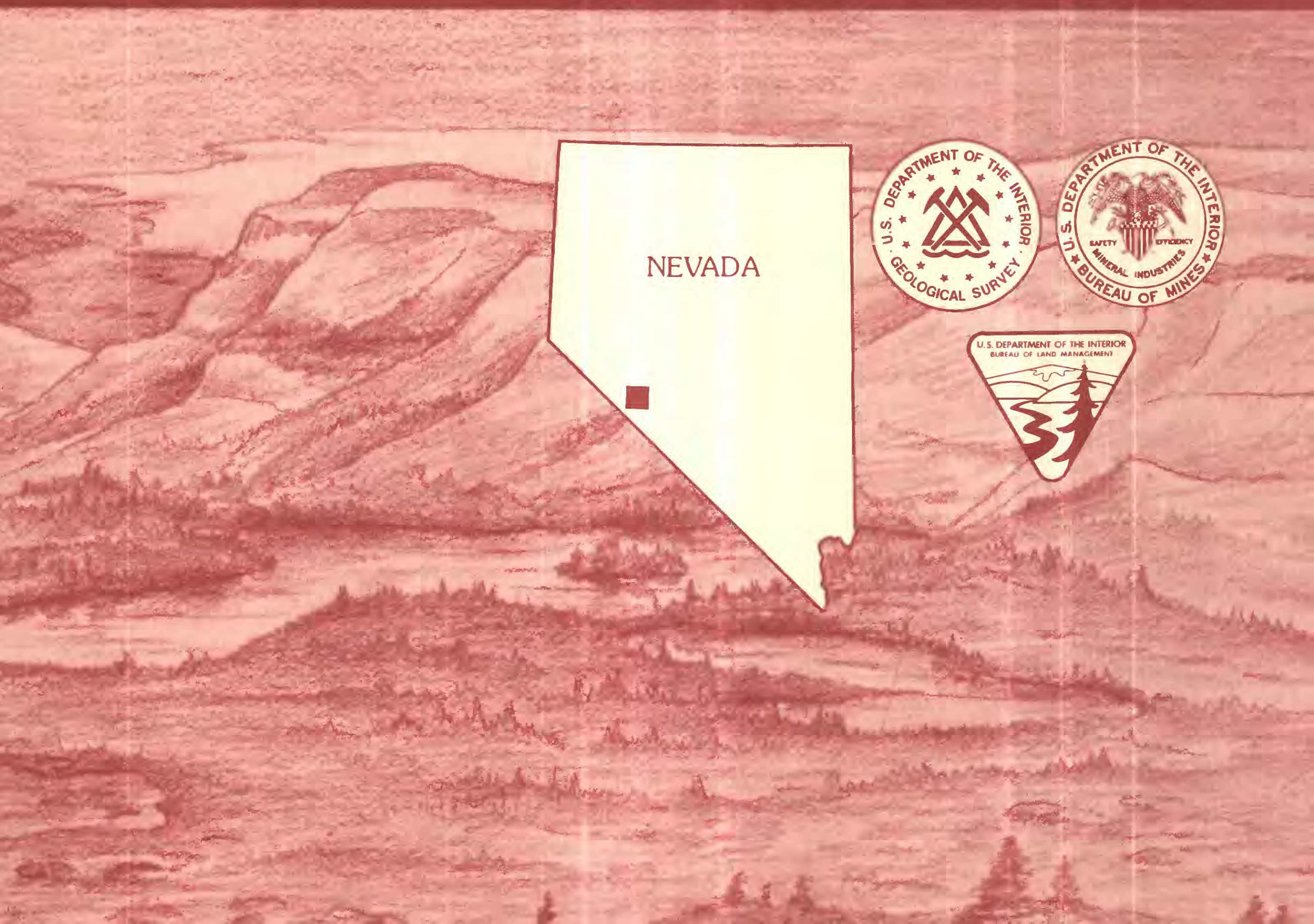
Mineral Resources of the Silver Peak Range Wilderness Study Area, Esmeralda County, Nevada

U.S. GEOLOGICAL SURVEY BULLETIN 1731–G



Chapter G

Mineral Resources of the Silver Peak Range Wilderness Study Area, Esmeralda County, Nevada

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MINERAL RESOURCES OF WILDERNESS STUDY AREAS:
CENTRAL NEVADA

DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY
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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Area

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys of certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of part of the Silver Peak Range Wilderness Study Area (NV-060-338), Esmeralda County, Nevada.

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Mineral Resources of the Silver Peak Range Wilderness Study Area, Esmeralda County, Nevada

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SUMMARY

Abstract

At the request of the Bureau of Land Management, 17,850 acres of the Silver Peak Range Wilderness Study Area (NV-060-338) were studied. In this report, the area studied is referred to as "the wilderness study area," or simply "the study area." The study area lies in the central part of the Silver Peak Range in Esmeralda County, Nev. Geological, geochemical, geophysical, and mineral surveys were conducted by the U.S. Geological Survey and the U.S. Bureau of Mines in 1985 and 1986 to assess the mineral resources (known) and mineral resource potential (undiscovered) of the study area. No identified resources are present in the study area. However, two parts of the study area have high and moderate resource potential and the remainder has low resource potential for gold and silver in epithermal veins. The entire study area has low resource potential for gold and silver in epithermal disseminated deposits and geothermal energy. One small area in Icehouse Canyon has low resource potential for cement-grade marble.

There is low potential for oil and (or) gas resources and also for uranium and thorium resources in the entire study area.

Character and Setting

The study area is located in the central part of the Silver Peak Range, Esmeralda County, Nev. (fig. 1). This is an area of rugged topography that ranges from 5,200 ft at the mouth of Icehouse Canyon in the northwest to 9,450 ft at Piper Peak near the south boundary. Although the study area lies within the Basin and Range physiographic province, local topography is controlled by the Silver Peak caldera and associated rock types, rather than by basin and range faulting. The predominant rock types in the study area are volcanic flows and pyroclastic rocks of Tertiary age (1.7 to 66 million years before present, or Ma) (see geologic time chart in appendixes) that overlie sedimentary rocks of Paleozoic age and plutonic rocks of Jurassic age. The study area is bordered on the northwest by a broad alkali flat that is part of Fish Lake Valley and on the east by the west margin of the Silver Peak caldera (fig. 1). The rest of the study area is within the Silver Peak Range.

Identified Resources

There are no identified resources in the Silver Peak Range Wilderness Study Area. However, development of Sunshine Mining Company's Sixteen-To-One gold and silver mine (fig. 1), located in the Silver Peak mining district near the east boundary of the study area (fig. 1), has stimulated interest. The Sunshine Mining Company claimed two sites within the study area in 1985.

The important mineralization observed in the study area consists of epithermal veins. These veins are along a zone that transects volcanic and metasedimentary rocks and crosses the study area between the Silver Peak and the Dyer mining districts (fig. 1). Along the zone within the study area are four mineral sites (including the two claims currently being held). No resources were identified at the four sites.

Mineral Resource Potential

The southern part of the study area has high resource potential for gold and silver in epithermal veins (fig. 2) similar to the Sixteen-To-One mine east of the study area (fig. 1) (Engineering and Mining Journal, 1984). Stream-sediment and rock samples from this part of the study area contain anomalous concentrations of elements (antimony, arsenic, mercury, and silver) that typically occur in gold and silver vein deposits. Geophysical studies indicate the possibility of near-surface alteration concealed by an overlying caprock of unaltered material in this area. The rock units in this area are the same units that host the mineralization in the Red Mountain mining district (part of the Silver Peak mining district) on the east edge of the caldera (fig. 1). Mineralization in the Red Mountain mining district is controlled by high-angle northeast-trending normal faults of the same type and age as those in this area (Keith, 1977).

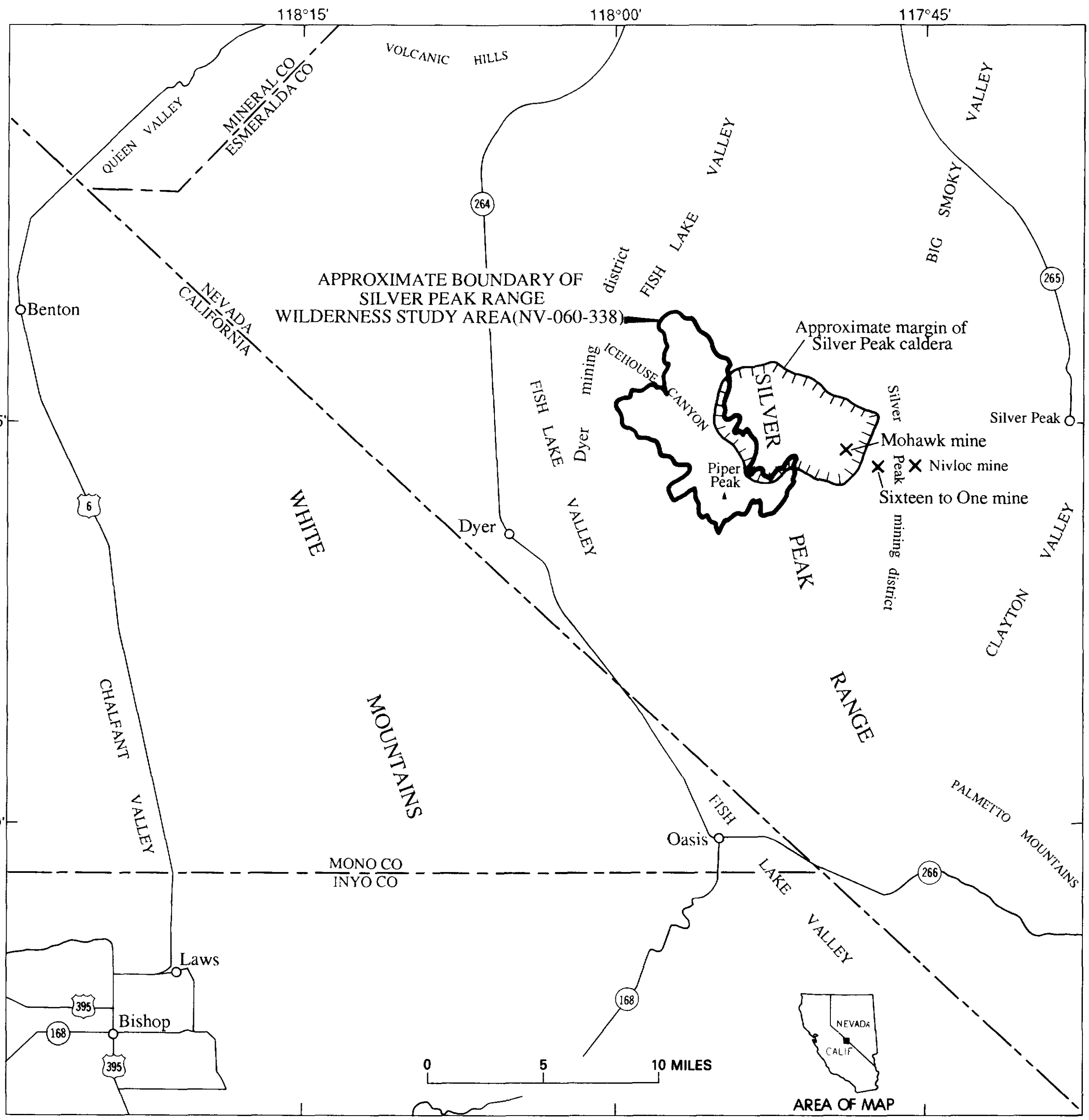

Figure 1. Index map showing location of Silver Peak Range Wilderness Study Area, Esmeralda County, Nevada.

One area in the northwestern part of the study area (fig. 2) has moderate potential for gold and silver in similar deposits. Stream-sediment and rock samples from this area contain anomalous concentrations of elements that are commonly associated with gold and silver vein deposits. Rock units in this area are the same as in the high-potential area but the area lacks the geophysical and structural evidence found in the high-potential area.

The remainder of the area has low potential for gold and silver in epithermal veins.

The entire study area has a low resource potential for gold and silver in bulk low-grade silver-gold deposits similar to those described by Guilbert and Park (1986, p. 557). Evidence that supports the vein type mineralization also supports the disseminated systems.

An active geothermal system exists in Fish Lake Valley (Geothermal Resources Council, 1986) about 5 miles northwest of the study area and many geothermal energy leases exist near the northwest boundary of the study area (Great Basin GEM Joint Venture, 1983). No evidence of an active hydrothermal system was found in the study area, but the Fish Lake Valley system may extend into the study area. For this reason, the entire area is classified as having low potential for geothermal energy resources.

A small area along the west side of Icehouse Canyon has low resource potential for cement-grade marble.

The resource potential for oil and (or) gas in the study area is low. There are no known source beds or likely reservoir rocks for petroleum products in the study area. No oil or seeps are known to occur in the study area and there is no indication of any good structural or stratigraphic traps to contain oil and (or) gas.

There are no known deposits of uranium or thorium in the study area and the radiometric studies of the area (J.S. Duval, written commun., 1985) do not indicate any anomalous concentrations of these elements. However, the geologic setting is permissive and the potential for uranium and thorium resources is therefore low.

INTRODUCTION

This mineral survey was requested by the U.S. Bureau of Land Management and is a joint effort by the U.S. Geological Survey and the U.S. Bureau of Mines. An introduction to the wilderness review process, mineral survey methods, and agency responsibilities were provided by Beikman and others (1983). The U.S. Bureau of Mines (USBM) evaluates identified resources at individual mines and known mineralized areas by collecting data on current and past mining activities and through field examination of mines, prospects, claims, and mineralized areas. Identified resources are classified according to the system described by U.S. Bureau of Mines and U.S. Geological Survey (1980). Studies by the U.S. Geological Survey (USGS) are designed to provide a reasonable scientific basis for assessing the potential for undiscovered mineral resources by determining geologic units and structures, possible environments of mineral deposition, presence of geochemical and geophysical anomalies, and applicable ore-deposit models. Mineral assessment methodology and terminology as they apply to these surveys were discussed by Goudarzi (1984). See appendix for the definition of levels of mineral resource potential, certainty of assessment, and classification of identified resources.

Area Description

At the request of the Bureau of Land Management, 17,850 acres of the 33,900-acre Silver Peak Range Wilderness Study Area (NV-060-338) were studied. In this report, the area studied is referred to as "the wilderness study area," or simply "the study area." The study area is located in the central part of the Silver Peak Range. It consists of rugged, sparsely vegetated terrain bordering the southeast edge of Fish Lake Valley in western Esmeralda County, Nev. (fig. 1). Jeep trails provide access to a few points around the boundary but access generally is best by foot, helicopter, or horseback. Altitudes range from 5,200 ft at the mouth of Icehouse Canyon in the northwestern part of the area to 9,450 ft at Piper Peak in the southern part of the area (fig. 1).

Previous and Present Investigations

A geologic map of the study area prepared by the U.S. Geological Survey in 1986 (pl. 1) at a scale of 1:48,000 provides a base for the interpretation of geochemical, geophysical, remote sensing, and mining claim data.

The geologic map is a generalization of two published geologic maps: the Piper Peak 15' quadrangle by Stewart and others (1974) and the Rhyolite Ridge 15' quadrangle by Robinson and others (1976). The parts of these maps that are within the study area were field checked, found to be of excellent quality, and were used without any remapping.

Studies by Albers and Kleinhampl (1970), Albers and Stewart (1972), Earnest (unpub. data, 1984), Great Basin GEM Joint Venture (1983), Keith (1977), Krauskopf (1971), Lincoln (1923), Robinson (1972), Robinson and Crowder (1973), Robinson and others (1968), Spurr (1906), and Young (unpub. data, 1984) also provided geologic data for this report.

Geochemical data were obtained from analyses of stream-sediment and rock-chip samples collected by the U.S. Geological Survey.

Geophysical data consist of an aeromagnetic survey of the Silver Peak Range Wilderness Study Area (U.S. Geological Survey, 1985) and measurements of natural remanent magnetism (NRM) and magnetic susceptibility on representative rock samples.

A remote-sensing study of this area was done by Ehmann (unpub data, 1987) and resulted in a map of the hydrothermally altered rocks in this area.

The U.S. Bureau of Mines mineral investigation of the study area entailed prefield research of county records, field checking, and report writing, all conducted between 1985 and 1987. Four mineralized sites within the study area and nine outside (along zones that extend into the study area) were found and sampled. At the thirteen prospects, a total of 88 samples was taken and analyzed. A detailed description is contained in Close (1987). Additional information is available from the U.S. Bureau of Mines, Western Field Operations Center, E-360 third Avenue, Spokane, WA 99202.

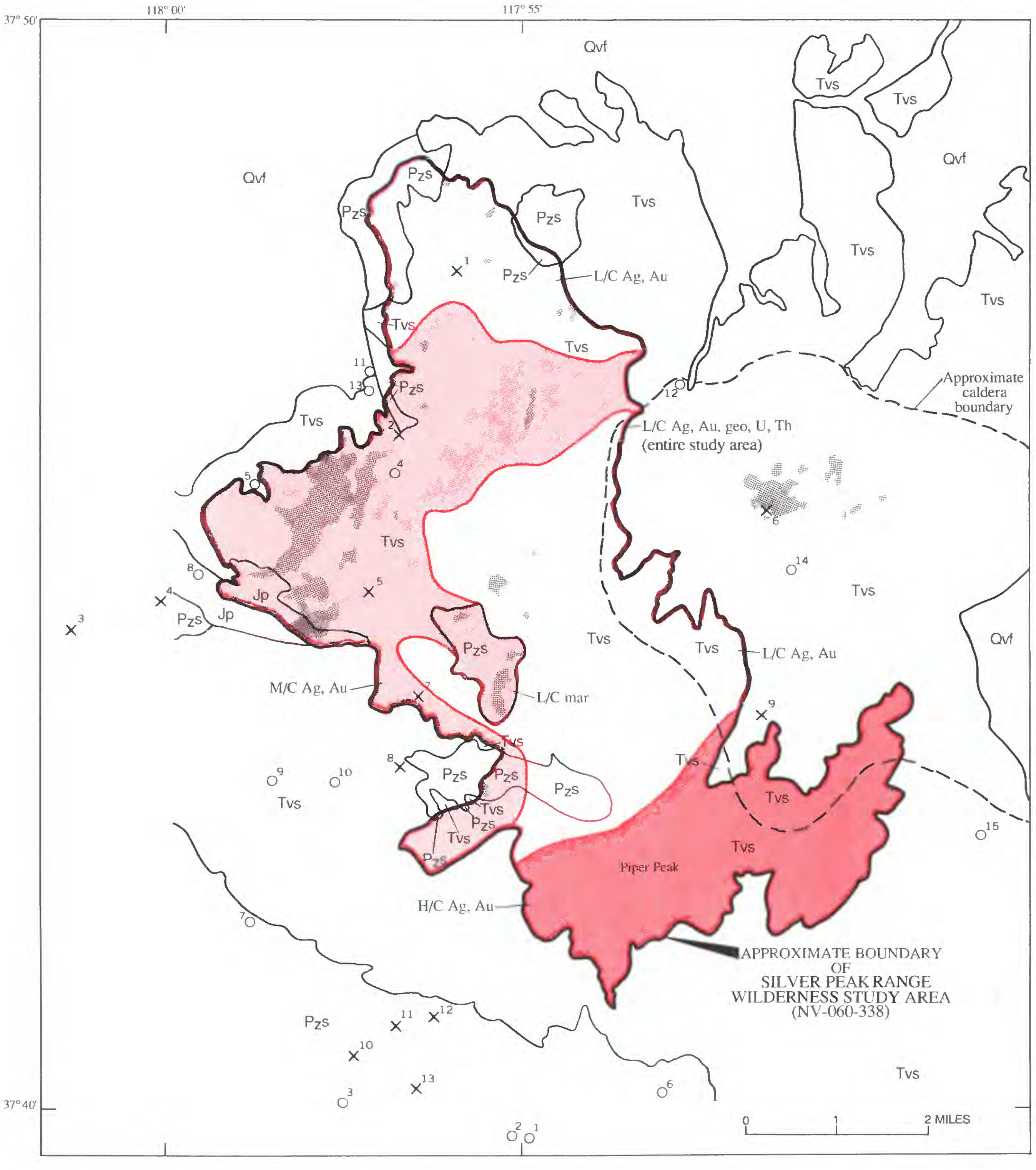

Figure 2. Generalized geologic map of Silver Peak Range Wilderness Study Area showing prospects, mineralized areas, and areas of mineral resource potential, Esmeralda County, Nevada.

Acknowledgments

The U.S. Geological Survey and the U.S. Bureau of Mines thank the following for assistance on the project: U.S. Bureau of Land Management Nevada State Office for vehicle support; Bishop Police Department Dispatch Office for logistical support; Donald Earnest, Sunshine Mining Company, and Edward Tomany, Production Exploration Resources, Incorporated, for discussions; David Brickey, U.S. Geological Survey, and Richard Gaps and David Lipton, U.S. Bureau of Mines, for assistance in the prefield research and field work.

EXPLANATION

(pink, dark)	Area with high mineral resource potential
(pink, light)	Area with moderate mineral resource potential
(outline)	Area with low mineral, geothermal, and petroleum resource potential

See appendixes for definition of levels of mineral resource potential (H,M,L) and certainty of assessment (C)

Commodities

Ag	Silver
Au	Gold
mar	Marble
geo	Geothermal
U	Uranium
Th	Thorium

Geologic map units

Qvf	Valley fill (Quaternary)--Colluvial and alluvial valley fill deposits
Tvs	Volcanic and sedimentary rocks (Tertiary)
Jp	Plutonic rocks (Jurassic)
P_Zs	Metamorphosed sedimentary rocks (Paleozoic)

——— Contact

$\times^6$ Prospect--Numbers refer to table 1

Alteration area indicated by remote sensing

O^9 Geochemical sample site--Numbers refer to text

Figure 2. Continued.

APPRAISAL OF IDENTIFIED RESOURCES

By Terry J. Close
U.S. Bureau of Mines

Mining History

The nearby Silver Peak mining district (fig. 1) has a long mining history. U.S. Bureau of Mines files indicate that between the 1870's and 1986, more than 5 million ounces of silver and 300,000 troy ounces of gold were produced. The major mine in the district is the Sixteen-To-One mine. It began operations in 1982, and in 1986 produced about 800 tons of ore per day from underground workings. Silver and gold are recovered from the ore by cyanide leaching in vats. The small amounts of base metals (copper, lead, zinc) contained in the ore are discarded with the tailings. The Dyer mining district (fig. 1) was discovered in the 1860's, and, by 1912, a few tons of silver-lead ore worth about $13,000 at that time were produced. There are no producing mines in the study area. However, development of Sunshine Mining Company's Sixteen-To-One mine (fig. 1) has stimulated interest. Sunshine Mining Company claimed two sites within the study area in 1985.

Esmeralda County records indicate that only a few mining claims have been located in the study area. There are no patented mining claims or mineral leases. Only the Sunshine Springs (prospect No. 2, fig. 2) and Extra Gold (prospect No. 5, fig. 2) claims, both held by the Sunshine Mining Company, are current (1987).

Identified Resources

Fractures were the main controls for epithermal vein emplacement along a zone that trends east across the Tertiary-age volcanic and Paleozoic-age metasedimentary rocks that underlie the study area. The zone can be traced by the veins, propylitic and argillic alteration, and color anomalies (bleached, yellow- to orange-colored rocks) along it. The zone trends east from the DR mine area (prospect No. 4, fig. 2) located in the Dyer mining district to the Mud Springs prospect (No. 6, fig. 2) located in the Silver Peak mining district and includes most of the important prospects in the study area. The second zone, located south of the study area, follows McAfee Canyon from the Wildhorse mine (prospect No. 10, fig. 2) to the Valley View prospect (No. 13, fig. 2).

Thirteen mineral sites were examined (4 within the study area, prospect Nos. 1, 2, 5, and 7, fig. 2) that contain over 40 epithermal veins. The vein exposures examined at the thirteen sites are as thick as 21 ft and as long as 1,000 ft. They are leached and composed mainly of quartz, calcite, or jasperoid that may contain limonite, malachite, acanthite, galena, sphalerite, chalcopyrite, or pyrite. Samples across the veins contained as much as 0.02 ounce per ton gold, 2.1 troy ounce per ton silver, 1.0 percent copper, 2.6 percent lead, 0.4 percent zinc, 0.07 percent arsenic, and 0.007 percent tungsten. The values are too low and erratic to allow a calculation of resources. The small amounts of base metals in the veins would not be recoverable using the cyanide leaching process, which is the most economic process to recover the precious metals. Subsurface exploration was needed to substantiate minable deposits in the Silver Peak and Dyer mining districts, and similar work would be necessary in the study area. The data indicate that the prospects in the study area most likely to have resources at depth are Sunshine Springs prospect (No. 2), Extra Gold prospect (No. 5), and prospect No. 7 (fig. 2)

The only potentially minable, nonmetallic mineral commodity in the study area is marble that crops out on the west side of Icehouse Canyon. It is present in beds as thick as 10 ft and as long as 2 mi. Analyses of three samples indicate that the marble is good quality; it could be used to make lime or cement. However, the beds are too far from potential markets to be classified as identified mineral resources. There is abundant alluvium (sand and gravel) along Icehouse Canyon. However, this material contains a high percentage of clay and soft minerals. Better quality sand and gravel are more readily obtainable elsewhere.

Data acquired during the Bureau study of the extensive mineralized zone and four mineral sites observed in the study area are limited. Enough data were obtained by the USBM to establish that resources may be present but not enough to be able to quantify them. Further work is needed to determine if there are metal-bearing resources at depth, the tonnages and grades of those possible resources, and if additional sites are present. This work includes mapping and sampling followed by trenching or drilling. If resources are identified, then detailed economic, engineering, and financial analyses can be done.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By William J. Keith, Robert L. Turner,
Richard Blakely, and William J. Ehmann
U.S. Geological Survey

Geological Studies

The Silver Peak Range is an arcuate mountain range on the edge of the Basin and Range physiographic province. The wilderness study area is in the central part of the range (fig. 1) and is underlain by Paleozoic sedimentary rocks that were intruded by a small Jurassic pluton; these units are stratigraphically overlain by a series of potassic volcanic rocks of Tertiary age (pl. 1). Much of the faulting in the area consists of high-angle normal faulting. Argillic and propylitic alteration is widespread.

The generalized rock units are described in order of decreasing age (oldest to youngest). The geology shown on plate 1 and generalized on figure 2 is based on the work of Robinson and others (1976) and Stewart and others (1974).

The Paleozoic sedimentary rocks (metamorphosed sedimentary rock unit) contain rocks from the Ordovician-age Palmeto Formation and the Cambrian-age Harkless and Polita Formations. These rocks consist of phyllitic siltstone to phyllite, fine-grained quartzite, shale, hornfels, and thin- to thick-bedded limestone or marble beds.

Plutonic rocks (adamellite of Beer Creek unit) are confined to the west edge of the study area and consist of a medium- to coarse-grained porphyritic Jurassic-age adamellite. These rocks intrude and locally alter the older Paleozoic sedimentary rocks.

The oldest volcanic unit in the area (rhyolite ash-flow tuff unit) is a porphyritic rhyolite ash-flow tuff with multiple cooling units. The nonwelded parts are white to pink and the welded and crystallized areas vary from brown to red brown to blue gray. Phenocrysts consist of quartz, feldspar, and biotite. The unit is locally propylitized and has approximate potassium-argon (K-Ar) radiometric ages of 21.5 and 22.8 Ma (Stewart and others, 1974).

A gray to greenish-gray trachyandesite unit (andesite of Icehouse Canyon unit) overlies the rhyolite ash-flow. It consists of porphyritic trachyandesite flows, breccias, and minor tuffs. Locally the unit contains gray to greenish-gray andesitic sandstone and siltstone containing some lenses of dark-gray to redish-gray pebble conglomerate and coarse sandstone composed of clasts of Paleozoic limestone, siltstone, and chert. Phenocrysts in the trachyandesite consist of plagioclase, clinopyroxene, olivine, and hornblende. The unit commonly exibits propylitic alteration with local silicification.

Overlying the trachyandesite is a white to greenish-gray, moderately welded porphyritic ash-flow tuff (latite ash-flow tuff unit) that contains phenocrysts of sanidine and plagioclase and numerous andesitic lithic fragments. The unit is locally silicified.

Light-brown to light-green sedimentary rocks (sedimentary rocks unit) unconformably overlie the latitic ash-flow. They consist of thin-bedded, moderately to poorly sorted volcanic sandstone and granule conglomerate. Volcanic glass in the unit is typically altered to zeolite and (or) clay minerals, which is consistent with propylitic alteration.

The rhyolite of Cottonwood Spring unit consists of white, light-gray, and light-brown vitric and lithic tuff, lava flows, dikes, and breccia that unconformably overlie the sedimentary rocks. The flows are commonly flow banded and spherulitic. Phenocrysts in the tuffs include quartz, sanidine, and oligoclase. Propylitic alteration occurs sporadically throughout this unit with locally developed argillization and silicification. An approximate K-Ar age on the tuff is 6.1 Ma (Stewart and others, 1974).

Unconformably overlying the rhyolite unit is a gray to brownish-gray, coarsely porphyritic latite (latite of Sheep Mountain unit) that locally includes laharic breccia composed largely of the same material. The unit is commonly hydrothermally altered and locally mineralized. Phenocrysts in the unit consist of sanidine, oligoclase, augite, and biotite. The unit has an approximate K-Ar age of 5.9 Ma (Albers and Stewart, 1972)

The andesite of Piper Peak unit is a dark-gray, porphyritic trachyandesite containing phenocrysts of plagioclase, olivine, augite, and hypersthene. The unit is typically unaltered.

The latite of Blind Spring unit as used in this report includes a latite ash-flow tuff and latite dikes, as well as the lava flows described by Stewart and others (1974). The flows and dikes consist of coarsely porphyritic brownish-gray latite containing phenocrysts as much as 3 cm across. The flows are typically unaltered although locally the unit contains areas of argillization and silicification. The tuff is a porphyritic reddish-brown ash flow consisting of three partial cooling units that are moderately to densely welded. Some of the layers are lithic rich with rock fragments as much as 18 in. in diameter. The tuff has an approximate K-Ar age of 6.1 Ma (Stewart and others, 1974).

The youngest rock unit in the area is the basalt of Piper Canyon, which consists of black fine-grained porphyritic trachybasalt lava flows and dikes locally interbedded with sediments. The unit is typically unaltered and has an approximate K-Ar age of 4.8 Ma (Stewart and others, 1974).

Maps by Stewart and others (1974) and Robinson and others (1976) show an approximate boundary for the Silver Peak caldera that will be referred to as the caldera boundary (pl. 1). According to Robinson (1968), the caldera was formed after the emplacement of the rhyolite of Cottonwood Spring, which would make its age about 6 Ma. None of the caldera structure is evident and the caldera boundaries (Robinson and others, 1976; Stewart and others, 1974) were presumably drawn on the basis of thickness and location of lavas in and near the caldera (Robinson, 1968; Robinson, 1972, p. 1696) Faulting in the study area consists almost entirely of northeast-trending high-angle normal faults (pl. 1). These do not appear to be related to the caldera ring fractures but rather to a northwest-southeast crustal extension of the Silver Peak structural block (Keith, 1977). Faults of this same type and trend acted as hosts for the vein systems in the Nivloc, Mohawk, and Sixteen-To-One mines and other epithermal vein systems in the Silver Peak mining district.

The age of epithermal mineralization in the Silver Peak mining district is not known other than it is younger than the latite of Sheep Mountain. Whether or not the mineralization is genetically related to the caldera is unknown, but the two are geometrically related and are probably quite close in age.

The stratigraphic units in the study area are, for the most part, the same as the ones in the Silver Peak mining district; the alteration patterns appear to be the same; and the same type, trend, and age of faults occur in both places. From this, one would expect mineralization in the study area to be similar in type and possibly in quantity.

Geochemical Studies

A reconnaissance geochemical survey was conducted in the study area during 1985-1986 as an aid in the mineral resource appraisal of the area. Minus-80-mesh stream-sediment and heavy-mineral-concentrate samples were selected as the primary sample media because they represent a composite of the rock and soil exposed upstream from the sample site. Rock samples were also collected from the same sample sites and analyzed as examples of the alteration and mineralization in the area. Thirty-three sites were sampled in this study.

The sediment samples were collected from the active alluvium in the stream channel. Each sample was composited from several localities within an area no greater than 100 ft in diameter.

The analytical data for the nonmagnetic fraction of the heavy-mineral-concentrate samples identify four areas in the study area containing anomalous concentrations of indicator elements. The first anomalous area encompasses three drainage basins (sample sites 1, 2, and 3, fig. 2) in the southern part of the study area. These heavy-mineral-concentrate samples contain anomalous concentrations of cadmium (50 parts per million or ppm), lead (200-700 ppm), and zinc (1,000-3,000 ppm). The second area encompasses two drainage basins (sample sites 4 and 5, fig. 2), the area contains anomalous concentrations of arsenic (1,000 ppm), gold (70 ppm), lead (200 ppm), and silver (20 ppm). The third area consists of a single drainage basin (sample site 10, fig. 2), and contains anomalous concentrations of silver (2 ppm) and lead (1,500 ppm). Another single drainage basin (sample site 15, fig. 2) contains 20 ppm silver. These elements are typically not detectable in heavy-mineral-concentrates from drainage basins in this area where alteration and (or) mineralization has been less pronounced (U.S. Geological Survey, unpub. data, 1986). The concentrations of these elements relative to the background values and to the average crustal abundance (Krauskopf, 1967, p. 639) are considered anomalous.

The analytical data for the rock samples also identify four areas containing anomalous concentrations of indicator elements. The rock samples are float and therefore represent isolated areas in the drainage basins above them. Rock samples representing the first anomalous area (sample sites 1, 2, 3, 6, and 7, fig. 2) contain anomalous concentrations of antimony (2-3 ppm), arsenic (5-230 ppm), bismuth (1 ppm), cadmium (3.1 ppm), copper (700-1,500 ppm), lead (150-3,000 ppm), mercury (0.7 ppm), molybdenum (30 ppm), silver (2 ppm), and zinc (740 ppm). Samples from the second anomalous area (sample sites 4, 8, 9, and 10, fig. 2) contain anomalous concentrations of antimony (2-4 ppm), arsenic (5 ppm), and molybdenum (5 ppm). The third area (sample sites 11, 12, and 13, fig. 2) has anomalous concentrations of arsenic (11-220 ppm), silver (0.5 ppm), and zinc (110-120 ppm). An individual basin (sample site 14, fig. 2) contains anomalous concentrations of antimony (9 ppm), arsenic (58 ppm), and mercury (0.82 ppm).

Geophysical Studies

Most outcrops within the Silver Peak study area are composed of relatively young and unmetamorphosed volcanic rocks that typically have high magnetic susceptibility and high remanent magnetization. Therefore, an aeromagnetic survey over the study area should be dominated by high-amplitude, short-wavelength magnetic anomalies. Conversely, volcanic units in regions with more subdued anomalies are expected to be either relatively thin or relatively nonmagnetic. The latter cause may indicate that magnetic minerals were altered to less magnetic phases. Consequently, magnetic studies provide information for mineral appraisal of the volcanic terrane of the study area insofar as altered magnetic minerals are associated with concentrations of ore-related mineralization.

For this reason, an aeromagnetic survey (U.S. Geological Survey, 1985) was flown over the Silver Peak Range Wilderness Study Area along flightlines directed east-west, located 1,000 ft above average terrain, and spaced 0.5 mi apart. Digital anomaly values were interpolated to a rectangular grid with intersections spaced 0.31 mi apart and then contoured at an appropriate scale for comparison with geologic and topographic maps (pl. 1).

In addition, natural remanent magnetization (NRM) and magnetic susceptibility were measured for 13 oriented hand-samples collected from representative outcrops within the study area. As expected, all samples are substantially magnetic, although the basalt and andesite samples are somewhat more magnetic than the less mafic latite and rhyolite samples. The latite of Blind Spring and latite of Sheep Mountain have reversed NRM directions and apparently were extruded during a time when the Earth's magnetic field was reversed. Anomalies over these reversely magnetized units are expected to be negative in sign.

The most striking anomaly within the study area is negative in sign and coincides directly over the north-trending ridge extending north from Piper Peak (pl. 1). Although the ridge is capped by the basalt of Piper Canyon, it is primarily composed of reversely magnetized latite of Sheep Mountain, which explains the negative sign of the anomaly. If this anomaly is typical for outcrops of this volcanic unit, it is surprising that anomalies over the same volcanic unit elsewhere in the study area are more subdued and rarely negative. Notably, the region centered several miles northeast of Piper Peak (pl. 1) is underlain by latite of Sheep Mountain, but anomalies associated with this outcrop are greatly subdued. Either the latite flows in this region are relatively thin or relatively nonmagnetic. The latter explanation would suggest that the area several miles northeast of Piper Peak may be an area of substantial and pervasive alteration. This explanation is supported by the results of the remote sensing studies of Ehmann (written commun, 1987) that show intense alteration in this area.

On the basis of laboratory measurements of oriented rock samples, andesite of Piper Peak should be substantially magnetic and produce high-amplitude magnetic anomalies. Within the study area, however, the aeromagnetic data indicate subdued magnetic anomalies over outcrops of this unit (see area of high potential, pl. 1). If the rock samples are representative of this unit, then outcrops of andesite of Piper Peak within the study area are either thin or relatively nonmagnetic. For example, the magnetic anomaly directly over Piper Peak itself (pl. 1) is lower in magnitude than expected for this pronounced topographic feature. Consequently, the andesite of Piper Peak in the southern part of the study area is suspected to be an area of alteration or a thin cover over an altered zone. The prevalent northeast-trending normal faults in this area suggest that tectonic events may have controlled the sites of alteration.

An arcuate string of positive magnetic anomalies trends north-northwest through the central part of the study area (pl. 1) extending from 1 mi east of Piper Peak to lat 37° 47' N. These anomalies are relatively broad in wave-length and do not appear to correlate with the volcanic units exposed at the surface, which suggests that these anomalies may be caused by features buried beneath the surface. Plausible sources include a buried caldera wall, which aligns well with the proposed caldera boundary, or small isolated intrusions of mafic composition.

Concentrations of potassium and equivalent thorium and uranium were estimated for the study area by examining composite-color maps of gamma-ray spectrometric data (J.S. Duval, written commun., 1985). The data were obtained from radiometric profiles compiled by Geodata International, Inc. (1978). Based on criteria discussed by Duval (1983), the study area has moderate radioactivity with values of 1 to 2.5 percent potassium, 3 to 3.5 ppm equivalent thorium, and 9.5 to 12 ppm equivalent uranium. There are no thorium anomalies within the boundaries of the study area or in the immediate vicinity. A moderate potassium anomaly occurs along the northeast border of the area, and a uranium anomaly occurs southwest of the area.

A study of satellite remote sensing imagery has identified 21 areas within the western part of the study area (fig. 2) that are consistent with the presence of hydrothermally altered rocks. This was done by looking at the ratios of various bands in the visible and near-infrared part of the spectrum for Landsat Thematic Mapper data. Ratios of specific bands allow the identification of minerals with hydroxyl groups such as clays, micas, and alunite as well as carbonates. Other ratios allow the identification of limonitic materials and also the distinction between bare rock and vegetation. By identifying these minerals, it is possible to categorize the type of hydrothermal alteration present. The eastern part of the study area could not be evaluated by remote sensing due to a dense vegetation cover and deep shadows. Among the 15 areas field checked within the study area, only one represented unaltered rocks. Within the andesite of Icehouse Canyon, propylitic and argillic alteration occur, and most of the anomalies are spatially associated with faulting. Propylitic alteration is present among all the anomalies mapped in the rhyolite ash-flow tuff unit. Propylitic alteration (zeolitization) also occurs within the rhyolite of Cottonwood Springs, and is especially widespread southwest of Icehouse Canyon. Sericitic alteration is found in pyrite-rich phyllites mapped as metamorphosed sedimentary rocks. East of the study area, above Mud Spring, a large area of advanced argillic and alunitic alteration occurs in rocks mapped as latite of Sheep Mountain (fig. 2, prospect No. 6) This area lies within the Silver Peak caldera and contains the most intense alteration observed. Overall, the alteration pattern in the Silver Peak Range appears to be concentrically zoned, with intensity increasing toward the caldera center.

Propylitic alteration occurs 5-7.5 mi from the caldera center, intermediate argillic and sericitic alteration occurs within 4 mi, and advanced argillic and alunitic alteration occurs within 2 mi of the caldera center (Ehmann, written commun., 1987).

Mineral and Energy Resources

The southern part of the study area (fig. 2) has a high mineral resource potential (certainty level C) for gold and silver in epithermal veins. Anomalous concentrations of antimony, arsenic, copper, lead, mercury, silver, and zinc in many of the basins draining this part of the study area indicate that host rocks have been altered. Geophysical studies of the area indicate a possibility of near-surface alteration. The eastern edge of the caldera is near post-caldera epithermal gold and silver deposits (Mohawk, Nivloc, Sixteen-To-One mines and other smaller deposits). These deposits are all hosted predominantly by the same Tertiary geologic section (Keith, 1977) and appear to be concentrated in the rhyolite of Cottonwood Spring and the andesite flows and breccia units. The mineralization in these deposits was controlled by high-angle northeast-trending normal faults that acted as conduits for the mineralizing fluids and hosts for the vein systems. These same conditions (spatial relation to caldera, rock units, high-angle normal faults) occur in the high-potential area of this study, and when considered with the geochemical and geophysical data, suggest a high potential area for gold and silver in epithermal veins similar in size and having the same chemical signature as the Sixteen-To-One mine.

A larger area in the northwestern part of the study area (fig. 2) has moderate resource potential (certainty level C) for gold and silver in epithermal veins. This area is similar to the high-potential area except that it lacks the geophysical support and does not have the prominent northeast-trending high-angle normal faults. Stream-sediment samples from drainage basins in this area contain anomalous concentrations of antimony, arsenic, cadmium, copper, gold, lead, mercury, molybdenum, silver, and zinc. The area encompasses zones of quartz-calcite veins that contain anomalous concentrations of copper, gold, lead, silver, tungsten, and zinc (fig. 2 and table 1, prospect Nos. 4, 5, and 7). The area encloses part of a zone of quartz-calcite veins on its south boundary (fig. 2 and table 1, No. 2) that also contains anomalous concentrations of these elements.

The outer boundaries of the resource potential areas coincide with the boundary of the study area. The boundaries within the study area for the moderate potential areas were drawn to coincide with the anomalous drainage basins as well as large vein systems examined by the U.S. Bureau of Mines (table 1 and fig. 2). The northwest boundary for the high-potential area was extended approximately 0.5 mi beyond the north edge of the anomalous drainage basins to include as much of the prominent faulting as possible. It also includes the area between two of the large drainage-basin areas discussed in Geochemical Studies section. Since the geophysics supports the possibility of near-surface alteration in this unit (andesite of Piper Peak), the alteration in the anomalous basins probably extends partly or entirely through the connecting area. The area between the two individual drainage basins on the east side of the high-potential area (pl. 1) was also included because the alteration is probably through-going.

The rest of the study area has low resource potential (certainty level C) for gold and silver in epithermal veins due to the presence of permissive rock types and ages, spatial relations to known mineralization, and the presence of numerous areas of hydrothermal alteration.

The entire study area is considered to have low mineral resource potential for gold and silver in epithermal, low-grade, bulk-mineable deposits. Permissive evidence for this is location of the study area near a caldera rim, a hydrothermal system that was and may still be active in the area, high porosity and permeability of the rocks in the study area, and the presence of vein systems and pervasive alteration in the area. However, this type of mineralization is not known to exist in this area, the Dyer mining district, or the Silver Peak mining district. Therefore the resource potential classification for low-grade bulk-minable gold and silver in deposits in this area is low (certainty level C) rather than moderate.

Resource potential for geothermal energy is low (certainty level C) in the entire study area. An active geothermal system occurs in Fish Lake Valley (Geothermal Resources Council, 1986) approximately 5 mi northwest of the study area and many geothermal energy leases exist near the northwest boundary of the study area (Great Basin GEM Joint Venture, 1983). No evidence of an active present-day hydrothermal system was found in the area but the possibility exists that the system under Fish Lake valley extends into the study area.

A small area in Icehouse Canyon has low resource potential (certainty level C) for cement-grade marble. The marble occurs as beds in the Paleozoic sedimentary rocks and crops out on the west side of Icehouse Canyon in beds as thick as 10 ft and as long as 2 mi.

Potential for oil and (or) gas resources is low (certainty level C) in the entire study area. There are no known source beds or likely reservoir rocks for petroleum products in the study area. No oil or seeps are known to occur in the study area and there is no indication of any good structural or stratigraphic traps to contain oil and (or) gas. Two sections are under lease for oil and gas on the west boundary of the study area and drilling was done north of the study area. However, the drill holes had no oil or gas shows and, as mentioned earlier, there are no known source beds underlying the study area (Great Basin GEM Joint Venture, 1983). The petroleum potential studies of Sandberg (1982) show no potential for petroleum in this area.

There are no known deposits of uranium or thorium in the study area, and the radiometric studies of the area (J.S. Duval, written commun., 1985) do not indicate any anomalous concentrations of these elements. As mentioned in the Geophysical Studies section, concentrations of potassium and equivalent thorium and uranium were estimated for the study area by examining composite-color maps of gamma-ray spectrographic data (J.S. Duval, written commun., 1985). There is no indication of anomalous concentrations of radioelements in the study area. However, the permissive nature of the geologic setting requires that the study area be give a low potential (certainty level C) for uranium and thorium resources.

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APPENDIXES

DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

Definitions of Mineral Resource Potential

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

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

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

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

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

Levels of Certainty

LEVEL OF RESOURCE POTENTIAL

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

LEVEL OF CERTAINTY

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

Abstracted with minor modifications from:

Taylor, R. B., and Steven, T. A., 1983, Definition of mineral resource potential: Economic Geology, v. 78, no. 6, p. 1268–1270.

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RESOURCE/RESERVE CLASSIFICATION

	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	Speculative
ECONOMIC	Reserves		Inferred Reserves		
MARGINALLY ECONOMIC	Marginal Reserves		Inferred Marginal Reserves		
SUB-ECONOMIC	Demonstrated Subeconomic Resources.		Inferred Subeconomic Resources		

Major elements of mineral resource classification, excluding reserve base and inferred reserve base. Modified from U.S. Bureau of Mines and U.S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U.S. Geological Survey Circular 831, p. 5.

GEOLOGIC TIME CHART

Terms and boundary ages used by the U.S. Geological Survey in this report

EON	ERA	PERIOD		EPOCH	AGE ESTIMATES OF BOUNDARIES (in Ma)
Phanerozoic	Cenozoic	Quaternary		Holocene	0.010
				Pleistocene	1.7
		Tertiary	Neogene Subperiod	Pliocene	5
				Miocene	24
			Paleogene Subperiod	Oligocene	38
				Eocene	55
				Paleocene	66
	Mesozoic	Cretaceous		Late	96
				Early	138
		Jurassic		Late Middle Early	205
		Triassic		Late Middle Early	~240
	Paleozoic	Permian		Late Early	290
		Carboniferous Periods	Pennsylvanian	Late Middle Early	~330
			Mississippian	Late Early	360
		Devonian		Late Middle Early	410
		Silurian		Late Middle Early	435
		Ordovician		Late Middle Early	500
		Cambrian		Late Middle Early	~570[1]
Proterozoic	Late Proterozoic				900
	Middle Proterozoic				1600
	Early Proterozoic				2500
Archean	Late Archean				3000
	Middle Archean				3400
	Early Archean				(3800?)
pre-Archean[2]					4550

[1]Rocks older than 570 Ma also called Precambrian, a time term without specific rank.

[2]Informal time term without specific rank.

Table 1. Summary of descriptions of mines and prospects in and adjacent to the Silver Peak Range Wilderness Study Area

[Sites underlined may have resources at depth; *, outside study area; principal commodities shown in parenthesis, gold (Au), silver (Ag), copper (Cu), lead (Pb), and zinc (Zn); USBM samples averaged 0.12 parts per million (ppm) silver, 30 ppm copper, 40 ppm lead, 110 ppm zinc, and 70 ppm aresnic]

Map No. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
1	Prospect No. 1 (Ag)	A 2- to 4-ft-thick zone of epithermal, calcite-quartz stringers trends east and dips 90° in kaolinized tuff. Zone is leached, limonite stained, and exposed for about 100 ft along strike.	None	Two chip samples taken. One across east end of zone assayed 0.051 ppm silver, 16.1 ppm lead, and 16.5 ppm arsenic. A sample across west end contained 0.073 ppm silver, 31.1 ppm copper, 84.5 ppm lead, and 42.1 ppm arsenic.
2	Sunshine Springs prospect area	A 1.3-mi-wide zone of epithermal, quartz-calcite fissure veins in fractured, propylitically altered, interbedded volcanic and metasedimentary rocks exposed within Icehouse Canyon. Veins examined are 0.3 to 4.0 ft thick, strike N. 10° to 70° E., and dip 70° NW. to 80° SE. They are leached, limonitic, and contain pyrite, acanthite, galena, and malachite.	Raw prospect; claim monuments only.	Fifteen chip samples taken by USBM personnel. Data for another 16 chip samples were supplied by Sunshine Mining Company. Thirty samples across veins and fractures had as much as 1.52 ppm gold, 167.6 ppm silver, 100 ppm copper, 2,800 ppm lead, 220 ppm zinc, 190 ppm arsenic, and 71 ppm tungsten. Three samples contained 0.103 to 1.52 ppm gold and two 64 to 71 ppm tungsten; 8 had more than 0.12 ppm silver; 11 over 30 ppm copper; 18 more than 40 ppm lead; 8 more than 110 ppm zinc, and 5 over 70 ppm arsenic. A chip sample of country rock contained 0.005 ppm silver, 4.1 ppm copper, 14.9 ppm lead, 64.3 ppm zinc, and 4.5 ppm arsenic. None of 16 veins examined is high enough grade to be classified a resource. However, they contain metal values, are similar to silver-bearing veins in Silver Peak and Dyer mining districts, and may have resources at depth.
3	Elizabeth prospect (Au)*	Gold-bearing, epithermal calcite and jasperoid veins along a N. 40° to 50° E. striking, 65° to 85° SW. dipping zone that transects altered limestone, calcareous siltstone, shale, and volcanic rocks. Zone is at least 100 ft thick and can be traced for 3,300 ft. It dips under talus into study area.	Numerous pits and caved underground workings, and about 1 mi of drill roads; none within study area.	Intermountain Resources, Inc., took 65 rock chip samples. Of 65 samples, 12 had more than 0.01 oz/ton gold, with 0.26 oz/ton being highest gold value detected. Drilling (outside study area) to outline a minable deposit was in progress in 1986.

Table 1. Summary of descriptions of mines and prospects in and adjacent to the Silver Peak Range Wilderness Study Area—*Continued*

Map No. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
4	DR mine area (Ag, Au)*	West of study area, and along a zone in altered, calcareous sedimentary beds, granitic rocks, and volcanic rocks, are epithermal quartz-calcite-jasperoid veins. Veins examined are 0.7 ft to 2.1 ft thick, trend east, dip steeply, and contain limonite, malachite, pyrite, and acanthite.	For about 3 mi along zone are many small underground workings, prospect pits, and cuts. Production is indicated, but none is recorded.	Six of 18 samples taken by claimants had 1.92 to 66.8 oz/ton silver; four contained more than 20 oz/ton. Also detected were minor amounts of gold and copper. A 2.1-ft-long chip sample taken across vein outcrop nearest study area by USBM personnel had 0.07 oz/ton gold and 6.4 oz/ton silver. A grab sample from a nearby stockpile assayed 0.05 oz/ton gold, 24.1 oz/ton silver, 450 ppm copper, 0.73 percent lead, 480 ppm zinc, 560 ppm antimony, and 0.54 percent arsenic. Veins probably have resources at depth; zone that contains them trends east into study area.
5	Extra Gold prospect area (Ag, Au)	Epithermal veins poorly exposed over a 1- by 2-mi area of northwest-trending, gently southwest dipping, altered, calcareous sedimentary beds and volcanic rocks. Calcareous sedimentary beds consist of marble and hornfels, and volcanic rocks consist of andesitic flows, pyroclastics, and sediments. All contain veins and are limonite stained, silicified, and propylitically altered. Veins examined are 0.6 to 21 ft thick, trend northeast, dip steeply, and are mainly quartz and calcite containing minor amounts of limonite.	A raw prospect with claim notices and cabin.	Thirty-three samples taken by USBM personnel. Data for another sample were supplied by Sunshine Mining Company. Of 19 chip samples across veins, two assayed 0.69 and 0.137 ppm gold; one had 6.17 ppm silver, five had over 0.12 ppm silver; four contained more than 30 ppm copper; four over 40 ppm lead; two more than 110 ppm zinc; four more than 70 ppm arsenic; and three had 37 to 71 ppm tungsten. Eight grab samples of quartz assayed as much as 0.02 oz/ton silver, 120 ppm copper, 16 ppm lead, 64 ppm zinc, and 310 ppm arsenic. Three grab samples contained more than 0.12 ppm silver, two over 30 ppm copper, one more than 40 ppm lead, and 70 ppm arsenic. Seven chip samples of country rock averaged 0.07 ppm silver, 18 ppm copper, 7 ppm lead, 48 ppm zinc, and 8 ppm arsenic. Nineteen veins observed are too low grade to be identified resources. However, thick and persistent veins, geology, and metal values indicate that silver-gold resources may be present at depth.

Table 1. Summary of descriptions of mines and prospects in and adjacent to the Silver Peak Range Wilderness Study Area—*Continued*

Map No. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
6	Mud Springs prospect (Ag)*	East of study area is an east-trending, 80°- to 90°-N.-dipping zone of altered, limonitic rhyolite that is overlain by nearly horizontal latite. Zone is 400 to 800 ft wide and crops out for about 1.5 mi. Rocks along zone are sheared, propylitically and argillically altered, silic-ified, limonitic, and contain epithermal quartz veins and manganese oxide.	About 600 ft of bulldozer trenching and drill site preparation has been done.	Two samples taken by USBM personnel. A 3-ft chip sample across a shear zone had 0.7 ppm silver and 0.2 percent zinc. A grab sample of quartz breccia assayed 0.1 oz/ton silver, 49 ppm copper, 580 ppm lead, and 390 ppm zinc. Twenty-five soil samples taken and analyzed by Sunshine Mining Company. These are reported to have contained anomalous amounts of antimony, mercury, thallium, and arsenic. Metal values and geology indicate zone may have resources at depth. It extends west under latite into study area.
7	Prospect No. 7 (Ag)	An epithermal vein of leached, limonitic, quartz breccia strikes N. 70° to 85° E. and dips 85° NW. to 85° SE. in beds of kaolinized, rhyolitic volcanics. Beds trend north, dip 10° to 20° W., and contain a 2-ft thick rhyolite dike that strikes N. 50° E. and dips 90°. 1.8- to 4.0-ft-thick-vein can be traced for about 1,000 ft.	Two prospect pits and a 10-ft adit.	Five chip samples taken. Three were taken across vein, one from each of workings. A 1.8-ft sample across vein exposure in adit assayed 2.1 oz/ton silver. Second vein chip sample had 0.1 ppm silver, 33 ppm copper, 43 ppm zinc, and 200 ppm arsenic. Third contained 0.1 ppm silver. A sample of wallrock contained 0.169 ppm silver, 25 ppm copper, 29.4 ppm lead, 54.9 ppm zinc, and 1.59 ppm arsenic. A sample across dike had 0.108 ppm silver and 11 ppm arsenic. Geology and adit vein sample suggest that silver resources may be present below leached vein outcrop.
8	Prospect No. 8 (Ag)*	A 3.0-ft-thick, 25-ft-long exposure of a limonitic, epithermal quartz vein strikes N. 50° W. and dips 45° NE. in kaolinized andesite.	A 10-ft adit	A chip sample across quartz contained 2.7 ppm silver, 22 ppm copper, 280 ppm lead, 120 ppm zinc, and 700 ppm arsenic.
9	Jeff Davis prospect (Au, Ag)*	An east-trending zone of interbedded volcanic rocks that is leached, silicified, kaolinized, limonitic, and calcite-enriched is exposed in canyon bottom. Zone is exposed over an area that measures 800 ft by 600 ft and is covered by latite beyond canyon. Beds along zone strike N. 20° to 30° E., dip 35° to 85° NW., and are transected by shear zones that are 3 to 4 ft thick.	Two adits that total 25 ft.	Five chip samples taken. Two across shear zone followed by adits, and two of wallrock. One shear zone sample had 0.058 ppm gold; the other contained 0.566 ppm mercury. They also had 0.135 and 0.254 ppm silver. One wallrock sample assayed 0.054 ppm gold; the two had 0.039 and 0.005 ppm silver. Sample of tuff had no significant metal values. An epithermal mineral system that may have gold and silver resources at depth is suggested by geology and sample data.

Table 1. Summary of descriptions of mines and prospects in and adjacent to the Silver Peak Range Wilderness Study Area—*Continued*

Map No. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
10	Wildhorse mine (Ag, Pb, Zn)*	A zone of leached, epithermal, quartz, calcite, and jasperoid veins trends northeast across intensely folded, fractured, limonite-stained, kaolinized, calcareous, metasedimentary beds that trend northeast and dip southeast and volcanic rocks that are nearly horizontal. Zone is at least 300 ft wide and can be traced for about 1 mi along trend. Vein exposures examined along zone are leached, as thick as 5.0 ft, as long as 1,000 ft, strike N. 35° E. to S. 40° E., dip over 30°, and contain pyrite, sphalerite, galena, and limonite boxwork.	Eight prospect pits and three underground workings that total about 60 ft. About 100 tons of ore production is indicated; none is recorded.	A total of nine samples taken. A grab sample of vein material from stockpile had 0.13 ppm silver, 164 ppm lead, 0.88 percent zinc, and 17.2 ppm arsenic. A 2.9-ft chip sample across vein exposure in underground workings near stockpile contained 3.33 ppm silver, 0.12 percent lead, 1.05 percent zinc, and 99.6 ppm arsenic. Both samples were of material that probably came from underground. Six chip samples taken across surface vein exposures located northeast of underground workings. Of the six, two had over 0.12 ppm silver; three contained over 40 ppm lead; three had over 110 ppm zinc; and two contained more than 70 ppm arsenic. A sample of country rock assayed 0.193 ppm silver, 12.8 ppm lead, 10.1 ppm zinc, and 14.3 ppm arsenic. None of five veins examined is well enough exposed or high enough grade to warrant an estimate of resources. Geology indicates presence of an epithermal mineralized system.
11	Copper Quartz prospect (Cu, Au, Ag)*	A leached, epithermal vein containing quartz, limonite, and malachite in calcareous metasedimentary beds that strike N. 30° E. and dip 50° SE. Beds are overlain by volcanic rocks. Vein strikes N. 45° W., dips 62° NE., averages 2.2 ft thick, and can be traced for about 200 ft.	One 15-ft adit and two prospect pits.	Four chip samples taken; three chips across vein and a grab of quartz from dump. A chip sample across south end had 0.49 oz/ton gold, 0.35 oz/ton silver and 1.65 percent copper. All chip samples averaged 0.16 oz/ton silver and 1 percent copper. Grab sample assayed 0.1 oz/ton silver and 1.1 percent copper. Leached vein exposure is too erratically mineralized to be classified a resource. It, however, may have resources at depth.

Table 1. Summary of descriptions of mines and prospects in and adjacent to the Silver Peak Range Wilderness Study Area—*Continued*

Map No. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
12	American gold mine (Ag, Pb, Zn)*	A poorly exposed epithermal vein along marble beds that strike N. 30° E. and dip 25° SE. Marble is overlain by altered hornfels and volcanic beds. Vein is as thick as 3 ft, as long as 500 ft, and is mainly quartz with galena, sphalerite, limonite, and malachite.	One 50-ft shaft, seven adits totaling 200 ft, and at least 10 prospect pits. Production is indicated by workings. However, none is recorded.	Two samples taken. A 3.0-ft chip sample across only vein exposure assayed 0.6 oz/ton silver, 120 ppm copper, 2.6 percent lead, and 360 ppm zinc. A grab sample of quartz with limonite and hematite from a 10-ton stockpile had 0.03 ppm gold, 1.0 oz/ton silver, 580 ppm copper, 29.3 percent lead, and 4.1 percent zinc.
13	Valley View prospect (Cu, Au, Ag)*	Epithermal veins 2.3 to 3.6 ft thick and composed of quartz, calcite, jasperoid, limonite, hematite, and malachite strike N. 50° to 80° W. and dip 30° to 90° NE. in nearly horizontal, kaolinized, volcanic rocks near marble beds.	Three adits totaling 450 ft and seven small pits are scattered for 2.5 mi along east-trending zone that contains veins.	Six samples taken. Five chip samples across leached vein exposures and wallrock had as much as 0.85 ppm gold, 1.9 ppm silver, 0.97 percent copper, 38 ppm lead, 460 ppm zinc, and 560 ppm arsenic. A grab sample of stockpiled quartz contained trace gold, 0.85 percent copper, and 110 ppm zinc.

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