein, clots huebnerite, purple and pale green fluorite, muscovite on vein walls.
3204	Quad: Round Mountain 7 1/2' Sec: Unsurv. T: 9N R: 44E UTM: 4278370 N 0499750 E Senator (Red Bird) Mine Round Mountain District	Quartz-barite vein with clots and stringers of cinnabar up to 1" thick.
3205	Quad: Round Mountain 7 1/2' Sec: Unsurv. T: 9N R: 44E UTM: 4278210 N 0499690 E Senator (Red Bird) Mine Round Mountain District	Metacinnabar and cinnabar clots in massive, white barite vein.
3206	Quad: Baxter Springs 15' Sec: 6 T: 7N R: 44E UTM: 4260900 N 0492000 E Hiatt Beryl-Fluorite Manhattan District	Quartz-feldspar pegmatite, greissen, no obvious mineralization.
3207	Quad: Manhattan 7 1/2' Sec: 14 T: 8N R: 43E UTM: 4267150 N 0489500 E Sk Claims Manhattan District	Brecciated quartz vein, cemented with Fe-oxides, fine-grained, black metallic mineral-Mn?
3208	Quad: Tonopah 15' Sec: 31 T: 4N R: 43E UTM: 4242450 N 0483150 E Tonopah-Pegleg Mine Tonopah District	Massive garnet-epidote skarn, trace molybdenite, grains and fine clouds of medium to fine-grained scheelite.
3209	Quad: Sec: T: R: UTM: N E	

Sample Description

Sample Number	Location	Description
3210	Quad: Sec: T: R: UTM: N E	
3211	Quad: Sec: T R: UTM: N E	
3212	Quad: Sec: T: R: UTM: N E	
3213	Quad: Sec: T: R: UTM: N E	
3214	Quad: Sec: T: R: UTM: N E	
3215	Quad: Manhattan 7 1/2' Sec: 19 T: 8N R: 44E UTM: 4265700 N 0493150 E Mustang Hill (Tenneco) Manhattan District	Sandy phyllite, silicified, adularia, fluorite, FeOx.
3216	Quad: Manhattan 7 1/2' Sec: 19 T: 8N R: 44E UTM: 4265590 N 0492820 E Mustang Hill (Tenneco) Manhattan District	Sandy phllite, quartz-adularia, fluorite, FeOx.
3217	Quad: Manhattan 7 1/2' Sec: 19 T: 8N R: 44E UTM: 4265390 N 0492680 E Tenneco Manhattan Mine (NW) Manhattan District	Phyllite, quartz-adularia, FeOx.
3218	Quad: Manhattan 7 1/2' Sec: 19 T: 8N R: 44E UTM: 4265020 N 0493020 E Tenneco Manhattan Mine (SE) Manhattan District	Phyllite, quartz-adularia, FeOx.

A P P E N D I X B

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	288	289	290	291	292	293		298	299
Fe % (.05)	1.5	7	10	1.5	1	5		7	10
Mg % (.02)	.3	.02	.07	.07	10	10		1.5	5
Ca % (.05)	.3	L	.05	.2	20	20		10	20
Ti % (.002)	.05	.015	.02	.1	.07	.03		.5	.7
Mn (10)	200	20	50	200	1000	G(5000)		2000	5000
Ag (.5)	5	2000	2000	3	3	G(5000)		L	N
As (200)	N	G(10000)	G(10000)	N	N	N		N	N
Au (10)	N	N	L	N	N	N		N	N
B (10)	100	70	50	50	L	N		L	L
Ba (20)	1000	500	70	5000	L	N		20	50
Be (1)	2	1	1.5	N	N	N		50	50
Bi (10)	N	20	10	N	N	G(1000)		20	20
Cd (20)	N	200	G(500)	N	N	G(500)		N	N
Co (5)	N	L	5	10	N	15		15	30
Cr (10)	L	L	10	30	15	10		150	200
Cu (5)	50	50	1500	500	5	1500		20	10
La (20)	30	20	L	L	N	N		100	100
Mo (5)	N	15	7	N	N	70		7	10
Nb (20)	L	N	N	N	N	N		L	20
Ni (5)	L	L	L	20	L	5		30	100
Pb (10)	1000	G(20000)	G(20000)	100	150	20000		20	30
Sb (100)	N	1500	2000	N	N	N		N	L
Sc (5)	5	5	5	5	5	L		20	20
Sn (10)	N	20	70	N	N	N		20	10
Sr (100)	100	100	L	100	700	300		1000	2000
V (10)	L	10	L	100	10	10		200	200
W (50)	N	N	N	N	2000	N		50	100
Y (10)	20	L	20	15	10	50		50	70
Zn (200)	1000	1500	5000	N	N	G(10000)		200	200
Zr (10)	100	50	70	30	30	10		200	500
Th (100)	N	N	N	N	N	N		N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	425	426	427		441		529	530	
Fe % (.05)	1	1	2		.3		.7	.05	
Mg % (.02)	.02	.15	2		.05		L	L	
Ca % (.05)	15	.1	3		.07		.7	.2	
Ti % (.002)	.07	.2	.007		.05		.01	.015	
Mn (10)	30	30	5000		200		L	N	
Ag (.5)	1	.5	2000		300		7	1	
As (200)	200	N	N		N		N	N	
Au (10)	N	N	N		N		N	N	
B (10)	10	50	30		N		10	10	
Ba (20)	2000	700	150		500		G(5000)	G(5000)	
Be (1)	N	3	15		2		1	N	
Bi (10)	N	N	N		N		N	N	
Cd (20)	N	N	150		N		N	N	
Co (5)	20	N	N		N		5	N	
Cr (10)	20	L	15		10		150	50	
Cu (5)	100	30	700		30		100	15	
La (20)	70	70	L		L		L	L	
Mo (5)	10	N	7		70		20	L	
Nb (20)	N	20	N		N		N	N	
Ni (5)	70	5	10		7		150	L	
Pb (10)	100	70	2000		300		10	10	
Sb (100)	G(20000)	500	2000		N		N	N	
Sc (5)	5	5	L		N		5	L	
Sn (10)	N	N	10		N		N	N	
Sr (100)	150	100	N		N		500	G(5000)	
V (10)	100	20	70		20		500	150	
W (50)	N	N	L		N		N	N	
Y (10)	10	15	L		N		20	15	
Zn (200)	200	N	G(10000)		500		200	N	
Zr (10)	30	200	L		20		20	10	
Th (100)	N	N	N		N		N	N	

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Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

lement

Sample Number

	601	602	603	604	605	606	607	608	609
Fe %(.05)	1.5	.3	1	3	.7	.7	5	7	7
Mg %(.02)	.2	.07	.1	.3	1.5	.07	3	.1	1
Ca %(.05)	.15	.05	.5	.05	1.5	2	3	.3	.5
Ti %(.002)	.1	.07	.02	.2	.1	.1	.5	.07	.5
Mn(10)	700	50	300	20	150	10	1000	20	100
Ag(.5)	100	50	15	1	1	7	L	.5	1
As(200)	300	N	500	N	N	N	N	L	N
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	50	30	20	100	70	70	50	50	500
Ba(20)	10000	200	3000	2000	G(5000)	5000	5000	300	2000
Be(1)	5	2	N	2	L	2	3	20	7
Bi(10)	N	N	N	N	N	N	N	N	N
Cd(20)	N	N	N	N	N	N	N	L	500
Co(5)	5	N	7	7	7	L	30	15	20
Cr(10)	10	10	15	50	50	150	200	30	150
Cu(5)	50	20	7000	70	30	100	50	150	150
La(20)	100	50	L	20	20	20	30	30	100
Mo(5)	70	70	N	10	N	20	N	200	100
Nb(20)	L	N	N	N	N	N	N	N	L
Ni(5)	5	5	10	15	30	20	100	300	200
Pb(10)	30	20	300	10	L	10	30	15	30
Sb(100)	100	L	5000	N	N	N	N	N	N
Sc(5)	5	5	L	7	5	5	15	7	10
Sn(10)	N	N	N	N	N	N	N	N	N
Sr(100)	L	L	L	100	1000	1000	700	300	200
V(10)	100	70	20	300	100	500	150	1000	1000
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	20	L	L	20	15	30	20	700	70
Zn(200)	N	N	700	N	N	N	N	1000	2000
Zr(10)	150	70	10	100	70	50	150	50	300
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	630	631		774	775	776	777A	777B	
Fe %(.05)	2	2		7	10	5	2	5	
Mg %(.02)	1.5	2		1	3	.7	.2	1.5	
Ca %(.05)	1	7		.5	3	.05	.5	1.5	
Ti %(.002)	.5	.2		.3	.2	.2	.05	.5	
Mn(10)	1000	200		2000	G(5000)	700	100	1000	
Ag(.5)	1	2		.7	50	50	200	20	
As(200)	N	1500		N	N	N	N	300	
Au(10)	N	N		N	N	N	N	N	
B(10)	500	200		200	100	200	1500	100	
Ba(20)	G(5000)	G(5000)		G(5000)	500	1000	2000	1500	
Be(1)	5	1.5		2	1.5	2	N	5	
Bi(10)	N	N		N	N	N	500	70	
Cd(20)	N	N		N	N	N	N	N	
Co(5)	15	15		30	20	10	N	50	
Cr(10)	70	100		150	150	50	10	30	
Cu(5)	200	100		30	500	30	1000	15000	
La(20)	50	50		30	30	20	20	50	
Mo(5)	5	70		10	N	15	20	N	
Nb(20)	L	N		N	N	N	N	L	
Ni(5)	70	100		100	70	50	5	20	
Pb(10)	20	30		100	5000	500	15000	15000	
Sb(100)	N	100		L	300	N	100	N	
Sc(5)	10	10		20	15	7	L	10	
Sn(10)	N	N		N	N	N	N	N	
Sr(100)	200	200		150	200	N	100	150	
V(10)	500	2000		200	150	50	50	200	
W(50)	N	N		N	N	N	L	70	
Y(10)	20	50		30	15	10	N	20	
Zn(200)	N	700		N	N	N	N	N	
Zr(10)	200	300		100	70	100	L	70	
Th(100)	N	N		N	N	N	N	N	

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	778								
Fe % (.05)	10								
Mg % (.02)	.15								
Ca % (.05)	.3								
Ti % (.002)	.05								
Mn (10)	100								
Ag (.5)	1000								
As (200)	1500								
Au (10)	N								
B (10)	20								
Ba (20)	500								
Be (1)	N								
Bi (10)	N								
Cd (20)	100								
Co (5)	N								
Cr (10)	20								
Cu (5)	300								
La (20)	L								
Mo (5)	N								
Nb (20)	N								
Ni (5)	7								
Pb (10)	10000								
Sb (100)	500								
Sc (5)	5								
Sn (10)	N								
Sr (100)	N								
V (10)	20								
W (50)	N								
Y (10)	N								
Zn (200)	2000								
Zr (10)	15								
Th (100)	N								

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	849	850	851	851A					
Fe % (.05)	3	15	20	10					
Mg % (.02)	.5	.15	.7	.07					
Ca % (.05)	10	1	15	.15					
Ti % (.002)	.02	.015	.015	.007					
Mn (10)	G(5000)	G(5000)	500	G(5000)					
Ag (.5)	2000	700	10	5000					
As (200)	2000	G(10000)	2000	7000					
Au (10)	N	N	N	N					
B (10)	N	20	N	10					
Ba (20)	150	100	200	50					
Be (1)	N	3	N	L					
Bi (10)	N	N	200	N					
Cd (20)	150	500	N	G(500)					
Co (5)	N	N	N	N					
Cr (10)	N	N	L	N					
Cu (5)	1000	2000	500	3000					
La (20)	L	N	20	L					
Mo (5)	N	20	N	N					
Nb (20)	N	N	N	N					
Ni (5)	L	L	L	L					
Pb (10)	G(20000)	G(20000)	2000	G(20000)					
Sb (100)	10000	10000	L	G(10000)					
Sc (5)	L	L	N	L					
Sn (10)	500	700	20	1000					
Sr (100)	300	N	L	N					
V (10)	50	50	30	10					
W (50)	N	N	N	N					
Y (10)	15	30	N	15					
Zn (200)	10000	G(10000)	5000	G(10000)					
Zr (10)	N	30	N	N					
Th (100)	N	N	N	N					

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	1101	1102	1103	1104	1105	1106	1107	1108	1109
Fe %(.05)	.03	.15	.7	7	.7	.7	.1	7	3
Mg %(.02)	1.5	.07	.15	5	.05	.07	L	.05	1
Ca %(.05)	20	5	2	10	.2	.2	.15	1	3
Ti %(.002)	.03	L	.03	.2	.03	.07	.002	.07	.3
Mn(10)	20	1000	700	1500	150	50	150	300	700
Ag(.5)	N	2000	5000	10	500	N	5	7	5
As(200)	N	3000	1500	N	N	N	N	2000	500
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	N	10	L	300	300	30	100	50	500
Ba(20)	30	300	150	1500	100	150	G5000	700	500
Be(1)	7	3	3	L	N	N	N	1.5	1.5
Bi(10)	N	N	L	N	N	N	N	N	N
Cd(20)	N	L	200	N	L	N	N	N	N
Co(5)	N	N	7	70	5	N	N	30	10
Cr(10)	15	L	10	30	L	N	L	L	15
Cu(5)	50	5000	15000	200	1500	7	30	1000	30
La(20)	L	L	20	L	L	20	20	20	L
Mo(5)	N	N	N	L	N	7	N	5	N
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	7	7	7	50	10	L	L	15	15
Pb(10)	15	2000	3000	50	70	50	L	30	100
Sb(100)	N	1500	10000	L	1000	N	N	L	N
Sc(5)	N	N	N	10	N	N	N	L	10
Sn(10)	N	N	N	N	N	N	N	N	N
Sr(100)	100	100	100	200	N	150	G5000	300	300
V(10)	15	50	30	100	30	10	20	50	200
W(50)	N	700	N	N	N	N	N	N	N
Y(10)	L	N	N	20	N	L	N	10	10
Zn(200)	N	500	10000	N	500	N	N	N	N
Zr(10)	15	L	N	30	10	50	N	30	30
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	1472	1473							
Fe % (.05)	.7	.1							
Mg % (.02)	.02	.02							
Ca % (.05)	.5	1							
Ti % (.002)	.5	.5							
Mn (10)	50	70							
Ag (.5)	30	50							
As (200)	L	N							
Au (10)	L	L							
B (10)	N	N							
Ba (20)	5000	2000							
Be (1)	N	N							
Bi (10)	700	50							
Cd (20)	N	N							
Co (5)	N	N							
Cr (10)	N	L							
Cu (5)	70	30							
La (20)	L	L							
Mo (5)	5	5							
Nb (20)	N	N							
Ni (5)	L	L							
Pb (10)	100	70							
Sb (100)	1500	500							
Sc (5)	5	5							
Sn (10)	N	N							
Sr (100)	100	300							
V (10)	20	20							
W (50)	N	N							
Y (10)	N	N							
Zn (200)	N	N							
Zr (10)	150	150							
Th (100)	N	N							

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement					Sample Number				
					1768	1769	1770	1771	1772
Fe % (.05)					L	.5	.1	.5	1
Mg % (.02)					L	.07	.07	.07	.2
Ca % (.05)					G(20)	1	G(20)	G(20)	G(20)
Ti % (.002)					.002	.03	.02	.015	.07
Mn (10)					100	50	200	200	5000
Ag (.5)					2	5	5	7	N
As (200)					N	N	N	N	N
Au (10)					N	N	N	N	N
B (10)					N	20	N	N	15
Ba (20)					N	150	50	300	500
Be (1)					3	2	1	2	5
Bi (10)					N	N	N	N	N
Cd (20)					N	N	N	N	N
Co (5)					N	N	N	N	L
Cr (10)					N	N	N	N	N
Cu (5)					N	5	7	7	5
La (20)					N	N	L	L	70
Mo (5)					7	20	L	7	L
Nb (20)					N	N	N	N	N
Ni (5)					N	7	N	N	N
Pb (10)					10	30	15	30	50
Sb (100)					N	N	N	N	N
Sc (5)					N	N	N	N	N
Sn (10)					N	N	N	N	N
Sr (100)					200	N	100	150	100
V (10)					N	L	L	L	10
W (50)					N	N	N	N	N
Y (10)					200	N	100	70	50
Zn (200)					N	N	N	N	N
Zr (10)					30	50	20	20	50
Th (100)					N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ement — Sample Number

	1773	1774	1775	1776	1777	1778	1779	1780	1781
Fe % (.05)	2	1	.07	.05	15	.2	.05	.5	.5
Mg % (.02)	1	.2	.03	L	.07	2	1.5	.2	.7
Ca % (.05)	7	G(20)	G(20)	G(20)	2	G(20)	G(20)	G(20)	5
Ti % (.002)	.07	.07	.02	.002	.1	.015	.02	.05	.02
Mn (10)	3000	100	50	N	70	100	70	30	100
Ag (.5)	.5	L	N	N	L	N	N	N	2
As (200)	N	N	N	N	200	N	N	N	N
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	10	L	N	N	30	N	N	50	L
Ba (20)	500	100	N	N	70	N	N	L	100
Be (1)	1.5	5	2	1	1.5	1	2	2	1.5
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	7	N	N	N	L	N	N	L	N
Cr (10)	L	N	N	20	N	N	N	15	10
Cu (5)	7	5	N	N	15	N	N	7	5
La (20)	L	50	L	L	L	N	N	N	N
Mo (5)	5	30	5	N	15	20	30	N	20
Nb (20)	N	N	N	N	L	N	N	N	N
Ni (5)	5	L	N	N	7	N	N	L	10
Pb (10)	50	20	L	N	15	20	70	L	20
Sb (100)	N	N	N	N	N	N	N	N	N
Sc (5)	N	L	N	N	N	N	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	L	200	300	500	150	L	100	N	N
V (10)	20	15	10	10	150	10	15	100	30
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	L	200	15	L	15	20	20	20	N
Zn (200)	N	N	N	N	N	N	N	N	N
Zr (10)	50	50	30	15	70	30	20	30	10
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported [illegible] all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	1782	1783	1784						
Fe %(.05)	5	5	G(20)						
Mg %(.02)	.1	.3	2						
Ca %(.05)	1.5	10	10						
Ti %(.002)	.07	.07	.05						
Mn(10)	100	1500	G(5000)						
Ag(.5)	N	1500	20						
As(200)	500	G(10000)	G(10000)						
Au(10)	N	L	N						
B(10)	30	20	20						
Ba(20)	150	200	200						
Be(1)	1	1	L						
Bi(10)	N	N	1000						
Cd(20)	N	500	200						
Co(5)	N	N	10						
Cr(10)	15	10	L						
Cu(5)	20	1000	200						
La(20)	30	100	L						
Mo(5)	30	20	N						
Nb(20)	N	N	N						
Ni(5)	30	10	L						
Pb(10)	10	G(20000)	300						
Sb(100)	N	G(10000)	150						
Sc(5)	5	N	N						
Sn(10)	N	N	N						
Sr(100)	700	500	200						
V(10)	100	70	15						
W(50)	N	N	N						
Y(10)	200	N	10						
Zn(200)	N	G(10000)	10000						
Zr(10)	30	20	15						
Th(100)	N	N	N						

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	1996	1997							
Fe % (.05)	.7	L							
Mg % (.02)	.2	.02							
Ca % (.05)	20	G(20)							
Ti % (.002)	.07	.01							
Mn (10)	150	20							
Ag (.5)	5	.7							
As (200)	N	N							
Au (10)	N	N							
B (10)	L	N							
Ba (20)	300	L							
Be (1)	3	1							
Bi (10)	N	N							
Cd (20)	N	N							
Co (5)	N	N							
Cr (10)	N	N							
Cu (5)	5	N							
La (20)	70	30							
Mo (5)	N	N							
Nb (20)	N	N							
Ni (5)	L	N							
Pb (10)	30	10							
Sb (100)	N	N							
Sc (5)	N	N							
Sn (10)	N	N							
Sr (100)	300	500							
V (10)	15	L							
W (50)	N	N							
Y (10)	150	10							
Zn (200)	N	N							
Zr (10)	200	10							
Th (100)	N	N							

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	1998	1999	2000						
Fe %(.05)	.2	.1	.1						
Mg %(.02)	.05	.03	.03						
Ca %(.05)	G(20)	G(20)	20						
Ti %(.002)	.03	.02	.015						
Mn(10)	70	20	30						
Ag(.5)	N	N	N						
As(200)	N	N	N						
Au(10)	N	N	N						
B(10)	N	N	N						
Ba(20)	150	G(5000)	150						
Be(1)	1	1	7						
Bi(10)	N	N	N						
Cd(20)	N	N	N						
Co(5)	N	N	N						
Cr(10)	N	N	N						
Cu(5)	N	N	L						
La(20)	20	L	L						
Mo(5)	N	5	10						
Nb(20)	N	N	N						
Ni(5)	N	L	L						
Pb(10)	20	20	15						
Sb(100)	N	N	N						
Sc(5)	N	N	N						
Sn(10)	N	N	N						
Sr(100)	300	300	150						
V(10)	L	L	L						
W(50)	N	N	N						
Y(10)	150	150	100						
Zn(200)	N	N	N						
Zr(10)	30	15	30						
Th(100)	N	N	N						

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fe % (.05)	3	1.5	1	1	3	.2	1.5	.7	2
Mg % (.02)	.07	.1	.07	.15	.3	.03	.3	.3	.15
Ca % (.05)	.15	1	1.5	.07	.3	.15	1.5	.7	.15
Ti % (.002)	.03	.07	.07	.1	.003	.01	.15	.07	.15
Mn (10)	150	300	500	150	100	5000	3000	G5000	G5000
Ag (.5)	5	200	7	5	N	2000	3000	5000	700
As (200)	N	300	L	L	L	N	N	300	L
Au (10)	N	50	N	N	N	N	N	L	N
B (10)	15	30	30	70	10	L	N	30	10
Ba (20)	20	50	100	150	L	50	150	200	200
Be (1)	2	3	3	3	N	3	3	3	5
Bi (10)	N	N	N	N	N	N	10	100	N
Cd (20)	N	N	N	N	N	N	L	L	L
Co (5)	10	N	N	N	15	L	N	N	15
Cr (10)	N	N	20	L	L	10	15	L	15
Cu (5)	30	20	50	20	100	1000	3000	3000	3000
La (20)	N	20	L	20	L	L	L	20	20
Mo (5)	100	15	100	10	N	N	150	5	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	5	5	5	7	5	L	10
Pb (10)	50	70	150	70	10	300	5000	3000	5000
Sb (100)	L	100	N	N	N	700	700	5000	150
Sc (5)	N	L	L		L	N	L	L	L
Sn (10)	N	N	N	N	N	N	N	30	N
Sr (100)	N	L	150	N	N	N	L	N	N
V (10)	30	30	30	50	30	L	20	20	30
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	10	20	15	10	N	20	15	L	20
Zn (200)	N	N	L	L	N	700	2000	2000	7000
Zr (10)	30	30	30	70	10	10	70	30	30
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	2021	2022	2023	2024	2025	2026	2027	2028	2029
Fe %(.05)	.7	.7	.7	.5	.7	.2	1.5	1.5	.5
Mg %(.02)	.3	.1	.1	.03	.07	.02	.03	.02	.1
Ca %(.05)	.5	L	L	L	3	1.5	.15	.07	3
Ti %(.002)	.03	.1	.07	.003	.2	.01	.02	.02	.03
Mn(10)	G5000	150	300	G5000	700	70	500	30	200
Ag(.5)	700	100	700	150	7	2000	1000	700	1500
As(200)	N	2000	300	N	700	700	700	200	L
Au(10)	N	N	N	N	N	N	N	50	N
B(10)	10	70	15	L	20	20	20	10	L
Ba(20)	100	500	20	L	200	200	200	1000	L
Be(1)	3	1.5	3	2	1.5	3	3	2	1.5
Bi(10)	N	N	N	N	N	70	15	10	N
Cd(20)	N	N	N	N	L	70	50	50	L
Co(5)	N	L	N	20	7	N	N	N	N
Cr(10)	15	10	10	15	15	L	10	15	L
Cu(5)	700	20	20	70	30	15000	10000	700	1000
La(20)	20	20	20	L	20	30	30	L	20
Mo(5)	15	10	5	L	10	1000	1000	300	20
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	10	L	5	5	20	5	L	L	L
Pb(10)	200	30	70	20	15	1500	2000	3000	700
Sb(100)	100	150	700	200	N	G10000	10000	700	1500
Sc(5)	L	N	N	N	L	N	N	N	N
Sn(10)	N	N	N	L	N	N	N	N	L
Sr(100)	N	N	N	N	500	N	N	N	N
V(10)	15	20	L	15	150	N	10	L	30
W(50)	N	N	N	N	50	N	300	N	N
Y(10)	30	L	10	N	15	N	N	N	15
Zn(200)	300	N	N	N	1000	7000	2000	3000	5000
Zr(10)	15	100	50	L	50	10	20	20	10
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	2048	2049	2050	2051	2052	2053	2054	2055	2056
Fe %(.05)	1.5	1.5	3	3	3	3	2	.2	1.5
Mg %(.02)	.1	.02	.3	.07	.3	.15	.07	.07	.1
Ca %(.05)	.07	.2	.1	.2	.05	5	.5	.5	L
Ti %(.002)	.1	.07	.05	.05	.1	.1	.02	.015	.1
Mn(10)	70	200	1000	300	700	200	100	2000	70
Ag(.5)	150	3	200	150	30	3	500	3	1.5
As(200)	2000	2000	1000	2000	500	500	L	N	1000
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	30	70	10	10	30	70	20	20	10
Ba(20)	500	300	150	70	1500	1000	200	300	1500
Be(1)	5	7	L	L	5	1.5	L	1.5	2
Bi(10)	N	N	200	100	100	N	150	N	N
Cd(20)	N	N	G500	L	N	N	N	N	N
Co(5)	N	N	70	L	7	10	L	N	N
Cr(10)	L	L	30	30	10	30	20	15	10
Cu(5)	20	10	7000	2000	700	70	5000	30	15
La(20)	20	20	20	L	20	20	N	20	20
Mo(5)	N	7	50	50	5	7	15	N	7
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	L	L	20	5	5	50	20	5	L
Pb(10)	30	30	15000	20000	2000	100	1000	30	30
Sb(100)	500	500	N	L	N	N	1000	N	100
Sc(5)	L	N	L	N	L	5	N	N	L
Sn(10)	N	N	N	N	30	N	N	N	N
Sr(100)	N	100	N	N	N	150	N	N	L
V(10)	15	50	150	70	50	70	70	10	20
W(50)	N	N	N	N	N	N	L	N	N
Y(10)	N	N	15	N	10	15	N	10	L
Zn(200)	N	N	G10000	2000	3000	L	L	N	N
Zr(10)	70	50	20	30	50	30	N	100	150
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2030	2031	2032	2033	2034	2035	2036	2037	2038
Fe % (.05)	5	1.5	1	3	1.5	2	1.5	.7	2
Mg % (.02)	.7	.05	.2	.03	.2	.1	.07	.05	.07
Ca % (.05)	10	.15	20	.07	L	.2	.15	.2	.05
Ti % (.002)	.15	.015	.07	.2	.1	.03	.03	.03	.03
Mn (10)	G5000	150	1000	15	300	200	150	300	30
Ag (.5)	10	30	3	30	1.5	3	150	200	3000
As (200)	N	300	N	1000	200	1500	700	N	700
Au (10)	N	20	N	N	N	N	N	N	N
B (10)	N	10	N	15	1000	1000	30	20	15
Ba (20)	20	70	L	300	100	300	70	150	150
Be (1)	20	7	L	1.5	1.5	1.5	L	1.5	L
Bi (10)	N	N	N	150	N	N	15	N	L
Cd (20)	N	N	N	N	N	N	L	N	200
Co (5)	10	L	L	N	5	N	N	N	N
Cr (10)	30	10	N	10	30	20	20	20	30
Cu (5)	20	50	30	300	30	30	3000	700	7000
La (20)	50	L	L	L	L	20	L	L	20
Mo (5)	500	10	5	7	L	L	500	150	G2000
Nb (20)	L	N	N	N	N	N	N	N	N
Ni (5)	15	5	5	7	7	5	15	10	70
Pb (10)	30	50	30	5000	150	200	10000	2000	G20000
Sb (100)	N	150	N	150	100	2000	300	200	500
Sc (5)	7	N	N	N	5	5	N	N	N
Sn (10)	50	N	N	N	N	N	N	N	N
Sr (100)	N	N	L	N	N	L	N	N	N
V (10)	50	70	70	L	30	20	150	100	1000
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	20	N	10	N	15	20	N	N	N
Zn (200)	300	N	N	200	N	N	2000	1500	1000
Zr (10)	150	15	L	30	100	150	50	20	20
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	2039	2040	2041	2042	2043	2044	2045	2046	2047
Fe % (.05)	1.5	.7	7	.3	.7	2	1.5	2	1
Mg % (.02)	.05	.15	7	5	.1	.2	.7	.5	.2
Ca % (.05)	L	L	3	15	.05	.07	5	10	7
Ti % (.002)	.05	.03	.015	.02	.07	.1	.05	.03	.05
Mn (10)	20	70	1500	200	70	50	700	1000	700
Ag (.5)	5000	300	7	3	10	5	2	20	50
As (200)	700	N	N	N	N	L	G10000	3000	1000
Au (10)	N	N	N	N	N	N	20	15	L
B (10)	20	30	10	L	15	30	50	30	20
Ba (20)	100	100	150	150	G5000	1000	20	200	500
Be (1)	L	3	L	7	2	2	1	2	3
Bi (10)	N	N	N	N	N	N	N	N	15
Cd (20)	200	N	N	N	N	N	N	N	N
Co (5)	N	N	150	N	N	L	L	N	5
Cr (10)	20	30	2000	20	20	30	20	20	15
Cu (5)	7000	700	200	15	10	30	20	20	30
La (20)	20	L	N	L	L	L	20	L	L
Mo (5)	1500	50	L	10	100	15	15	7	7
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	10	10	3000	30	L	15	5	5	7
Pb (10)	10000	1000	50	30	30	30	50	100	50
Sb (100)	700	1000	N	N	N	N	3000	200	150
Sc (5)	N	N	5	N	N	5	L	L	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	L	N	150	150	300	N	N	N	300
V (10)	300	70	150	50	30	70	L	10	10
W (50)	N	L	N	N	N	N	N	N	N
Y (10)	N	N	20	L	N	20	15	20	15
Zn (200)	300	N	500	N	N	L	N	N	N
Zr (10)	30	20	N	10	50	100	20	20	15
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2066	2067	2068	2069	2070	2071	2072	2073	2074
Fe % (.05)	3	1.5	.7	3	1.5	.7	.7	2	.7
Mg % (.02)	.2	.1	.1	.5	.15	.07	.15	.05	.1
Ca % (.05)	.15	.07	,15	15	5	.05	1.5	L	.07
Ti % (.002)	.07	.07	.07	.15	.1	.07	.07	.015	.15
Mn (10)	300	500	1500	1000	300	70	200	150	1500
Ag (.5)	5	2	7	L	200	1000	30	20	7
As (200)	300	700	N	N	L	N	N	N	N
Au (10)	N	N	N	N	N	20	N	N	N
B (10)	20	20	50	20	30	50	70	20	30
Ba (20)	1000	700	1000	200	2000	500	1500	300	1000
Be (1)	1.5	1.5	3	3	5	2	3	2	7
Bi (10)	N	N	15	N	N	N	N	G1000	30
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	10	10	N	15	7	N	N	N	N
Cr (10)	30	20	L	30	30	L	30	15	N
Cu (5)	30	30	30	20	100	30	100	150	70
La (20)	20	L	N	20	20	L	L	N	20
Mo (5)	10	10	N	L	5	N	5	50	30
Nb (20)	N	N	L	N	N	N	N	N	N
Ni (5)	50	30	5	20	20	L	15	7	L
Pb (10)	100	10	70	15	150	1000	70	300	150
Sb (100)	N	N	L	N	200	150	100	N	N
Sc (5)	L	L	N	7	5	N	L	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	N	N	300	N	N	N	200
V (10)	70	100	20	50	70	15	100	150	30
W (50)	N	N	700	N	N	N	N	N	100
Y (10)	15	N	N	30	30	N	10	N	N
Zn (200)	500	200	N	L	N	300	N	200	N
Zr (10)	20	20	30	50	50	30	30	20	30
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2084	2085	2086	2087	2088	2089	2090	2091	2092
Fe % (.05)	1	1.5	3	2	5	2	5	2	.7
Mg % (.02)	.1	.07	.7	.5	.1	.15	.2	.07	L
Ca % (.05)	L	.07	1.5	5	3	10	.15	L	L
Ti % (.002)	.05	.07	.05	.05	.03	.07	.1	.03	.1
Mn (10)	150	300	100	1500	200	1000	50	300	20
Ag (.5)	300	1	L	L	N	L	700	30	3
As (200)	500	N	N	L	N	700	500	L	N
Au (10)	N	N	N	N	N	15	50	N	N
B (10)	30	15	30	50	20	200	200	30	L
Ba (20)	70	300	100	300	200	200	1000	500	500
Be (1)	2	5	L	L	5	L	N	N	1.5
Bi (10)	N	N	N	N	N	N	700	15	N
Cd (20)	N	N	N	100	N	N	L	N	N
Co (5)	N	N	L	5	10	L	15	N	N
Cr (10)	N	L	50	100	30	30	30	10	N
Cu (5)	30	15	30	20000	100	30	G20000	5000	50
La (20)	20	20	N	N	N	L	L	N	L
Mo (5)	150	N	N	N	15	15	10	50	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	70	100	150	7	7	L	L
Pb (10)	30	30	20	30	30	30	5000	10000	100
Sb (100)	200	N	N	N	N	L	3000	100	N
Sc (5)	N	L	L	N	N	7	5	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	150	200	150	100	L	150	N
V (10)	100	20	100	500	200	150	700	100	30
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	10	L	20	N	10	N	N	N
Zn (200)	N	N	N	300	1000	L	L	300	N
Zr (10)	70	50	L	10	L	15	30	15	150
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2057	2058	2059	2060	2061	2062	2063	2064	2065
Fe % (.05)	2	2	3	3	3	3	5	1.5	3
Mg % (.02)	.2	.3	.3	.2	.3	.15	.3	.1	5
Ca % (.05)	.05	1.5	1.5	.05	.15	.1	3	.2	7
Ti % (.002)	.15	.07	.03	.05	.1	.1	.05	.005	.003
Mn (10)	200	700	500	150	200	300	300	50	500
Ag (.5)	.7	L	L	.5	N	N	N	N	N
As (200)	N	N	N	N	L	700	200	L	500
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	L	20	15	2000	300	70	50	20	30
Ba (20)	500	100	L	100	150	150	500	200	300
Be (1)	2	1	1	1.5	2	L	L	L	N
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	L	10	10	5	5	10	15	10	50
Cr (10)	30	10	20	30	30	150	500	2000	2000
Cu (5)	10	30	150	30	70	30	200	10	15
La (20)	L	L	L	100	20	L	L	N	N
Mo (5)	N	N	N	N	N	N	15	N	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	7	20	20	20	10	70	150	150	500
Pb (10)	15	30	30	20	20	15	30	L	20
Sb (100)	N	N	N	N	N	N	N	N	N
Sc (5)	L	N	N	5	5	L	5	N	5
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	N	N	L	N	300	N	700
V (10)	30	10	10	30	30	20	300	30	30
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	10	20	10	15	10	10	N	N
Zn (200)	N	N	N	N	L	N	L	L	N
Zr (10)	70	30	10	15	30	20	15	L	N
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2075	2076	2077	2078	2079	2080	2081	2082	2083
Fe % (.05)	2	.7	1	.1	.7	3	5	3	.7
Mg % (.02)	.1	L	.05	.07	.07	.1	.5	.5	.07
Ca % (.05)	.05	.2	1.5	.2	L	1	1	1.5	L
Ti % (.002)	.05	.2	.02	.01	.02	.05	.05	.03	.03
Mn (10)	1500	150	700	150	70	300	1500	1000	50
Ag (.5)	70	1000	500	70	150	2	1.5	30	200
As (200)	2000	700	L	N	N	2000	200	2000	300
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	30	L	15	L	20	30	30	20	20
Ba (20)	300	50	100	300	150	1500	G5000	G5000	150
Be (1)	1.5	N	1.5	L	1.5	1.5	1.5	L	1.5
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	L	N	N	N	N	N	N	N
Co (5)	5	N	N	N	N	10	5	15	N
Cr (10)	10	N	20	10	15	150	10	20	15
Cu (5)	100	700	300	300	300	2000	100	G20000	150
La (20)	L	N	L	N	N	20	N	L	L
Mo (5)	7	100	L	N	20	N	7	L	100
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	15	L	50	5	L	70	20	30	L
Pb (10)	700	7000	3000	700	3000	50	3000	3000	70
Sb (100)	150	300	300	500	500	100	N	5000	200
Sc (5)	N	N	N	N	N	N	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	N	N	N	500	L	150	N
V (10)	300	500	500	300	150	300	50	30	200
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	N	N	N	20	L	L	N
Zn (200)	1000	10000	10000	300	200	L	1500	1500	N
Zr (10)	15	N	50	L	15	20	20	L	20
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	2093	2094	2095	2096	2097	2098	2099	2100	
Fe % (.05)	1	5	5	3	3	1	1.5	3	
Mg % (.02)	.3	.7	1	.05	.2	.07	.07	.07	
Ca % (.05)	.05	5	5	.07	1.5	.05	.07	.05	
Ti % (.002)	.07	.3	.07	.15	.07	.1	.1	.05	
Mn (10)	150	1000	G5000	100	500	150	70	200	
Ag (.5)	30	15	150	1	1000	50	1000	500	
As (200)	N	N	N	L	L	500	500	500	
Au (10)	N	N	N	N	N	N	L	N	
B (10)	100	N	L	10	10	20	50	10	
Ba (20)	1500	100	1000	1000	2000	500	5000	500	
Be (1)	1	L	15	L	L	1.5	1.5	2	
Bi (10)	N	20	200	L	N	N	N	N	
Cd (20)	N	N	500	N	N	N	N	N	
Co (5)	L	20	70	7	7	N	N	N	
Cr (10)	20	30	30	30	50	15	10	L	
Cu (5)	150	5000	5000	70	3000	50	30	30	
La (20)	L	L	N	30	L	L	L	L	
Mo (5)	30	10	100	20	20	7	7	300	
Nb (20)	N	N	N	N	N	N	N	N	
Ni (5)	L	15	15	10	15	L	5	L	
Pb (10)	500	700	15000	500	7000	70	100	150	
Sb (100)	N	N	N	N	200	N	L	N	
Sc (5)	L	10	L	5	L	L	L	N	
Sn (10)	N	N	N	N	N	N	N	N	
Sr (100)	N	300	300	1500	100	150	200	N	
V (10)	30	150	200	150	150	30	30	30	
W (50)	N	N	200	N	L	N	N	N	
Y (10)	N	15	10	15	L	L	L	N	
Zn (200)	L	500	G10000	200	1000	N	N	L	
Zr (10)	50	50	50	150	15	50	100	20	
Th (100)	N	N	N	N	N	N	N	N	

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	2207	2208	2209	2210	2211	2212	2213	2214	2215
Fe % (.05)	1.5	2	3	1.5	3	2	3	10	.7
Mg % (.02)	.1	3	2	.3	.7	3	.15	1	5
Ca % (.05)	5	10	7	5	3	7	.3	2	15
Ti % (.002)	.02	.02	.15	.1	.07	.02	.007	.01	L
Mn (10)	5000	G5000	G5000	3000	1500	G5000	G5000	1000	700
Ag (.5)	150	20	7	N	1000	30	G5000	200	7
As (200)	L	L	N	N	L	N	10000	1000	N
Au (10)	1	N	N	N	N	N	N	N	N
B (10)	30	N	N	10	30	10	70	50	N
Ba (20)	20	150	L	150	1000	100	N	L	N
Be (1)	2	L	100	50	N	3	N	N	N
Bi (10)	L	N	20	N	G1000	20	N	N	N
Cd (20)	G500	200	50	N	70	N	G500	500	N
Co (5)	N	N	5	N	20	N	N	N	N
Cr (10)	L	L	20	15	30	L	15	20	L
Cu (5)	700	100	150	20	G20000	70	5000	2000	30
La (20)	20	L	N	L	N	N	L	N	L
Mo (5)	70	50	N	5	100	15	1000	50	L
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	5	L	10	L	L	L	L
Pb (10)	G20000	5000	50	50	20000	150	G20000	10000	150
Sb (100)	100	N	N	N	N	N	200	L	N
Sc (5)	N	N	7	5	L	7	N	N	N
Sn (10)	N	N	150	15	N	20	70	N	N
Sr (100)	N	200	N	500	N	300	200	N	N
V (10)	10	30	50	50	1500	200	15	20	15
W (50)	N	N	L	200	N	500	N	N	N
Y (10)	20	N	20	20	15	50	N	N	N
Zn (200)	G10000	7000	10000	1000	1500	700	G10000	G10000	700
Zr (10)	30	15	50	30	30	20	N	N	N
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ment

Sample Number

	2216	2217	2218	2219	2220	2221	2222	2223	2224
Fe % (.05)	10	3	20	1.5	3	5	3	.7	G 20
Mg % (.02)	.7	3	.7	.3	2	.3	.7	.7	1
Ca % (.05)	1.5	.05	L	7	7	.1	.07	1.5	.7
Ti % (.002)	.002	L	L	.1	.07	.15	.07	.03	.015
Mn (10)	5000	150	500	150	500	300	150	100	150
Ag (.5)	10	200	150	1	N	2	2	300	N
As (200)	N	500	2000	N	N	N	N	1000	N
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	50	10	N	100	300	1000	20	500	N
Ba (20)	150	20	L	L	30	G 5000	300	150	L
Be (1)	L	N	N	3	L	1.5	3	L	N
Bi (10)	N	N	N	N	N	N	1000	50	N
Cd (20)	500	50	G 500	N	N	N	N	50	N
Co (5)	15	N	N	7	100	150	10	7	70
Cr (10)	L	15	15	20	15	15	30	10	20
Cu (5)	1000	1500	700	30	10	15000	150	20000	300
La (20)	N	N	N	L	N	N	N	L	N
Mo (5)	50	1000	N	5	N	20	30	L	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	7	5	L	10	30	30	70	7	30
Pb (10)	2000	15000	7000	100	50	20	700	700	L
Sb (100)	N	100	N	N	N	N	N	1500	N
Sc (5)	N	N	N	5	7	7	L	N	N
Sn (10)	N	20	N	N	N	N	N	N	N
Sr (100)	N	N	N	300	200	1000	N	150	N
V (10)	30	15	L	70	50	70	100	30	100
W (50)	L	150	N	N	N	N	N	N	N
Y (10)	L	N	N	15	30	20	L	15	15
Zn (200)	G 10000*	3000	G 10000	700	L	N	3000	500	N
Zr (10)	N	N	N	50	50	100	50	15	N
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Added 30 Dec 87

Atomic-Adsorbtion Analysis

Element — Sample Number

	2021	2022	2023	2024	2025	2026	2027	2028	2029
As (5)	50	G2000	430	N(10)	1300	1000	840	250	130
Au (.05)	.50	.95	.20	.20	N(.05)	.15	.05	1.4	.50
Sb (1)	74	80	210	66	20	G1000	G1000	530	840
Zn (5)	390	N(5)	10	50	1100	G2000	G2000	1800	250

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2030	2031	2032	2033	2034	2035	2036	2037	2038
As (5)	N(10)	700	90	1900	500	G2000	1000	N(10)	950
Au (.05)	N(.05)	20	.05	.10	L(.05)	.05	N(.05)	N(.05)	N(.05)
Sb (1)	N(2)	68	4	100	72	670	170	150	G1000
Zn (5)	250	45	20	320	10	55	1900	2000	840

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2039	2040	2041	2042	2043	2044	2045	2046	2047
As (5)	1200	60	110	30	80	280	G2000	1800	1200
Au (.05)	L(.05)	L(.05)	L(.05)	N(.05)	1.0	4.3	27	15	3.9
Sb (1)	G1000	400	6	N(2)	N(2)	4	G1000	170	78
Zn (5)	410	110	550	30	20	80	45	40	30

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2048	2049	2050	2051	2052	2053	2054	2055	2056
As (5)	360	400	440	1500	720	780	200	N(10)	1000
Au (.05)	1.2	.10	1.3	.65	.25	.20	L(.05)	N(.05)	N(.05)
Sb (1)	22	88	12	40	N(2)	18	610	4	76
Zn (5)	20	35	G2000	1600	G2000	120	160	25	20

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2057	2058	2059	2060	2061	2062	2063	2064	2065
As (5)	10	N(10)	N(10)	N(10)	330	1100	480	150	810
Au (.05)	.15	N(.05)	N(.05)	N(.05)	N(.05)	.10	N(.05)	N(.05)	N(.05)
Sb (1)	N(2)	N(2)	N(2)	N(2)	N(2)	8	6	30	10
Zn (5)	25	40	35	30	40	10	150	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2066	2067	2068	2069	2070	2071	2072	2073	2074
As (5)	250	800	N(10)	100	130	70	80	20	N(10)
Au (.05)	1.4	3.1	L(.05)	L(.05)	1.4	25.	.75	.10	L(.05)
Sb (1)	10	12	38	N(2)	140	34	46	8	6
Zn (5)	220	160	20	120	70	180	45	160	120

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement

Sample Number

	2075	2076	2077	2078	2079	2080	2081	2082	2083
As (5)	G2000	880	200	N(10)	N(10)	1600	300	1600	200
Au (.05)	.20	.70	.35	L(.05)	N(.05)	N(.05)	.15	.25	1.5
Sb (1)	120	330	100	180	230	66	16	G1000	82
Zn (5)	600	G2000	G2000	230	240	140	1500	340	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2084	2085	2086	2087	2088	2089	2090	2091	2092
As (5)	790	230	70	80	230	1100	860	60	50
Au (.05)	1.7	N(.05)	L(.05)	N(.05)	.20	18.	76.	.15	.10
Sb (1)	92	24	18	8	8	16	G1000	12	2
Zn (5)	15	60	25	420	810	110	130	450	40

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement — Sample Number

	2093	2094	2095	2096	2097	2098	2099	2100
As (5)	20	10	30	250	240	780	770	640
Au (.05)	2.3	N(.05)	L(.05)	.05	6.1	5.2	16	7.7
Sb (1)	6	N(2)	12	N(2)	110	14	40	26
Zn (5)	100	550	G2000	230	1400	35	40	110
Wt.	10							

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2207	2208	2209	2210	2211	2212	2213	2214	2215
As (5)	110	170	L(10)	N(10)	110	20	G(2000)	1000	30
Au (.05)	2.50	40	.05	N(.05)	1.20	N(.05)	2.20	.80	N(.05)
Sb (1)	46	10	N(2)	N(2)	N(2)	N(2)	170	56	N(2)
Zn (5)	G(2000)	G(2000)	G(2000)	940	2000	860	G(2000)	G(2000)	400

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Added 4 Nov 86

Atomic-Adsorbtion Analysis

lement

Sample Number

	2216	2217	2218	2219	2220	2221	2222	2223	2224
As (5)	80	510	460	90	(L(10)	N(10)	100	660	N(10)
Au (.05)	N(.05)	1.70	2.00	N(.05)	N(.05)	N(.05)	N(.05)	L(.05)	N(.05)
Sb (1)	6	8	12	10	N(2)	N(2)	4	G(1000)	N(2)
Zn (5)	G(2000)	2000	G(2000)	140	70	40	G(2000)	640	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Added 4 Nov 86

Atomic-Adsorbtion Analysis

Element — Sample Number

	2225	2226	2227	2228	2229	2230	2231	2232	2233
As (5)	1500	610	950	1500	420	10	80	500	480
Au (.05)	L(.05)	N(.05)	.15	N(.05)	4.20	N(.05)	.80	N(.05)	.20
Sb (1)	24	G(1000)	G(1000)	G(1000)	400	32	700	440	420
Zn (5)	360	1700	1200	680	50	20	220	520	1100

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection, < detected, but below value shown.

added 4 Nov 86

Atomic-Adsorbtion Analysis

Element	Sample Number								
	2234	2235							
As (5)	G(2000)	20							
Au (.05)	N(.05)	N(.05)							
Sb (1)	180	2							
Zn (5)	180	G(2000)							

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Added
4 Nov 86

Atomic-Adsorbtion Analysis

Element — Sample Number

	2393	2394	2395	2396	2397	2398	2399	2400
As (5)	G2000	400	140	N(10)	840	10	L(10)	570
Au (.05)	4.0	12	.20	.05	N(.05)	N(.05)	10	13.00
Sb (1)	310	66	N(2)	N(2)	G(1000)	4	10	10
Zn (5)	35	20	30	N(5)	1800	40	140	1600

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

2397-2400 added 4 Nov 86

Atomic-Adsorbtion Analysis

lement	Sample Number								
	2576								
As (5)	N(10)								
Au (.05)	N(.05)								
Sb (1)	L(2)								
Zn (5)	N(5)								

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2683	2684	2685	2686	2687	2688	2689	2690	2691
As (5)	840	G2000	G2000	250	280	620	100	350	1400
Au (.05)	.70	2.1	N(.05)	.30	.55	.10	.40	N(.05)	.10
Sb (1)	150	290	N(2)	N(2)	100	360	G1000	230	G1000
Zn (5)	10	1000	G2000	G2000	330	35	5	20	2000
Sw								10	

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2692	2693	2694	2695	2696	2697	2698	2699	2700
As (5)	900	650	40	10	30	60	150	80	480
Au (.05)	.25	.50	N(.05)	N(.05)	N(.05)	.30	1.7	.50	7.0
Sb (1)	G1000	390	90	14	10	8	62	20	20
Zn (5)	20	1200	70	15	30	25	45	20	30

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown. N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2729	2730	2731	2732	2733	2734	2735	2736	2737
As (5)	260	170	85	70	30	160	60	130	380
Au (.05)	.50	.50	10	.55	.20	L(.05)	.10	L(.05)	.05
Sb (1)	440	36	74	2	N(2)	970	140	G1000	520
Zn (5)	N(5)	5	5	40	15	200	80	250	2000
Sw									10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement — Sample Number

	2738	2739	2740	2741	2742	2743	2744	2745	2746
As (5)	160	100	90	100	980	G2000	G2000	280	500
Au (.05)	L(.05)	N(.05)	.15	N(.05)	.10	.35	.15	N(.05)	L(.05)
Sb (1)	150	66	44	80	16	G1000	G1000	66	70
Zn (5)	200	330	5	85	45	430	670	15	N(5)

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element	Sample Number								
	2747	2748							
As (5)	110	2000							
Au (.05)	N(.05)	6.1							
Sb (1)	4	720							
Zn (5)	140	G2000							

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2749	2750	2751	2752	2753	2754	2755	2756	2757
As (5)	G2000	G2000	220	100	80	60	20	50	50
Au (.05)	3.5	.40	.15	.15	1.3	150	L(.05)	.6	L(.05)
Sb (1)	300	550	6	4	2	2	2	180	16
Zn (5)	G2000	G2000	240	10	10	65	20	1800	G2000
Au(Sw)	10	10	10	10	10	10	10		

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2758	2759	2760	2761	2762	2763	2764	2765	2766
As (5)	30	1100	60	140	800	35	30	30	60
Au (.05)	N(.05)	16	.2	.05	1.0	N	N	2.4	23
Sb (1)	4	G2000	250	18	700	4	N(2)	6	70
Zn (5)	280	45	120	200	G2000	G2000	90	25	30

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2767	2768	2769	2770	2771	2772	2773	2774	2775
As (5)	800	G2000	60	20	N(107)	50	190	690	90
Au (.05)	25	6.4	.45	2.8	.7	.5	.85	3.4	.05
Sb (1)	160	320	32	14	20	6	16	18	10
Zn (5)	110	30	35	40	50	30	20	40	15

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2776	2777	2778	2779	2780	2781	2782	2783	2784
As (5)	150	830	580	200	760	450	200	230	90
Au (.05)	.80	.50	.20	20	3.5	2.6	.75	7.8	.20
Sb (1)	42	450	8	120	42	190	130	530	8
Zn (5)	5	30	5	55	N(5)	5	55	240	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2785	2786	2787	2788	2789	2790	2791	2792	2793
As (5)	130	140	150	140	130	30	20	690	1700
Au (.05)	1.0	1.7	N(.05)	L(.05)	.05	.10	.10	.20	N(.05)
Sb (1)	8	4	200	2	6	200	180	140	28
Zn (5)	20	15	5	55	25	30	40	5	35

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2794	2795	2796	2797	2798	2799	2800		
As (5)	1000	1300	180	130	110	40	100		
Au (.05)	.80	.80	.25	.30	2.4	6.1	27		
Sb (1)	G1000	G1000	G1000	330	360	46	46		
Zn (5)	10	5	N(5)	35	15	10	15		

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element	Sample Number								
	3066	3067	3068	3069	3070				
As (5)	220	150	100	720	140				
Au (.05)	.05	.15	14	.20	.05				
Sb (1)	20	34	560	22	8				
Zn (5)	10	N(5)	5	15	25				

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	3071	3072	3073	3074	3075	3076	3077	3078	3079
As (5)	G2000	1100	310	830	600	100	80	350	150
Au (.05)	.40	.25	.15	.40	1.4	.50	1.3	.30	.05
Sb (1)	32	420	76	68	54	860	310	4	N(2)
Zn (5)	60	65	100	100	120	90	100	60	180
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement — Sample Number

	3080	3081	3082	3083	3084	3085	3086	3087	3088
As (5)	20	90	810	G2000	G2000	G2000	1500	570	330
Au (.05)	L(.05)	.20	1.2	1.6	.80	.40	.60	.10	.05
Sb (1)	8	22	12	68	290	340	G1000	16	G1000
Zn (5)	5	35	45	G2000	160	30	2000	20	170
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	3084	3085	3086	3087	3088	3089	3090	3091	3092
Fe %(.05)	1.5	1	1.5	1	1.5	.7	.3	.3	.3
Mg %(.02)	.07	.07	.15	.15	.7	.3	.02	3	2
Ca %(.05)	.05	L	.5	.3	3	3	.15	7	7
Ti %(.002)	.15	.07	.03	.15	.03	.07	.015	.005	.015
Mn(10)	200	100	300	100	70	50	500	200	150
Ag(.5)	500	1500	5000	20	1000	150	N	5000	1000
As(200)	7000	5000	1500	300	300	1500	N	2000	200
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	100	50	20	20	70	20	30	30	30
Ba(20)	150	200	100	200	1000	150	1000	20	L
Be(1)	1	1	N	L	N	N	10	N	N
Bi(10)	N	N	N	N	N	150	N	15	N
Cd(20)	N	N	L	N	100	50	N	G500	300
Co(5)	N	N	N	N	N	N	70	N	N
Cr(10)	N	L	L	10	30	20	L	L	10
Cu(5)	1000	50	15000	70	3000	5000	500	G20000	700
La(20)	20	L	L	20	N	N	N	L	L
Mo(5)	N	N	N	N	7	50	N	20	30
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	5	5	5	5	15	20	150	10	15
Pb(10)	300	150	3000	50	2000	1000	N	10000	7000
Sb(100)	300	500	5000	L	2000	1500	N	G10000	2000
Sc(5)	N	N	N	N	N	N	N	N	N
Sn(10)	N	N	10	N	50	30	N	30	50
Sr(100)	N	N	N	N	N	L	N	L	N
V(10)	15	10	L	20	150	70	20	100	50
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	L	10	20	N	N	L	20	N	N
Zn(200)	200	N	2000	N	L	N	200	1500	2000
Zr(10)	50	50	30	30	20	30	L	N	10
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement

Sample Number

	3089	3090	3091	3092	3093	3094	3095	3096	3097
As (5)	1200	70	1400	120	20	N(10)	340	230	1000
Au (.05)	.30	N(.05)	.55	.10	N(.05)	L(.05)	L(.05)	N(.05)	.20
Sb (1)	G1000	4	G1000	890	160	230	140	92	290
Zn (5)	160	1000	1300	G2000	320	1200	110	50	G2000
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ement

Sample Number

	3098	3099	3100	3101	3102	3103	3104	3105	3106
As (5)	1400	270	760	370	2000	N(10)	N(10)	N(.10)	N(.10)
Au (.05)	.35	.10	.60	.15	.15	N(.05)	N(.05)	.05	.05
Sb (1)	330	G1000	G1000	G1000	870	50	42	94	12
Zn (5)	90	15	50	5	220	G2000	270	G2000	G2000
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ment

Sample Number

	3107	3108	3109	3110	3111	3112	3113	3114	3115
As (5)	470	G2000	20	50	40	360	550	280	G2000
Au (.05)	L(.50)	7.5	3.8	.15	N(.05)	12	1.4	6.0	6.3
Sb (1)	510	8	8	2	N(2)	4	2	2	130
Zn (5)	470	G2000	1400	900	15	280	680	560	280
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement

Sample Number

	3116	3117	3118	3119	3120	3121	3122	3123	3124
As (5)	400	120	120	10	N(10)	30	20	G2000	G2000
Au (.05)	.05	4.0	N(.05)	N(.05)	N(.05)	19	N(.05)	.20	.40
Sb (1)	2	4	6	14	4	4	N(2)	G1000	G1000
Zn (5)	100	10	40	10	55	10	15	G2000	610
Sw	10	10	10	10	10	10			

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ment

Sample Number

	3125	3126	3127	3128	3129	3130	3131	3132	3133
As (5)	G2000	330	1700	530	20	70	90	N(10)	N(10)
Au (.05)	N(.05)	N(.05)	N(.05)	N(.05)	2.0	N(.05)	.25	N(.05)	N(.05)
Sb (1)	310	82	40	G1000	120	4	28	N(2)	N(2)
Zn (5)	G2000	G2000	25	15	730	G2000	G2000	120	75

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ment

Sample Number

	3134	3135	3136	3137	3138	3139	3140	3141	3142
As (5)	1400	500	30	950	G2000	1400	G2000	G2000	700
Au (.05)	.10	.20	N(.05)	.15	2.6	2.5	N(.05)	7.7	N(.05)
Sb (1)	8	10	2	10	G1000	G1000	82	300	12
Zn (5)	10	5	45	40	80	120	100	G2000	140

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ement

Sample Number

	3143	3144	3145	3146	3147	3148	3149	3150	3151
As (5)	70	140	140	80	140	350	200	120	1100
Au (.05)	.45	N(.05)	2.2	2.5	.65	2.2	2.0	.15	2.2
Sb (1)	310	26	20	8	66	G1000	G1000	290	80
Zn (5)	G2000	35	170	60	25	690	340	G2000	25

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ement

Sample Number

	3152	3153	3154	3155	3156	3157	3158	3159	3160
As (5)	1700	100	10	490	20	30	410	20	30
Au (.05)	N(.05)	.25	N(.05)	3.4	2.60	2.20	.35	.35	.35
Sb (1)	30	10	12	24	10	12	10	L(2)	4
Zn (5)	60	N(5)	N(5)	20	880	500	170	30	20

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

3156 - 3160 added 4 Nov 86

Atomic-Adsorption Analysis

lement

Sample Number

	3161	3162	3163	3164	3165	3166	3167	3168	3169
As (5)	30	30	450	180	400	1300	1300	980	G(2000)
Au (.05)	13.00	22.00	4.30	3.20	210.00	24.00	3.20	1.00	11.00
Sb (1)	2	6	160	10	400	6	720	120	90
Zn (5)	20	10	50	50	30	40	110	440	40

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

added
4 Nov 86

Atomic-Adsorbtion Analysis

ement	Sample Number								
	3170	3171	3172	3173	3174	3175	3176	3177	3178
As (5)	90	50	N(10)	80	400	330	180	20	150
Au (.05)	12.00	.90	N(.05)	.90	.30	1.30	.10	N(.05)	.15
Sb (1)	18	52	N(2)	32	22	130	34	2	2
Zn (5)	5	60	5	G(2000)	1200	G(2000)	1100	70	L(5)

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

added 4 Nov 86

Atomic-Adsorbtion Analysis

Element — Sample Number

	3179	3180	3181	3182	3183	3184	3185	3186	3187
As (5)	440	560	20	30	650	40	10	10	90
Au (.05)	.50	2.80	18.00	9.70	.65	.20	.85	.30	.40
Sb (1)	50	170	8	140	210	G(1000)	760	210	100
Zn (5)	G(2000)	1300	G(2000)	1000	G(2000)	200	70	20	5

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

added 4 Nov 86

Atomic-Adsorbtion Analysis

lement

Sample Number

	3201	3202	3203	3204	3205	3206	3207	3208
As (5)	10	10	L(10)	L(10)	10	10	480	10
Au (.05)	.10	N(.05)	N(.05)	N(.05)	N(.05)	N(.05)	.05	N(.05)
Sb (1)	6	8	4	10	2	N(2)	86	N(2)
Zn (5)	G(2000)	90	10	1100	150	30	600	60

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

added
4 Nov 86

Atomic-Absorption Analysis

lement	Sample Number								
	3215	3216	3217	3218					
As (5)	870	80	80	150					
Au (.05)	15.00	7.60	4.20	.40					
Sb (1)	12	2	L(2)	L(2)					
Zn (5)	90	20	50	30					

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

added 4 Nov 86

Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	2234	2235							
Fe % (.05)	20	20							
Mg % (.02)	.1	1.5							
Ca % (.05)	.1	1							
Ti % (.002)	.015	.07							
Mn (10)	150	3000							
Ag (.5)	5	N							
As (200)	3000	N							
Au (10)	N	N							
B (10)	N	N							
Ba (20)	100	150							
Be (1)	L	L							
Bi (10)	20	15							
Cd (20)	N	N							
Co (5)	N	70							
Cr (10)	10	10							
Cu (5)	700	500							
La (20)	N	N							
Mo (5)	100	150							
Nb (20)	N	N							
Ni (5)	5	10							
Pb (10)	100	30							
Sb (100)	150	L							
Sc (5)	N	5							
Sn (10)	N	N							
Sr (100)	N	N							
V (10)	30	70							
W (50)	N	70							
Y (10)	L	L							
Zn (200)	N	3000							
Zr (10)	N	70							
Th (100)	N	N							

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ement	Sample Number								
	2576								
e %(.05)	.5								
Mg %(.02)	.02								
Ca %(.05)	L								
Ti %(.002)	.5								
Mn(10)	10								
Ag(.5)	N								
As(200)	N								
Au(10)	N								
B(10)	20								
Ba(20)	5000								
Be(1)	N								
Bi(10)	N								
Cd(20)	N								
Co(5)	N								
Cr(10)	20								
Cu(5)	15								
La(20)	N								
Mo(5)	L								
Nb(20)	N								
Ni(5)	L								
Pb(10)	N								
Sb(100)	N								
Sc(5)	10								
Sn(10)	N								
Sr(100)	L								
V(10)	15								
W(50)	L								
Y(10)	N								
Zn(200)	N								
(10)	G(1000)								
Th(100)	N								

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater [illegible] alue shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2684	2685	2686	2687	2688	2689	2690	2691	2692
Fe % (.05)	7	7	.5	15	3	.7	2	3	1
Mg % (.02)	.15	1	.03	.15	5	1.5	5	5	.7
Ca % (.05)	2	.15	L	L	10	5	10	20	1.5
Ti % (.002)	.07	.3	.02	.1	.003	.02	.03	.05	.15
Mn (10)	1000	1000	100	70	1000	300	1000	2000	300
Ag (.5)	700	10	1000	700	3	30	.5	700	30
As (200)	G10000	1500	L	L	300	L	300	1500	1000
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	N	N	L	1500	15	15	20	70	70
Ba (20)	500	20	1500	200	70	70	150	200	700
Be (1)	L	1.5	L	L	N	N	L	N	L
Bi (10)	N	N	G1000	700	10	N	N	N	N
Cd (20)	200	500	G500	N	N	N	N	50	N
Co (5)	7	10	20	N	70	N	50	N	N
Cr (10)	100	70	L	20	3000	70	2000	70	70
Cu (5)	3000	500	70	500	30	200	50	3000	500
La (20)	L	20	N	N	L	30	N	30	30
Mo (5)	N	200	15	N	N	N	5	N	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	7	70	5	5	500	30	300	10	100
Pb (10)	G20000	7000	G20000	G20000	1500	7000	200	5000	7000
Sb (100)	500	N	N	150	1000	G10000	700	10000	G10000
Sc (5)	5	5	N	5	5	N	5	N	L
Sn (10)	N	N	N	N	N	N	N	50	N
Sr (100)	100	L	N	N	500	300	700	300	150
V (10)	50	100	L	20	30	L	70	20	20
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	10	20	N	N	N	N	L	15	L
Zn (200)	10000	5000	G10000	1500	L	N	N	2000	N
Zr (10)	30	150	20	30	N	L	15	20	150
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

lement Sample Number

	2693	2694	2695	2696	2697	2698	2699	2700	
Fe % (.05)	2	.5	2	1.5	1	1.5	1.5	1	
Mg % (.02)	3 .07	1	.3	.07	.3	.3	.1		
Ca % (.05)	7	.3	10	.2	10	.1	.07	.07	
Ti % (.002)	.02	.02	.07	.2	.07	.15	.15	.1	
Mn (10)	700	100	700	300	200	700	300	150	
Ag (.5)	1000	7	1.5	2	20	700	1500	30	
As (200)	500	N	N	N	N	N	N	200	
Au (10)	N	N	N	N	N	N	N	N	
B (10)	10	20	30	10	N	20	10	10	
Ba (20)	L	150	3000	1000	700	300	300	500	
Be (1)	L	N	L	2	3	5	3	2	
Bi (10)	N	N	N	N	N	N	N	N	
Cd (20)	N	N	N	N	N	N	N	N	
Co (5)	10	N	L	N	N	L	N	N	
Cr (10)	700	L	70	15	10	15	20	N	
Cu (5)	70	30	15	7	15	30	20	10	
La (20)	L	N	L	L	L	20	20	L	
Mo (5)	N	N	N	150	10	L	N	15	
Nb (20)	N	N	N	N	N	N	N	N	
Ni (5)	200	15	70	5	L	7	5	L	
Pb (10)	1000	30	30	30	30	150	70	100	
Sb (100)	700	300	N	N	N	100	N	N	
Sc (5)	L	N	L	L	L	L	5	L	
Sn (10)	N	N	N	N	N	N	N	N	
Sr (100)	150	N	L	150	L	N	N	N	
V (10)	10	300	50	70	15	30	50	30	
W (50)	N	N	N	N	N	N	N	N	
Y (10)	N	N	15	L	100	15	15	L	
Zn (200)	1500	N	N	N	N	N	N	N	
Zr (10)	15	L	50	150	50	150	150	30	
Th (100)	N	N	N	N	N	N	N	N	

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement — Sample Number

	2729	2730	2731	2732	2733	2734	2735	2736	2737
Fe % (.05)	1	.7	.7	.7	.7	1.5	1.5	.5	1.5
Mg % (.02)	.07	.07	.07	.05	.1	.1	.15	.5	.7
Ca % (.05)	L	L	L	L	L	1	1.5	3	1.5
Ti % (.002)	.07	.05	.1	.1	.07	.05	.1	.02	.02
Mn (10)	100	30	30	30	100	700	20	50	1500
Ag (.5)	3000	1000	1500	70	150	700	700	1500	700
As (200)	L	L	N	N	N	200	N	200	200
Au (10)	N	N	L	N	N	N	N	N	N
B (10)	L	10	10	L	15	15	20	10	10
Ba (20)	70	100	70	700	500	100	70	G5000	G5000
Be (1)	1.5	2	3	1.5	2	L	L	L	L
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	50
Co (5)	N	N	N	N	N	L	N	N	N
Cr (10)	L	L	N	N	N	10	30	10	100
Cu (5)	30	20	15	10	L	7000	1500	5000	5000
La (20)	L	L	L	L	L	L	L	N	L
Mo (5)	50	70	30	30	30	50	70	200	50
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	L	L	7	10	7	7	20
Pb (10)	70	70	150	70	30	70	70	200	500
Sb (100)	700	100	200	N	N	1500	200	3000	1000
Sc (5)	N	N	N	L	L	N	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	L
Sr (100)	N	100	N	N	N	N	L	500	N
V (10)	15	15	L	L	15	20	30	30	15
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	N	L	L	L	10	N	N
Zn (200)	N	N	N	N	N	200	N	200	1500
Zr (10)	30	30	30	50	50	30	150	15	20
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	2738	2739	2740	2741	2742	2743	2744	2745	2746
Fe % (.05)	2	1.5	1	2	1.5	15	7	1	1.5
Mg % (.02)	.15	.07	.05	.3	.3	.07	.07	.05	.02
Ca % (.05)	.15	1.5	.3	.3	1.5	1.5	1.5	.05	.05
Ti % (.002)	.015	.05	.05	.2	.15	.01	.03	.07	.1
Mn (10)	150	700	150	700	700	100	20	15	500
Ag (.5)	100	15	15	.7	20	300	700	3	5
As (200)	200	L	300	N	700	5000	7000	200	300
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	10	10	10	15	15	N	L	15	15
Ba (20)	300	30	100	700	300	500	70	1000	1000
Be (1)	1	L	L	2	1	N	N	1	1.5
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	L	N	15	N	N	N	N	N	N
Cr (10)	L	15	20	L	N	L	N	N	20
Cu (5)	150	1000	30	10	30	1000	300	15	10
La (20)	L	N	30	20	L	N	20	20	20
Mo (5)	7	N	N	N	N	70	150	10	15
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	10	7	10	L	L	N	L	L	7
Pb (10)	70	700	30	30	30	G20000	G20000	1000	500
Sb (100)	500	100	G10000	500	100	3000	7000	200	150
Sc (5)	N	N	L	7	L	N	5	L	L
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	L	N	150	N	200	300	300	L	N
V (10)	10	20	20	20	30	L	20	10	L
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	20	20	10	N	20	20	15
Zn (200)	300	300	N	L	N	3000	1000	N	N
Zr (10)	L	15	150	200	50	N	15	70	100
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2747	2748	2749	2750	2751	2752	2753	2754	2755
Fe % (.05)	3	10	5	5	1.5	3	3	2	.7
Mg % (.02)	.07	.07	.15	.15	3	.15	.1	.1	.02
Ca % (.05)	.1	.07	.3	.5	10	.1	L	.05	L
Ti % (.002)	.1	.02	.07	.15	.07	.2	.2	.15	.15
Mn (10)	30	700	700	500	5000	100	30	300	30
Ag (.5)	.7	1000	700	100	70	3	7	3	.5
As (200)	N	1000	10000	3000	N	N	N	N	N
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	15	N	20	100	30	50	50	70	10
Ba (20)	700	100	70	300	100	1000	500	700	1500
Be (1)	2	N	L	N	1	1.5	1.5	1.5	1
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	G500	200	300	N	N	N	N	N
Co (5)	N	N	7	L	N	N	N	N	L
Cr (10)	15	N	20	30	15	10	20	20	15
Cu (5)	10	300	200	300	10	20	50	30	7
La (20)	20	N	N	L	L	20	20	20	20
Mo (5)	7	N	N	15	N	30	20	10	30
Nb (20)	N	N	N	L	N	N	N	N	N
Ni (5)	L	L	5	7	L	L	L	L	L
Pb (10)	150	G20000	G20000	15000	700	500	70	70	30
Sb (100)	N	1500	500	700	N	N	N	N	N
Sc (5)	L	N	N	5	N	5	7	5	N
Sn (10)	N	15	20	200	15	N	N	N	N
Sr (100)	100	N	N	N	1000	500	150	200	200
V (10)	30	L	30	300	50	50	100	70	20
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	20	N	N	10	L	15	10	15	10
Zn (200)	200	G10000	G10000	G10000	200	N	N	L	L
Zr (10)	100	L	30	70	30	150	150	150	300
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2756	2757	2758	2759	2760	2761	2762	2763	2764
Fe % (.05)	1.5	5	1	2	7	.5	5	1	3
Mg % (.02)	.07	1.5	.03	.02	.03	.07	.1	2	.1
Ca % (.05)	.07	3	5	1.5	.1	10	10	10	.15
Ti % (.002)	.05	.07	.003	.1	.07	.015	.07	.05	.3
Mn (10)	500	700	1000	150	50	500	G5000	700	50
Ag (.5)	1000	15	15	700	15	1.5	700	10	L
As (200)	N	N	N	1000	N	N	1000	N	N
Au (10)	N	N	N	20	N	N	N	N	N
B (10)	15	10	L	70	50	10	20	15	10
Ba (20)	1000	700	150	G5000	500	G5000	1000	G5000	1500
Be (1)	1	1	L	L	N	L	L	N	L
Bi (10)	200	L	N	150	20	N	N	N	N
Cd (20)	N	30	N	N	N	N	70	70	N
Co (5)	N	7	N	7	N	N	5	N	N
Cr (10)	15	20	N	L	15	20	15	20	20
Cu (5)	1000	100	70	G20000	700	100	10000	70	20
La (20)	N	N	N	20	N	N	L	N	30
Mo (5)	200	15	N	N	20	N	50	100	20
Nb (20)	N	N	N	N	N	N	N	N	L
Ni (5)	7	15	L	20	5	30	30	10	L
Pb (10)	2000	G20000	200	200	1500	50	20000	5000	70
Sb (100)	500	N	N	2000	500	150	700	N	N
Sc (5)	N	5	N	5	5	L	N	L	5
Sn (10)	N	N	N	300	N	N	N	N	N
Sr (100)	N	200	L	700	300	500	200	500	1500
V (10)	30	50	15	100	50	100	200	50	100
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	10	N	N	15	10	20	N	10
Zn (200)	700	10000	L	L	L	200	G10000	7000	N
Zr (10)	30	20	N	30	30	N	50	L	200
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

ement — Sample Number

	2765	2766	2767	2768	2769	2770	2771	2772	2773
Fe % (.05)	.3	.7	3	5	1	.5	.3	.7	1
Mg % (.02)	L	.05	.15	.07	.1	.07	L	.1	.03
Ca % (.05)	.05	.05	.05	.07	.1	L	.5	.05	L
Ti % (.002)	.03	.07	.07	.1	.07	.05	.005	.03	.01
Mn (10)	150	150	150	100	2000	70	50	50	30
Ag (.5)	15	500	700	100	150	30	50	500	1000
As (200)	N	N	1000	5000	N	N	N	N	300
Au (10)	N	15	15	50	N	N	N	N	N
B (10)	10	15	10	15	15	10	10	10	10
Ba (20)	500	200	300	700	200	150	200	200	150
Be (1)	1.5	3	2	1.5	7	3	3	1	1.5
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	N	N	L	N	N	N	N	N	N
Cr (10)	L	L	10	L	20	15	15	N	N
Cu (5)	20	7	100	20	30	100	150	50	30
La (20)	N	L	N	N	L	N	N	N	N
Mo (5)	5	N	100	50	30	20	15	70	10
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	7	L	10	10	7	5	10	5	10
Pb (10)	100	30	700	50	70	500	200	200	150
Sb (100)	N	200	500	700	N	N	N	N	N
Sc (5)	N	L	L	5	L	N	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	L	300	N	N	N	N	N
V (10)	20	20	70	70	30	50	L	30	15
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	15	N	L	N	N	N	N	L
Zn (200)	N	N	L	N	N	N	N	N	N
Zr (10)	20	50	70	50	30	30	N	20	10
Th (100)	N	N	N	N	N	N	N	N	N

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Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2774	2775	2776	2777	2778	2779	2780	2781	2782
Fe % (.05)	2	.3	2	.7	2	2	2	2	.7
Mg % (.02)	.07	L	.1	L	.07	.02	.02	.1	.02
Ca % (.05)	.05	L	L	L	.05	L	.05	L	L
Ti % (.002)	.2	.03	.05	.03	.2	.015	.03	.07	.02
Mn (10)	30	50	150	70	150	100	150	50	150
Ag (.5)	150	30	70	1500	15	1000	700	700	700
As (200)	700	N	L	700	700	200	700	300	L
Au (10)	N	N	N	N	N	10	L	10	N
B (10)	10	10	10	L	10	L	L	L	N
Ba (20)	200	L	150	200	500	100	200	100	70
Be (1)	1.5	2	1.5	1.5	3	3	3	2	2
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	N	N	N	N	N	N	N	N	N
Cr (10)	L	N	L	10	20	15	15	N	20
Cu (5)	30	L	20	150	20	20	30	70	70
La (20)	N	N	L	N	N	N	N	L	L
Mo (5)	200	N	50	20	70	15	50	30	100
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	15	7	5	5	30	7	7	15	10
Pb (10)	30	30	150	100	20	30	20	50	150
Sb (100)	N	N	L	700	N	200	150	200	200
Sc (5)	L	N	L	N	L	N	N	L	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	200	L	200	N	N	N	N	N	L
V (10)	70	L	30	L	50	15	15	30	15
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	10	N	N	N	N	10	20
Zn (200)	N	N	N	N	N	N	N	N	N
Zr (10)	30	30	50	15	30	N	N	30	15
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ement

Sample Number

	2783	2784	2785	2786	2787	2788	2789	2790	2791
Fe % (.05)	.7	.3	1.5	5	1	1.5	.7	.3	.2
Mg % (.02)	.05	.03	.05	.1	.03	.1	.03	.5	.3
Ca % (.05)	L	.05	.05	.05	L	.07	L	.7	.5
Ti % (.002)	.07	.03	.05	.07	.05	.07	.03	.03	.05
Mn (10)	100	50	150	150	100	70	100	70	100
Ag (.5)	3000	20	150	3	70	2	7	500	1000
As (200)	200	N	200	N	L	L	N	N	N
Au (10)	15	N	N	N	N	N	N	N	N
B (10)	L	L	10	15	15	20	L	N	N
Ba (20)	50	100	200	150	50	150	150	100	100
Be (1)	1.5	2	3	5	2	3	3	L	1
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	N	N	N	N	N	N	N	N	5
Cr (10)	10	N	N	L	N	15	N	10	15
Cu (5)	300	10	30	10	10	L	5	30	30
La (20)	L	L	N	N	L	L	N	N	N
Mo (5)	150	20	15	30	200	50	N	N	10
Nb (20)	N	N	N	L	N	N	N	N	N
Ni (5)	5	10	10	5	5	5	5	15	30
Pb (10)	150	30	30	30	30	50	15	70	50
Sb (100)	500	N	N	N	300	N	N	300	300
Sc (5)	N	N	N	N	N	N	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	N	N	N	N	N	N	N
V (10)	10	20	15	10	70	30	L	20	20
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	10	L	N	15	N	10	N	N	N
Zn (200)	700	N	N	N	N	N	N	N	N
Zr (10)	50	50	30	100	30	100	20	L	20
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ɜment

Sample Number

	2792	2793	2794	2795	2796	2797	2798	2799	2800
Fe %(.05)	3	5	2	1	1	1.5	2	.5	.7
Mg %(.02)	.15	.02	.07	.07	.05	.15	.1	.1	.1
Ca %(.05)	.05	.05	.1	.1	.1	.07	L	L	L
Ti %(.002)	.15	L	.1	.1	.07	.07	.07	.05	.07
Mn(10)	20	30	50	30	20	100	100	30	50
Ag(.5)	20	3	7	5	7	1	500	150	1000
As(200)	700	1000	1000	2000	300	N	N	N	N
Au(10)	N	N	N	N	N	N	N	N	L
B(10)	30	20	30	15	15	10	10	10	10
Ba(20)	500	L	5000	200	150	500	500	500	700
Be(1)	L	3	L	L	L	3	3	2	2
Bi(10)	N	N	N	N	N	N	N	N	N
Cd(20)	N	N	N	N	N	N	N	N	N
Co(5)	N	N	10	L	20	N	N	N	N
Cr(10)	30	20	10	L	10	N	15	15	N
Cu(5)	30	20	20	30	100	L	30	7	15
La(20)	20	L	30	30	100	20	L	L	L
Mo(5)	10	N	10	N	N	150	200	150	150
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	L	5	10	7	10	5	5	L	L
Pb(10)	50	N	30	30	30	30	100	30	30
Sb(100)	200	N	G10000	G10000	G10000	1500	700	500	150
Sc(5)	N	7	L	L	L	L	L	N	L
Sn(10)	N	N	N	N	N	N	N	N	N
Sr(100)	300	1500	300	300	N	L	N	N	N
V(10)	50	30	30	20	15	30	30	50	70
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	N	N	L	L	10	L	L	N	N
Zn(200)	N	N	N	N	N	N	N	N	N
Zr(10)	50	N	20	50	30	100	30	50	30
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	3066	3067	3068	3069	3070	3071	3072	3073	3074
Fe % (.05)	2	2	1	3	1	1.5	.7	3	1.5
Mg % (.02)	.05	.03	.07	.03	.1	.1	.07	.1	.1
Ca % (.05)	.2	.05	L	L	.2	.05	L	.1	.07
Ti % (.002)	.07	.1	.07	.07	.1	.1	.07	.2	.1
Mn (10)	300	30	50	100	200	70	30	100	30
Ag (.5)	5	7	2000	30	1.5	200	1500	500	500
As (200)	L	N	N	700	N	200	1500	200	700
Au (10)	N	N	15	N	N	N	N	N	N
B (10)	10	10	L	L	30	50	50	50	50
Ba (20)	1000	1500	500	700	500	700	300	300	500
Be (1)	2	1.5	1	L	1.5	3	2	1.5	1.5
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	N	N	N	N	N	N	N	7	N
Cr (10)	L	L	N	10	20	10	L	30	N
Cu (5)	7	5	7	15	5	20	30	150	20
La (20)	L	L	L	20	20	20	20	L	L
Mo (5)	5	L	200	50	20	15	20	100	50
Nb (20)	N	L	N	N	N	N	N	N	N
Ni (5)	7	5	7	L	10	L	7	20	20
Pb (10)	L	L	150	30	30	50	70	100	70
Sb (100)	L	L	700	L	N	N	500	100	100
Sc (5)	N	N	N	L	L	L	N	L	N
Sn (10)	N	N	N	N	N	N	N	15	N
Sr (100)	200	200	N	N	200	N	L	N	N
V (10)	70	30	30	20	50	30	15	50	15
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	N	L	10	15	L	N	N
Zn (200)	N	N	N	N	N	N	N	L	L
Zr (10)	30	150	30	50	50	150	150	150	100
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement

Sample Number

	3075	3076	3077	3078	3079	3080	3081	3082	3083
Fe %(.05)	5	1	1	2	3	.7	1.5	1.5	7
Mg %(.02)	.03	.1	.03	.03	.1	.07	.05	.1	.2
Ca %(.05)	.05	.05	L	L	.07	.1	.05	.05	5
Ti %(.002)	.05	.015	.03	.07	.1	.07	.05	.07	.3
Mn(10)	300	70	70	50	G5000	150	100	70	5000
Ag(.5)	700	1000	1500	700	15	7	5	70	1500
As(200)	300	L	N	200	N	N	N	700	7000
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	15	15	10	10	15	15	20	30	L
Ba(20)	300	300	300	1000	1000	300	300	700	150
Be(1)	2	2	1.5	1	5	7	5	1.5	L
Bi(10)	N	N	N	N	N	N	N	N	N
Cd(20)	N	N	N	N	N	N	N	N	150
Co(5)	N	N	N	N	70	N	N	N	10
Cr(10)	L	N	N	N	10	10	10	L	N
Cu(5)	20	30	30	30	7	5	7	15	5000
La(20)	L	N	N	20	20	L	20	20	L
Mo(5)	5	15	7	5	N	N	20	15	N
Nb(20)	N	N	N	N	N	N	N	N	L
Ni(5)	L	7	5	5	7	10	10	5	10
Pb(10)	2000	700	200	3000	30	20	30	30	20000
Sb(100)	L	700	300	N	N	N	N	N	L
Sc(5)	N	N	N	L	N	N	N	L	L
Sn(10)	N	N	N	N	N	N	N	N	200
Sr(100)	200	N	N	200	150	100	200	N	500
V(10)	30	20	15	15	70	20	30	20	50
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	N	N	L	L	20	N	N	10	15
Zn(200)	L	N	L	N	L	N	N	N	G10000
Zr(10)	30	15	20	150	150	30	30	50	150
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	3093	3094	3095	3096	3097	3098	3099	3100	3101
Fe %(.05)	.3	.1	1.5	3	5	2	.7	.7	1
Mg %(.02)	7	7	5	3	2	1	L	.05	.03
Ca %(.05)	15	20	20	20	20	.15	.15	.15	.5
Ti %(.002)	.03	.01	.01	.07	.05	.15	.05	.03	.03
Mn(10)	200	500	500	1000	5000	70	30	20	70
Ag(.5)	300	1500	70	.7	70	700	.7	20	7
As(200)	N	N	200	N	1500	1500	500	1000	2000
Au(10)	N	N	N	N	N	N	N	N	N
B(10)	50	30	N	N	30	30	N	30	30
Ba(20)	L	20	L	70	300	100	150	150	1000
Be(1)	N	N	1.5	2	1	L	1	1.5	3
Bi(10)	N	N	N	N	50	N	N	N	N
Cd(20)	N	150	N	N	200	N	N	N	N
Co(5)	N	N	N	N	20	N	15	70	50
Cr(10)	10	L	10	15	15	20	N	L	L
Cu(5)	70	150	30	7	500	700	20	100	20
La(20)	N	N	N	L	L	N	30	30	50
Mo(5)	N	N	N	L	N	5	10	10	30
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	10	L	20	5	50	15	10	10	15
Pb(10)	100	200	30	70	10000	150	20	30	100
Sb(100)	200	500	200	N	300	300	G10000	G10000	G10000
Sc(5)	N	N	L	5	L	L	N	N	N
Sn(10)	N	20	N	N	10	N	N	N	N
Sr(100)	N	N	200	1000	300	N	L	N	N
V(10)	20	15	30	50	30	50	20	15	10
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	N	N	20	30	15	L	N	15	30
Zn(200)	300	1500	N	N	7000	N	N	L	200
Zr(10)	L	L	10	20	30	70	15	15	30
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

ement — Sample Number

	3102	3103	3104	3105	3106	3107	3108	3109	3110
Fe % (.05)	5	2	2	.5	3	3	5	1.5	3
Mg % (.02)	3	.15	.07	.07	1.5	2	.03	.02	L
Ca % (.05)	7	.05	L	1.5	10	15	L	L	L
Ti % (.002)	.05	.15	.1	.015	.03	.15	.007	.005	.002
Mn (10)	1500	70	50	50	5000	5000	70	20	15
Ag (.5)	5	15	20	100	10	L	1000	100	200
As (200)	3000	N	N	N	N	N	N	N	N
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	50	10	15	10	N	15	L	10	10
Ba (20)	150	300	150	70	300	300	100	100	N
Be (1)	10	L	L	N	30	20	7	L	L
Bi (10)	N	20	15	30	150	N	1000	200	200
Cd (20)	N	30	N	200	G500	N	N	N	N
Co (5)	N	10	N	N	15	L	N	N	N
Cr (10)	30	20	30	20	20	15	15	15	15
Cu (5)	15	70	150	30	100	15	150	70	100
La (20)	L	20	N	L	N	N	N	N	N
Mo (5)	15	N	N	N	20	N	N	10	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	20	7	7	7	5	10	7	L	L
Pb (10)	20	G20000	G20000	G20000	200	150	15000	G20000	5000
Sb (100)	1500	500	200	200	N	1000	N	N	N
Sc (5)	L	L	L	N	N	L	5	N	N
Sn (10)	15	N	N	N	30	20	N	N	N
Sr (100)	1000	N	N	300	N	300	N	N	N
V (10)	70	30	30	L	50	50	15	10	L
W (50)	N	N	N	N	200	700	N	N	L
Y (10)	20	20	10	N	10	10	N	N	N
Zn (200)	300.	10000	300	10000	G10000	500	2000	1500	1000
Zr (10)	50	150	150	L	10	30	N	L	L
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	3111	3112	3113	3114	3115	3116	3117	3118	3119
Fe %(.05)	2	2	3	2	5	1.5	1.5	2	.7
Mg %(.02)	L	.02	.1	.02	L	.15	.15	.7	.07
Ca %(.05)	N	L	7	.07	.15	5	7	5	7
Ti %(.002)	N	.03	.01	.01	.007	.05	.03	.3	.01
Mn(10)	L	10	50	15	10	150	150	200	150
Ag(.5)	10	30	10	50	150	2	2	L	N
As(200)	N	300	500	200	G10000	300	N	N	N
Au(10)	N	20	N	10	L	N	N	N	N
B(10)	L	N	L	N	N	N	N	L	L
Ba(20)	100	50	50	70	70	20	1000	150	500
Be(1)	N	1	1	1	N	1	1	3	1
Bi(10)	150	70	30	150	50	N	N	N	N
Cd(20)	N	N	N	N	N	N	N	N	N
Co(5)	N	N	N	N	N	L	N	10	N
Cr(10)	15	10	10	10	10	20	20	70	N
Cu(5)	30	15	20	15	200	30	15	20	L
La(20)	N	N	N	N	N	L	L	L	N
Mo(5)	N	50	30	30	N	5	20	N	20
Nb(20)	N	N	N	N	N	N	N	N	N
Ni(5)	L	7	7	7	10	20	10	30	7
Pb(10)	70	500	300	700	G20000	300	70	30	20
Sb(100)	N	N	N	N	150	N	N	N	N
Sc(5)	N	N	N	N	N	N	N	7	N
Sn(10)	N	N	N	N	150	N	N	N	N
Sr(100)	N	N	200	N	200	N	N	100	L
V(10)	L	150	100	150	10	50	70	70	30
W(50)	N	N	N	N	N	N	N	N	N
Y(10)	N	N	N	N	N	N	N	15	N
Zn(200)	N	300	500	500	700	N	N	N	N
Zr(10)	N	10	10	15	N	15	10	30	N
Th(100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element	Sample Number								
	3120	3121	3122	3123	3124	3125	3126	3127	3128
Fe % (.05)	.7	.5	.7	5	3	1.5	3	1.5	1
Mg % (.02)	.15	.15	.1	.3	.03	3	.1	.07	.03
Ca % (.05)	15	10	.15	.7	.05	10	5	.05	L
Ti % (.002)	.02	L	.05	.007	L	N	.003	.05	.07
Mn (10)	100	150	30	500	15	1000	G5000	1000	50
Ag (.5)	10	L	N	700	700	150	1000	5	5
As (200)	N	N	N	G10000	10000	7000	N	1500	300
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	N	N	15	N	N	N	N	20	10
Ba (20)	L	L	30	L	L	N	N	200	1500
Be (1)	N	L	1.5	N	N	L	N	1	1
Bi (10)	30	N	N	L	N	N	N	N	N
Cd (20)	N	N	N	G500	N	G500	100	N	N
Co (5)	N	N	N	N	N	7	N	N	N
Cr (10)	10	10	10	L	N	N	N	N	L
Cu (5)	200	20	7	70	700	5000	50	15	10
La (20)	N	L	L	N	L	N	20	L	20
Mo (5)	L	N	N	15	20	15	L	L	15
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	10	L	5	15	L	L	5	5	5
Pb (10)	150	10	10	G20000	G20000	G20000	20000	150	50
Sb (100)	N	N	N	1500	2000	300	100	100	5000
Sc (5)	N	N	N	N	N	N	N	L	N
Sn (10)	N	N	N	150	G1000	70	100	N	N
Sr (100)	700	L	N	N	N	N	300	N	N
V (10)	50	20	20	L	200	200	50	10	20
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	N	N	N	N	N	N	L
Zn (200)	N	N	N	G10000	2000	G10000	5000	N	N
Zr (10)	N	N	50	N	N	N	N	30	70
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	3129	3130	3131	3132	3133	3134	3135	3136	3137
Fe % (.05)	.5	1.5	1.5	3	2	.7	1	3	1.5
Mg % (.02)	.07	.05	.1	.7	.7	.02	.05	.1	.3
Ca % (.05)	L	.1	.15	10	7	L	L	.5	.05
Ti % (.002)	.05	L	.003	.05	.1	.05	.07	.07	.1
Mn (10)	500	100	200	5000	1000	30	20	200	70
Ag (.5)	500	15	500	N	N	2	15	5	7
As (200)	N	N	N	N	N	L	300	N	500
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	L	20	30	N	20	L	10	15	G2000
Ba (20)	2000	70	150	70	300	500	500	1000	150
Be (1)	2	1.5	2	5	5	5	1.5	2	L
Bi (10)	N	50	500	N	L	N	N	N	N
Cd (20)	N	150	150	N	N	N	N	N	N
Co (5)	N	N	L	10	10	N	N	N	N
Cr (10)	N	N	N	20	30	10	N	15	100
Cu (5)	30	50	150	15	70	L	10	20	30
La (20)	L	N	N	N	20	N	L	L	N
Mo (5)	70	N	N	50	20	L	N	10	L
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	L	15	20	L	L	L	L
Pb (10)	200	2000	G20000	200	70	30	50	30	150
Sb (100)	150	N	L	N	N	100	L	N	100
Sc (5)	N	N	N	N	7	N	L	N	5
Sn (10)	N	N	N	30	N	N	N	N	L
Sr (100)	N	N	N	N	500	N	N	N	N
V (10)	30	L	L	200	70	15	30	20	70
W (50)	N	N	N	150	N	N	N	N	N
Y (10)	N	N	L	15	20	N	L	N	L
Zn (200)	700	3000	3000	L	N	N	N	N	N
Zr (10)	30	10	N	20	100	20	150	30	50
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement	Sample Number								
	3138	3139	3140	3141	3142	3143	3144	3145	3146
Fe % (.05)	2.	3	3	2	3	1.5	1	3	2
Mg % (.02)	.02	.1	.7	.03	.3	.3	.7	.5	.2
Ca % (.05)	.15	.07	10	15	.7	7	20	.15	.07
Ti % (.002)	.005	.05	.07	L	.1	.05	.05	.2	.1
Mn (10)	150	700	1000	300	150	1500	700	200	150
Ag (.5)	1500	2000	3	500	7	2000	10	5	20
As (200)	G10000	1000	5000	7000	500	L	N	N	N
Au (10)	L	L	N	N	N	N	N	N	N
B (10)	150	500	70	30	70	20	15	70	50
Ba (20)	150	150	2000	L	700	20	20	300	1000
Be (1)	N	L	L	N	L	L	N	N	1
Bi (10)	20	70	N	20	N	N	N	N	N
Cd (20)	500	L	N	300	N	200	N	N	N
Co (5)	7	7	N	N	L	N	N	10	L
Cr (10)	30	70	50	15	150	20	30	100	70
Cu (5)	2000	2000	70	700	500	700	20	30	20
La (20)	20	L	N	N	N	L	N	L	N
Mo (5)	20	70	N	N	L	20	L	150	100
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	10	15	15	5	30	10	7	20	15
Pb (10)	G20000	G20000	200	G20000	500	7000	100	150	100
Sb (100)	G10000	3000	150	500	N	500	N	L	L
Sc (5)	L	N	L	N	5	N	N	7	7
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	100	300	N	200	200	500	200	200
V (10)	70	50	50	L	70	50	30	100	150
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	L	15	N	15	N	L	10	10
Zn (200)	N	L	N	10000	L	5000	N	200	N
Zr (10)	L	20	30	N	100	15	10	70	50
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

ement — Sample Number

	3147	3148	3149	3150	3151	3152	3153	3154	3155
Fe % (.05)	.5	.7	.5	1	1.5	1.5	.7	2	5
Mg % (.02)	.07	.15	.07	.15	.1	.07	.07	.07	.1
Ca % (.05)	.05	.05	.07	L	.05	.1	.07	.07	L
Ti % (.002)	.05	.02	.015	.05	.07	.05	.05	.05	.05
Mn (10)	100	500	500	300	70	500	70	200	100
Ag (.5)	700	2000	3000	700	200	15	3	2	2
As (200)	N	200	N	N	700	1500	N	L	300
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	30	30	30	50	30	10	30	20	15
Ba (20)	50	300	300	300	700	200	200	70	700
Be (1)	1	N	N	N	L	1	1	1.5	1
Bi (10)	N	L	N	N	N	N	N	N	N
Cd (20)	N	70	50	300	N	N	N	N	N
Co (5)	L	N	N	5	N	N	N	N	N
Cr (10)	10	15	15	20	15	10	L	L	L
Cu (5)	30	1500	200	500	30	30	L	7	30
La (20)	N	N	N	L	N	L	L	N	N
Mo (5)	30	N	30	30	10	15	70	5	L
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	5	5	5	7	L	5	5	5	L
Pb (10)	150	3000	3000	7000	150	70	30	15	30
Sb (100)	200	1500	1500	300	150	100	N	N	N
Sc (5)	L	N	N	N	N	N	N	N	L
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	N	N	N	L	N	N	N	300
V (10)	70	300	200	150	20	20	15	15	20
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	N	N	L	L	N	N	N
Zn (200)	N	700	500	G10000	N	N	N	N	N
Zr (10)	30	10	L	15	50	30	150	30	50
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	3156	3157	3158	3159	3160	3161	3162	3163	3164
Fe % (.05)	.7	1	1.5	.5	.7	.7	.5	3	3
Mg % (.02)	.2	.1	.2	.1	.07	.1	.03	.3	.15
Ca % (.05)	.3	.1	.3	.05	.05	.05	.05	.07	.05
Ti % (.002)	.03	.07	.15	.07	.07	.07	.03	.07	.07
Mn (10)	2000	200	500	150	150	150	30	150	30
Ag (.5)	300	500	20	70	50	30	100	15	20
As (200)	N	N	500	N	N	N	N	300	300
Au (10)	N	N	N	N	N	15	20	N	N
B (10)	10	15	15	L	10	10	15	2000	2000
Ba (20)	300	200	700	500	700	500	500	150	100
Be (1)	1.5	2	2	2	2	3	1.5	2	1.5
Bi (10)	N	N	N	N	N	N	N	15	L
Cd (20)	N	N	N	N	N	N	N	N	N
Co (5)	N	N	L	N	N	N	N	50	10
Cr (10)	N	10	20	N	L	N	N	10	20
Cu (5)	100	100	70	7	5	10	10	3000	700
La (20)	N	L	L	20	20	20	L	L	L
Mo (5)	50	70	30	N	15	N	N	N	50
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	L	5	L	L	L	L	7	10
Pb (10)	700	500	150	20	30	20	30	50	500
Sb (100)	N	1	N	N	N	N	L	300	N
Sc (5)	N	N	L	L	N	N	N	5	5
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	N	L	L	100	150	L	N	100	N
V (10)	10	20	50	15	20	15	15	70	100
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	N	N	L	L	10	50	N	L	L
Zn (200)	700	500	200	N	N	N	N	N	N
Zr (10)	30	30	100	50	50	50	20	L	20
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	3165	3166	3167	3168	3169	3170	3171	3172	3173
Fe % (.05)	2	7	.7	5	1	.7	.5	G20	5
Mg % (.02)	.5	.2	.07	.15	.15	.15	.05	.7	2
Ca % (.05)	3	.2	L	.15	L	L	L	1.5	.7
Ti % (.002)	.07	.15	.03	.1	.03	.07	.01	.015	L
Mn (10)	500	150	10	150	5	30	30	150	3000
Ag (.5)	20	15	1500	150	5	15	700	.5	150
As (200)	300	1500	1500	1000	7000	N	N	N	1000
Au (10)	L	N	N	N	15	N	N	N	N
B (10)	30	20	30	100	30	30	30	N	N
Ba (20)	500	2	1	100	300	L	500	N	L
Be (1)	2	2000	500	2	2	1.5	N	N	N
Bi (10)	N	N	N	N	N	N	N	N	N
Cd (20)	N	N	N	N	N	N	N	N	G500
Co (5)	5	15	N	50	N	N	N	70	N
Cr (10)	15	20	L	15	L	N	15	15	N
Cu (5)	700	70	300	300	15	20	3000	150	500
La (20)	L	N	L	N	20	L	N	N	N
Mo (5)	150	7	20	15	50	L	N	N	N
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	L	15	L	50	L	L	30	30	N
Pb (10)	20	20	500	150	20	30	2000	30	G20000
Sb (100)	700	N	700	200	150	100	100	N	L
Sc (5)	L	7	L	5	N	L	N	N	N
Sn (10)	N	N	N	N	N	N	N	N	N
Sr (100)	100	150	N	N	N	N	L	N	L
V (10)	50	70	15	50	20	70	200	100	10
W (50)	N	N	N	N	N	N	N	N	N
Y (10)	10	20	L	10	15	N	N	L	N
Zn (200)	N	500	N	700	N	N	N	N	G10000
Zr (10)	20	30	15	30	50	30	N	N	N
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
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Semi-Quantitative Spectrographic Analysis

lement	Sample Number								
	3174	3175	3176	3177	3178	3179	3180	3181	3182
Fe % (.05)	3	3	3	1	.7	3	3	.7	.5
Mg % (.02)	.7	.15	.1	.15	.1	.15	.15	.07	.15
Ca % (.05)	.07	.7	L	.07	L	.07	.7	.2	L
Ti % (.002)	.3	.07	.003	.1	.15	.07	.07	.015	.05
Mn (10)	150	300	70	300	30	150	200	150	200
Ag (.5)	20	700	500	10	15	100	100	3000	1500
As (200)	300	5000	500	N	200	500	500	N	N
Au (10)	N	N	N	N	N	N	N	15	50
B (10)	G2000	30	20	50	20	30	30	L	L
Ba (20)	1500	70	L	5000	1000	3000	2000	300	300
Be (1)	2	L	L	1.5	L	1	L	L	1.5
Bi (10)	N	20	150	30	N	N	N	10	N
Cd (20)	N	L	N	N	N	50	N	30	20
Co (5)	N	N	N	N	N	5	N	N	N
Cr (10)	50	20	20	10	10	50	30	N	N
Cu (5)	150	3000	700	50	15	700	700	700	150
La (20)	L	L	N	L	20	N	N	N	N
Mo (5)	70	500	200	N	50	10	300	10	30
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	7	5	5	5	L	30	30	L	L
Pb (10)	3000	G20000	G20000	500	100	10000	10000	5000	700
Sb (100)	L	300	L	N	N	100	300	N	700
Sc (5)	10	N	N	L	N	N	5	N	N
Sn (10)	N	N	N	N	N	20	10	N	N
Sr (100)	200	700	N	200	N	500	200	N	N
V (10)	70	20	20	30	30	100	50	15	30
W (50)	N	70	70	N	N	N	N	N	N
Y (10)	15	N	N	N	L	L	L	N	N
Zn (200)	2000	5000	1500	N	N	3000	1000	5000	1500
Zr (10)	70	20	L	30	100	30	30	30	30
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement

Sample Number

	3183	3184	3185	3186	3187				
Fe % (.05)	.3	.05	.05	L	.7				
Mg % (.02)	.03	7	7	7	.15				
Ca % (.05)	.15	15	15	15	.15				
Ti % (.002)	L	L	.003	.003	.07				
Mn (10)	30	700	700	1000	70				
Ag (.5)	3000	5000	G5000	5000	700				
As (200)	1000	N	N	N	N				
Au (10)	N	N	N	N	N				
B (10)	10	30	15	N	15				
Ba (20)	L	N	N	N	300				
Be (1)	N	N	N	N	2				
Bi (10)	N	N	N	N	N				
Cd (20)	N	300	100	N	N				
Co (5)	N	N	N	N	N				
Cr (10)	L	10	10	15	L				
Cu (5)	1000	3000	700	300	20				
La (20)	N	N	N	L	L				
Mo (5)	200	N	N	N	20				
Nb (20)	N	N	N	N	N				
Ni (5)	L	N	N	N	5				
Pb (10)	G20000	3000	2000	200	70				
Sb (100)	500	3000	1500	700	200				
Sc (5)	N	N	N	N	N				
Sn (10)	N	100	N	N	N				
Sr (100)	N	N	N	N	N				
V (10)	700	30	30	30	20				
W (50)	L	N	N	N	N				
Y (10)	N	N	N	N	N				
Zn (200)	10000	200	N	N	N				
Zr (10)	N	N	N	N	20				
Th (100)	N	N	N	N	N				

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

lement

Sample Number

	3201	3202	3203	3204	3205	3206	3207	3208
Fe % (.05)	3	.7	.5	.7	L	.3	5	7
Mg % (.02)	1.5	.1	.07	.07	N	.05	.1	.7
Ca % (.05)	10	.07	.2	L	N	.15	.15	10
Ti % (.002)	.3	.07	.03	.05	.05	.02	.07	.1
Mn (10)	G5000	150	3000	300	L	500	200	5000
Ag (.5)	100	7	7	15	3	15	5	N
As (200)	N	N	N	N	N	N	700	N
Au (10)	N	N	N	N	N	N	N	N
B (10)	N	70	30	70	L	20	1000	N
Ba (20)	300	700	1500	2000	G5000	1500	2000	3000
Be (1)	L	7	5	7	2	5	1	15
Bi (10)	150	N	10	L	N	N	N	N
Cd (20)	G500	N	N	N	N	N	N	N
Co (5)	70	N	N	N	N	N	7	15
Cr (10)	150	N	10	10	N	L	30	50
Cu (5)	30	30	15	50	20	20	30	20
La (20)	L	N	20	20	L	N	N	N
Mo (5)	30	20	5	150	10	N	30	150
Nb (20)	N	N	N	N	N	N	N	N
Ni (5)	30	L	N	N	L	L	150	20
Pb (10)	G20000	150	100	100	15	30	50	20
Sb (100)	N	N	N	N	N	N	150	N
Sc (5)	7	N	N	N	N	L	L	L
Sn (10)	N	N	N	50	N	N	N	30
Sr (100)	500	N	200	200	1500	N	200	200
V (10)	70	10	10	30	L	10	150	100
W (50)	150	N	700	L	N	N	N	150
Y (10)	15	N	N	N	N	N	15	15
Zn (200)	G10000	300	N	1000	200	N	700	200
Zr (10)	200	30	30	30	50	L	30	30
Th (100)	N	N	N	N	N	N	N	N

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Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
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Semi-Quantitative Spectrographic Analysis

Element — Sample Number

	3215	3216	3217	3218					
Fe % (.05)	3	.7	3	2					
Mg % (.02)	.5	.2	.7	.5					
Ca % (.05)	.15	3	.15	.15					
Ti % (.002)	.5	.15	.7	.7					
Mn (10)	300	150	200	200					
Ag (.5)	5	3	3	L					
As (200)	1000	N	N	200					
Au (10)	L	N	N	N					
B (10)	30	10	20	15					
Ba (20)	300	2000	1000	500					
Be (1)	1.5	3	3	3					
Bi (10)	N	N	N	N					
Cd (20)	N	N	N	N					
Co (5)	1.5	N	15	7					
Cr (10)	50	20	100	50					
Cu (5)	30	15	30	15					
La (20)	20	L	20	20					
Mo (5)	N	7	N	N					
Nb (20)	N	N	N	N					
Ni (5)	20	5	20	15					
Pb (10)	30	15	20	15					
Sb (100)	N	N	N	N					
Sc (5)	7	L	7	7					
Sn (10)	N	N	N	N					
Sr (100)	N	N	N	N					
V (10)	100	30	70	70					
W (50)	N	N	N	N					
Y (10)	15	15	20	20					
Zn (200)	L	N	N	N					
Zr (10)	150	20	200	300					
Th (100)	N	N	N	N					

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

NEVADA BUREAU OF MINES AND GEOLOGY

** Geochemical Laboratory **

University of Nevada-Reno
Reno, Nevada 89557-0088
(702) 784-6691

CLIENT: Joe Tingley

Analytical Report

DATE: 17Nov85

2012:

Au(Oz/Ton)	Ag(Oz/Ton)
0.040	0.27

2013:

Au(Oz/Ton)	Ag(Oz/Ton)
0.728	2.39

2014

Au(Oz/Ton)	Ag(Oz/Ton)
0.186	0.40

2015:

Au(Oz/Ton)	Ag(Oz/Ton)
0.024	0.166

P. Lechler

Paul J. Lechler
Chief Chemist/Geochemist

Atomic-Adsorbtion Analysis

Element — Sample Number

	288	289	290	291	292	293	298	299	
As (5)	60	G(200)	G(200)	30	L(5)	N(5)	N(5)	N(5)	
Au (.05)	N(.05)	.80	2.50	.05	N(.05)	1.80	N(.05)	N(.05)	
Sb (1)	3	340	330	7	N(1)	4	N(1)	N(1)	
Zn (5)	640	350	1100	35	50	7800			

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element	Sample Number								
	425	426	427		441		529	530	
As (5)	15	N(5)	120		35		5	N	
Au (.05)	H	L(.05)	.05				N(.05)	N(.05)	
Sb (1)	G(4000)	20	680		19		N(1)	N	
Zn (5)	60	1600	G(2000)		G200		370	5	

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ement	Sample Number								
	607	608	609		630	631		774	775
As (5)	N(5)	60	25		N(5)	740		25	45
Au (.05)	N(.05)	N(.05)	N(.05)		N(.05)	N(.05)		N(.05)	L(.05)
Sb (1)	N(1)	5	5		30	62		10	120
Zn (5)	40	340	680		30	800		65	85

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element	Sample Number								
	776	777A	777B	778		849	850	851A	851B
As (5)	N(5)	65	270	1100		1800	G2000	G2000	G200
Au (.05)	.15	.40	L(.05)	1.2		.10	N	H	.20
Sb (1)	21	80	8	240		G(4000)	G1000	G1000	13
Zn (5)	35	55	120	2600		G(4000)	G2000	G2000	G200
Au Sw							10.00 g	10.00 g	

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement	Sample Number								
	1106	1230	1281		1471		1768	1769	1770
As (5)	10	180	420		750		N(5)	10	N(5)
Au (.05)	N(.05)	.05	.05		.15		.05	L(.05)	L(.05)
Sb (1)	1	8	30		50		N(2)	L(2)	L(.05)
Zn (5)	20	15	200				L(5)	10	N(5)
Au wT			10		10				

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element	Sample Number								
	1472	1473							
As (5)	270	50							
Au (.05)	1.05	1.5							
Sb (1)	1000	180							
Zn (5)	90	45							
Hg	G10	G10							

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

:lement | Sample Number

	1780	1781	1782	1783	1784		1996	1997	
As (5)	20	55	310	G2000	G2000		10	L(5)	
Au (.05)	.05	.10	.05	2.6	1.3		L(.05)	N(.05)	
Sb (1)	2.0	8.0	18	G1000	140		2.0	N(2)	
Zn (5)	10	20	35	G2000	1600		30	5.0	

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	1771	1772	1773	1774	1775	1776	1777	1778	1779
As (5)	15	10	10	25	15	15	210	L(5)	N(5)
Au (.05)	N(.05)	N(.05)	L(.05)	.05	L(.05)	N(.05)	L(.05)	.05	.10
Sb (1)	2.0	L(2)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Zn (5)	15	10	40	10	5.0	L(5)	5.0	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

lement

Sample Number

	2012	2013	2014	2015	2016	2017	2018	2019	2020
As (5)	130	530	300	150	300	90	140	430	80
Au (.05)	2.0	150	3.7	75	N(.05)	.65	6.8	4.9	.70
Sb (1)	8	8	4	N(2)	2	680	310	G1000	100
Zn (5)	10	30	30	20	10	1100	G2000	G2000	G2000

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado

All elements reported in ppm.

Lower limits of determination are in parentheses.

G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

lement — Sample Number

	2225	2226	2227	2228	2229	2230	2231	2232	2233
Fe % (.05)	20	.3	1	5	3	.5	.7	1.5	5
Mg % (.02)	.3	.5	.1	.07	.1	2	.7	.7	.5
Ca % (.05)	.07	10	1.5	.2	.05	15	10	.7	1.5
Ti % (.002)	.01	.01	.05	.002	.2	.03	.015	.2	L
Mn (10)	150	100	100	100	70	100	150	300	500
Ag (.5)	1	1000	500	200	10	1	30	20	50
As (200)	1000	1000	2000	2000	300	N	N	300	500
Au (10)	N	N	N	N	N	N	N	N	N
B (10)	30	300	50	150	150	70	100	20	15
Ba (20)	100	30	300	500	500	N	20	300	L
Be (1)	N	N	N	N	L	1	L	7	5
Bi (10)	15	150	150	200	15	N	150	150	N
Cd (20)	N	500	70	50	N	L	100	L	L
Co (5)	N	N	15	7	5	N	N	15	70
Cr (10)	20	10	20	L	10	N	15	20	10
Cu (5)	300	15000	G20000	20000	700	50	3000	10000	20000
La (20)	N	20	30	20	N	L	20	N	N
Mo (5)	30	N	N	N	N	N	N	150	200
Nb (20)	N	N	N	N	N	N	N	N	N
Ni (5)	15	L	10	15	L	L	L	15	10
Pb (10)	30	150	70	200	150	20	150	200	30
Sb (100)	N	5000	G10000	10000	700	L	700	700	1000
Sc (5)	N	N	N	N	5	L	N	7	N
Sn (10)	N	N	N	70	N	N	N	10	N
Sr (100)	N	200	N	N	N	300	500	N	N
V (10)	20	30	20	10	200	10	10	20	100
W (50)	N	N	N	N	N	50	N	N	100
Y (10)	N	N	N	N	L	10	N	20	N
Zn (200)	200	1000	1000	700	N	N	N	500	700
Zr (10)	N	N	30	N	30	70	N	70	N
Th (100)	N	N	N	N	N	N	N	N	N

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Semi-Quantitative Spectrographic Analysis

lement	Sample Number								
	2393	2394	2395	2396	2397	2398	2399	2400	
Fe % (.05)	1.5	1	1.5	1.5	.7	2	1	3	
Mg % (.02)	.2	.07	.2	.07	.2	1	.15	.1	
Ca % (.05)	.05	L	.1	.2	15	10	1.5	.05	
Ti % (.002)	.15	.07	.15	.1	.015	.2	.07	.02	
Mn (10)	500	30	150	150	100	700	700	300	
Ag (.5)	2000	700	15	2	2000	5	7	30	
As (200)	10000	200	N	N	1500	N	N	700	
Au (10)	N	15	N	N	N	N	N	N	
B (10)	20	15	20	20	700	20	10	300	
Ba (20)	300	300	1000	500	20	30	300	100	
Be (1)	2	1.5	3	1	N	100	10	1	
Bi (10)	N	N	N	N	200	70	500	200	
Cd (20)	N	N	N	N	G500	N	N	70	
Co (5)	N	N	N	N	N	10	N	N	
Cr (10)	10	10	10	10	N	30	N	N	
Cu (5)	30	30	15	5	20000	50	50	700	
La (20)	L	L	L	L	20	L	N	N	
Mo (5)	30	30	10	N	N	20	N	20	
Nb (20)	L	L	L	N	N	N	N	N	
Ni (5)	L	L	L	L	L	20	L	L	
Pb (10)	700	1000	70	30	700	30	150	7000	
Sb (100)	500	L	N	N	7000	N	N	N	
Sc (5)	L	N	L	L	N	10	N	L	
Sn (10)	N	N	N	N	N	10	N	N	
Sr (100)	N	N	L	N	N	300	200	N	
V (10)	30	20	50	30	L	100	20	15	
W (50)	N	N	N	N	N	100	100	N	
Y (10)	10	L	10	N	N	20	15	N	
Zn (200)	N	N	N	N	2000	N	N	1500	
Zr (10)	70	50	70	150	10	50	20	10	
Th (100)	N	N	N	N	N	N	N	N	

Analysis by Branch Exploration Research, U.S. Geol. Survey, Denver, Colorado
Fe, Mg, Ti reported in %, all other elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

ement	Sample Number								
	2576								
As (5)	N(10)								
Au (.05)	N(.05)								
Sb (1)	L(2)								
Zn (5)	N(5)								

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection

Atomic-Adsorbtion Analysis

Element — Sample Number

	2683	2684	2685	2686	2687	2688	2689	2690	2691
As (5)	840	G2000	G2000	250	280	620	100	350	1400
Au (.05)	.70	2.1	N(.05)	.30	.55	.10	.40	N(.05)	.10
Sb (1)	150	290	N(2)	N(2)	100	360	G1000	230	G1000
Zn (5)	10	1000	G2000	G2000	330	35	5	20	2000
Sw								10	

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. — not detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2692	2693	2694	2695	2696	2697	2698	2699	2700
As (5)	900	650	40	10	30	60	150	80	480
Au (.05)	.25	.50	N(.05)	N(.05)	N(.05)	.30	1.7	.50	7.0
Sb (1)	G1000	390	90	14	10	8	62	20	20
Zn (5)	20	1200	70	15	30	25	45	20	30

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	2729	2730	2731	2732	2733	2734	2735	2736	2737
As (5)	260	170	85	70	30	160	60	130	380
Au (.05)	.50	.50	10	.55	.20	L(.05)	.10	L(.05)	.05
Sb (1)	440	36	74	2	N(2)	970	140	G1000	520
Zn (5)	N(5)	5	5	40	15	200	80	250	2000
Sw									10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	2738	2739	2740	2741	2742	2743	2744	2745	2746
As (5)	160	100	90	100	980	G2000	G2000	280	500
Au (.05)	L(.05)	N(.05)	.15	N(.05)	.10	.35	.15	N(.05)	L(.05)
Sb (1)	150	66	44	80	16	G1000	G1000	66	70
Zn (5)	200	330	5	85	45	430	670	15	N(5)

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element	Sample Number								
	2747	2748							
As (5)	110	2000							
Au (.05)	N(.05)	6.1							
Sb (1)	4	720							
Zn (5)	140	G2000							

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. [illegible] detected, but below [illegible]

Atomic-Adsorbtion Analysis

Element — Sample Number

	2749	2750	2751	2752	2753	2754	2755	2756	2757
As (5)	G2000	G2000	220	100	80	60	20	50	50
Au (.05)	3.5	.40	.15	.15	1.3	150	L(.05)	.6	L(.05)
Sb (1)	300	550	6	4	2	2	2	180	16
Zn (5)	G2000	G2000	240	10	10	65	20	1800	G2000
Au(Sw)	10	10	10	10	10	10	10		

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2758	2759	2760	2761	2762	2763	2764	2765	2766
As (5)	30	1100	60	140	800	35	30	30	60
Au (.05)	N(.05)	16	.2	.05	1.0	N	N	2.4	23
Sb (1)	4	G2000	250	18	700	4	N(2)	6	70
Zn (5)	280	45	120	200	G2000	G2000	90	25	30

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2767	2768	2769	2770	2771	2772	2773	2774	2775
As (5)	800	G2000	60	20	N(107)	50	190	690	90
Au (.05)	25	6.4	.45	2.8	.7	.5	.85	3.4	.05
Sb (1)	160	320	32	14	20	6	16	18	10
Zn (5)	110	30	35	40	50	30	20	40	15

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. < — detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2776	2777	2778	2779	2780	2781	2782	2783	2784
As (5)	150	830	580	200	760	450	200	230	90
Au (.05)	.80	.50	.20	20	3.5	2.6	.75	7.8	.20
Sb (1)	42	450	8	120	42	190	130	530	8
Zn (5)	5	30	5	55	N(5)	5	55	240	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.

Atomic-Adsorbtion Analysis

Element — Sample Number

	2785	2786	2787	2788	2789	2790	2791	2792	2793
As (5)	130	140	150	140	130	30	20	690	1700
Au (.05)	1.0	1.7	N(.05)	L(.05)	.05	.10	.10	.20	N(.05)
Sb (1)	8	4	200	2	6	200	180	140	28
Zn (5)	20	15	5	55	25	30	40	5	35

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown, N — not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	2794	2795	2796	2797	2798	2799	2800		
As (5)	1000	1300	180	130	110	40	100		
Au (.05)	.80	.80	.25	.30	2.4	6.1	27		
Sb (1)	G1000	G1000	G1000	330	360	46	46		
Zn (5)	10	5	N(5)	35	15	10	15		

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3066	3067	3068	3069	3070				
As (5)	220	150	100	720	140				
Au (.05)	.05	.15	14	.20	.05				
Sb (1)	20	34	560	22	8				
Zn (5)	10	N(5)	5	15	25				

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3071	3072	3073	3074	3075	3076	3077	3078	3079
As (5)	G2000	1100	310	830	600	100	80	350	150
Au (.05)	.40	.25	.15	.40	1.4	.50	1.3	.30	.05
Sb (1)	32	420	76	68	54	860	310	4	N(2)
Zn (5)	60	65	100	100	120	90	100	60	180
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown, N — not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3080	3081	3082	3083	3084	3085	3086	3087	3088
As (5)	20	90	810	G2000	G2000	G2000	1500	570	330
Au (.05)	L(.05)	.20	1.2	1.6	.80	.40	.60	.10	.05
Sb (1)	8	22	12	68	290	340	G1000	16	G1000
Zn (5)	5	35	45	G2000	160	30	2000	20	170
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	3089	3090	3091	3092	3093	3094	3095	3096	3097
As (5)	1200	70	1400	120	20	N(10)	340	230	1000
Au (.05)	.30	N(.05)	.55	.10	N(.05)	L(.05)	L(.05)	N(.05)	.20
Sb (1)	G1000	4	G1000	890	160	230	140	92	290
Zn (5)	160	1000	1300	G2000	320	1200	110	50	G2000
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	3098	3099	3100	3101	3102	3103	3104	3105	3106
As (5)	1400	270	760	370	2000	N(10)	N(10)	N(.10)	N(.10)
Au (.05)	.35	.10	.60	.15	.15	N(.05)	N(.05)	.05	.05
Sb (1)	330	G1000	G1000	G1000	870	50	42	94	12
Zn (5)	90	15	50	5	220	G2000	270	G2000	G2000
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3107	3108	3109	3110	3111	3112	3113	3114	3115
As (5)	470	G2000	20	50	40	360	550	280	G2000
Au (.05)	L(.50)	7.5	3.8	.15	N(.05)	12	1.4	6.0	6.3
Sb (1)	510	8	8	2	N(2)	4	2	2	130
Zn (5)	470	G2000	1400	900	15	280	680	560	280
Sw	10	10	10	10	10	10	10	10	10

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	3116	3117	3118	3119	3120	3121	3122	3123	3124
As (5)	400	120	120	10	N(10)	30	20	G2000	G2000
Au (.05)	.05	4.0	N(.05)	N(.05)	N(.05)	19	N(.05)	.20	.40
Sb (1)	2	4	6	14	4	4	N(2)	G1000	G1000
Zn (5)	100	10	40	10	55	10	15	G2000	610
Sw	10	10	10	10	10	10			

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown. N — not detected at limit of detection. < detected, but below value shown.

Atomic-Adsorbtion Analysis

Element — Sample Number

	3125	3126	3127	3128	3129	3130	3131	3132	3133
As (5)	G2000	330	1700	530	20	70	90	N(10)	N(10)
Au (.05)	N(.05)	N(.05)	N(.05)	N(.05)	2.0	N(.05)	.25	N(.05)	N(.05)
Sb (1)	310	82	40	G1000	120	4	28	N(2)	N(2)
Zn (5)	G2000	G2000	25	15	730	G2000	G2000	120	75

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3134	3135	3136	3137	3138	3139	3140	3141	3142
As (5)	1400	500	30	950	G2000	1400	G2000	G2000	700
Au (.05)	.10	.20	N(.05)	.15	2.6	2.5	N(.05)	7.7	N(.05)
Sb (1)	8	10	2	10	G1000	G1000	82	300	12
Zn (5)	10	5	45	40	80	120	100	G2000	140

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown, N = not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

Element — Sample Number

	3143	3144	3145	3146	3147	3148	3149	3150	3151
As (5)	70	140	140	80	140	350	200	120	1100
Au (.05)	.45	N(.05)	2.2	2.5	.65	2.2	2.0	.15	2.2
Sb (1)	310	26	20	8	66	G1000	G1000	290	80
Zn (5)	G2000	35	170	60	25	690	340	G2000	25

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G — greater than value shown, N — not detected at limit of detection, < detected, but below value shown

Atomic-Adsorbtion Analysis

ement

Sample Number

	3152	3153	3154	3155	3156	3157	3158	3159	3160
As (5)	1700	100	10	490	20	30	410	20	30
Au (.05)	N(.05)	.25	N(.05)	3.4	2.60	2.20	.35	.35	.35
Sb (1)	30	10	12	24	10	12	10	L(2)	4
Zn (5)	60	N(5)	N(5)	20	880	500	170	30	20

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. L = detected, but below value shown.

added on 3152 - 3160, 1/20/78

Atomic-Adsorbtion Analysis

ement

Sample Number

	3161	3162	3163	3164	3165	3166	3167	3168	3169
As (5)	30	30	450	180	400	1300	1300	980	G(2000)
Au (.05)	13.00	22.00	4.30	3.20	210.00	24.00	3.20	1.00	11.00
Sb (1)	2	6	160	10	400	6	720	120	90
Zn (5)	20	10	50	50	30	40	110	440	40

Analysis Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown

added 4 6/1/86

Atomic-Adsorbtion Analysis

ement

Sample Number

	3170	3171	3172	3173	3174	3175	3176	3177	3178
As (5)	90	50	N(10)	80	400	330	180	20	150
Au (.05)	12.00	.90	N(.05)	.90	.30	1.30	.10	N(.05)	.15
Sb (1)	18	52	N(2)	32	22	130	34	2	2
Zn (5)	5	60	5	G(2000)	1200	G(2000)	1100	70	L(5)

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown

added 4/10/86

Atomic-Adsorbtion Analysis

ement

Sample Number

	3179	3180	3181	3182	3183	3184	3185	3186	3187
As (5)	440	560	20	30	650	40	10	10	90
Au (.05)	.50	2.80	18.00	9.70	.65	.20	.85	.30	.40
Sb (1)	50	170	8	140	210	G(1000)	760	210	100
Zn (5)	G(2000)	1300	G(2000)	1000	G(2000)	200	70	20	5

Analysis -, Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection

added

4/10/86

Atomic-Adsorbtion Analysis

ement

Sample Number

	3201	3202	3203	3204	3205	3206	3207	3208
As (5)	10	10	L(10)	L(10)	10	10	480	10
Au (.05)	.10	N(.05)	N(.05)	N(.05)	N(.05)	N(.05)	.05	N(.05)
Sb (1)	6	8	4	10	2	N(2)	86	N(2)
Zn (5)	G(2000)	90	10	1100	150	30	600	60

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection

added

Atomic-Adsorbtion Analysis

ement

Sample Number

	3215	3216	3217	3218					
As (5)	870	80	80	150					
Au (.05)	15.00	7.60	4.20	.40					
Sb (1)	12	2	L(2)	L(2)					
Zn (5)	90	20	50	30					

Analysis by Branch Exploration Geochemistry, U.S. Geol. Survey, Denver, Colorado
All elements reported in ppm.
Lower limits of determination are in parentheses.
G = greater than value shown. N = not detected at limit of detection. < detected, but below value shown

Recorded