UNITED STATES DEPARTMENT OF THE INTERIOR
(BUREAU OF MINES)

SUMMARY REPORT

MINERAL INVESTIGATION OF THE SUGARLOAF RARE II AREA (NO. 5296), ESMERALDA AND MINERAL COUNTIES, NEVADA

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This open file report summarizes the results of a Bureau of Mines wilderness study and will be incorporated in a joint report with the U.S. Geological Survey. The report is preliminary and has not been edited or reviewed for conformity with the U.S. Bureau of Mines standards and nomenclature. Work on this study was conducted by personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, Washington 99202

FOREWORD

The U.S. Bureau of Mines and U.S. Geological Survey jointly conduct mineral surveys of lands which in the U.S. Forest Service Second Roadless Area Review and Evaluation (RARE II) program have been designated for further planning. These evaluations are used in the RARE II program which conforms with the Multiple-Use Sustained-Yield Act of 1960 (74 Stat. 215; 16 U.S.C. 528-531), the Forest and Rangeland Renewable Resources Planning Act of 1974 (88 Stat. 476, as amended; 16 U.S.C. 1601 note), and the National Forest Management Act of 1976 (90 Stat. 2949; 16 U.S.C. 1600 note). Reports on these surveys provide the President, Congress, the U.S. Forest Service, and the general public with information essential for determining the suitability of land for inclusion in the National Wilderness Preservation System.

This report is on the Sugarloaf RARE II area (No. 5296), Nevada.

CONTENTS

ILLUSTRATION

TABLES

SUMMARY

The Sugarloaf RARE II area (No. 5296) covers 11,100 acres in the northern part of the White Mountain Range, in the Inyo National Forest. It is in Nevada, about 45 mi north of Bishop, California.

A mineral survey was conducted by the U.S. Bureau of Mines in 1982 and by the U.S. Geological Survey in 1980-1982. The Bureau reviewed pertinent literature, searched Esmeralda and Mineral County mining records, obtained current claim information from the administrative agencies, and contacted claim owners. Thirty-six properties were examined, and 674 samples were taken from them to help assess mineral resources and potential. The Geological Survey evaluated the regional mineral potential by geologic, geochemical, and geophysical surveys.

The principal metallic mineral commodities are silver, gold, and mercury, with lesser lead, zinc, and copper. The nonmetallic mineral fluorite occurs locally, but no fluorspar resources have been identified. Alunite, a possible source of alumina, is widespread in the southeastern part of the study area. Little is known of its extent or grade. In several parts of the RARE II area, extensive alteration and mineralized zones, and probable unexposed extensions of structures in existing mines suggest potential undiscovered resources.

Thirty-six adits, 10 shafts, 153 pits or trenches, as well as several areas of extensive bulldozer excavation reflect mining activity on the 633 claims located in the area since 1862. One patented claim lies inside and another is contiguous with the study area boundary. The Indian Queen-Poorman Mine in the southwestern part of the study area and the Brownie Mine in the north-central part produced a combined total of 485 oz gold, 109,198 oz silver, 161,535 lb lead, 31,062 lb copper and 543 lb zinc. The F and L and Red Rose properties produced 14 flasks of mercury during the 1930's and early 1940's.

The Indian Queen-Poorman Mine contains an estimated 170,000 tons of inferred subeconomic resources, averaging 2 oz silver per ton, with localized, minor amounts of zinc, lead, and copper; an additional 10,000 tons of measured, subeconomic resources averaging more than 2 oz silver per ton is in dumps. The Brownie Mine, has about 8,800 tons of indicated and inferred subeconomic resources averaging 0.21 oz gold per ton. Both properties have moderate potential for additional resources. Four other properties in the study area have low potential for silver, lead, zinc, copper, fluorspar or mercury resources. A mercury occurrence at the F and L Mine contains 200,000 tons of rhyolite averaging 0.8 lb of mercury per ton.

Outside the study area at least five localities adjacent to the north-central and southeastern parts of the study area have produced mercury. Just north of the study area, the King-Blue Bell Mine produced fluorspar. Along the western boundary there are several fluorspar occurrences. The Tip Top Mine, adjacent to the north study boundary, was the largest gold producer in the district. Tungsten was also reported in this area in literature, but none was found.

There is no evidence of fossil or geothermal energy deposits in the RARE II area.

INTRODUCTION

Location and Access

The Sugarloaf RARE II area (No. 5296) covers 11,100 acres in the northern part of the White Mountains in Esmeralda and Mineral Counties, Nevada. It lies in Inyo National Forest, 60 mi west of Tonopah, Nevada, and 45 mi north of Bishop, California via U.S. Highway 6. Access is by a network of unimproved roads that surround the perimeter and penetrate some portions of the study area (fig. 1).

The area has great daily and seasonal temperature changes, with summer temperatures as high as 110°; most of the 16 in. of annual precipitation occurs as winter snowfall. Several small springs provide a more consistent water supply than the ephemeral streams which have cut deep drainages eastward and westward from the center of the area. The steep slopes are partially grass covered with patches of mountain mahogany and sage brush, juniper and pinyon pine, and bristlecone pine at higher elevations. Elevation ranges from 6,400 ft to 10,288 ft.

Previous and Present Studies

The main references that contain information on early mining activity, past producing mines, and geology in the Sugarloaf area were written by Whitehill (1875-76), Whiting (1888) Lincoln (1923), Bailey and Phoenix (1944), Horton (1961), Crowder and others (1972), and Robinson and Crowder (1973).

For the present studies, Esmeralda and Mineral County mining claim records, U.S. Bureau of Land Management mining plats, U.S. Forest Service files, Bureau of Mines production files, and various publications were examined to determine sites of mining activity. All claimants known to have current mining claims were contacted prior to field examinations.

In 1982, the Bureau of Mines spent about eight man-months evaluating the mines and prospects. Those peripheral to the study area were not evaluated. Helicopter support was used to locate workings and to transport men and equipment to remote areas. The prospects and mines in the RARE II area were examined, mapped, and sampled. A total of 647 samples were collected, crushed, pulverized, split, mixed, and checked for anomalous radioactivity and fluorescence. Samples were analyzed by combined fire assay-atomic absorption for determination of gold and silver; atomic absorption for copper, lead, and zinc; cold vapor-atomic absorption for mercury; and specific ion electrolysis-atomic absorption for fluorite. Selected samples were analyzed by semi-quantitative emission spectroscopy for 40 elements 1/.

Geologic Setting

The Sugarloaf area lies at the northern end of a 100-mi long uplifted and tilted fault block which forms the Inyo-White Mountains, between two relatively depressed areas within the Basin and Range geologic province (Anderson, 1933, p. 23). The core of the mountains is made up of several intrusive plutons which are primarily composed of quartz monzonite and diorite (Crowder and Ross, 1973, p. 1, 3). This core is flanked by Paleozoic metasedimentary rocks.

1/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.

The study area, geologically different than other parts of the range, is underlain by several thousand feet of Tertiary volcanic rocks and unconsolidated sedimentary debris, which cover the intrusive and metasedimentary units (Anderson, 1933, p. 218). Paleozoic slate, phyllite, and argillite are exposed only in Queen Canyon, in the southwest corner of the study area (fig. 1). The metasediments are intruded by diorite to the south and overlain by Tertiary volcanic rocks on the north rim of the canyon (McKee, 1982). Geologic evidence indicates a possible eruptive center near the head of Queen Canyon, at Horseshoe Rock (Crowder and others, 1972). Silicification and alteration are locally pervasive (McKee, 1982).

Most of the large scale structural features are covered by Tertiary volcanic and sedimentary rocks. Shear zones in these rocks are poorly defined and are generally small scale. Faults and shear zones are recognized at the Brownie Mine and at a number of places in the south half of the study area.

Precious- and base-metals, alunite, and fluorspar occur in three modes: in fissure filling veins, in shear zones, and (or) in silicified, bleached and otherwise altered rocks. Deposits and occurrences of these minerals are in the rhyolite and metasedimentary rocks, but not in the granitic plutons.

MINING ACTIVITY

Mining History

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, p. 140). 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 was mostly in three parts of the study area; Queen Canyon, Sugarloaf Mountain, and Trail Canyon. Prospecting in Queen Canyon began in 1862, but it wasn't 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, California. 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, personal communication, 1982).

Prospecting in the late 1800's lead to several gold and mercury discoveries near Sugarloaf Mountain. The most significant gold producer inside the study area was the Brownie Mine (which is on the currently-held Gold Nos. 1-6 Claims). 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 (Thorndyke and Bley) (Heikes, 1915, p. 631). Production from this property which is adjacent to the study 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, it has conducted geologic mapping, 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 (fig. 1, Table 2).

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 study area boundary, 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 liquid 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 Forest Service for a prospecting permit for potassium and alunite, which is a source of alumina and potassium. Work by Earth Sciences, Inc., in the MTC permit area, indicates two poorly-defined alunite bodies. Exploration of the occurrence is still in a preliminary stage; there is no current activity. Extraction of alumina from alunite is an economically unproven procedure. However, with technological advancements and processing refinements, alumina and by-product potassium sulfate are potential resources in the study area.

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, geological, and geochemical data have been collected to determine the presence of precious metal deposits beneath the mercury-bearing zone.

Table 1 summarizes recorded production from the mines in and adjacent to the RARE II area.

Table 1.--Recorded production from lode deposits in and adjacent to the Sugarloaf RARE II area (No. 5296)

[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

Table 1.--Recorded production from lode deposits in and adjacent to the Sugarloaf RARE II area (No. 5296)--Continued

Property	Year(s)	Tons	Gold (oz)	Silver (oz)	Mercury (76-lb flasks)
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 RARE II area		4,047	485.2	109,198	38
Total in and adjacent to RARE II 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. W.R. Whitehill, (1876) 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.

Mining Claims

At least 633 lode claims were located in or near the study area since 1862. About 255 of those have been located between 1980 and 1982; many are included in the large Jon, Tip, and Beth claim groups. Also, in 1975, Earth Sciences, Inc., National Steel Corp., and the Southwire Co. applied for a prospecting permit for the MTC potassium and alunite property. It covers 2,200 acres; 960 acres lie inside the study 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 study area. The Tip Top Mine is adjacent to patented ground (Buena Vista and Gold Standard) that is contiguous with a northern study area boundary. There are no coal, oil and gas, or geothermal leases in the area.

MINES, PROSPECTS, AND MINERALIZED AREAS

Geologic Factors Related to Deposits

Most of the study area is underlain by rhyolite and associated volcanic rocks. Near Sugarloaf Mountain, gold and silver minerals are associated with brecciated quartz in the largest shear zone observed in the study area; it is about 4 ft thick and partly exposed for 1,100 ft along a northeast trend. Other shear zones in the rhyolite are not easily detected, but those sampled have gold, silver, or mercury minerals associated with them.

In Queen Canyon, silver-lead-zinc minerals are concentrated in quartz veins or in shear zones in phyllite. Lead isotope studies indicate the metal source is from the nearby Jurassic-age plutons (Robert Zartman, U.S. Geological Survey, personal communication, 1982). Few veins in the area exceed 1.0 ft in thickness or 20 ft in length. Most segments are displaced by northeast- and northwest-trending high-angle faults. Silver and base-metal sulfide concentrations appear to be fault controlled, but the relationship is unclear.

Mercury minerals occur in the vicinity of Trail Canyon and near Sugarloaf Mountain in silicified rhyolite and fractured chert conglomerate. At least 10 properties in a northwest-trending zone 10 mi long and 1 mi wide in and adjacent to the study area have produced mercury. A concealed fault or fault system within this zone is suggested by the lineation of mercury-bearing properties transcending Tertiary to Ordovician rock types.

Fluorite (fluorspar) occurs in several widely spaced locales in Paleozoic metasedimentary rocks, granitic rocks, rhyolites, and metavolcanic rocks along the west boundary of the study area. Several occurrences of thin, discontinuous zones of closely spaced fluorite veinlets are inside the study area . White, purple, and green fluorite veins 1 to 2 ft thick and several hundred ft long occur just outside the area.

High potassium-to-sodium ratios, mercury, fluorite, alunite occurrences, and extensive silicification are believed to be indicators of buried metallic mineral deposits in silicic or volcanogenic rocks (Boyle, 1974, p. 346-347; Polikarpuchkin and Kitav, 1970, p. 381; Wallace and others, 1968, p. 624, 626, 639; Boyle, 1979, p. 91; Silberman, 1968, p. 131-143). These indicators occur within the Sugarloaf area.

Mineral Properties

Summary descriptions of all properties examined during this investigation are included in table 2, along with an assessment of mineral resources and 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.

Table 2.--Summary of mines and prospects in the Sugarloaf RARE II area (No. 5296)

[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 Meridian]

Property no. (fig. 1)	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 flourspar (CaF_2) and averaged 2.39 percent. This is part of a larger fluorspar occurrence along the western boundary of the Sugarloaf area. The property has a low potential for fluorspar resources.
2	Unknown prospect (NW1/4 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 (NE1/4 18, 1, 33)	A dark green diabase dike with associated marble and calcite.	One trench 32 ft long.	One sample contained 0.9 percent fluorspar (CaF_2).
4	Unknown prospect (NW1/4 17, 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 southern 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 (SE1/4 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 northern 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 fluorspar (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 fluorspar resources.
6	Unknown prospect (SW1/4 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 fluorspar (CaF_2).
7	Unknown prospect (SE1/4 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 RARE II area (No. 5296)--Continued

Property no. (fig. 1)	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 inferred subeconomic resources averaging 0.21 oz gold per ton are 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).

Table 2.--Summary of mines and prospects in the Sugarloaf RARE II Area (No. 5296)--Continued

Property no. (fig. 1)	Name	Summary	Workings and production	Resource/sample data
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 fluorspar (CaF_2). One sample assayed 0.4 oz silver per ton.
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 ft 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, in 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 (1876) 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 square 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, lead, and zinc resources.

Table 2.--Summary of mines and prospects in the Sugarloaf RARE II Area (No. 5296)--Continued

Property no. (fig. 1)	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	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 ft in rhyolite.	Two pits.	A grab sample from one pit and a random chip sample from the other showed no significant values.
19	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.
20	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.
21	Unknown prospect (27/34, 1, 33)	Opaline tuff, tuff breccia, and rhyolite.	Three small pits.	Three grab samples contained no significant values.
22	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.
23	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.
24	Jon 9 Prospect	Rhyolite tuff and tuff agglomerate is locally iron-oxide-stained and opalized.	One shallow bulldozer trench and small pit.	Two grab samples contained no significant values.
25	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.
26	Jon 43 Prospect	Rhyolite colluvium.	Two trenches, each 15 ft long.	Two grab samples, one from each trench, contained no significant values.
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 a pit.	Four samples contained no significant values.
28	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.

Table 2.--Summary of mines and prospects in the Sugarloaf RARE II Area (No. 5296)--Continued

Property no. (fig. 1)	Name	Summary	Workings and production	Resource/sample data
29	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.
30	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 20 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.
31	Jon 18 Prospect	Iron-oxide-stained, siliceous rhyolite.	One caved shaft.	No significant values were detected in a grab sample from the dump.
32	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.
33	Unknown prospect (35, 1, 33)	Iron-oxide-stained, tan, siliceous rhyolite.	One pit.	Two grab samples contained no significant values.
34	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.
35	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.
36	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.

1/ The Indian Queen Project covers a large area, mostly outside the study area; it included the Indian Queen-Poorman Mine, Morgan (Diana), Albert, Spohr, and Queen Canyon mines. In this report, only the portion of the "project" in the study area was evaluated.

The definitions of mineral resource classifications are basically from U.S. Geological Survey Circular 831, (1980). The measured, indicated, and inferred categories, respectively, reflect decreasing knowledge of the characteristics of a deposit. Also for this report, an attempt has been made to further define subeconomic resources and resource potential.

Mineral Resources: Deposits classified as reserves are mineral resources believed to be mineable at a profit, under current economic conditions. Feasibility studies were conducted to substantiate this classification. Properties having marginal reserves would require a modest improvement of economic conditions; about 50 percent increase in commodity price, or identification of a larger deposit. 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 property may not be sufficient to support a subeconomic resource classification. However, it might be favorably located for consolidated development with other deposits and with centrally located processing facilities. Because of relatively small tonnages at individual properties, they would be developed by small-scale mining operations, possibly involving portable concentrating equipment.

Resource potential: The terms high, moderate, and low resource potential, as used in this report, reflect degrees of probability that undiscovered resources exist. The terms are based on the assessment of published information, the results of field examination, particularly sample analyses, the apparent degree of geologic continuity, and the judgement of the evaluator.

A complete description of the mines and properties is in a file report in preparation at the Bureau of Mines' Western Field Operations Center in Spokane, Washington, entitled "Mineral Investigation of the Sugarloaf RARE II Area (No. 5296), Esmeralda and Mineral Counties, Nevada."

APPRAISAL OF MINERAL DEPOSITS

Queen Canyon Area

The Indian Queen Mine is the most important property in the Sugarloaf RARE II 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. In addition, there are about 10,000 tons of subeconomic resources averaging at least 2.0 oz silver per ton in the dumps. This property also has a moderate potential for additional silver resources and for lead, zinc, and copper resources.

In Queen Canyon a large block of claims, known as the Indian Queen Project, covers several properties including the Indian Queen-Poorman Mine. The adjacent properties are geologically similar. The part of this claim group in the study area has a low potential for silver, lead, zinc, and copper resources; most of the veins are narrow and short.

None of the mineral deposits in the Queen Canyon area are mineable. However, with higher metal prices, several of the properties in and near the RARE II area might be consolidated to support centrally-located ore-processing facilities. This would reduce milling and transportation costs.

Sugarloaf Mountain Area

The most important property in this area is the Brownie Mine. Only a small segment of the mineralized shear zone was accessible. From 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 in silicified brecciated rhyolite.

Tonnage or grade estimates of scattered mercury occurrences in and adjacent to this part of the study area could not be made.

There are several widely spaced fluorspar properties in and adjacent to the west boundary of the study area. Data was insufficient to estimate tonnage and grade. The resource potential for fluorspar is low at the Fluorspar No. 1 and the Unknown (SE1/4 18, 1, 33) 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 in opalized silicified rhyolite.

Alunite (hydrous potassium aluminum sulfate) is known to occur in the southeast corner of the study area. Exploration by Earth Sciences, Inc. is in a preliminary stage at the MTC alunite property. Little is known about extent or grade of the deposit. Extraction of alumina from alunite is an economically unproven procedure. However, alunite may be more economical to process than higher grade oxide ores of aluminum, which contain silicate mineral impurities. A proposed treatment process yields byproduct potassium sulfate and sulfuric acid, which could be sold for fertilizer production.

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LIST OF MINES AND PROSPECTS

1. Fluorspar No. 1
2. Unknown (NW¼17,1,33)
3. Unknown (NE¼18,1,33)
4. Unknown (NW¼17,1,33)
5. Unknown (SE¼18,1,33)
6. Unknown (SW¼17,1,33)
7. Unknown (SE¼8,1,33)
8. Starlight
9. Old Sheepherder
10. Tip Group
11. Beth Group
12. Brownie Mine (Gold Nos. 1-6)
13. Unknown (29,1,33)
14. Shawna No. 4
15. Indian Queen Project
16. Indian Queen-Poorman Mine
17. Double Eagle
18. Saddle Back
19. Unknown (13,1,33)
20. Linda
21. Unknown (27/34,1,33)
22. Jon 1
23. Jon 6
24. Jon 9
25. Jon 23
26. Jon 43
27. Jon 48
28. F and L Mine
29. Jon 57
30. Red Rose Mine (Tiger claim)
31. Jon 18
32. Unknown (34,1,33)
33. Unknown (35,1,33)
34. I.B.E.X.
35. Wild Horse
36. Lucky (Red Cloud)

16. Indian Queen-Poorman Mine

Underlined properties refer to those with mineral resources or resource potential

EXPLANATION

- Study area boundary
- U.S. Highway
- Improved road
- Unimproved road
- Jeep trail
- Patented mining claims
- Buildings
- Mine
- Prospect

Commodity symbol indicates mineral resource or resource potential

Ag - silver
Au - gold
Ca F_2 - fluorspar
Hg - mercury
Pb - lead
Zn - zinc

Figure 1. – Location of Mines and prospects in and adjacent to Sugarloaf RARE II Area (No. 5296).

USBM MLA 96-83