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MINERAL RESOURCE POTENTIAL OF THE SELWAY-BITTERROOT WILDERNESS IDAHO COUNTY, IDAHO, AND MISSOULA AND RAVALLI COUNTIES, MONTANA

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Studies Related To Wilderness

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Selway-Bitterroot Wilderness in the Clearwater National Forest, Idaho County, Idaho; the Bitterroot National Forest, Ravalli County, Montana, and Idaho County, Idaho; the Lolo National Forest, Missoula and Ravalli Counties, Montana; and the Nez Perce National Forest, Idaho County, Idaho. The Selway-Bitterroot Wilderness was established as a primitive area by the U.S. Forest Service in 1932, received wilderness classification in 1963, and became a part of the National Wilderness Preservation System with the passage of the Wilderness Act in 1964.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

Mineral resource studies by the U.S. Bureau of Mines and the U.S. Geological Survey indicate that five areas within the Selway-Bitterroot Wilderness have mineral resource potential. Regional studies suggest that three granitic plutons within the wilderness, the Running Creek pluton on the southwestern border of the wilderness, the Painted Rocks pluton on the southern border of the wilderness, and the Whistling Pig pluton in the west-central portion of the wilderness, have low potential for molybdenite deposits, but detailed surface investigations failed to recognize a deposit. Placer deposits in the Elk Summit area on the north side of the wilderness contain subeconomic resources of niobium- (columbium-) bearing ilmenite. A vein on the northeast side of the wilderness at the Cliff mine at Saint Joseph Peak contains subeconomic silver-copper-lead resources. The wilderness has no known potential for oil and gas, coal, geothermal resources, or other energy-related commodities.

INTRODUCTION

A mineral survey of the Selway-Bitterroot Wilderness was done by the U.S. Bureau of Mines and the U.S. Geological Survey between 1976 and 1981 covering about 1.25 million acres (0.5 million hectares). The Bureau of Mines was responsible for determining the resources of mines, prospects, and mineralized areas and the Geological Survey was responsible for geological, geochemical, and geophysical investigations. The 105,000 acre (42,500 hectares) Magruder Corridor area, added to the Wilderness by Public Law 96-312 in 1980, was not included in this study. The wilderness lies across the Bitterroot Range, which forms the boundary between Idaho and Montana, and includes large parts of the drainage basins of the Selway, Lochsa, and Bitterroot Rivers (fig. 1). Elevations range from 1,800 ft (550 m) on the Selway River near Lowell to 10,157 ft (3,096 m) at Trapper Peak in the Bitterroot Mountains. Cities within 50 mi (80 km) of the wilderness include Missoula, Hamilton, and Salmon on the east and Orofino and Grangeville on the west. Access to trail heads near the edge of the wilderness is by dirt roads.

Geologic research in the region was started by Leiberg (1898). Since then there have been several reports on the geology and mineral deposits, including ones by Shenon and Reed (1934), Lorain (1938), and Sahinen (1957).

Field investigations were done by the U.S. Bureau of Mines in 1976, 1978, and 1981. The authors were assisted at various times by Dennis D. Finn, M. C. McCarthy, and Michael Longinotti. Analytical work was done at the Bureau of Mines Reno, Nevada laboratory under the direction of H. H. Heady. The location of claims and mineral deposits was

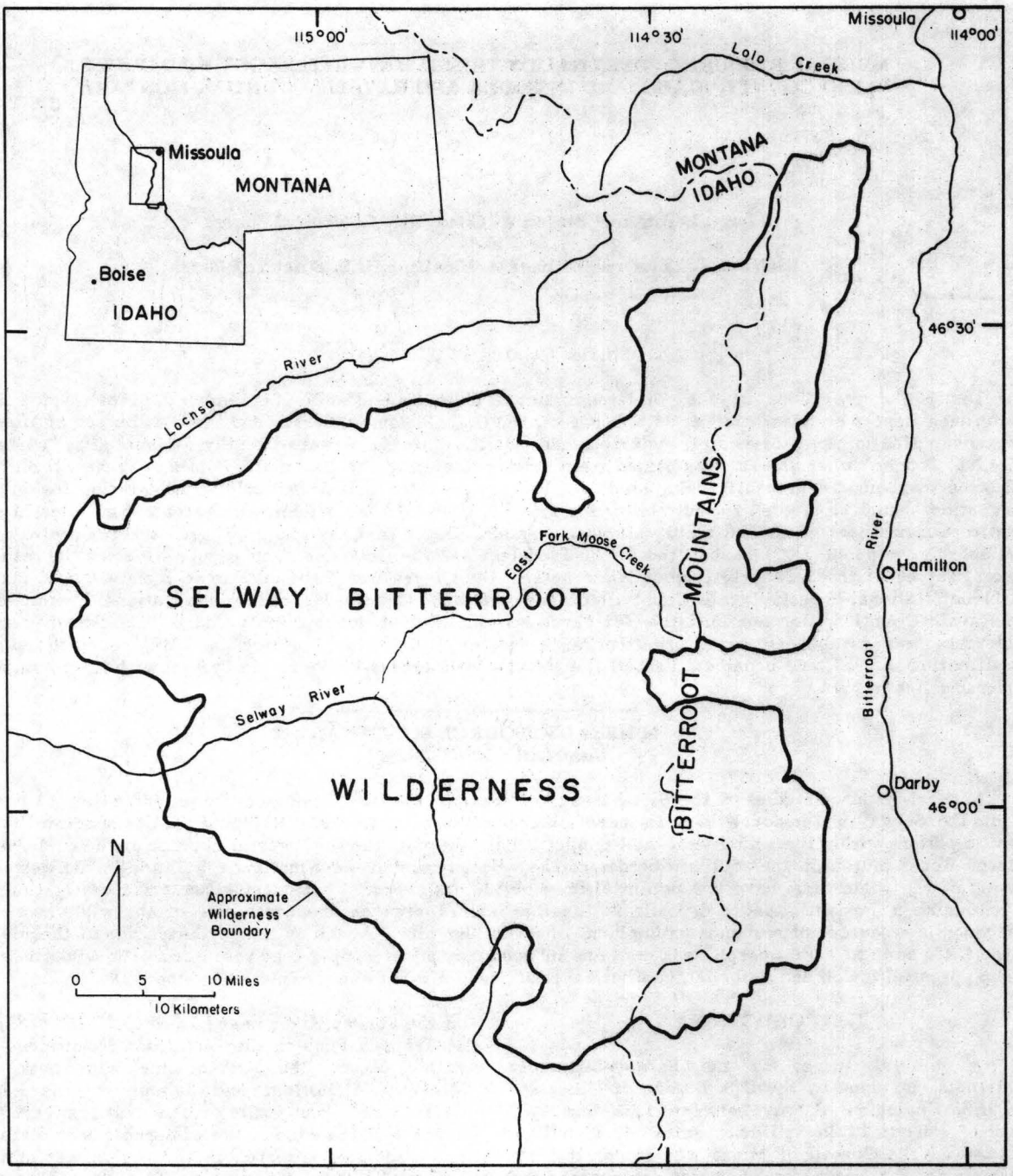

Figure 1.--Index map showing location of the Selway-Bitterroot Wilderness

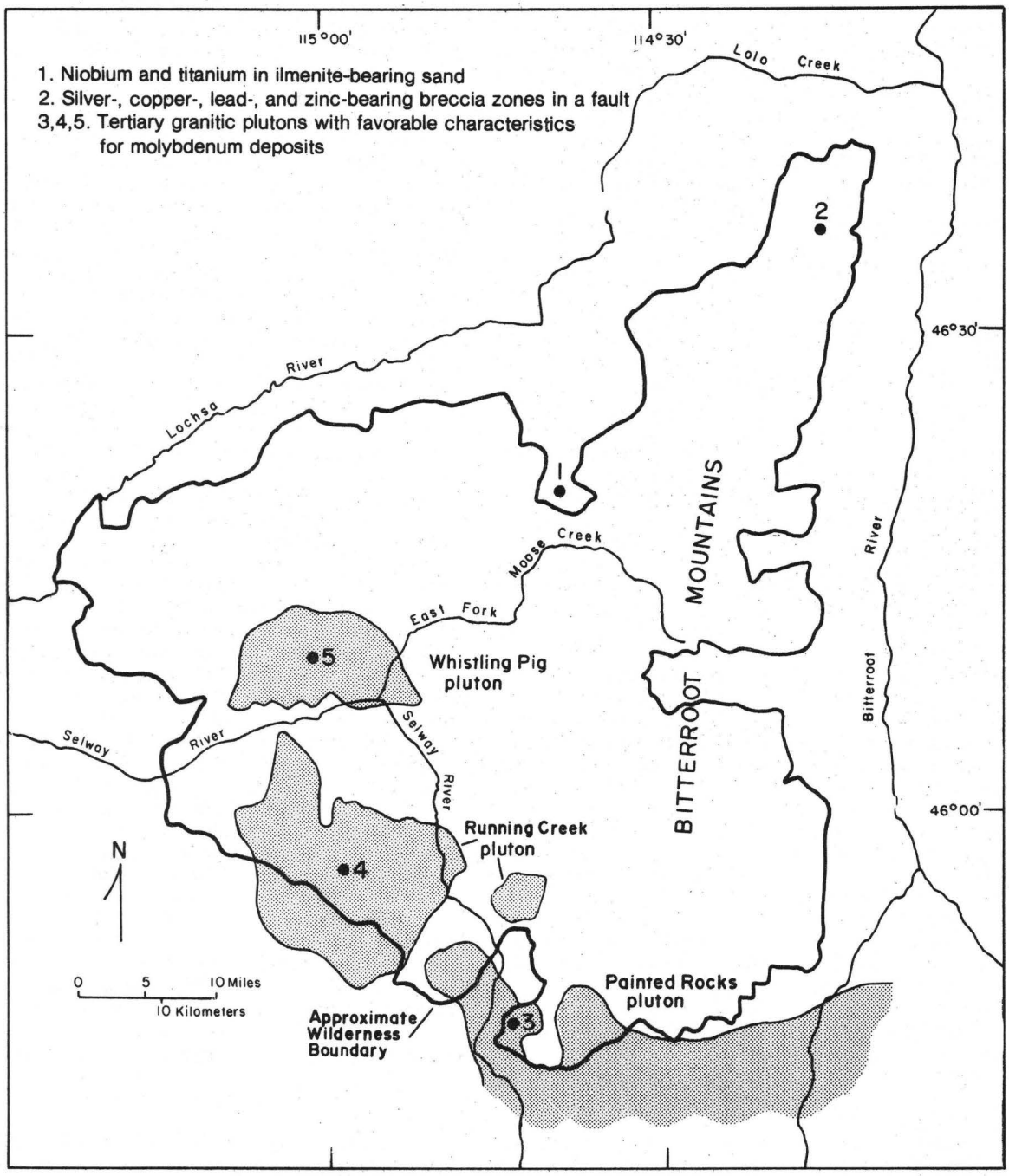

Figure 2.--Map showing areas (1-5) of mineral resource potential in the Selway-Bitterroot Wilderness

determined by a search of Ravalli and Idaho County courthouse records and a literature search. Claim owners were contacted when possible. Attempts were made to find all known mines, prospects, and claims in the field. All claims were sampled and all workings were mapped. Samples were also taken of any mineralized material found in the wilderness.

Field investigations by the U.S. Geological Survey were done in 1976 and 1978-1981. Geologic mapping (Toth, 1983), was supplemented by the collection of rock samples, stream sediments, and panned concentrates for geochemical analyses (Coxe and Toth, 1983). Geophysical studies were done from 1978 to 1980 (Kleinkopf and Bankey, unpub. data).

GEOLOGY, GEOCHEMISTRY, AND GEOPHYSICS

Geologic setting

The Selway-Bitterroot Wilderness encompasses a major part of the Bitterroot lobe of the Idaho batholith. Foliated hornblende-biotite tonalite and quartz diorite of Cretaceous age form the western border of the Bitterroot lobe and are found along the northeastern border as isolated plutons (not shown on map). Tertiary and (or) Cretaceous mesozonal foliated muscovite-biotite granodiorite to monzogranite forms the major part of the lobe and intrudes the tonalite in the west, southwest, and north. In many places, complex migmatite terranes separate the tonalitic from granodioritic to monzogranitic plutons and involve septa of Proterozoic Y(?) and possible older metasedimentary rocks.

During a period of extensional tectonics in Eocene time, massive epizonal highly differentiated subalkalic granitic to syenogranitic plutons were emplaced along the southern, southwestern, and northern parts of the Bitterroot lobe. The plutons are pink, contain crystals of smoky-quartz and fluorite in miarolitic cavities, and commonly have granophyric textures. Extensive networks of rhyodacitic to rhyolitic dikes extend outward from each of the plutons and crosscut all other lithologic units.

A steep normal fault borders the eastern and southeastern margins of the Bitterroot lobe and separates the granitic rocks of the batholith to the west from the younger epizonal plutons to the east. Northwest-trending thrust faults of small displacement crosscut the mesozonal monzogranitic to granodioritic rocks in the eastern parts of the Bitterroot lobe. Northeast-trending, high-angle, normal and strike-slip faults crosscut rock units of all ages and have offsets of as much as 1.25 mi (2 km).

Geochemical survey

A detailed geochemical survey of the wilderness was done by the U.S. Geological Survey in 1976 and from 1978 to 1981 by sampling stream sediments and rocks for chemical analysis. Approximately 980 sediment sample sites were chosen using a statistically unbiased method. Large volume, composite samples were taken at each site and separated in the lab into three fractions before analysis using size, density, and magnetic concentrating techniques.

Composite rock samples were taken of representative and anomalous outcrops at the sampler's discretion. Representative rock samples were also taken at predetermined locations at the corners of 3 mi by 3 mi (5 km by 5 km) grids. Approximately 3000 rock samples were collected.

All samples were analyzed for 30 elements by the 6-step DC-arc semiquantitative emission-spectrographic technique (Grimes and Marranzino, 1968). Selected stream-sediment samples were additionally analyzed for U and Th by the delayed neutron-activation method. All these analytical data are stored on magnetic tape and are available from the National Technical Information Service (Coxe and others, 1982). Major-element oxide analyses were performed on almost 600 rock samples by automated X-ray fluorescence techniques, and the data from these analyses are available in a U.S. Geological Survey Open-File Report (Koesterer and others, 1982).

The results of the geochemical survey are discussed in detail in a report by Coxe and Toth (1983). In general, rocks in the Selway-Bitterroot Wilderness are lacking in ore-forming elements. Ag, Cu, Pb, Zn, As, Cd, Bi, Sb, Co, and Ni were detected in very low concentrations in the rock and stream sediment samples. In a few areas, sediment samples taken from several adjacent or nearby streams have anomalies in certain mineralizing elements. Such clusters of anomalies indicate some localized elemental enrichment, but no geologic source could be identified.

Three localized areas of mineralization and (or) alteration are present within the wilderness and rock samples from them yield strong geochemical anomalies. These include an altered shear and breccia zone of the Trout Peak and Trout Creek area, gossan and quartz-veined zone on Watchtower Pass, and Ag-, Pb-, and Cu-bearing breccia zones on the south side of Saint Joseph Peak (Cliff mine). Stream-sediment samples from these areas show no geochemical anomalies.

Three large epizonal granitic plutons are exposed within the wilderness: the Whistling Pig pluton in the west-central area, the Running Creek pluton in the southwest, and the Painted Rocks pluton in the south. Major-element data of these rocks are similar to those from plutons genetically related to granite-molybdenite deposits (Mutschler and others, 1981). Stream-sediment data also indicate a broad enrichment in Mo, Sn, Nb, Be, Y, Pb, and Zn in the Running Creek pluton, and to a lesser degree in the Whistling Pig pluton. Several multi-element anomaly clusters within the Running Creek pluton may also indicate further enrichment of these elements, especially Mo, by a mineralizing process, but there is no geologic evidence to support this hypothesis.

Geophysical survey

Magnetic and gravity data (Kleinkopf and Bankey, unpub. data) are too widely spaced to detect any geophysical expressions, if present, of the localized areas of mineralization and (or) alteration which exhibit strong geochemical anomalies. The Trout Peak/Trout Creek, Saint Joseph Peak, and Watchtower Pass areas correlate with broad negative magnetic features and occur near the base of steep magnetic gradients. The gradients likely reflect boundaries of rock units with contrasting magnetic properties, and possibly fault zones in some cases. In

the case of Watchtower Pass, the high gradient zones are more pronounced and form part of a broad negative feature which trends west-northwest. Other areas along these gradient zones west-northwest or east-southeast of Watchtower Pass may be favorable for other occurrences of mineralization.

The Whistling Pig, Running Creek, and Painted Rocks plutons show no distinctive magnetic signatures. However, the Running Creek pluton correlates somewhat with a broad northeast-trending gravity low and widely spaced gravity data suggest that the pluton could extend to the northeast beneath older granitic rocks.

MINES, PROSPECTS, AND MINERALIZED AREAS

History and Production

Mining activity in the region began in the 1860's and most of it was outside the wilderness boundary. There is no known mineral production within the wilderness.

Greatest activity occurred in the Elk City mining district on the upper tributaries of the South Fork of the Clearwater River about 10 mi (16 km) west of the wilderness. Some gold production was derived from fissure veins but most came from associated placers. The highest grade and most accessible deposits were worked out in the mid-1860's (Lorain and Metzger, 1938). The development of mining methods suited to high-volume, low-grade placers resulted in the resumption of large scale mining in 1892. Most of the remaining gravels were subsequently worked. Lode production occurred in the early 1900's. Published estimates of total production range from $5 million to $18.5 million (Shenon and Reed, 1934) (Gold at $20.67/troy oz).

Mining successes along the South Fork of the Clearwater River led to the establishment of numerous placer claims and operations along the lower parts of the Selway and Lochsa Rivers. Production was not recorded.

On the north side of the wilderness, along Lolo Creek, base-metal-bearing quartz veins intrude metasediments. Prospecting and mining started in that district during the 1890's (Sahinen, 1957), but the veins proved to be small and the total value of production was only a few thousand dollars (U.S. Bureau of Mines production records). A mine is currently being developed on 215 claims by Ward Development Inc. at the head of Dick Creek, 4 mi (6.4 km) northwest of the wilderness boundary. An open pit exposes a large north-northwest-trending fault zone containing lead, zinc, and silver minerals. An adit several thousand feet long has been driven under the pit. Future plans include construction of a mill at the mine site. Negotiations involving legal and environmental considerations have currently halted work.

Several lode mines and prospects are located just east of the wilderness in the Curlew (Deep Canyon) and Pleasant View (Sweathouse) mining districts. Mining activity began in 1865 on placers along the Bitterroot River and its tributaries, but in 1871 the activity shifted to lodes. Most of the production came from the Curlew mine which started operation in 1887 (Sahinen, 1957). It was developed by a 500-ft (152 m) shaft connected to a multilevel network of drifts and crosscuts. Lead, zinc, and silver production prior to 1949 was approximately $1.4 million. In recent years the mine, converted to an open-pit operation, has been intermittently active.

Ten miles (16 km) south of the wilderness the drainage basin of the West Fork of the Bitterroot River contains placer mines of the Overwich-Hughes Creek mining district and lode mines of the Mineral Point mining district. Placer mining started in 1870; production totalled more than $250,000 (Sahinen, 1957). Lode mines were in copper-silver bearing fissure veins in metasedimentary rocks. Recent exploration has sought large-tonnage deposits of disseminated copper-silver minerals.

Mineral Deposits

Courthouse records for Ravalli County, Mont., and Idaho County, Idaho indicate that 93 lode and 5 placer mining claims have been established within the wilderness, the first in 1884. Several are relocations of previous claims and none have been patented.

In the wilderness, three unclaimed areas have mineral resource potential and two of 30 prospects are significantly mineralized. Details of the prospects are presented in a U.S. Bureau of Mines Open-File Report (Zilka and Hamilton, 1982).

Several Eocene multiphase epizonal granitic plutons underlie the wilderness. The Painted Rocks pluton, which is mostly outside the wilderness, consists of rocks ranging from muscovite syenogranite to biotite-hornblende quartz monzonite, and the Running Creek and Whistling Pig plutons are mostly composed of highly differentiated medium- to coarse-grained hornblende-biotite syenogranite. The general geochemical, petrologic, and tectonic characteristics of the more silicic units, especially those intruded by comagmatic rhyolite bodies, match those commonly associated with granite-molybdenite deposits. However, the porphyritic textural variants associated with molybdenite deposits are notably absent, and detailed surface mapping did not produce evidence for the existence of such a deposit.

The claim for the Cliff mine on Saint Joseph Peak in the northeast part of the area has been held almost continuously since 1889 but has had little production. Two adits and a shaft are on the property. Detailed geophysical surveys by the U.S. Bureau of Mines and surface and underground sampling indicate that a northwest-trending fault contains at least 100,000 tons of material with a few small, randomly distributed breccia zones. Only the breccia zones are significantly mineralized. Galena, chalcopyrite, sphalerite, bornite, and tetrahedrite are found in the zones and samples contained as much as 7.3 oz silver per ton (250 g/t), 3.4 percent lead, 1.0 percent copper, and 0.5 percent zinc. Because the breccia zones are small, the deposit is considered subeconomic.

About 5 million cubic yards (3.8 million m^3) of alluvium containing 37.2 pounds of niobium-bearing ilmenite per cubic yard (22.0 kg/m^3) are in the meadows around Elk Summit. The deposits have been claimed several times but not mined. Because the titanium oxide content (46%) of the ilmenite does not meet present market specifications (54%) and the niobium currently cannot be recovered, the deposits are a subeconomic resource.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Although major mining activity has occurred on the periphery of the Selway-Bitterroot Wilderness, none is known within it. Investigations indicate that five areas have low mineral resource potential (fig. 2).

Several factors suggest that the three Eocene granitic plutons on the south and southwestern sides of the wilderness may have favorable characteristics for molybdenite mineralization. Major-element chemistry (Koesterer, 1982) is comparable to that of other plutons genetically related to granite-molybdenite deposits (Mutschler and others, 1981). Stream-sediment data also indicate an enrichment in Mo, and associated Sn, Nb, Be, Y, Pb, and Zn, especially in the Running Creek pluton. However, the composite nature and porphyritic texture of the rocks associated with granite-molybdenite deposits are notably absent. Geochemical analyses of rocks located only two samples with detectable Mo or other mineralizing elements. Detailed surface mapping also failed to locate any alteration patterns characteristic of molybdenite mineralization. For these reasons, potential for a granite-molybdenite deposit is low.

Niobium-bearing ilmenite is found in 5 million cubic yards (3.8 million m^3) of alluvium in the Elk Summit area on the north edge of the wilderness. Major market and (or) technological changes are required before these resources can be profitably mined. About 100,000 tons of rock along a fault contains silver-lead-copper resources in small randomly-distributed breccia zones at the Cliff mine on the northeast side of the wilderness. Because the breccia zones are quite localized, the deposit is considered to be subeconomic. There is no geological evidence for oil, gas, coal, geothermal resources, or other energy-related commodities.

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