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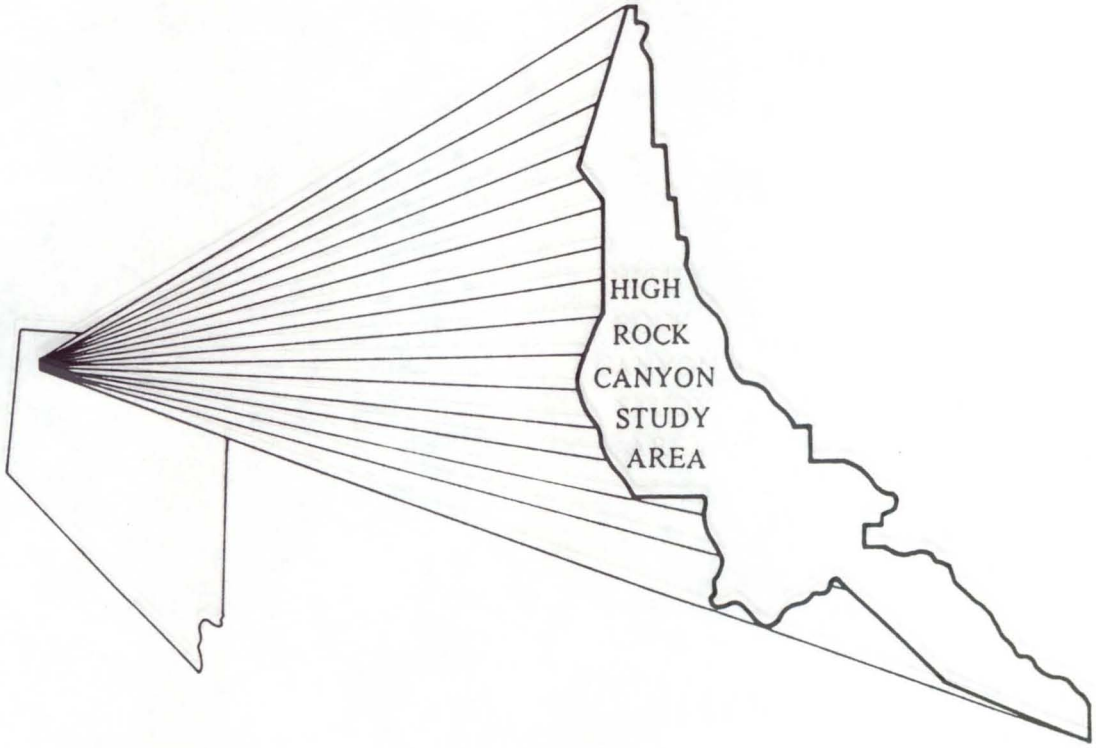
Open File Report

Mineral Resources of the High Rock Canyon Study Area, Washoe County, Nevada



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE HIGH ROCK CANYON STUDY AREA, WASHOE COUNTY, NEVADA

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UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

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Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study 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 Bureau of Mines mineral survey of a portion of the High Rock Canyon Wilderness Study Area (CA-020-913B), Washoe County, NV.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, E. 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

CONTENTS

ILLUSTRATIONS

SUMMARY

In 1985, at the request of the U.S. Bureau of Land Management, the U.S. Bureau of Mines studied an 11,980-acre part of the 33,300-acre High Rock Canyon Wilderness Study Area, CA-020-913B, in order to evaluate its identified mineral resources. No mineral resources were identified during this study, and no significant amounts of gold, silver, mercury, gem-grade opal, or placer gold are present. The study area is located in Washoe County, NV, about 53 miles southeast of Cedarville, CA.

No mining districts or mineral production are known, and no oil and gas leases are in the area. No current claims are in the area; however, six placer claims were located in 1911 in High Rock Canyon near its confluence with Mahogany Creek.

One opal prospect is along an opalized breccia-filled fault in ash-flow tuff near Conlon Camp in the southeast part of the area. Twenty-eight opal claims are 4 miles west from the area. Fractured, dull-colored, and massive opal at these locations is not suitable for gemstones, and prospecting of opal for gemstone use is not expected.

Several hundred million tons of ash-flow tuff occur in the study area, and zeolites were found at several locations. Low zeolite concentrations, unknown thickness and areal extent of zeolite-bearing tuff, and absence of a proximal mill preclude identification of possible zeolite resources. Further exploration may define the extent and concentration of zeolites in tuff; however, because adequate deposits exist near mills and market demands for zeolites are low, interest by mining companies at this time should be minor.

Forty-four gold-silver-mercury claims are about 3 miles northwest of the area and were maintained by Tenneco in 1984. Massive opal sinter and opalized breccia at these claims contain mercury. No gold, silver, or mercury resources were identified within the study area or at the claims 3 miles north; however, based on exploration activity near the study area and similarities of geologic features in the study area to geologic features associated with known mineralized calderas, the northwest part of the area may be of future interest to mining companies for gold, silver, or mercury exploration.

Very low gold concentrations in small accumulations of alluvial material indicate no placer gold resources exist at the six abandoned placer claims in the High Rock Canyon drainage, and future exploration for placer gold in and near the area is not expected.

Sand and gravel, in small accumulations, occur sporadically in the area. Because there is adequate sand and gravel outside the area and occurrences in the area are small and sporadic, sand and gravel in the area does not constitute a resource.

No oil, gas, or geothermal resources are known in the area.

INTRODUCTION

This report describes the USBM (U.S. Bureau of Mines) portion of a cooperative study with the USGS (U.S. Geological Survey) to evaluate mineral resources and potential of part of the High Rock Canyon WSA 1/ (Wilderness Study Area) at the request of the BLM (U.S. Bureau of Land Management). The USBM examines individual mines, prospects, claims, and mineralized zones, and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys. Results of the investigations will be used to help determine the suitability of the study area for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The High Rock Canyon WSA (CA-020-913B) contains 33,300 acres of which 11,980 acres were requested by the BLM for mineral study. Within this report these 11,980 acres are referred to as the "study area." The study area is in the north Calico Mountains in Washoe County, NV. Cedarville, CA, is about 53 mi (miles) by road northwest from the area, and Highrock Lake is less than 1 mi to the southeast.

Steep-walled canyons are the dominant feature, with elevations ranging from about 4,920 ft (feet) near High Rock Lake to about 6,000 ft in the southwest part of the area. The area is characterized by a cool, semiarid, continental climate with warm summers and cold winters, and about 10 in. (inches) of precipitation per year (Bonham, 1969, p. 3). Vegetation includes sagebrush and grasses.

California State Highway 299, east from Cedarville, CA, and Nevada State Highway 8A (fig. 1) provide access to a BLM-maintained dirt road to Stevens Camp. From Stevens Camp, a jeep trail in High Rock Canyon provides access to the north part and the east one-half of the area; another jeep trail from Stevens Camp parallels the west boundary of the area and provides access to the west one-half and south part of the area.

1/ A WSA is a roadless area or island that has been inventoried by the U.S. Bureau of Land Management and found to have wilderness characteristics as described in section 603 of the Federal Land Policy and Management Act and section 2 (c) of the Wilderness Act of 1965 (78 Stat. 891).

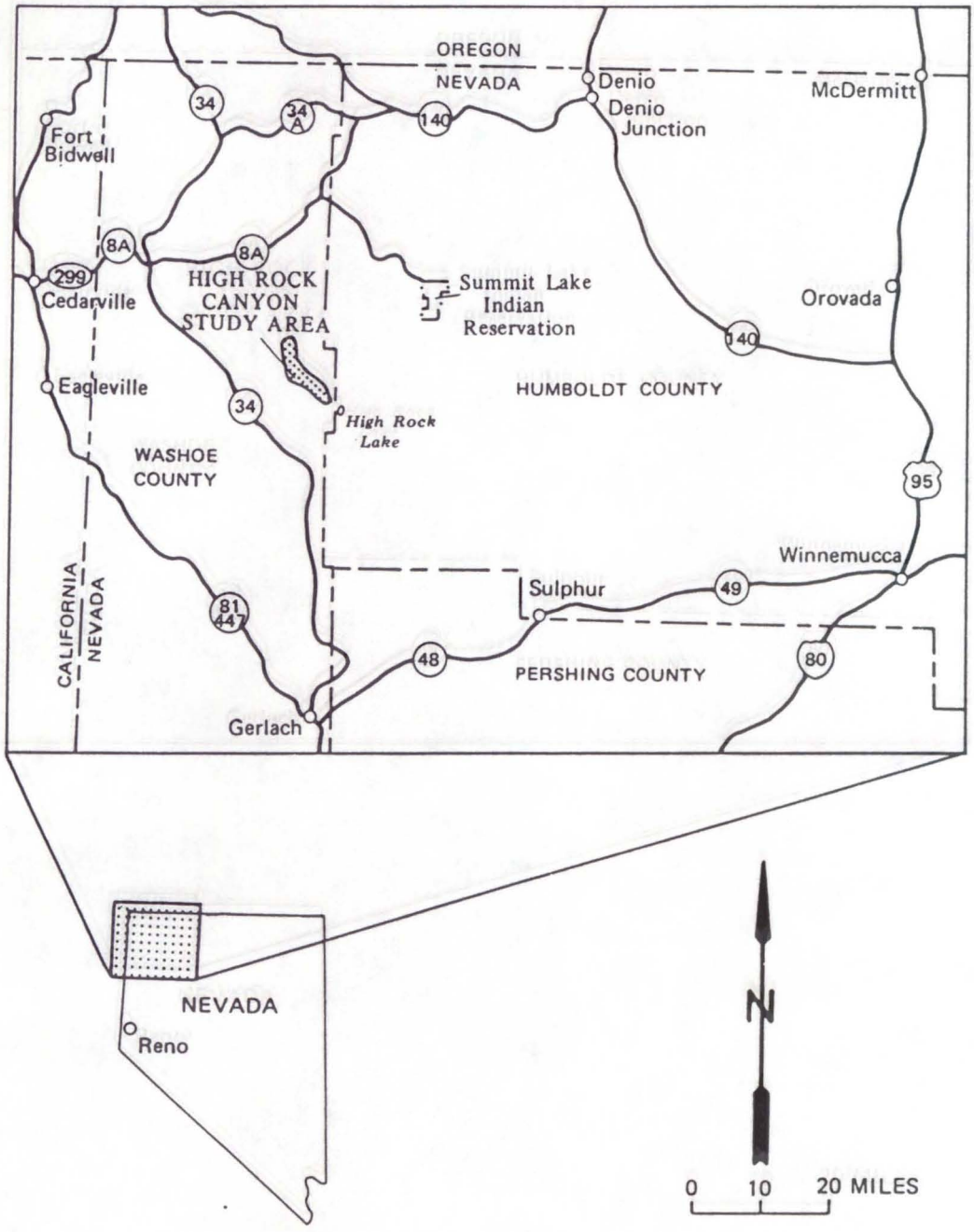

FIGURE 1. – Location of the High Rock Canyon study area, Washoe County, NV

Previous Studies

Publications concerning geology and mineral deposits in northwest Nevada are few. General geology of Nevada was compiled by Stewart and Carlson (1978). Geology and mineral deposits of Washoe and Storey counties, Nevada, are described by Bonham (1969). Conners and others (1982) prepared a geochemical and geostatistical evaluation of wilderness study areas in the Winnemmucca District, NV, for the BLM.

Geodata International, Inc. (1979), conducted an airborne radiometric and magnetic survey of the Vya 2° quadrangle during the U.S. Department of Energy's NURE (National Uranium Resource Evaluation) program.

Other USBM mineral resource investigations in the region include the High Rock Lake Wilderness Study Area by Neumann and Close (1985) and the East Fork High Rock Canyon study area by Schmauch (1986).

Present Study

USBM personnel gathered data concerning mines, claims, prospects, and mineralized areas from BLM records, published literature, USBM files and production records, and county mining records. Field work was conducted during June and July 1985 and consisted of ground and helicopter reconnaissance and an examination of all known claims and prospects in or near the study area.

Twenty-six lode samples and seven placer samples were collected in or adjacent to the study area. Samples were of five types: (1) chip--a series of continuous chips of rock across an exposure; (2) grab--unselected rock pieces from an outcrop, stockpile, or dump; (3) random--chips taken at random intervals from an apparently homogenous exposure; (4) select--handpicked material of apparently high-grade rock; and (5) pan--a measured volume of alluvium, which is partially concentrated by washing to check for presence of gold or other heavy minerals. Samples were crushed, pulverized, thoroughly mixed, split, and checked for radioactivity and fluorescence. Quantitative values of gold and silver were determined by fire assay methods; values for other elements were determined by atomic absorption or inductively coupled plasma analysis. At least one sample from each prospect, claim, or mineralized area was analyzed for 40 elements 2/ by semiquantitative spectrographic methods to determine the presence of unsuspected elements. Lode samples were prepared at the USBM Western Field

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2/ 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.

Operations Center, Spokane, WA, and analyzed at the USBM Reno Research Center, Reno, NV. Most placer samples were panned in the field and further concentrated on a laboratory-size Wilfley table. Nine 10-lb (pound) samples from discolored ash-flow tuff were microscopically examined for clay and zeolite minerals, and analyzed for zeolites by x-ray diffraction. Detailed sample analyses are available from the U.S. Bureau of Mines, Western Field Operations Center, E. 360 Third Ave., Spokane, WA 99202.

ACKNOWLEDGEMENTS

The USBM appreciates the cooperation of Leroy Delaney, area manager of the Surprise Resource Area, BLM, Cedarville, CA, who provided storage facilities, logistics information, and a temporary base for field work. Joe McFarlan, geologist, also of the Surprise Resource Area office, provided maps of the study area and information about geology and mining company exploration activities in and near the study area. The author was assisted in the field by Douglas Causey, physical scientist, USBM, Western Field Operations Center, Spokane, WA.

GEOLOGIC SETTING

The High Rock Canyon study area is in the Basin and Range physiographic province and is underlain by Cenozoic extrusive volcanic rocks and sedimentary rocks. Most of the area is underlain by the Miocene-to-Pliocene High Rock sequence, consisting of diatomite, shale, mudstone, sandstone, basalt-lapilli-tuff and agglomerate, sodic-rhyolite ash-fall tuff and welded ash-flow tuff, and areally restricted flows of rhyolite and basalt (Bonham, 1969, plate 1). The Miocene Canon Rhyolite underlies the High Rock sequence and is locally interfingered with the High Rock sequence. The Canon rhyolite is composed of flows, protrusive domes, and subordinate welded ash-flow tuffs of soda rhyolite (see Bonham, 1969, plate 1). Exposures of Canon Rhyolite occur near the confluences between High Rock Canyon with Mahogany Creek, Yellow Rock Canyon, and Grassy Canyon.

MINING ACTIVITY, PROSPECTS, AND MINERALIZED AREAS

No mining districts, current claims, oil, gas or geothermal leases, or production are known in the area.

In 1911, six placer claims were located in High Rock Canyon (adjacent to east edge of area) from the confluence of Mahogany Creek and extending north for about 1 mi. Seven placer samples collected from these abandoned placer claims contained gold values ranging from zero to $0.06 3/ per cubic yard (fig. 2, nos. 17-23).

3/ Gold valued at $400 per troy ounce.

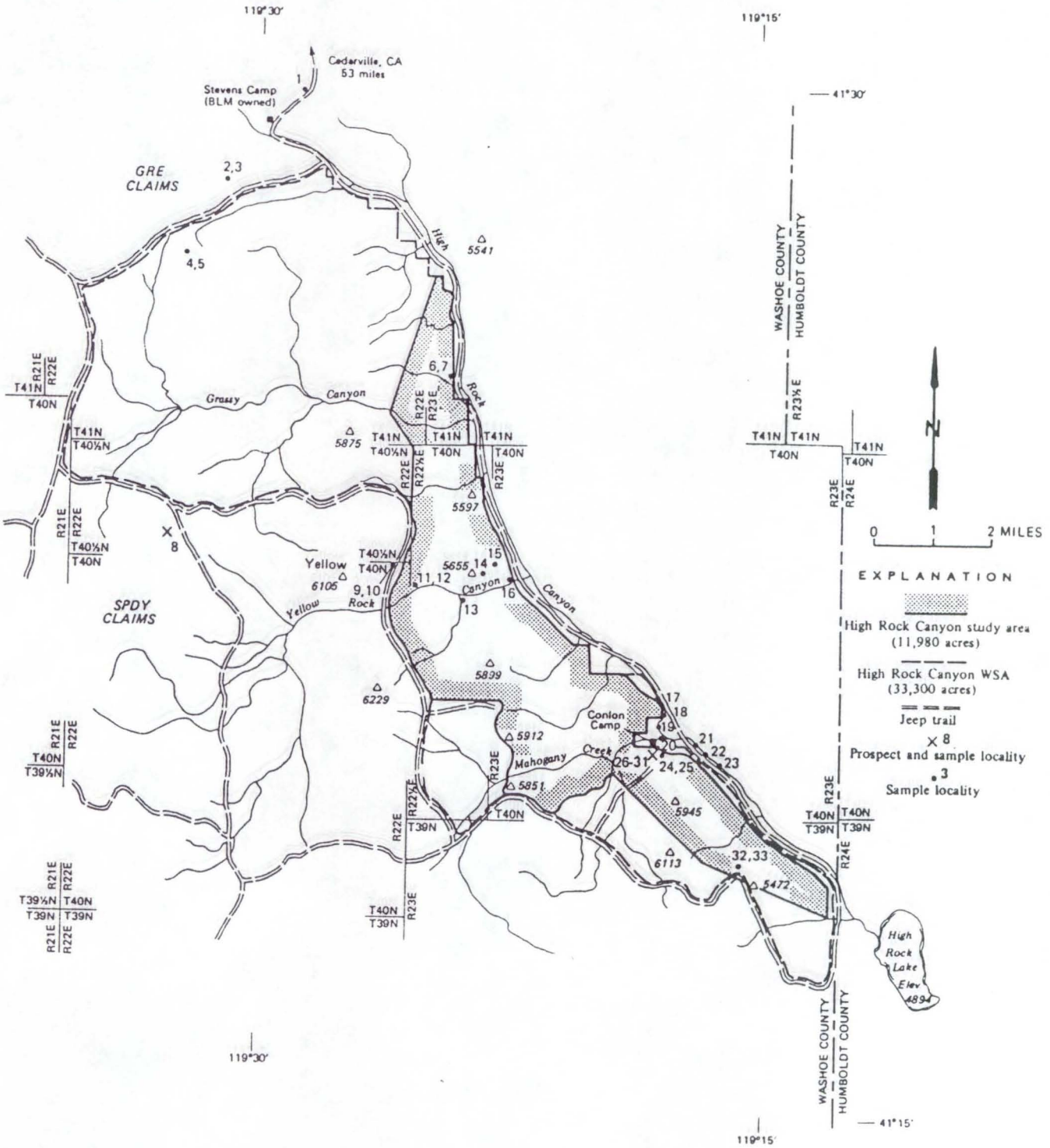

FIGURE 2.– Prospects and sample locations in and adjacent to the High Rock Canyon study area, Washoe County, NV

One prospect trench in the study area (fig. 2, nos. 26-31) is about 50 ft long, 12 ft wide, and 6 ft deep. The trench is along a fault zone that strikes N. 65° E. and dips vertically in ash-flow tuff. The zone is filled with green, fractured, and opalized breccia, averages 35 ft thick, and outcrops discontinuously for at least 200 ft. Six samples were taken. Three chip samples (fig. 2, nos. 29-31) of opalized breccia contained no detectable gold, silver, arsenic, or mercury and one sample (fig. 2, no. 27) of opal contained no gold, silver, or mercury, and 72.0 ppm arsenic. Two random samples (fig. 2, nos. 26 and 28) of ash-flow tuff contained 50.0 and 56.0 percent zeolites (clinoptilolite).

Zeolites occur in varying concentrations in ash-flow tuff in Yellow Rock Canyon and lower Mahogany Creek. Within the study area, seven samples (fig. 2, nos. 11, 12, 15, 16, 25, 26 and 28) of ash-flow tuff contained from 50 to 65 percent clinoptilolite. Two samples of discolored ash-flow tuff (fig. 2, nos. 9 and 10), adjacent to the area, contained 65.0 and 80.0 percent clinoptilolite. The basal part of the ash-flow tuff was not exposed; therefore, thickness of the tuff is unknown. In the study area, ash-flow tuff outcrops are several hundred feet thick and occurs discontinuously in an area of about 6 square miles. Several hundred million tons of ash-flow tuff occur in the area, and zeolites were found at several locations. Reconnaissance samples of ash-flow tuff were random and less than 50 ft in length.

Near Grassy Canyon, a 3.5-ft-thick fracture in basalt is filled with brown, cryptocrystalline quartz and fractured and dark-colored opal (fig. 2, nos. 6 and 7). The samples contained no detectable gold or silver.

About 4 mi west from the area are 28 opal claims (fig. 2, no. 8) known as the SPDY claims. Fractures in ash-flow tuff are filled with massive white-to-green opal. The opal is fractured and massive and not gem quality.

Major mining companies are exploring (1984) for disseminated gold-silver-mercury deposits north, south, and west of the area. Forty-four gold-silver-mercury claims (GRE claims, fig. 2, nos. 1-5) were maintained by Tenneco in 1984. Mercury occurs in cinnabar in massive opal and opalized breccia. Concentrations of mercury from two samples (fig. 2, nos. 2 and 3) were 120.0 and 330.0 ppm. Concentrations of gold and silver were low; however, similarities between geologic features in the study area and those associated with known disseminated gold-silver and mercury deposits indicate company interest may continue near and into the northwest part of the area.

COMMODITY HIGHLIGHTS

Zeolites commonly occur in volcanic-rich sedimentary rocks (e.g., tuff). Ground water reacts with the glass to form about 20 varieties of zeolites. Commercially, clinoptilolite is the zeolite preferred, and major uses include water treatment, agriculture, and filler applications (Industrial Minerals, 1983). Physical properties for economic zeolite deposits depend on color, bulk density, and porosity. Chemical properties for economic zeolite deposits depend on CEC (cation exchange capacity), dehydration and rehydration capabilities, silica composition, and adsorption characteristics. Additional requirements for economic deposits of zeolites include: no cristobalite contamination; close proximity to a mill; near or at the surface; and grade consistency (Glen Teague, personal commun., 1985). Ore grade for zeolites with potassium cations averages about 80 percent clinoptilolite and a 1.5 CEC; ore grade for zeolites with sodium cations averages about 60 to 65 percent clinoptilolite and a 1.5 CEC (Glen Teague, personal commun., 1985). The price of zeolites is dependent on the amount of processing time, color, and CEC (Glen Teague, personal commun., 1985). Prices of mill-processed zeolites may range from $62.00 to $500.00 per ton FOB plant (Glen Teague, personal commun., 1985). Demand for zeolites is estimated at 25,000 tons per year (Industrial Minerals, 1983).

USBM samples of zeolite-bearing tuff in the area ranged from 50 to 65 percent zeolites, which is below ore grade.

APPRAISAL OF MINERAL RESOURCES

No mineral resources were identified in or adjacent to the High Rock Canyon study area.

Massive opal, opalized breccia, ash-flow tuff, and mercury in opal exist in several known disseminated gold-silver and mercury deposits. These geologic conditions occur in and near the north, south, and west parts of the area. Bureau of Mines samples adjacent to the northwest part of the area indicated as much as 120.00 and 330.0 ppm mercury in opal and opalized breccia. Although no resources were identified, continued mining company exploration near the area, especially in or near the north, south, and west parts of the area, is expected.

Zeolite resources were not estimated because of:

1. sampled zeolite concentrations are low
2. unknown areal extent of zeolite-bearing tuff
3. unknown thickness of zeolite-bearing tuff
4. incomplete identification of zeolite-bearing tuff outcrops
5. current low market demand for zeolite
6. difficulty in field identification of zeolite-bearing tuffs
7. absence of proximal mill

Futher exploration may define the extent and concentration of zeolites in tuff; however, because adequate deposits of higher and more consistent grade are proximal to existing mills and market demands for zeolites are low, interest by mining companies should be minor now and in the foreseeable future.

Opal in the study area is massive, dark-colored, and fractured; therefore, not gem quality. Future interest by gem collectors for opal should be minor.

Placer gold exploration is not expected due to very low concentrations of gold in the alluvium sampled.

Sand and gravel occur in small amounts sporadically in the area. Because sand and gravel outside the area are adequate for present market demands, sand and gravel in the area do not constitute a resource.

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APPENDIX A.--Sample Analyses and Descriptions

APPENDIX A-1.--Analyses of rock samples from the High Rock Canyon study area, Washoe County, Nevada

[--, not analyzed; <, less than shown; N, none detected]
(*Denotes sample is outside study area boundary)

Map no. (fig. 2)	Sample Type	Sample Description	Gold (ppm)	Silver (ppm)	Arsenic (ppm)	Mercury (ppm)	Zeolites-Clinoptilolite (%)
*1	Select	White-to-gray, silicified, tuff breccia. Breccia fragments as much as 0.08 ft in diameter are coated with yellow-to-brown opal----	0.007	<0.3	--	--	--
*2	do--	Pink-to-red, opalized breccia float. Breccia fragments are as much as 0.08 ft in diameter, and pieces of float are as much as 1.0 ft in diameter----------	<.007	1.01	3.0	120.0	--
*3	do--	Massive, white-to-cream, opal float and white-to-cream, opalized, breccia float. Pieces of breccia are as much as 3.0 ft in diameter; float covers an estimated 500 square feet----------	<.007	.510	5.0	330.0	--
*4	do--	Clear-to-gray, red-brown chalcedony float. Pieces of float were as much as 0.5 ft in diameter----------	<.007	<.3	5.0	<70.0	--
*5	do--	White, silicified, rhyolite float, red-to-brown rhyolite float, and white-to-pink rhyolite float--------	<.007	<.3	22.9	<70.0	--

APPENDIX A-1.--Analyses of rock samples from the High Rock Canyon study area, Washoe County, Nevada--Continued

Sample			Gold (ppm)	Silver (ppm)	Arsenic (ppm)	Mercury (ppm)	Zeolites-Clinoptilolite (%)
Map no. (fig. 2)	Type	Description					
6	Chip	A 3.0-ft-thick fissure vein consists of about 90% yellow-to-brown silica and about 10% white-to-brown opal. The fissure vein is exposed for about 150 ft, strikes N. 20° W., and dips vertically in black, vesicular basalt----------	<0.007	<0.03	16.7	<70.0	--
7	do--	do----------	<.007	<.3	--	--	--
*8	Select	White-to-black opal in fractures in ash-flow tuff----------	<.007	<.3	--	--	--
*9	Random	Outcrop of green ash-flow tuff contains about 40% voids filled with green, powdery chlorite--------	<.007	.3	<2.0	--	80.0
*10	do--	Outcrop of yellow ash-flow tuff contains about 40% voids filled with kaolinized material-----	<.007	<.3	9.5	--	65.0
11	do--	Outcrop of dark green ash-flow tuff contains basalt fragments as much as 1.0 ft in diameter and about 40% voids filled with chlorite----------	<.007	<.3	4.0	--	65.0

APPENDIX A-1.--Analyses of rock samples from the High Rock Canyon study area, Washoe County, Nevada--Continued

Sample			Gold (ppm)	Silver (ppm)	Arsenic (ppm)	Mercury (ppm)	Zeolites-Clinoptilolite (%)
Map no. (fig. 2)	Type	Description					
12	Random	Outcrop of cream-to-buff ash-flow tuff contains basalt fragments as much as 1.0 ft in diameter and about 40% voids filled with kaolinized material----------	--	--	--	--	65.0
13	do--	Yellow-to-brown silica in fractures in gray-pink rhyolite----------	1.405	0.380	15.3	--	--
14	do--	Yellow-brown-to green opal in fractures in pink rhyolite----------	<.007	<.3	--	--	--
15	do--	A 6-ft-thick outcrop of white-to cream ash-flow tuff contains basalt and rhyolite fragments. A mudflow overlies the ash-flow tuff--	--	--	--	--	65.0
16	do--	Outcrop of yellow-to-brown ash-flow tuff contains about 20% voids filled with kaolinized material-----	1.12	.770	3.0	--	55.0
24	do--	A 30-ft-thick outcrop of white ash-flow tuff----------	--	--	--	--	N
25	do--	A 50-to-60 ft-thick outcrop of white-to-cream ash-flow tuff----------	--	--	--	--	60.0
26	do--	Green ash-flow tuff----------	--	--	--	--	50.0

APPENDIX A-1.--Analyses of rock samples from the High Rock Canyon study area, Washoe County, Nevada--Continued

Sample			Gold (ppm)	Silver (ppm)	Arsenic (ppm)	Mercury (ppm)	Zeolites-Clinoptilolite (%)
Map no. (fig. 2)	Type	Description					
27	Random	Fractures strike N. 15° E., and dip 54° SE. in ash-flow tuff, and are filled with white-to-brown opal----------	<0.007	<0.3	72.0	--	--
28	do--	White ash-flow tuff----------	--	--	--	--	56.0
29	Chip	A 3.0-ft-thick fault filled with green, opalized breccia strikes N. 65° E. and dips vertically in ash-flow tuff----------	<.007	<.3	<2.0	--	--
30	Random	do----------	<.007	<.3	<2.0	--	--
31	do--	A fault filled with green, opalized breccia strikes N. 65° E., and dips vertically in ash-flow tuff----	<.007	<.3	<2.0	--	--
32	Grab	Buff-to-pink, silicified rhyolite breccia----------	<.007	<.3	5.8	--	--
33	Select	Yellow-to-brown and green opal in fractures in rhyolite----------	<.007	<.3	--	--	--

APPENDIX A-2.--Analysis of placer samples from placer claims near the High Rock Canyon study area, Washoe County, Nevada

Map no. (fig. 2)	Sample volume (yd^3) 1/	Gold value 2/ (dollars per yd^3) 1/	Sample description
17	0.012	0.01	Gravel contains about 50% basalt and 50% rhyolite
18	.008	.03	do
19	.008	.0	do
20	.008	.02	Gravel contains about 35% basalt, 35% tuff, and 30% scoriaceous basalt
21	.008	.03	Gravel contains about 32% basalt, 32% tuff, 32% scoriaceous basalt, and 4% chalcedony
22	.008	.05	do
23	.008	.06	do

1/ Cubic yards
2/ Gold valued at $400 per troy ounce.