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Mineral resources and resource potential of the Wildrose Canyon Wilderness Study Area, Inyo County, California

by

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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Illustration

STUDIES RELATED TO WILDERNESS

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas "... to determine the mineral values, if any, that may be present ...". Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Wildrose Canyon Wilderness Study Area (CDCA-134), California Desert Conservation Area, Inyo County, California.

SUMMARY

Scattered, small, barium, bismuth, and molybdenum geochemical anomalies in stream sediments from drainage basins within the Wildrose Canyon Wilderness Study Area may indicate the presence of hydrothermal deposits containing base and precious metals and molybdenum-bearing skarn deposits. These types of deposits are known to occur elsewhere in the region but have not been identified in or near the study area. There is low potential for undiscovered base- and precious-metal resources in veins and (or) molybdenum, tungsten, and copper in skarns in carbonate rocks exposed on the east boundary of the study area. The study area contains abundant sand and gravel, but it is limited to local use because of distance to major markets.

INTRODUCTION

Area description

The Wildrose Canyon Wilderness Study Area encompasses 17,366 acres in the Panamint Range, Inyo County, California. It is about 50 mi east of Lone Pine, California, by state and county roads and adjoins the west boundary of Death Valley National Monument, and the southeast boundary of the Panamint Dunes Wilderness Study Area. The terrain is moderately rugged with elevations ranging from 6,000 ft along the east boundary to 2,200 ft at the foot of the range. The climate is arid with a wide range in temperatures. Vegetation is sparse with creosotebush, desert holly, burroweed and encelia on the flanks of Panamint Valley, and Joshua tree, sage, and rabbit brush on the higher parts of the study area.

California Highway 190 marks the northwest boundary of the study area and permits access to the northern part of the area. The southern part of the study area may be reached by unimproved dirt roads leading to the mouths of major canyons from Panamint Valley.

Previous and present studies

The Wildrose Canyon Wilderness Study Area lies within the Panamint Butte 15' quadrangle. A geologic map of this quadrangle was published by Hall (1971) and a study of mineral deposits in it was published by Hall and Stephens (1963). A compilation geologic map, made as part of this study, includes the Hunter Mountain, Panamint Dunes, and Wildrose Canyon Wilderness Study Areas (Conrad and McKee, 1984).

Fieldwork for this report was done in 1981 by the U.S. Bureau of Mines and in 1982 and 1983 by the U.S. Geological Survey. The studies included examination and evaluation of individual mines, prospects and mineralized zones by the Bureau of Mines, and reconnaissance geologic mapping and geochemical sampling of drainage basins by the Geological Survey.

Back up work included a literature search by the Bureau of Mines for data pertaining to mineral resources and deposits in the region, and a search of Inyo County and U.S. Bureau of Land Management claim records.

Geochemical sampling by the Geological Survey included 14 stream-sediment samples and 14 panned heavy-mineral concentrates. Chemical analyses of these samples are available in Detra and others (1984).

Sampling by the Bureau of Mines included 14 rock and 8 stream-sediment samples. Complete sample analyses and an open-file summary report are on file at the U.S. Bureau of Mines Western Field Operations Center, Spokane, Washington (Willett, 1983).

GEOLOGY

The rocks in the study area are divided into four major groups: (1) Proterozoic(?) micaceous quartzite and dolomite; (2) Paleozoic marine sedimentary rocks; (3) upper Tertiary and Quaternary fanglomerates and interbedded basalt flows; and (4) Quaternary surficial deposits.

Proterozoic(?) rocks consist of a 700 ft thick section of quartzite, quartz-mica schist and dolomite. This unit is overthrust by a sequence of Paleozoic marine sedimentary rocks of Late Cambrian to Mississippian age. Composite stratigraphic thickness of this sequence is nearly 5,000 ft, although only partial fault-bounded sections are exposed in the study area. The rocks are predominantly dolomite and limestone with some interbedded quartzite units.

About three-quarters of the study area is underlain by fanglomerates and basalt flows of Pliocene to Late Pleistocene age. The fanglomerates are comprised of three units separated by angular unconformities of as much as 20°. The composite thickness of the fanglomerates is more than 10,000 ft. Breccias of shattered Paleozoic dolomite and quartzite, interpreted as landslide masses off highlands east of the study area, and basalt flows of Pliocene age are interbedded in the fanglomerates. A detailed description of the Paleozoic and Cenozoic formations is given in Hall (1971) and Conrad and McKee (1984).

Structurally, the area is characterized by gently to moderately dipping, strongly faulted strata. Three major periods of deformation are recognized. These are: (1) pre-Jurassic faulting and folding, recognized by regional geologic studies; (2) deformation associated with emplacement of Jurassic plutonic rocks near the study area; and (3) late Tertiary basin and range high-angle normal faulting.

Deformation occurring in the latter period of deformation is responsible for most of the physiography of the region. Combined uplift on north-trending normal faults that cut the Paleozoic and Cenozoic units is over 10,000 ft. Movement on these faults formed a highland east of the study area that was the source for the Pliocene fanglomerates, and caused tilting of the fanglomerates of up to 40° to the east.

GEOCHEMICAL STUDIES

Stream sediments were selected as the primary medium for the geochemical investigation because they represent a composite of rock and soil exposed in the drainage basin upstream from the sample site. The drainage basins cover areas ranging from a fraction to several square miles. Chemical analysis of sediments provides information helpful in identifying those basins that contain concentrations of elements possibly related to mineral deposits.

Two samples were gathered at each sample locality. The stream-sediment sample was sieved and the fine fraction saved for analysis. This sample contains material predominately derived from major rock units of the drainage basin as well as scavenged materials such as amorphous iron-manganese oxides, clays, and organic matter.

The second sample, the heavy-mineral concentrate, was sieved and wet panned to remove most of the quartz, feldspar, and clay-sized minerals. The less dense grains that remained were removed by heavy-liquid mineral separation techniques. The remaining concentrate was divided into three fractions: highly magnetic, weakly magnetic, and nonmagnetic. The nonmagnetic fraction (containing most of the sulfide minerals, their oxidation products, and other minerals that contain most of the ore and ore-related elements) was split into two parts: one fraction was saved for chemical analysis, and the other retained for optical mineralogy studies. The content of ore and ore-related elements is thus enhanced to the point where they can be measured by spectroscopic methods and the variation in dilution by sedimentary processes is lessened.

All samples were analyzed for 31 elements by a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968). The analytical results are given in Detra and others (1984). These analyses show drainages with anomalous concentrations of metals or ore-related elements. Most often these anomalies reflect mining activity or mineralization, but in some instances they indicate areas of concealed mineralization. An anomalous area is a locality where ore-related elements in the sample deviate sufficiently from the upper limit of normal background values to suggest that concentrations of these metals may occur in the rocks. Anomalous values were determined by inspection of histograms, percentiles, and enrichment relative to crustal abundance.

Analysis of the stream sediments and heavy-mineral concentrates disclosed anomalous elemental concentrations at a few places in the study area (plate 1). These anomalies may reflect minor hydrothermal activity and mineralization in or near the study area.

MINING HISTORY

No record of mineral claims or mineral production was found, and no workings or monuments associated with mining claims were found in the field. The Wildrose Canyon Wilderness Study Area is not in any mining district. The nearest districts, the Wildrose and the Harrisburg, are located to the east within Death Valley National Monument. Lode deposits in both districts have yielded gold.

Sand and gravel is removed from a pit leased by the California Department of Transportation, about 1 mi southeast of Towne Pass. Permits allow 45,000 cu yds of material to be removed for road maintenance in parts of Death Valley National Monument and along Highway 190 (Dan Young, oral commun., 1981).

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The assessment of mineral resource potential in the Wildrose Canyon Wilderness Study Area is expressed by a dual favorability-certainty classification (plate 1). The favorability factor is expressed by the terms high, moderate, and low resource potential: high indicates that the nature of the geologic environment and the geologic processes that have acted on the area suggest a high degree of likelihood of the presence of a stated mineral resource. The data define a geologic environment favorable for the presence of mineral resources, and support the interpretation that resources are present; moderate indicates that the nature of the geologic environment and the geologic processes that have acted in the area suggests a reasonable chance for the presence of mineral resources; low indicates that the data define a geologic environment permissive for the presence of mineral resources, but there is no evidence of the processes of resource accumulation.

The certainty factor used in the assessment has five levels. The lowest level, A, indicates that available data are not adequate for determination of occurrence of mineral resources. The second level, B, infers that available data are adequate to suggest a degree of potential (high, moderate, or low), but evidence is insufficient to precisely define the potential of geologic environments or activity of resource-forming processes. The third level of certainty, C, exists when available data provide a good indication of the level of potential, but are minimal in terms of definition of degree of activity of possible resource-forming processes, and nature of geologic environments. The fourth level of certainty, D, is when data clearly define the level of resource potential, the geologic environment, and the degree of activity of possible resource-forming processes. The highest level, E, exists when available information verifies that resources or reserves have been identified and specifies the kinds of valuable materials.

The Wildrose Canyon Wilderness Study Area lies within a province characterized by the presence of lead, zinc, and silver hydrothermal-type deposits. These lead-zinc-silver deposits are mainly metalliferous vein and replacement bodies in carbonate rocks close to granitic plutons. Skarns with tungsten, molybdenum, and copper metallization are also present at other localities in the region where large granitic plutons have metamorphosed carbonate rocks.

Weak anomalies at widely separated localities and low elemental concentration levels suggest that small deposits of either type may occur, but no specific evidence for such deposits was found in the study area. Carbonate rocks, possible hosts for these types of mineralization, are exposed only along the east boundary of the study area and granitic rocks are nowhere exposed in the study area. The upper Tertiary and Quaternary fanglomerates that underlie most of the study area may contain eroded debris from mineralized areas east of the study area, and may account for some or all of the anomalies observed. They do not constitute a mineral resource, because no volume of rock has been identified that is currently or potentially minable. Areas with mineral resource potential, and sampling locations of drainages with anomalous geochemical values are shown on plate 1.

Spectrographic analysis of the stream sediments revealed slightly anomalous molybdenum values in two drainages along the southern margin of the wilderness study area. This may represent a fine-grained phase of molybdenum that traveled as a constituent of Fe-Mn oxides or possibly was incorporated within the lattice of migratory clay minerals. The absence of molybdenum in the nonmagnetic heavy-mineral concentrates (the Fe-Mn oxides and clay minerals are presumably removed from this concentrate fraction when they are processed prior to analysis) corroborates this assumption. The lack of bedrock in the drainages containing anomalous molybdenum, and the indication that the molybdenum is a transitory phase associated with Fe-Mn oxides suggests that it has no significant resource potential in this part of the study area.

Anomalous barium, antimony, and bismuth values were detected in the nonmagnetic fraction of the heavy-mineral concentrates at 5 localities. These elemental anomalies are widely distributed, and do not occur together. Under microscopic examination, stibnite (Sb_2S_3) and barite ($BaSO_4$) were identified; the stibnite occurs with pyrite and tourmaline.

The antimony (stibnite) was found outside the southeast corner of the wilderness study area, in a drainage north of known antimony deposits in Nemo and Wildrose Canyons (Tucker and Sampson, 1938). In Wildrose Canyon stibnite is associated with pyrite and fluorite in quartz veins in schist or disseminated in brecciated amphibolite (White, 1940). It is likely of low- temperature hydrothermal origin. Antimony is not considered to have resource potential in the study area. The single antimony anomaly is probably derived from stibnite bearing rocks in Wildrose and Nemo Canyons which are not exposed in the study area.

The barium (barite) is widely dispersed within the study area, and suggests some hydrothermal activity. Barite is a common gangue mineral of carbonate-hosted base-metal deposits, although evidence for such deposits is lacking in the study area.

The single anomalous bismuth value occurs in a drainage north of Nova Canyon. The source of the bismuth is not known. Bismuth may be associated with granitic accessory minerals, or reflect local hydrothermal processes (metasomatism).

The scattered barium and bismuth anomalies may indicate minor hydrothermal alteration of the carbonate rocks along the east boundary of the study area. These rocks are judged to have low resource potential for tungsten and possibly molybdenum and copper in skarns and (or) lead, zinc, and silver in hydrothermal veins. The certainty factor is considered to be level C. These ratings are based primarily on the geochemical anomalies and mineral deposit models based on deposits elsewhere in the region. Stream-sediment samples were collected only along the west border of the study area, so it cannot be determined with certainty that the anomalies are derived from the carbonate rocks in the study area, and not from mineralized clasts in the fanglomerates, whose original source is east of the study area. Field work disclosed the presence of only small, isolated, slightly altered zones in the carbonate rocks.

There is no indication of the existence of any other economic mineral deposits in the Wildrose Canyon Wilderness Study Area, except sand and gravel suitable for local use. No radioactive minerals, fossil fuels or geothermal resources were found in the Wildrose Canyon Wilderness Study Area during this study.

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