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MINERAL RESOURCE POTENTIAL OF THE SUGARLOAF ROADLESS AREA, ESMERALDA AND MINERAL COUNTIES, NEVADA

SUMMARY REPORT

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Sugarloaf Roadless Area (5296), Inyo National Forest, Esmeralda and Mineral Counties, Nevada. Sugarloaf Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

Geologic, geochemical, mineral, and mines and prospects investigations were conducted to evaluate the mineral resources of the Sugarloaf Roadless Area in Esmeralda and Mineral Counties, Nev., (fig. 1). The principal metallic mineral resources are silver, gold, and mercury, with low potential for lead, zinc, and copper resources. The nonmetallic mineral fluorite (fluorspar) occurs locally. Alunite (potassium aluminum sulfate) formed by alteration of the silicic volcanic rocks is widespread in the southeastern part of the area. Several areas of alteration and mineralization suggest that there is potential for undiscovered mineral resources not identified by surface exploration.

The southwestern part of the area around Queen Canyon has a moderate resource potential for silver and a low resource potential for lead, zinc, and copper. The Indian Queen-Poorman mine is the largest of several past producers in this area and contains 180,000 tons of measured and inferred low-grade resources averaging 2 oz silver per ton. The north-central part of the area south of Sugarloaf mountain has a low potential for gold resources. The Tip Top mine, adjacent to the roadless area, was the largest gold producer in the area. The Brownie mine within the roadless area contains 8,800 tons of indicated and inferred low-grade resources averaging 0.21 oz gold per ton. The eastern part of the roadless area has a low resource potential for mercury at a number of localities and some gold occurs in this area as well. The Red Rose and the F and L mercury mines have had small production and a number of other mines southeast of the roadless area have had significant mercury production. The F and L mine contains 200,000 tons of rhyolite averaging 0.8 lb mercury per ton. At several localities along the west boundary of the roadless area fluorite is found and has been mined at one place outside the roadless area (King-Blue Bell mine).

INTRODUCTION

Area description

The Sugarloaf Roadless Area covers 17.5 mi^2 in the northern part of the White Mountains in Esmeralda and Mineral Counties, Nev. It is about 45 mi north of Bishop, Calif., via U.S. Highway 6. Access is by unpaved roads leading eastward into Queen Canyon and southward from Montgomery Pass. The highest point in the roadless area is Mustang Mountain, 10,288 ft above sea level, located in the western part of the area. Queen Valley, on the west edge of the roadless area at the north end of Owens Valley, has an elevation of 6,400 ft above sea level. The region is arid, lying in the rain shadow of the Sierra Nevada which is located about 40 mi to the west. Vegetation is typical of the transition climatic zone and consists of sage and rabbitbrush with sparse grass at lower elevations and pinon and juniper at higher elevations. Willows and wild roses are prolific around springs and flowing streams.

Previous and present investigations

Information on early mining activity and production in the area is in Whitehill (1875-76), Whiting (1888), Lincoln (1923), Bailey and Phoenix (1944), and Horton (1961). Geologic maps of the area include Crowder and others (1973), Robinson and Crowder (1973), and McKee (1982). A map outlining drainages with geochemical anomalies in the roadless area is that of Donahoe and Chaffee (1983).

Geologic and geochemical investigations for this report were done in 1980-82 by the U.S. Geological Survey. The U.S. Bureau of Mines collected mineral-related information from published and unpublished literature, from the U.S. Bureau of Mines production files, county mining records, and from the U.S. Forest Service and U.S. Bureau of Land Management files. Field studies were carried out during the summer of 1982 to evaluate 36 mining properties in or near the roadless area and a total of 647 samples were collected for analysis. Detailed descriptions of mining properties from this area are in Schmauch and others (1983).

GENERAL GEOLOGY

Rocks of the northern White Mountains in the area that includes the Sugarloaf Roadless Area range from Cambrian to Quaternary in age. The oldest rocks are metamorphosed strata, now phyllite, slate, and marble, that

are correlated with Cambrian strata from the southern part of the White Mountains (Crowder and others, 1973). Limestone, shale, and chert of the Ordovician Palmetto Formation are in thrust contact with these Cambrian rocks. Mesozoic plutonic rocks of the Inyo batholith, an eastern part of the Sierra Nevada batholith, intrude the Paleozoic rocks. Lying unconformably on the Mesozoic granitic and Paleozoic metasedimentary rocks are late Cenozoic volcanic rocks and unconsolidated sedimentary deposits.

Sedimentary and metamorphic rocks

An undetermined thickness of low-grade metamorphic rocks crops out in the Queen Canyon area and elsewhere locally in the northern part of the White Mountains. These rocks are now mostly phyllite, spotted hornfels, and marble and are considered by Crowder and others (1973) most likely to be the Lower Cambrian Poleta and Harkless Formations. They are in thrust contact with the Ordovician Palmetto Formation.

The Palmetto Formation of Ordovician age consists of black chert, dark siltstone, and rhythmically alternating beds of brown fine-grained limestone that is now metamorphosed to marble. The dark fine-grained lithology of the formation indicates deep-water sedimentation and contrasts sharply with the limestone and sandstone shallow marine facies of the Cambrian rocks in the White Mountains.

Plutonic rocks

About one-half of all the rocks exposed in the White Mountains are granitic types of the multipluton Inyo batholith. Small parts of two of these plutons lie within the Sugarloaf Roadless Area.

Hornblende diorite of the Triassic and (or) Jurassic Queen Canyon pluton, one of the smallest plutons in the Inyo batholith, covers less than 0.5 mi^2 within the roadless area on the south side of Queen Canyon. The hornblende diorite of Queen Canyon is a heterogeneous medium- to fine-grained hornblende diorite cut by dikes of biotite-hornblende granodiorite, and less commonly by granitic and alaskite dikes.

The Pellisier Flat pluton of Jurassic age crops out over an area of about 60 mi^2 in the northern part of the White Mountains. About 1 mi^2 lies within the Sugarloaf Roadless Area in the area around Brownie Creek. This pluton is composed of medium- to coarse-grained biotite-hornblende quartz monzonite to granite. Fine-grained leucocratic granite, aplite, and pegmatite dikes are scattered throughout this pluton.

Stratified and hypabyssal rocks

Cenozoic volcanic and sedimentary rocks make up most of the Sugarloaf Roadless Area. These rocks include rhyolitic, andesitic, and basaltic lava flows, rhyolitic ash flows, and a variety of rhyolitic and andesitic agglomeratic and clastic volcanogenic sedimentary rocks. Rhyolite flows, tuff, and tuffaceous sandstone are the most widespread rocks in the roadless area. These units are the products of small exogenous volcanoes and are thickest near their vents. The units are lenticular and are interbedded with a wide variety of sedimentary and other volcanogenic rock types. The rhyolitic rocks weather to shades of pink, lavender, and gray, and zones of dark glass are common at the contact with older rocks. The lava flows and shallow intrusive bodies are typically aphanitic and contain less than 5 percent phenocrysts of quartz, sanidine, oligoclase, biotite, and hornblende. Silicification, alunitization, zeolitization, and other types of alteration are locally pervasive. Rhyolitic tuff and tuff-breccia are white to light gray, thin to thick bedded, and poorly sorted. They typically contain crystals of quartz, sanidine, and biotite in a groundmass of mostly devitrified glass shards.

Andesite occurs as lenticular randomly interbedded lava flows, agglomerate, tuff, and tuffaceous sedimentary rocks. Typically these rocks are dark-brown to gray porphyritic plagioclase-pyroxene or hornblende andesite. Agglomerate consists of poorly sorted angular fragments of andesite in a matrix of brown to lavender mud, silt, and sand.

Basalt lava flows form a cap on the northernmost part of the White Mountains north of the Sugarloaf Roadless Area and on Mustang Mountain within the area. The flows are medium to dark gray or brown, fine grained, and locally vesicular. Phenocrysts of olivine, plagioclase, and pyroxene are locally present in an intergranular groundmass of plagioclase, clinopyroxene, olivine, magnetite, and devitrified glass.

Structure

Structures in the northern White Mountains can be classified in three groups on the basis of style and age. From oldest to youngest, the groups are: (1) thrust faults, thought to have been formed during the middle Paleozoic Antler orogeny, which brought the Ordovician rocks into the White Mountains region from as much as 40 mi to the northwest; (2) small and large open folds, high-angle faults, and some contact metamorphism that is related to emplacement of Jurassic and Cretaceous granitic rocks of the Inyo batholith; and (3) late Tertiary to Holocene uplift of the range by high-angle normal faulting. This basin and range uplift accelerated erosion during the latter part of the Tertiary. Faults of this type are presently active.

Most of the large-scale structural features in the Sugarloaf Roadless Area are covered by a thick mantle of Tertiary volcanic and sedimentary rocks. Shear zones in the Tertiary rocks are poorly defined and generally of small scale. Faults or shear zones are recognized in Tertiary rocks at the Brownie mine and at a number of places in the eastern part of the area. These features are not shown in the geologic map as they are too small to be represented at a scale of 1:62,500.

GEOCHEMICAL STUDIES

Samples of rock, stream sediment, and nonmagnetic heavy-mineral concentrates collected by the U.S. Geological Survey were analyzed for 31 elements using a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968). Because of the limited amount of each sample, the nonmagnetic heavy-mineral concentrate was only analyzed spectrographically. All the rock and stream-sediment samples were also analyzed for zinc by atomic-absorption spectrometry (Ward and others, 1969); some of these samples were analyzed for gold by the same technique (Meier, 1980). Stream-sediment samples were also analyzed for uranium using a modification of the fluorimetric method of Centanni and others (1956). Results of the analyses and their geochemical interpretation are given by Donahoe and Chaffee (1983).

Of the as many as 34 elements determined in the three types of samples, 10 were selected from the stream-sediment samples and 18 were selected from the samples of nonmagnetic heavy-mineral concentrate as possibly being related to hydrothermal alteration and (or) mineralization. A background and anomaly range and a threshold value (highest background value) for these elements were selected on the basis of a visual inspection of a frequency distribution plot. The threshold values for the Sugarloaf Roadless Area were also compared with those determined in a much larger region north of the study area—the Walker Lake 1° by 2° quadrangle. For the sediment and concentrate samples, the anomalously high concentrations for each selected element were assigned to one of two or three concentration-range categories in order to better identify weakly, moderately, or strongly anomalous samples. Drainage basins with anomalous samples were assigned a numerical score based on the number of anomalous elements and their concentration levels (Donahoe and Chaffee, 1983). In general, the higher the anomaly score for a site, the more significant is that site (and drainage basin) in terms of mineral potential.

MINING HISTORY AND MINING ACTIVITY

Formed in 1862, the Oneota was the first mining

district which included part of the Sugarloaf area. This district was soon abandoned, but it was reorganized after the discovery and development of the Indian Queen mine in 1870 (Lincoln, 1923). The Oneota district was also known as the Mount Montgomery, Basalt, Queens, and Buena Vista district. A less well-known mining district that covered all or part of the study area was the White Mountain district.

Mining activity and production were mostly in three parts of the study area: Queen Canyon, Sugarloaf mountain, and Trail Canyon. Prospecting in Queen Canyon began in 1862, but it was not until the discovery of the Indian Queen mine in 1870 that interest in the area became significant. By 1873, a four-stamp mill was processing silver, gold, and lead ore. Several more mines were developed in Queen Canyon, and intermittent production was reported from them from 1873 to 1930. During the next 50 years the Indian Queen mine was leased several times. From 1980 to 1983 it was leased again by Candelaria Metals, Inc., of Bishop, Calif. Workings at several mines were reopened, and improvements to a mine haulage road were completed. Plans for mining and for millsite construction at the mouth of Queen Canyon were suspended when silver prices fell below $10 per oz (Paul Spor, oral commun., 1982).

Prospecting in the late 1800's led to several gold and mercury discoveries near Sugarloaf mountain. The most significant gold producer inside the roadless area was the Brownie mine. Production was continuous from 1908 to 1915, and intermittent to 1941. By 1915 the ores were processed on-site by a stamp mill and an amalgamation plant. Also by 1915, a 10-stamp mill with a 50-ton-per-day capacity was processing siliceous gold and silver ore at the Tip Top mine (Heikes, 1915). Production from this property, which is adjacent to the roadless area, ceased in 1919. During its short period of mining, it produced over 3,000 oz of gold. After a 50- to 60-year period of little activity, Cordex Exploration Company located the Tip and leased the Gold claim groups, which include the Brownie and Tip Top mines, and started an evaluation program in 1980. Since then, the company has conducted geologic mapping and geochemical surveys, and collected samples from outcrops, mine and prospect workings, and 27 core-drill holes.

There is little historical data regarding the mercury properties near Sugarloaf mountain. The Wild Rose mine (Starlight) was one of the earliest discoveries, and was the only producer. West of Sugarloaf mountain, several properties in the northwest corner of the study area contain copper or silver minerals, or fluorite.

Trail Canyon was first prospected for mercury. The F and L mine and the Red Rose (Tiger claim) produced mercury ore from 1934 to 1942. The B and B mine, adjacent to the roadless area, was the largest producer, followed by the Red Rock and Container mines, which are about 2 mi to the southeast. Mercury-bearing rhyolite was roasted in crude retorts to recover mercury at the small mines. The larger mines had more sophisticated equipment, but the recovery processes were similar.

Interest in this area was renewed in the 1970's when Earth Sciences, Inc., applied to the U.S. Forest Service for a prospecting permit for alunite, which contains aluminum and potassium. Work by Earth Sciences, Inc., indicates two poorly defined alunite bodies. Exploration of the occurrence is still in a preliminary stage and there is no current activity. Extraction of aluminum from alunite is an economically unproven procedure.

U.S. Steel Corporation has located the Jon claim group, part of which covers the Red Rose and F and L mine sites. Since 1980, drill-hole, geologic, and geochemical data have been collected to determine if there are precious-metal deposits beneath the mercury-bearing zone.

Table 1 summarizes recorded production from the mines in and adjacent to the Sugarloaf Roadless Area.

Mining claims

At least 633 lode claims were located in or near the roadless area since 1862. About 255 of these have been located between 1980 and 1982; many are included in the large Jon, Tip, and Beth claim groups. In 1975, Earth Sciences, Inc., National Steel Corp., and the Southwire Company applied for prospecting permits for the MTC potassium and alunite property. This property covers 2,200 acres; 960 acres lie inside the roadless area and include the Red Rose (Tiger claim) and the F and L mercury mines. The Indian Queen-Poorman mine is located on the only patented claims inside the roadless area. The Tip Top mine is adjacent to patented ground (Buena Vista and Gold Standard) that is contiguous with the north boundary of the roadless area.

Summary descriptions of all properties examined during this investigation are included in table 2, along with an assessment of mineral resource potential. The names of several properties listed as "unknown prospect" in table 2 could not be identified by claim notices or through published literature.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Definitions

The definitions of mineral resource classifications are from U.S. Bureau of Mines and U.S. Geological Survey (1980). The measured, indicated, and inferred categories, respectively, reflect decreasing knowledge of the characteristics of a deposit. For this report, an attempt has been made to further define subeconomic resources and resource potential. Deposits classified as reserves are deposits believed to be minable at a profit, under current economic conditions. Feasibility studies were conducted to substantiate this classification. Properties having marginal reserves would require improvement of economic conditions, as much as 50 percent increase in commodity price, or identification of a larger deposit for an equivalent reduction in unit production cost. Subeconomic resources would require a greater improvement in economic conditions and (or) identification of a larger deposit to be mined profitably. In this report, a subeconomic resource, if mined, is expected to return at least 20 percent of the cost of producing the commodity(s). In some cases, identified tonnage and grade estimated at a mining property may not be sufficient to support a resource classification, however, it would warrant that classification assuming consolidation and development with other properties.

The terms high, moderate, and low resource potential, as used in this report, reflect degrees of probability that undiscovered resources exist. The resource potential is based on assessment of published information, field examination of geologic features, geochemical sample analyses, and mine and prospect evaluation. The mineral resource potential of the Sugarloaf Roadless Area is summarized in figure 2.

Areas and deposits

Most of the eastern part of the roadless area is underlain by rhyolitic, dacitic, and andesitic rocks. Geochemical anomalies in this area consist predominantly of the element mercury. These anomalies, like most others in western Nevada, are closely and probably genetically related to Tertiary silicic igneous activity. Locally, as near Sugarloaf mountain, gold and silver mineralization is associated with quartz in a northeast-trending brecciated fault zone. Other faults in the volcanic rocks are not easily detected, but those recognized contain gold and mercury minerals in places. The extensive silicification and alunitization and the presence of mercury and fluorite are further indications of regional alteration of silicic volcanic rocks. Hydrothermal alteration on this large scale suggests the possibility of base and precious metalization at depth.

The western part of the roadless area contains Paleozoic metamorphic rocks, Mesozoic granitic rocks, and Tertiary volcanic rocks. Most of the stream-sediment and panned-concentrate samples from drainage basins in this part of the area contain significant anomalies for many of the elements that are indicative of hydrothermal alteration and (or) mineralization. The anomalous elements include silver, gold, and locally mercury and zinc in the stream-sediment samples, and silver, lead, and locally arsenic, gold, bismuth, cadmium, copper, tin, tungsten, and zinc in panned-

concentrate samples. Lead isotope studies of ores from Queen Canyon suggest that the metal source is from the nearby Jurassic plutons (Robert Zartman, oral commun., 1982).

The three parts of the Sugarloaf Roadless Area that have significant mineral resource potential are: (1) the southwestern part, particularly the Queen Canyon area, which has a moderate resource potential for silver and a low resource potential for lead, zinc, and copper; (2) the north-central part, near Sugarloaf mountain, which has a low resource potential for gold, silver, and fluorspar; and (3) the southeastern part which has a low resource potential for mercury.

Queen Canyon area

The Indian Queen mine is the most important mining property in the Sugarloaf Roadless Area. A near-surface mineralized zone in Paleozoic phyllite is estimated to contain 170,000 tons of subeconomic resources at an average grade of 2.0 oz silver per ton. There are about 10,000 tons of subeconomic resources averaging at least 2.0 oz silver per ton in the old mine dumps. This mining property has a moderate potential for undiscovered silver resources and a low potential for lead, zinc, and copper resources.

In Queen Canyon a large group of claims, known as the Indian Queen project, covers several properties including the Indian Queen-Poorman mine. The part of this claim group in the roadless area has a low potential for silver, lead, zinc, and copper resources.

None of the mineral deposits in the Queen Canyon area are presently minable at a profit.

Sugarloaf mountain area

The most important property in this area is the Brownie mine. Only a small segment of the mineralized zone was accessible; from these limited exposures a total of 8,800 tons of indicated and inferred subeconomic resources with an average grade of 0.21 oz gold per ton was estimated. This property has a moderate potential for additional gold and silver resources.

There are several widely spaced fluorspar properties in and adjacent to the west boundary of the roadless area. Data was insufficient to estimate tonnage and grade. The resource potential for fluorspar is low at the Fluorspar No. 1 and the unknown (SE 1/4 sec. 18, T. 1 S., R. 33 E.) prospects.

Trail Canyon area

The F and L mine is the most important mine in this area. It has 200,000 tons of mercury-bearing rhyolite averaging 0.8 lb mercury per ton. This property has a low potential for mercury resources.

Alunite (hydrous potassium aluminum sulfate) occurs in the southeast corner of the study area, but little is known about extent or grade of the deposit. Extraction of alumina from alunite is an economically unproven procedure.

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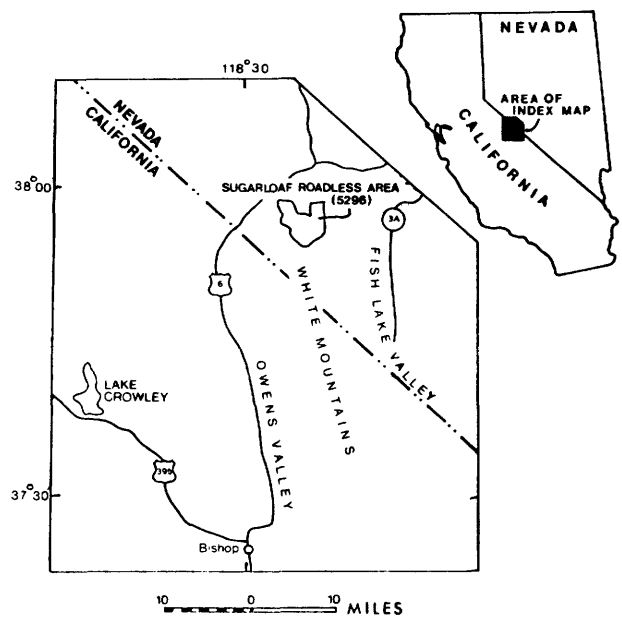

Figure 1.--Index map showing location of the Sugarloaf Roadless Area (5296), Nev.

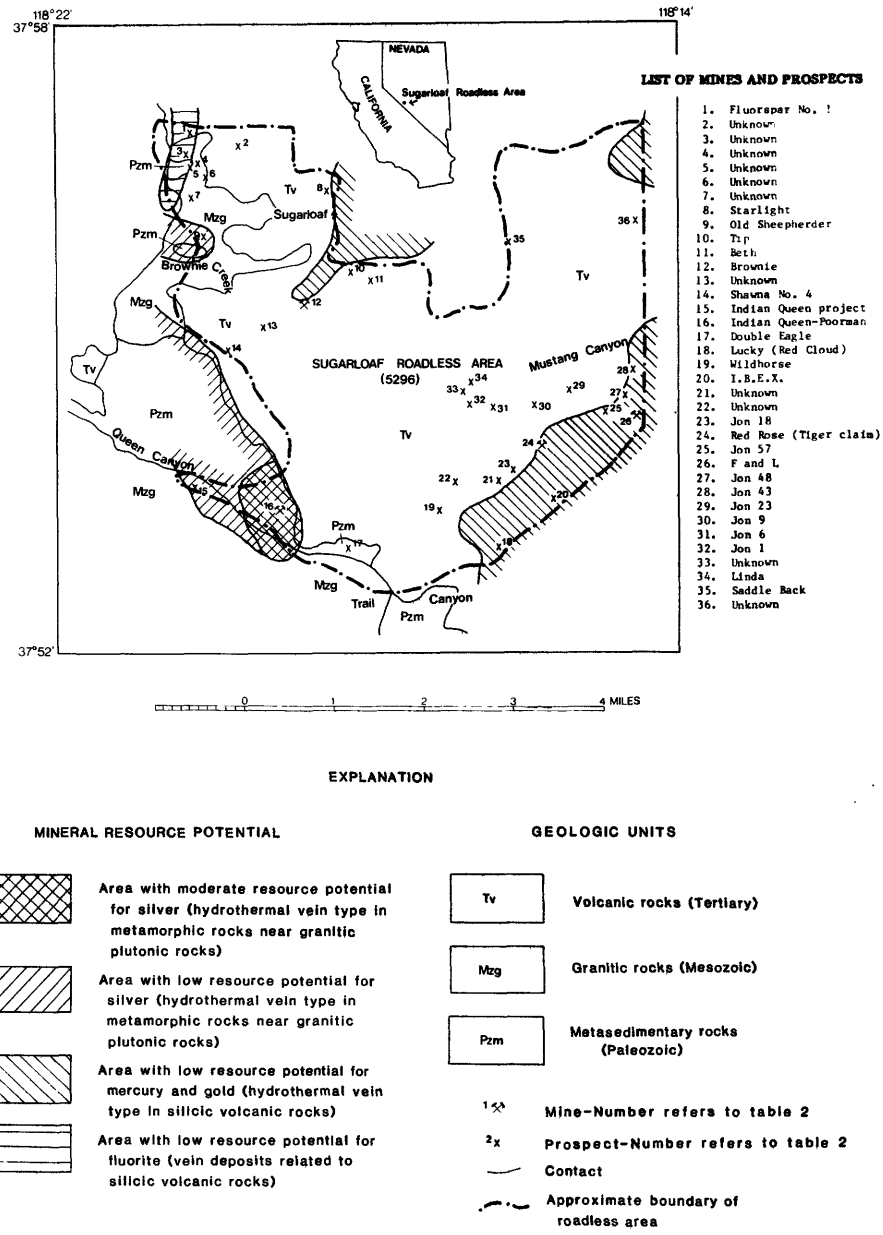

Figure 2.--Simplified geologic map showing areas of mineral resource potential and mines and prospects, Sugarloaf Roadless Area, Nev.

Table 1.--Recorded production from lode deposits in and adjacent to the Sugarloaf Roadless Area
[From U.S. Bureau of Mines production files; underlined properties are inside the area; NR, not reported]

Property	Year(s)	Tons	Gold (oz)	Silver (oz)	Mercury (76-lb flasks)
B and B mine	1927-1969	108,873	NR	NR	7,158
Brownie mine (Gold Nos. 1-6)	1908-1941	2,682	393.4	327	NR
F and L mine	1937-1941	125	NR	NR	13
King-Blue Bell mine[1]	1937	200	NR	NR	NR
Indian Queen-Poorman mine[2]	1870-1958	1,163	91.8	108,871	NR
Red Rose mine (Tiger claim)	1934-1942	NR	NR	NR	1
OK mine (Pinchot Canyon or Esmeralda)	1941	30	NR	NR	7
Tip Top mine (Thorndyke and Bley)	1912-1919	7,383	3,220.0	19,736	NR
L and D mine	1943-1944	60	NR	NR	26
Buckskin mine	1956	NR	NR	NR	2
Wild Rose mine[3] (Red Rose mines) (Starlight) (Mount Montgomery)	1916-1931	112	NR	NR	163
Total in roadless area		4,047	485.2	109,198	38
Total in and adjacent to roadless area		120,588	3,705.2	128,934	7,394

[1]Fluorspar, grade unknown.

[2]Exact production figures are not available; amounts reported here are from 1876 to 1914. The Indian Queen-Poorman mine also produced 161,535 lb of lead, 31,062 lb of copper, and 543 lb of zinc during this same time period. Mines in Queen Canyon which may have had production attributed to Indian Queen-Poorman mine or reported as Queen Canyon area production include: Albert mine, Morgan (Diana) mine, Spohr mine, Queen Canyon mine, Maley tunnel, and Mathieu tunnel. Whitehill (1875-76) attributes production of gold, silver, lead, zinc, and copper worth $1 million to the Indian Queen mine.

[3]This property was first known as Mount Montgomery in 1916. It was later known as the Red Rose from 1919 to 1931 [not to be confused with the Red Rose mine (Tiger claim)]. It was called Starlight group in 1929 and 1957, and the Starlight in 1981. Bailey and Phoenix (1944, p. 74) state that the Wild Rose mine produced 163 flasks of mercury by the end of 1943.

Table 2.--Summary of mines and prospects in the Sugarloaf Roadless Area

[Underlined names refer to properties with mineral resources or resource potential; those not underlined have no apparent potential or are insufficiently exposed to permit evaluation. The numbers in parentheses following "unknown prospect" represent the locations by section, Township 1 North, and Range 33 East, with respect to the Mount Diablo Baseline and Meridian]

Property no. (fig. 2)	Name	Summary	Workings and production	Resource/sample data
1	Fluorspar No. 1 prospect	Undefined zones of silicified rhyolite, opal, drusy quartz coatings on fractures, and bladed, iron-stained quartz boxwork in rhyolite. Fluorite crystals from 1/8 in. to 1/4 in. occur in some of the rhyolite.	Two inclined shafts. One is 15 ft deep, the other caved at 15 ft, and two trenches.	Nine samples contained between 0.5 percent and 8.4 percent fluorite (CaF_2) and averaged 2.39 percent. This is part of a larger fluorite occurrence along the west boundary of the Sugarloaf area. The property has a low potential for fluorite resources.
2	Unknown prospect (NW 1/4 17, 1, 33)	Outcrop of opaline rhyolite with quartz-filled vugs, pyrite, and limonite is exposed over a 115- by 55-ft area in tuff and tuff breccia.	One small pit.	Two random and one select samples contained no significant values.
3	Unknown prospect (NW 1/4 18, 1, 33)	A dark-green diabase dike with associated marble and calcite.	One trench 32 ft long.	One sample contained 0.9 percent fluorite (CaF_2).
4	Unknown prospect (NE 1/4 18, 1, 33)	A zone of silicified and altered volcanic rocks up to 50 ft wide trends north for about 1,000 ft. Rocks at the south end are stained with iron oxides.	One 50-ft adit and four small pits.	Seven grab or chip samples were collected. Two samples assayed 0.08 and 0.01 percent copper.
5	Unknown prospect (SE 1/4 18, 1, 33)	A poorly defined, northwest-trending shear zone 30 ft thick over a 40-ft exposed strike length may extend for 300 ft through highly altered granitic rocks and partly assimilated metavolcanic and metasedimentary rocks. The north end of this zone is heavily iron oxide-stained, silicified, and contains altered granitic rocks, epidote, calcite, chrysocolla, malachite, and azurite. Fluorite occurs as disseminations and fracture fillings and is not bounded by rock type or structure.	Two adits, 40 and 205 ft long, a caved adit, three partly filled shafts, an open cut, and a pit.	Twenty-three samples were collected. Sixteen ranged between 1.40 percent and 3.30 percent and averaged 2.05 percent fluorite (CaF_2). Six samples ranged between 0.2 and 2.6 oz silver per ton. One select sample assayed 4.8 percent copper. The property has a low potential for fluorite resources.
6	Unknown prospect (SW 1/4 17, 1, 33)	A silicified fracture about 0.3 ft thick strikes N. 84° E. and dips 30° NW. in altered volcanic rock.	One 16-ft adit.	A chip sample contained 2.3 percent fluorite (CaF_2).
7	Unknown prospect (SE 1/4 18, 1, 33)	A light-green to gray porphyritic andesite dike strikes generally north and dips to the east within granitic rocks. A fault zone offsets the dike.	One 12-ft adit.	Three chip samples contained no significant values.

Table 2.--Summary of mines and prospects in the Sugarloaf Roadless Area--Continued

Property no. (fig. 2)	Name	Summary	Workings and production	Resource/sample data
8	Starlight prospect	Opalite in tuff and siliceous rhyolite. Mafic intrusive rocks occur with rhyolite as inclusions at one locale.	Five shallow trenches, 50 to 60 ft long, a 180-ft-long bulldozer cut, and three small pits.	Ten samples were collected. One sample contained 0.4 oz silver per ton.
9	Old Sheepherder prospect	A milky-white quartz vein that ranges from 1 to 3 ft thick in an iron-stained fault-breccia and gouge zone is intermittently exposed for over 1/2 mi in granitic rock.	Five small pits.	Two of the five grab samples contained 0.2 and 0.3 oz silver per ton, and one contained 0.152 oz gold per ton.
10	Tip prospect	Andesite lies in contact with bleached and altered rhyolite along a N.-80°-E. trend. Opalite near the contact occurs as small pods and veinlets.	One 60-ft adit and 18 shallow pits and trenches.	Of the 23 grab and random chip samples, three contained 1.2, 0.4, and 0.2 oz silver per ton.
11	Beth prospect	Rust-brown to gray, vuggy andesite lies in contact with bleached and altered rhyolite along a N.-80°-E. trend. Rhyolite is iron stained, and contains pods and veinlets of opalite and siliceous breccia.	Seven pits.	Seven grab samples contained no significant values.
12	Brownie mine (Gold Nos. 1-6)	A northeast-trending shear zone is partly exposed for about 1,100 ft in rhyolite. A 106-ft segment in this area, exposed underground, averages 4.6 ft thick, strikes N. 60° E., and dips 60° to 70° SE. It is composed of friable, silicified rhyolite with brecciated and mineralized quartz fragments. A less well defined zone of shearing 30 ft thick is adjacent to the main shear-zone footwall, and contains lower gold values.	This mine was developed by adits on five levels, with about 3,000 ft of workings, of which 550 ft is accessible. Eight of the ten adits are caved near the portals. Other workings include a caved shaft, two shallow bulldozer cuts, and five small pits. From 1908 to 1941 the Brownie mine produced 393.4 oz of gold and 327.0 oz of silver from 2,682 tons of ore (U.S. Bureau of Mines production records).	In the accessible workings, 8,800 tons of indicated and inferred subeconomic resources averaging 0.21 oz gold per ton is estimated. Inaccessible workings preclude a complete resource estimate. Fifty-four samples were taken, including 27 from other workings near the mine. Of those 27 samples, four contained significant gold values, ranging from 0.172 to 0.546 oz per ton; four also contained a maximum of 0.8 oz silver per ton. The property has a moderate potential for additional gold and silver resources.
13	Unknown prospect (29, 1, 33)	Rhyolite and rhyolite porphyry are locally altered and silicified. The rocks are spherulitic to vesicular, iron stained, and contain quartz along fractures.	Five small pits.	One grab sample was collected at each pit. Two samples contained 0.3 and 0.6 percent fluorspar (CaF_2).
14	Shawna No. 4 prospect	Altered and iron-stained rhyolite and phyllite are locally silicified.	Numerous shallow bulldozer cuts occur over a distance of 2,000 ft.	Six samples contained from 0.3 to 0.4 percent fluorite (CaF_2). One sample assayed 0.4 oz silver per ton.

Table 2.--Summary of mines and prospects in the Sugarloaf Roadless Area--Continued

Property no. (fig. 2)	Name	Summary	Workings and production	Resource/sample data
15	Indian Queen [1] project	Sulfide minerals are concentrated in randomly oriented quartz-filled fractures and shears, or in tabular quartz veins in bedding-plane faults in phyllite. These veins are discontinuous, less than 0.5 ft thick, and offset within short distances. Galena, sphalerite, pyrite, and chalcopyrite are the main sulfide minerals observed.	There are fourteen adits, (several are caved underground), one inclined shaft, 24 pits and trenches, and several thousand feet of bedrock exposed in numerous shallow bulldozer trenches. Adits range from 60 to 520 ft long and total about 2,500 ft.	One hundred fifty-two samples were collected from dumps and mineralized structures. The two highest silver assays are 44.5 and 26.2 oz silver per ton; eight other samples ranged from 3.2 to 15.0 oz silver per ton. Of these ten highest grade samples, four assayed from 3.1 percent to 7.35 percent lead, and six ranged from 0.10 percent to 1.24 percent lead; one sample assayed 21 percent zinc, and nine ranged from 0.05 percent to 1.41 percent zinc and 0.10 to 0.60 percent copper. Eight other samples assayed from 1 to 3 oz silver per ton. The claim area has a low potential for silver, lead, zinc and copper resources, because veins are narrow and discontinuous.
16	Indian Queen-Poorman mine	Massive to thin-bedded green to tan phyllite strikes north to N. 20° W. and dips 17° to 37° NE. Bedding-plane and northeast- to northwest-trending faults and shear zones disrupt the rocks in a complex pattern. Dip directions are diverse with angles ranging from 20° to vertical. Most shear zones are less than 1 ft thick and 20 ft long, with extreme thickness variation along dip and strike. Contacts vary from well defined to a concentration of closely spaced fractures leading into competent rock. The sulfide minerals occur in thin streaks, up to 2 in. thick and 7 in. long, and fine disseminations in gray quartz, in shear-zone gouge, incompetent phyllite bordering mineralized shear zones, and in silicified competent horizons of phyllite. Galena, tetrahedrite, sphalerite, chalcopyrite, pyrite, and malachite were observed. Laboratory tests identified acanthite (argentite) and native silver.	There are about 2,500 ft of underground workings consisting of two main levels connected by a decline. Drifts, crosscuts, and stopes were developed where minerals were concentrated. The remains of a boiler, hoisting equipment, and vent systems are underground. Most production occurred between 1870 and 1917. There are no records from 1877 to 1901 and some additional production data is held by the owners. Publishable data from Bureau of Mines records indicate that from 1871 to 1914 1,163 tons of ore yielded 91.8 oz gold, 108,871 oz silver, 161,535 lb lead, 31,062 lb copper, and 543 lb zinc. Whitehall (1875-76) estimated production from this mine prior to 1876 at $1 million.	Thirty-nine of 196 samples taken underground contained from 3 to 52.1 oz silver per ton. Of the silver-rich samples, 19 contained 1 to 3 percent lead and (or) zinc each. Thirty of these samples came from a 200-ft^2 by 50-ft-thick block near the end of the Indian Queen level. The block contains 170,000 tons of inferred subeconomic resources averaging 2 oz silver per ton; lead and zinc values are negligible. Mine dumps contain 10,000 tons of measured subeconomic resources averaging at least 2 oz silver per ton. Sampling did not substantiate recorded production of copper and gold. Production from nearby workings, richer in copper and gold, may have been attributed to this mine. The property has a moderate potential for additional silver, and a low potential for lead and zinc resources.

Table 2.--Summary of mines and prospects in the Sugarloaf Roadless Area--Continued

Property no. (fig. 2)	Name	Summary	Workings and production	Resource/sample data
17	Double Eagle prospect	Phyllite is in contact with granitic rock and rhyolite. Quartz-vein material up to 5 in. thick was found in float. Rhyolite contains sparse amounts of opal.	One bulldozer trench and four small pits.	Five select or grab samples contained no significant values.
18	Lucky (Red Cloud) prospect	Rhyolite and tuff breccia with nodules and veinlets of white and red opalite.	Ten trenches or shallow bulldozer cuts, two pits, and one caved adit.	Twelve grab and one select sample were collected. Four samples ranged from 0.3 to 0.4 oz silver per ton. The select sample contained 9 lb mercury per ton; others had from none detected to a trace.
19	Wildhorse prospect	Tuff and tuff breccia with banded and nodular opalite.	Three shallow trenches up to 70 ft long.	Five grab or select samples were collected. Two samples contained 0.7 and 0.2 oz silver per ton.
20	I.B.E.X. prospect	Andesite float and colluvium.	Five bulldozer cuts up to 103 ft long.	No significant values were detected in five grab samples.
21	Unknown prospect (35, 1, 33)	Iron oxide-stained, tan siliceous rhyolite.	One pit.	Two grab samples contained no significant values.
22	Unknown prospect (34, 1, 33)	Rhyolite porphyry, rhyolite pebble breccia, and tuff with opaline fracture filling.	Two small pits.	Two grab samples contained no significant values.
23	Jon 18 prospect	Iron oxide-stained, siliceous rhyolite.	One caved shaft.	No significant values were detected in a grab sample from the dump.
24	Red Rose mine (Tiger claim)	Spherulitic, glassy flows, tuffs, and silicified, banded, flow rhyolite. Cinnabar is reported to occur as films and encrustations in clay gouge along an east-trending fault and as disseminations in opalized rhyolite (Bailey and Phoenix, 1944, p. 73).	An open pit, with highwalls up to 209 ft, covers an area 500 ft by 300 ft. Other workings include eleven small pits and trenches. Bailey and Phoenix (1944, p. 74) reported 1 flask of mercury was produced between 1934 and 1942.	No significant values were detected in 17 samples.
25	Jon 57 prospect	Iron oxide-stained rhyolite, bleached and iron oxide-stained tuff, tuffaceous sandstone, and calcite dikes.	Areas of extensive bulldozer excavation up to 200 ft long, 50 ft wide, and 1 to 2 ft deep.	Of ten grab or select samples collected, one contained 0.01 oz gold per ton.

Table 2.--Summary of mines and prospects in the Sugarloaf Roadless Area--Continued

Property no. (fig. 2)	Name	Summary	Workings and production	Resource/sample data
26	F and L mine	The country rocks are composed of layered sequences of bleached folded tuff, flow breccia, and rhyolite flows. Vertical plume structures of hematite stain contain traces of gold. Mercury occurs as cinnabar in poorly defined opalite bodies.	Three bench cuts cover an area about 1,200 ft by 1,400 ft. A 71-ft-deep shaft, a caved shaft, a caved adit, and several trenches are within the mine area. Thirteen flasks of mercury were produced from 1937 to 1941 (U.S. Bureau of Mines production records).	Thirty-four chip and grab samples were collected. Mercury was detected in 14 samples, all in the upper bench area. There is about 200,000 tons of mercury-bearing rhyolite in an area 300 ft by 500 ft with an estimated average depth of 20 ft. The grade averages about 0.8 lb mercury per ton. The property has a low potential for mercury resources.
27	Jon 48 prospect	A north-striking calcite dike 1 to 2 ft thick with quartz stringers is exposed for 60 ft. The dike is bounded by fractured and silicified rhyolite.	A 20-ft adit and pit.	Four samples contained no significant values.
28	Jon 43 prospects	Rhyolite colluvium.	Two trenches, each 15 ft long.	Two grab samples, one from each trench, contained no significant values.
29	Jon 23 prospect	Tan and purple, iron oxide-stained, flow-banded rhyolite with sparse secondary calcite.	Two shallow pits.	No significant values were detected in two grab samples.
30	Jon 9 prospect	Rhyolite tuff and tuff agglomerate are locally iron oxide stained and opalized.	One shallow bulldozer trench and small pit.	Two grab or select samples had no significant values.
31	Jon 6 prospect	Bleached tuff is iron stained and opal occurs locally.	Bulldozer trenches up to 5 ft deep cut an area 250 ft long and 50 ft wide.	Four grab or select samples had no significant values.
32	Jon 1 prospect	Tan to brown siliceous bedded tuff lies in contact with rhyolite along a N.-35°-E. trend.	Two trenches about 12 ft long.	No significant values were detected in two grab samples.
33	Unknown prospect (27/34, 1, 33)	Opaline tuff, tuff breccia, and rhyolite.	Three small pits.	Three grab samples contained no significant values.
34	Linda prospect	Brown to purple rhyolite and tuff are altered and silicified.	Three shallow trenches and one pit.	No significant values were detected in four grab samples.
35	Saddle Back prospect	A 20- to 80-ft-thick zone of banded tuff, tuffaceous sandstone, and opaline tuff, bounded by fractured volcanic glass, trends N. 80° W. for several hundred feet in rhyolite.	Two pits.	A grab sample from one pit and a random chip sample from the other showed no significant values.
36	Unknown prospect (13, 1, 33)	Bleached tuff and tuff breccia overlies rhyolite.	Two pits about 8 ft long.	A grab sample from each pit contained no significant values.

[1]The Indian Queen project covers a large area, mostly outside the roadless area; it includes the Indian Queen-Poorman mine, Morgan (Diana), Albert, Spohr, and Queen Canyon mines. In this report, only the portion of the "project" in the roadless area was evaluated.