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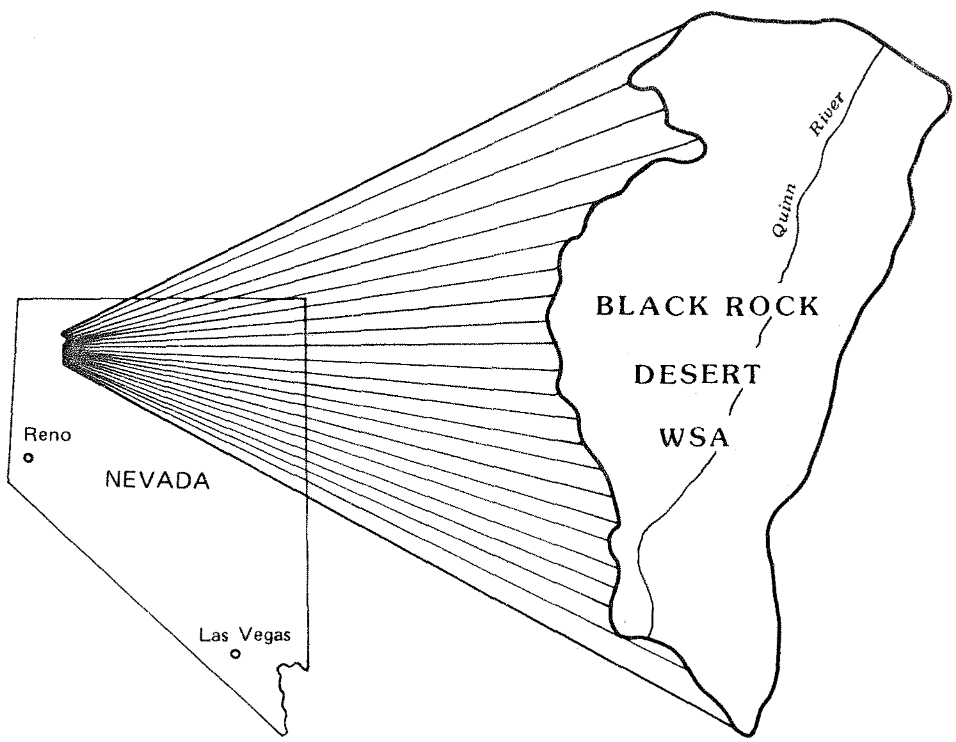
Open File Report

Mineral Resources of the Black Rock Desert Wilderness Study Area, Humboldt County, Nevada



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE BLACK ROCK DESERT WILDERNESS STUDY AREA, HUMBOLDT COUNTY, NEVADA

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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 submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of the Black Rock Desert Wilderness Study Area (NV-020-620), Humboldt 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, East 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.

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ILLUSTRATIONS

SUMMARY

In 1984, the U.S. Bureau of Mines conducted a mineral survey of the Black Rock Desert Wilderness Study Area (WSA) (NV-020-620), which covers approximately 319,000 acres in Humboldt County, Nevada. About 90% of the WSA is underlain by Pleistocene desert playa sediments; the remainder is comprised of Jurassic-Triassic metamorphic rocks, a Cretaceous intrusive and Tertiary volcanic rocks. Most of the WSA is within a down-dropped fault block of the Basin and Range physiographic province.

No mines or evidence of major exploration were identified within the WSA; but five claim blocks within or adjacent to the WSA and zones of anomalous character as defined by the Bureau of Land Management were examined. No mineral resources were identified, but anomalous gold, silver, and indicator element content of samples taken near Pinto Hot Springs indicate resources may exist. Lithium content of samples from near-surface sediments on the desert playa is too low for resources, but geologic conditions are favorable for higher concentrations at depth. Occurrences of zeolites are not considered to be of commercial interest.

Approximately 27,000 acres are held under geothermal lease, and most of the WSA is of interest for oil and gas. No evaluation of these commodities was made by the Bureau of Mines

INTRODUCTION

This report describes the U.S. Bureau of Mines (USBM) portion of a cooperative study with the U.S. Geological Survey (USGS) to evaluate mineral resources and potential of public lands recommended for wilderness, as required by the Federal Land Policy and Management Act of 1976. The USBM examines and evaluates individual mines, claims, prospects, and mineralized zones; USGS conducts broader geological, geochemical, and geophysical surveys.

Setting

The Black Rock Desert Wilderness Study Area (WSA) encompasses 319,000 acres in the western half of Humboldt County, Nevada, between the Jackson Mountains on the east and the Black Rock Range on the west (fig. 1). The major landform is the desert playa, an essentially flat feature that comprises nearly 90% of the study area. A north-south trending grouping of low hills, buttes and mesas borders the area on the northwest. Elevations range from 3,900 ft on the desert floor to 5,931 ft at the summit of Elephant Mountain. The perimeter of the area is mostly accessible year-round via maintained county and BLM roads; but a jeep trail that crosses the playa on the southwest boundary is usually impassable until July. Vegetation, mainly saltbush, grass and greasewood, is dense near the perimeter and sparse to non existent toward the center.

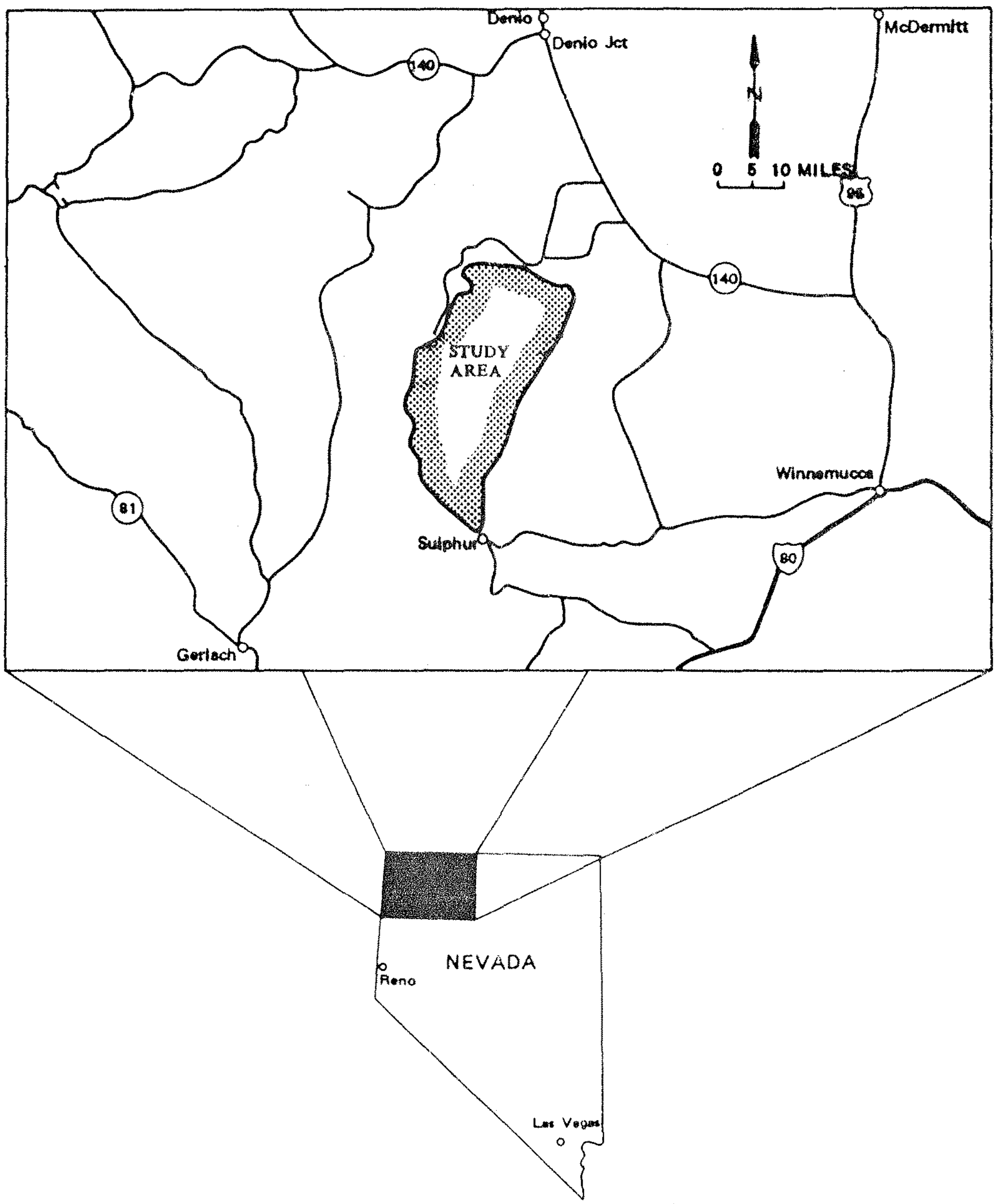


FIGURE 1. – Location of the Black Rock Desert WSA (NV-020-620), NV

Previous Studies

Geology and mineral resources of Humboldt County and northwest Nevada are discussed by Beatty (1955), and Willden (1964). Geology of Nevada was compiled by Stewart and Carlson (1978). Occurrences of lithium in Nevada are discussed by Smith and others (1971) and Vine and Dooley (1980). Geochemical and geostatistical studies of the BLM Winnemucca District were done by Barringer Resources, Inc. (1982). Geophysical characteristics of the southern desert area are discussed by Crewdson (1976). Information of a more historical nature can be found in a book by Wheeler (1978).

Present Study

Pre-field investigation for areas within and adjacent to the WSA included library research for pertinent literature, a search of BLM and Humboldt County mining records for claim locations, and an examination of U. S. Bureau of Mines (USBM) production records. Claim owners were contacted for additional information and for permission to examine and publish data on their properties. The USBM Mineral Industries Location System (MILS) was also searched for property locations within the area studied.

Field work, in 1984, included searching for and examining all mineral properties identified in the pre-field study. Aerial and ground reconnaissance of the entire WSA were conducted to locate unknown claims, prospects, or mineralized areas. All sites found were sampled and, if warranted, mapped.

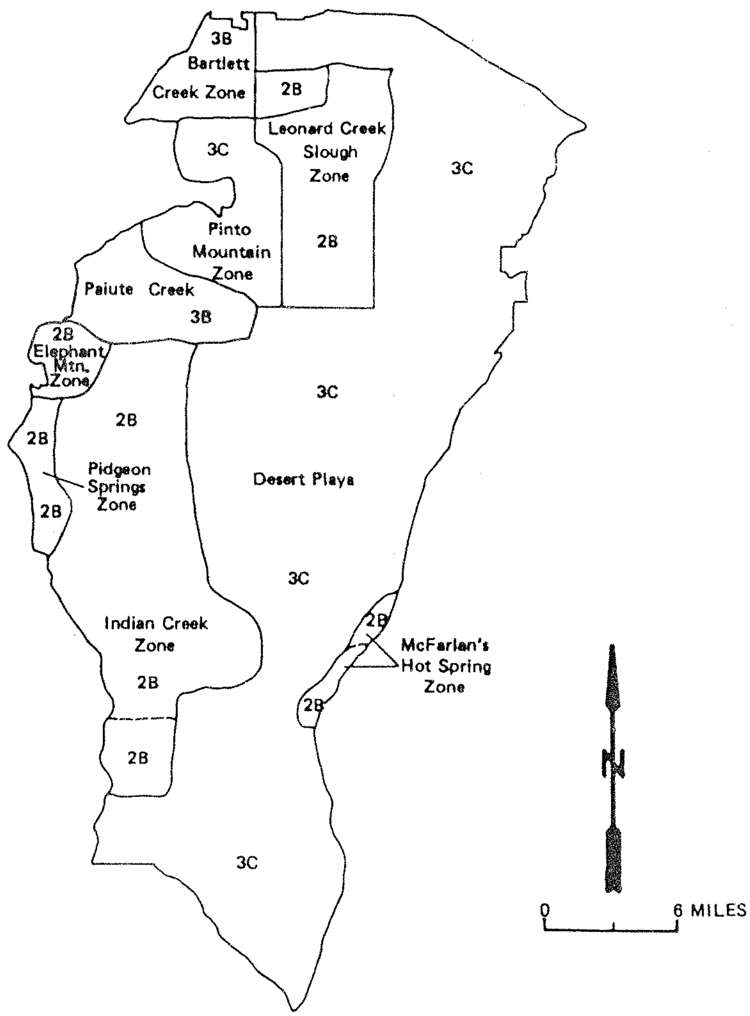
Using geochemical and statistical methods, Barringer Resources, Inc. (1982) identified 20 areas of significant mineral interest within the BLM Winnemucca District, two of which are inside the Black Rock Desert WSA. The BLM subdivided these two areas and added other zones (fig. 2) with various degrees of favorability and confidence (Bureau of Land Management, 1983). For this study, the zones within the Black Rock Desert WSA were examined and, where warranted, sampled in an effort to determine the source of the indicated anomalies.

Near-surface sediments of the desert playa were sampled with a hand auger to determine their favorability for lithium resources. Because access to the playa is limited, sampling was restricted to eleven holes. The presence of ground water and length of auger rods limited the depth of the holes to a maximum of 14 ft. In each hole, samples were separated on the basis of five-foot intervals or by a detectable change in strata.

Placer samples were taken along Leonard Creek to determine the existence of placer gold possibly derived from known deposits along the creek to the north.

Depending on the area or nature of the mineralization, all samples were analyzed for a particular suite of elements by inductively coupled plasma, atomic absorption, or other quantitative method. Detection limits used for gold, and silver are 0.007 and 0.3 parts per million

BLACK ROCK DESERT WSA



FAVORABILITY

1 Unfavorable potential
2 Low potential
3 Moderate potential
4 High potential

LEVEL OF CONFIDENCE

A Insufficient data
B Low confidence (indirect evidence)
C Moderate confidence (direct evidence)
D High confidence (abundant direct evidence)

— — — Boundary of zones with approximately equivalent mineral potential but which contain different minerals

Adapted from U.S. Bureau of Land Management (1983)

FIGURE 2. – Anomalous zones as defined by the BLM

(ppm) respectively (1 ppm = .029 oz/ton); detection limits for other elements vary with method, but are generally below 30 ppm. Most samples were analyzed by semi-quantitative spectrography of 40 elements 1/ to detect the presence of other elements in unsuspected amounts. Select samples were analyzed petrographically for rock type, petrogenesis, alteration assemblages, and other qualitative data.

ACKNOWLEDGEMENTS

Field work was carried out with the assistance of Richard S. Gaps and Nicholas T. Zilka of the U.S. Bureau of Mines. Appreciation is extended to Willis Bland for allowing us to set up a base camp at Paiute Meadows Ranch and for his assistance in many logistical matters. Victor Dunn of the BLM provided valuable information pertaining to the geologic and general mineral character of the WSA.

GEOLOGIC SETTING

The Black Rock Desert is within the Basin and Range physiographic province, which is characterized by northeast-trending, fault-bounded mountain ranges and valleys; the WSA is on a down-dropped block. Most of the WSA is underlain by Pleistocene playa sediments. Hills and mesas at the northwestern boundary of the study area are comprised of Jurassic-Triassic phyllite, slate, and quartzite, and Miocene-Pliocene tuff, rhyolite, and basalt (Willden, 1964). Additionally, a small hill composed of Cretaceous quartz monzonite near Pinto Hot Springs is possibly part of a continuum between the Sierra Nevada and Idaho batholiths (Smith and others, 1971, p. 2934). Basalt and rhyolite flows and domes at Elephant Mountain may be remnants a large collapsed caldera.

A summary of the regional geologic history is adapted from Crewdson (1976, p. 21) as follows:

1) Late Paleozoic formation of volcanic and minor sedimentary rocks in a eugeosynclinal environment.

2) Regional Mesozoic(?) dynamo-thermal metamorphism.

3) Emplacement of Cretaceous intrusives and associated contact metamorphism.

4) Early Tertiary uplift and erosion exposing intrusive and metavolcanic rocks and removing all Paleozoic rocks.

5) Mid-Tertiary deposition of volcanics.

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, phosphorous, platinum, potassium, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, zirconium.

6) Mid to late Tertiary Basin and Range style faulting.

7) Quaternary deposition of lake sediments, alluvium, playa sediments, and dunes.

8) Recent minor faulting.

9) Holocene hot spring development, including Pinto Hot Springs on the west and McFarland Hot Springs on the southeast side of the desert.

MINES, PROSPECTS, AND MINERALIZED AREAS

Mining History

Prospecting in Humboldt County began around 1850 by emigrants and prospectors travelling through the area on route to the California gold fields. The first account of a mineral discovery near the Black Rock Desert is summarized by Vanderburg (1938, p. 9) as follows:

> In the summer of 1849, Allen Hardin, in the company of other emigrants, arrived almost destitute on the edge of the Black Rock Desert. Hardin, with two companions, had left the main party in search of game for food. This region is one of the most barren and desolate sections in Nevada and the hunters found no game. However, on their return to camp they brought with them a piece of metal that weighed about 25 pounds, and they tried to get a member of the party to haul it to California for them. The party in question was short of oxen to haul his own property and he informed them that he would not pack it, even though it were pure gold. They were forced to leave the specimen beside the road, but before doing so they made a small button by melting a piece and molding it in the sand. Upon arriving in California the button was assayed and showed high values in silver. The rock that was left along side the road was found several months later by another party of emigrants and brought to Sacramento, where it was placed on exhibition in the leading bank at the time. In succeeding years numerous parties, numbering as high as 70 members in a single party, were organized by Hardin and others to search for the "lost mine", but these efforts were fruitless. Probably the metal found by Hardin was a specimen of hornsilver float from the Silver Camel Mine near Sulphur.

Mining has occurred in districts nearby and adjacent to the WSA, but only two prospects are located inside. The Sulphur district is located at the southern end of the WSA and evolved about 1870 when Indians first showed prospectors the location of native sulphur (Bailey and Phoenix, 1944, p. 107). In 1908, rich silver veins were discovered at the south end of the district (Vanderburg, 1938, p. 44). Production through 1920 totaled 15,369 tons of ore valued at $381,723 in silver (Bailey and Phoenix, 1944, p. 107). Although cinnabar had been noted as early as 1882, mercury mining did not begin until 1941. Reported production was 25 flasks through 1943. An old mining area near Sulphur, at the southern tip of the WSA, is currently under development as an open pit gold mine.

Other districts near the study area include the Varyville district to the northwest, the Leonard Creek placer district to the north, and the Red Butte and Jackson mining districts in the Jackson Mountains to the east.

According to the BLM, nearly 27,000 acres are held under geothermal lease near Pinto Hot Springs and McFarland Hot Springs. Although most of the WSA is of interest for oil and gas, an exploratory oil well, on the east side of the WSA, completed to a depth of 7931 ft in 1983, is reportedly dry (U.S Bureau of Land Management, 1983).

Sites and Zones Examined for This Study

Mining Claims

BLM mining records indicate five areas within or adjacent to the area studied are covered by active or recent claims. Of these, only the two areas near Pinto Hot Springs were found to have had any workings. A block of claims north of Sulphur and within the WSA is entirely on playa sediments and probably associated with the mining activity near Sulphur. The remaining two areas, one near the northeastern, and the other on the northern border of the WSA, are either mislocated or are of insufficient mineral character to warrant further analysis. The two properties with workings are discussed in the following sections. Sample locations are shown on figure 3 and analytical data in the accompanying table.

Anomalous Zones

Desert Playa. Desert playas in the Basin and Range Province are considered good targets for lithium exploration because 1) structural basins created by block faulting restrict the escape of soluble and clay size constituents, 2) deep seated block faults may act as conduits for circulating groundwater, 3) high temperature gradients, as indicated by the presence of hot springs, may drive ground water convection cells, and 4) excess evaporation relative to precipitation provides for lithium detection in the near surface environment (Vine, 1975, p. 484). Clayton Valley, near Silver Peak, Nevada, is one example of a desert playa enriched in, and presently producing, lithium. The upper Black Rock Desert is particularly interesting in that hectorite (lithium-bearing clays) derived from the McDermitt Caldera may have been transported and deposited within the desert basin.

Thirty samples, taken along an approximate north-south line from eight holes at two to ten mile spacings and three holes at 100 yard intervals (fig. 3), were composed predominantly of clay and fine silt. Occasional lenses of sand and fine pea gravel occur at the upper end of the desert.

Lithium values in these samples ranged from 20 ppm to a high of 60 ppm. Davis (1976, p. 106) suggests that lithium in surface clays may be anomalous at values exceeding 300 ppm. It is not yet clear, however, whether near-surface lithium values are reliable indicators of resources in the

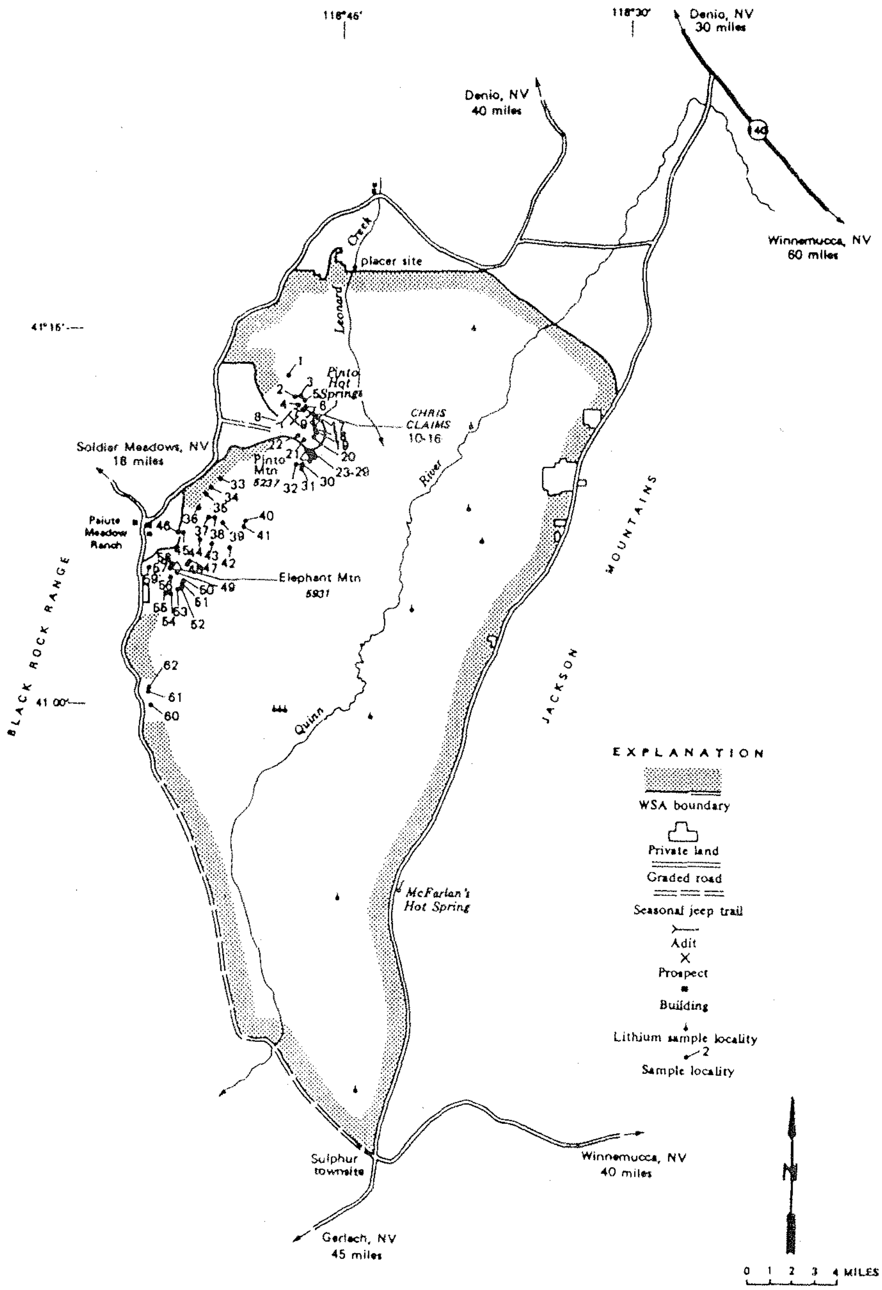


FIGURE 3. – Mines, prospects, and sample sites in the Black Rock Desert WSA (NV-020-620), NV

An unnumbered table to accompany figure 3, Mines, prospects, and sample sites in the Black Rock Desert WSA, NV

[N, none detected]

Sample		Content (ppm)							
No.	Description	Gold	Silver	Arsenic	Antimony	Barium	Molybdenum	Tungsten	Zinc
1	Welded crystal tuff with 20% phenocrysts-----------------------	N	N	56	N	900	N	N	58
2	Yellow-green-red jasper------------	N	N	N	N	N	N	N	9
3	Gray-maroon quartz, rhyolite porphyry; moderate silicification.	N	N	51	N	200	7	N	46
4	Gray pebble conglomerate-----------	N	N	38	N	600	N	N	88
5	Red-brown, medium grained volcanic.	N	N	N	N	400	N	N	89
6	White-gray tuff with horizontal micro-bedding-------------------	N	N	9	N	500	N	N	66
7	Brown, iron oxide stained tuff----	N	N	N	N	300	N	N	36
8	Weathered, medium grained, gray-brown quartz monzonite----------	0.025	N	42	N	500	5	N	N
9	do------------------------------	.478	N	120	N	300	N	6	63
10	Iron oxide banded, cryptocrystalline, silicified volcanic-------------	.021	1.448	19	N	600	N	N	88
11	do------------------------------	.020	1.373	0.005	N	300	N	N	33

An unnumbered table to accompany figure 3, Mines, prospects, and sample sites in the Black Rock Desert WSA, NV--Continued

Sample		Content (ppm)							
No.	Description	Gold	Silver	Arsenic	Antimony	Barium	Molybdenum	Tungsten	Zinc
12	See no. 10; additional argillic alteration	0.012	1.486	30	N	700	N	N	55
13	See no. 10; additional silicification	.009	1.069	43	N	400	N	N	56
14	Weathered, argillized, tuff with minor opal filling	.011	1.501	29	N	400	N	N	64
15	See no. 10	.064	1.394	14	N	400	N	N	43
16	do	.020	1.111	87	N	600	N	N	110
17	White-gray, banded, tuffaceous sediment with minor clay	N	N	15	N	N	N	N	N
18	do	N	N	17	N	400	N	N	52
19	do	N	N	N	N	500	N	N	68
20	do	.044	.35	37	N	900	N	6	36
21	do	.020	N	38	N	300	N	N	N
22	do	.015	N	41	N	500	6	N	28
23	White-gray tuffaceous sediment	N	N	N	N	1200	N	N	59

An unnumbered table to accompany figure 3, Mines, prospects, and sample sites in the Black Rock Desert WSA, NV--Continued

Sample		Content (ppm)							
No.	Description	Gold	Silver	Arsenic	Antimony	Barium	Molybdenum	Tungsten	Zinc
24	Red-brown silicated basalt with 5% green chalcedony--------------	N	N	N	N	700	N	N	35
25	White lithic tuff-----------------	N	N	49	N	300	N	N	N
26	Iron oxide stained chalcedony pod in small pit--------------------	N	N	53	N	N	53	N	N
27	Volcanic sediment with angular fragments up to 1.0 cm-----------	N	N	N	N	600	N	N	160
28	White-gray crystal tuff-----------	N	N	68	N	200	N	N	17
29	do--------------------------------	N	N	48	N	300	N	7	44
30	Silicified tuff with pyrolusite dendrites on fractures-----------	N	N	N	N	N	N	N	N
31	Tuffaceous sandstone--------------	N	N	52	N	500	10	N	79
32	Bentonitic tuffaceous sediment----	N	N	N	12	400	N	N	52
33	Light gray lithic tuff------------	0.023	N	74	N	900	N	6	22
34	Brown-buff rhyolite with minor silicification------------------	N	N	N	N	N	8	N	37
35	Light gray tuff underlying no. 34.	.027	N	N	N	500	N	N	N

An unnumbered table to accompany figure 3, Mines, prospects, and sample sites in the Black Rock Desert WSA, NV--Continued

Sample		Content (ppm)							
No.	Description	Gold	Silver	Arsenic	Antimony	Barium	Molybdenum	Tungsten	Zinc
36	Green-gray chalcedony float in basalt country rock--------------	0.019	N	N	N	N	11	N	N
37	Silicified volcanic breccia-------	.026	N	59	N	500	3	N	N
38	Maroon, silicified rhyolite-------	.021	N	86	N	900	5	N	43
39	Pink-brown, crystalline rhyolite with minor silicification--------	.045	N	N	N	N	N	N	N
40	Sandy tuffaceous sediments with manganese oxide on fractures-----	N	N	N	17	400	N	N	76
41	Gray, lithic tuff-----------------	N	N	N	N	500	N	N	39
42	Red-brown silicified tuff---------	N	N	N	N	400	N	N	61
43	Red-brown silicified rhyolite with opal (?) in fractures------------	N	N	N	N	900	N	N	59
44	Intermediate volcanic with green opal (?) in fractures------------	N	N	N	N	900	N	N	110
45	Gray lithic tuff from small pit---	N	N	N	N	700	N	N	69
46	Gray-purple lithic tuff near pit--	.027	1.868	N	N	600	N	N	19
47	Red-brown vesicular basalt with minor brecciation----------------	N	N	N	N	1600	N	N	100

An unnumbered table to accompany figure 3, Mines, prospects, and sample sites in the Black Rock Desert WSA, NV--Continued

Sample		Content (ppm)							
No.	Description	Gold	Silver	Arsenic	Antimony	Barium	Molybdenum	Tungsten	Zinc
48	White-maroon banded vitric tuff with quartz phenocrysts-----------	N	N	N	N	700	N	N	19
49	Brown basalt with 10% red jasper---	N	N	N	N	1300	N	8	140
50	Silicified volcanic breccia float--	N	N	N	N	N	N	N	37
51	Amygdaloidal basalt----------------	N	N	N	N	1200	N	N	88
52	Red-brown silicified basalt breccia.	N	N	N	N	1200	N	N	110
53	Japeroidal stringers in vesicular basalt---------------------------	N	N	N	N	400	N	N	43
54	Buff-brown, fractured, silicified volcanic-------------------------	N	N	N	N	1400	N	N	96
55	Light gray, banded tuff------------	N	N	N	N	1900	N	N	26
56	Gray massive tuff with minor manganese oxide------------------	N	N	N	N	800	N	N	28
57	Light gray rhyolitic tuff----------	N	N	N	N	800	N	N	23
58	Gray, banded, silicified rhyolite--	N	N	N	N	1400	N	N	19
59	Medium gray quartzite with minor hematite inclusions--------------	N	N	N	N	200	N	N	54
60	Brown, vesicular, banded tuff------	0.049	N	59	N	N	6	N	16

brines and clays at depth. Bohannon and Meier (1976, p. 1) state "...most large lithium deposits occur at depth and appear to be formed when deeply buried. Many may not manifest themselves at the surface at all." With the evaporation process and subsequent lowering of the water table lithium may be leached from the surface sediments. Therefore, although results of sample analyses taken during this study provide no direct evidence of positive favorability for lithium resources, they do not preclude the possibility of greater values at depth.

The USBM is currently studying methods to extract lithium from hectoritic clays of the McDermitt Caldera (Edlund, 1983). With new technology and a greater demand for lithium, such as in lightweight batteries, lithium-bearing clays and brines of desert regions may represent additional resources of nature's lightest metal.

Pinto Mountain. This zone is comprised of Triassic-Jurassic metamorphic rocks, Cretaceous quartz monzonite, and Oligocene-Pliocene volcanic tuffs and basalt. Pinto Hot Springs, an active thermal spring, is located near the center of the zone. The zone is classified by the BLM as having a moderate favorability with moderate confidence for base and precious metals and is reported to have anomalous values for barium, molybdenum, zinc, and tungsten.

Workings were found in two areas within the zone. The Chris claim group northwest of Pinto Hot Springs (fig. 3) contains 23 small pits and trenches. The host rock is extremely fine grained and difficult to identify, even in thin section. One petrographic sample of a silicified specimen was described as banded, cryptocrystalline, and rich in silica, with individual grains of K-feldspar, quartz, biotite, apatite, and other silicates less than 0.1 mm across. Most of the matrix shows minor argillic alteration, and an X-ray microprobe examination showed trace amounts of barite. Of seven samples taken from the workings, all contained gold, silver, arsenic, and barium in low amounts. One mile west of Pinto Hot Springs, one pit and an adit, approximately 100 ft long, are on a fault zone in quartz monzonite (fig. 3). Of two samples, one from the pit contained 0.478 ppm gold and 120 ppm arsenic. Results for the thirty-five samples taken within the Pinto Mountain zone, including those from the Chris Claims, are listed in the accompanying table.

Elephant Mountain. This zone includes Elephant Mountain, the highest point in the WSA, and surrounding foothills. According to the BLM, rock types include Oligocene-Miocene rhyolitic flows and shallow intrusives. Basalt flows and tuffs are also present on the southern side of the mountain, and quartzite was observed along the western foothills. Reported high background values in molybdenum are possibly associated with the Central Molybdenum Zone defined in the Panute Peak WSA to the west (U.S. Bureau of Land Management, 1983). No workings were identified within the zone. No gold, silver, or molybdenum were detected in thirteen samples taken from most rock types.

Paiute Creek. This zone is situated north of Elephant Mountain and is comprised mostly of Oligocene-Miocene tuffs, Miocene-Pliocene basalt, and

Quaternary playa sediments. Although prospecting activity is not recorded for the area, one small pit was found. One sample taken near the pit in tuffaceous rocks contained 0.027 ppm gold and 1.87 ppm silver. Analytical results for thirteen samples taken in the zone are listed in the accompanying table.

Leonard Creek. This zone is entirely underlain by playa sediments. Anomalous values for molybdenum and tungsten are probably attributable to outwash from other areas or hidden hot spring activity (U.S. Bureau of Land Management, 1983). Four samples from gravels on Leonard Creek at the northern boundary the WSA (fig. 3) contained a maximum [0.0002 troy ounces of gold/yd^3] value of \$0.07/yd^3 at a gold price of \$350/troy oz.

Pidgeon Springs. This zone is comprised of Miocene-Pliocene basalt flows and tuffs, and Quaternary sediments. Sample no. 60 (fig. 2) from a rhyolitic tuff contained 0.048 ppm gold and 59 ppm arsenic.

Others. The remaining zones in the WSA are entirely underlain by sediments and were not sampled for mineral content. Five reconnaissance samples for zeolite minerals were taken at various locations within the WSA. Two samples (#61 and #62), (fig. 3), comprised mostly of amorphous constituents, contained 34% and 45% clinoptilolite, trace amounts of quartz and felspar, and minor quantities of clay.

APPRAISAL OF MINERAL RESOURCES

No resources were identified within or adjacent to the WSA. Based on past exploration, sample data, and statistical studies, a broad area around Pinto Hot Springs may be favorable for precious metal resources [gold is currently being mined from some disseminated deposits at grades as low as 0.02 oz/ton (0.7 ppm) (Jayne, 1985)]. Samples of sediment from the desert playa provide no conclusive evidence for near-surface lithium resources, but geologic conditions are favorable for greater values at depth. Zeolite occurrences are not considered to be of economic interest.

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