

UNITED STATES DEPARTMENT OF THE INTERIOR

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Mineral Resources of the Flint Creek Range Wilderness Study Area,
Granite and Powell Counties, Montana

by

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STUDIES RELATED TO WILDERNESS

Under the Wilderness Act (Public Law 88-577, Sept. 3, 1964) and related Acts, certain areas within the National Forests previously classified as "wilderness," "natural," or "primitive" were incorporated into the National Wilderness Preservation System as wilderness areas. The act requires the U.S. Geological Survey and the U.S. Bureau of Mines to survey these wilderness areas to determine the mineral values, if any, that may be present. Results of such surveys must be made available to the public and submitted to the President and the Congress.

This report discusses the mineral resource potential of the Flint Creek Range Wilderness Study Area, Granite and Powell Counties, Montana. The area was classified as the Flint Range Further Planning Area, during the Second Roadless Area Review and Evaluation (RARE II) by the Forest Service, January 1979.

SUMMARY

The Flint Creek Range Wilderness Study Area comprises 52,340 acres (20,900 ha) in the central part of the Flint Creek Range in the Deer Lodge National Forest, Montana. It contains (1) a million tons of tungsten resources of possible ore grade in Finley Basin (fig. 1); (2) a multimillion-ton paramarginal phosphate-rock resource near the head of Boulder Creek; and (3) an estimated million tons of paramarginal silica (SiO_2) resources on the northeast side of Deer Lodge Mountain. Molybdenum resources comprising several million tons of submarginal grade occur near Tolean Lake. The deposit may extend westward into the study area. Other molybdenum resources may occur near East Goat Mountain. Stone, sand, and gravel occur in the area, but equal or better quality material is available closer to markets in western Montana. The study revealed no potential for coal, oil, gas, uranium, or geothermal energy.

INTRODUCTION

The U.S. Geological Survey and the U.S. Bureau of Mines, acting upon a request from the U.S. Forest Service, have evaluated the mineral-resource potential of the Flint Creek Range Wilderness Study Area, Granite and Powell Counties, Montana. In 1979, this area was classified by the U.S. Forest Service as the Flint Range Further Planning Roadless Area, I-428, during the Second Roadless Area Review and Evaluation (RARE II). The Geological Survey conducted geologic mapping and geochemical surveys and examined and sampled mineral occurrences in 1975 and 1980. The Bureau of Mines compiled mining claim, lease, and production data and mapped and sampled mines, prospects, and mineralized areas in 1975; it updated some industry exploration data in 1978 and 1981. All available information was utilized in the evaluation study. Cominco American, Inc., Amax Exploration, Inc., Union Carbide Corp., and Noranda Exploration, Inc., provided exploration data which were of great help to the authors. The Geological Survey collected a total of 490 samples of stream sediments, soils, and rocks. The Bureau of Mines collected a total of 264 rock chip and gravel samples. This report summarizes the results of these studies.

MINERAL RESOURCES

The study area includes parts of the South Boulder (Boulder or Clear) Creek and possibly part of the Flint Creek (Philipsburg) mining districts. Production from the Flint Creek, South Boulder, and Pioneer (3 miles to the north) districts totaled more than \$60 million (in 1954 dollars) between 1864 and 1954. It included about 88,500 ounces (2,750 kg) of gold, 21,200,000 ounces (659,000 kg) of silver, 53,200,000 pounds (24,100,000 kg) of zinc, 17,500,000 pounds (7,940,000 kg) of lead, 4,680,000 pounds (2,120,000 kg) of copper, and 560,000 long tons (560,000 metric tons (t)) of manganese ore. Principal producing mines were the Hope, Granite-Bimetallic, Trout, and Algonquin. The Gold Reef, Brooklyn, Powell, and

Port Royal mines, outside but adjacent to the study area, produced a total of about 2,400 ounces (74.6 kg) of gold, 100,000 ounces (3,100 kg) of silver, 94,000 pounds (42,600 kg) of copper, 240,000 pounds (109,000 kg) of lead, and 240,000 pounds (109,000 kg) of zinc. From 1908 to 1954, metal production along Gold Creek and elsewhere in the Pioneer mining district was valued at about \$1.4 million (in 1954 dollars), principally from placer gold and silver. No mineral production has been recorded from the study area, but small amounts of silver and gold probably have been recovered from prospects and small mines within it.

The metalliferous deposits in and near the study area were emplaced chiefly by hydrothermal fluids related to the three major plutons: Royal stock, Philipsburg batholith, and Mount Powell batholith (fig. 1). They tend to be located near the margins of the plutons, either within them or in nearby sedimentary host rocks. Clustering of hydrothermal mineral deposits at pluton margins and their paucity in the interiors are well-documented phenomena that reflect the temperature-pressure conditions at the time of emplacement. The deeper and hotter interiors of plutons are not favorable for accumulation of ore deposits, whereas cooler shallower margins are favorable. Therefore, it is unlikely that larger or richer deposits remain to be found in the interiors of the major plutons of the Flint Creek Range.

The plutons, which have been dated radiometrically as late Cretaceous to early Tertiary age (77 m.y.-58 m.y.), intruded a sequence of marine and continental sedimentary rocks of late Precambrian to Cretaceous age. Most sedimentary rocks in and near the study area were intensely folded and faulted prior to emplacement of the plutons and now are in recumbent to upright isoclinal folds broken by low-angle thrust faults and high-angle reverse faults. During intrusion of the plutons, the sedimentary rocks were thermally metamorphosed. Sandstone was transformed to quartzite; siltstone and shale were transformed to hornfels; pure limestone to marble; and impure limestone, calcareous sandstone, siltstone, and shale to tactite or hornfels. The only formation not changed by metamorphism is the Quadrant Quartzite, which in the unmetamorphosed state is relatively pure dense ortho-quartzite.

Geochemical exploration undertaken as part of the mineral-resource evaluation did not reveal the presence of potentially minable, heretofore undiscovered mineral deposits. Geochemical samples of stream sediments indicate clearly the presence of the recently discovered tungsten and molybdenum deposits. They also show local anomalous values of silver, lead, and zinc that reflect the presence of nearby upstream silver-bearing base-metal deposits. Geochemical sampling also brought to light relationships between distribution of certain trace elements and rock types. For example, lanthanum and yttrium, found to occur widely in anomalous amounts in panned concentrates, are associated with the mineral monazite, which probably is chiefly an erosion product of the major plutons. Anomalous amounts of these elements, however, also occur in phosphate rock of the Phosphoria Formation. Anomalous amounts of beryllium occur in the Mount Powell batholith and in tactites adjacent to that pluton.

Mineral exploration by Union Carbide Corporation since 1974 within the study area has identified about 1 million tons (0.9 million t) of tungsten resources averaging more than 0.6 percent tungsten trioxide (WO_3) in tactite along the contact of the Royal stock in the Finley Basin area (E.E. Nelson, oral commun., 1981). Additional tungsten resources probably occur in a similar tactite zone at Union Carbide's Thompson Lake prospect, and possibly at the company's North Fork Granite Creek prospect. Silver, copper, and zinc minerals are associated with tungsten in quartz veins on the ridge at the head of Deerlodge Basin north of Finley Basin. A sample of vein quartz from this area contained 0.70 percent tungsten trioxide (WO_3), 0.06 percent lead, 0.024 percent copper, and 0.9 ounces silver per ton (31 g/t). Eight other samples of vein quartz from this area show WO_3 values ranging from <0.01 to 0.08 percent. The Bureau of Mines author concludes that tungsten resources may be present in quartz veins of this area, and that the zone containing potential tungsten resources in tactite and quartz veins extends about 15,000 feet (4,600 m) northward from near Racetrack Peak.

In the mid-1960's, Cominco American, Inc., explored phosphate rock in the Phosphoria Formation in the south-central part of the study area (fig. 1) by bulldozer trenches and pits. The Phosphoria strike length is about 10,000 feet (3,050 m) in the study area. The company reported that phosphate rock exposed in these cuts averaged 5.9 feet (1.8 m) in thickness and the grade averaged 20 percent P_2O_5 . On the basis of these data, the Bureau of Mines author estimates that paramarginal resources of phosphate rock are 5 million tons (4.5 million t) of 20 percent P_2O_5 per 1,000 feet (300 m) of down-dip extension and that total resources may be 25 million tons (23 million t). However, this is an area of complex folds and faults so that the down-dip extension of phosphate rock is uncertain.

Molybdenum is associated with quartz-vein stockworks in granitic rocks adjacent to the study area near Tolean Lake (fig. 1). Geochemical and geophysical studies and three core-drill holes by AMAX Exploration, Inc., in the Tolean Lake area indicate the principal mineralized zone to be that shown in figure 1. The three drill holes penetrated to depths of 800 to 1,000 ft. (240-350 m). Several intervals tens of feet thick encountered in the drill holes averaged a few hundredths of a percent molybdenum, but one 20-ft. (6.1 m) core segment contained 0.08 percent MoS_2 (Giles Walker, oral commun., 1980). The Bureau of Mines author estimates that one mineralized unit contains more than 4 million tons (3.6 million t) of submarginal resources averaging 0.03 percent MoS_2 , and that molybdenum resources may extend into the study area.

Geologic mapping, sampling, and core drilling inside the study area on the northwest side of East Goat Mountain and nearby areas (fig. 1) by Noranda Exploration, Inc., have delineated another molybdenum-bearing stockwork zone similar to that at Tolean Lake (A.L. Lamarre, oral commun., 1981). Noranda's exploration, which is expected to continue in 1981, may prove molybdenum resources to exist in this area.

Copper, silver, lead, and zinc minerals are concentrated locally in quartz veins in and near the study area. Vein quartz from the Swiss Prospect south of the Powell Mine contained 40.7 ounces silver per ton (1,395 g/t), 0.01 ounce gold per ton (0.3 g/t), 0.89 percent copper, and 2.1 percent lead. Copper-stained vein quartz near the top of Goat Mountain (fig. 1) contained 30.7 ounces silver per ton (1,052 g/t), 3.1 percent copper, 4.6 percent lead, 0.36 percent zinc, 0.22 percent bismuth, and 0.57 percent antimony. Although these silver contents are the highest of all veins sampled in the study area, the veins generally are lower grade and the total metallic mineral resources probably are small. Other quartz veins and shear zones in the study area contain sporadic, small amounts of copper, silver, lead, and zinc. They either do not have resources or are too poorly exposed to be evaluated.

Reconnaissance placer samples were taken on La Marche, Robinson, Powell, Granite, Boulder, Royal Gold, Little Gold, Copper, Rock, and Tincup Joe Creeks. Only one sample from the study area, that from Powell Creek, had a trace of gold.

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