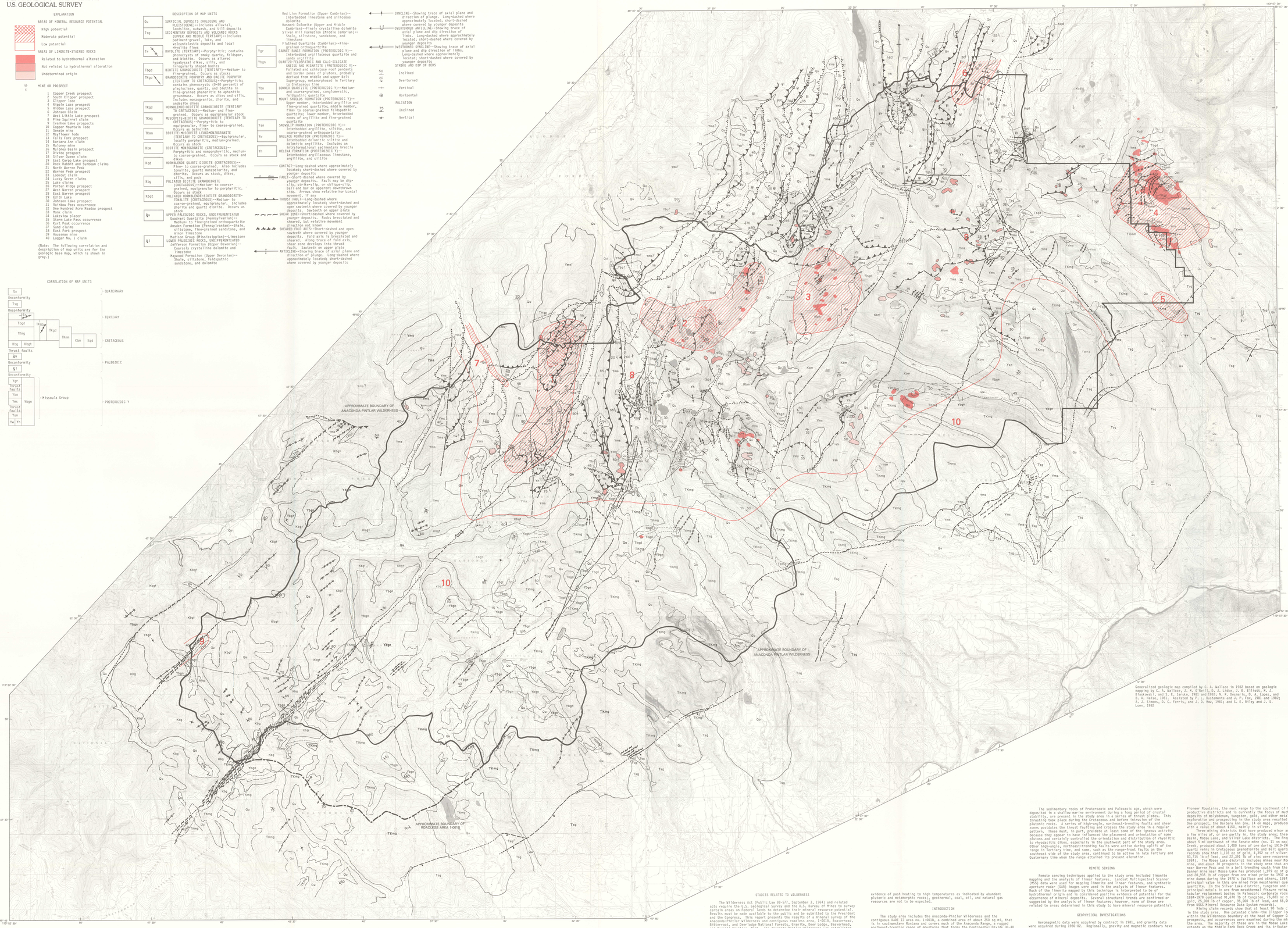

Table 1.--Mineral resource potential of the Anaconda-Pintlar Wilderness Study Area

Area	Potential	Identified resources	Undiscovered resources	Deposit types	Favorable criteria
1, Sonate mine-Kelly Lake area.	Moderate to high.	Ag, Cu, Pb Au,	Ag, Cu, Pb, Au,	Mesothermal vein, replacement, placer.	1. Occurrence of known deposits. 2. Geochemical anomalies in rock samples: Area of high potential defined by zone of Cu, Ag, Pb, Sb, As, Mo, and W anomalies; area of moderate potential by sporadic As, Cu, Pb, and Mo anomalies. 3. Occurrence of favorable quartzite unit conducive to brittle fracture. 4. Occurrence of favorable structural zone of highly fractured rocks. 5. Occurrence of surficial sedimentary deposits suitable for placer deposits.
2, Warren Peak area.	Moderate to high.	Ag, Pb, Cu	Ag, Pb, Cu, Zn, Mo,	Mesothermal vein, porphyry, or stock-work.	1. Occurrence of known deposits: Area of high potential defined by concentration of deposits including two with identified resources; area of moderate potential by several prospects and one deposit with identified resources. 2. Anomalous zinc contents in rock samples. 3. Favorable geology consisting of granodiorite stock intruded into siliceous and calcareous sediments. 4. Area in part coincides with and flanks area of positive magnetic anomaly. 5. Occurrence of hydrothermally altered rocks indicated by limonite mapping.
3, Beaver-head Mountain area.	Moderate---	None-------	Mo, Cu, Ag, W, Sn.	Stockwork or porphyry, mesothermal vein, skarn.	1. Geochemical anomalies of Mo, Sn, W, Ag, Zn, Be, As, Sb, Cu, Bi, and F in rock samples. 2. Favorable geology consisting of concentration of quartz veins with altered envelopes and altered dikes in granodiorite. 3. Area lies on flanks of negative magnetic anomaly. 4. Occurrence of hydrothermally altered rocks indicated by limonite mapping.
4, Mount Mount-Evans area.	Moderate---	None-------	Mo, Cu-----	Stockwork or porphyry, mesothermal vein.	1. Geochemical anomalies of Mo, Sn, Bw, Ag, Cu, As, Zn, W, Bi, and F in rock samples. 2. Favorable geology consisting of zone of contact-metamorphosed quartzites and amphibolites, concentration of dikes and quartz veins, and widespread altered rock. 3. Area in part coincides with and flanks a positive magnetic anomaly. 4. Widespread and intense limonite staining due to hydrothermal alteration.
5, Lower Seymour Lake area.	Moderate---	None-------	Mo, Ag, W--	Stockwork or porphyry.	1. Geochemical anomalies of Mo, Ag, Bi, Cu, Pb, Sn, W, Zn, F, and Be in rock and stream-sediment samples. 2. Favorable geology consisting of strongly altered rock, limonitic zones, and numerous veins in granodiorite. 3. Favorable structure consisting of closely spaced fractures and intensely sheared rock. 4. Area is on flank of positive magnetic anomaly.
6, One Hundred Acre Meadow area.	Moderate---	None-------	Ag, W, Cu--	Mesothermal vein, replacement zones.	1. Occurrence of known deposits. 2. Occurrence of favorable Paleozoic carbonate units. 3. Favorable structural zone of highly fractured rocks. 4. Area flanks major positive magnetic anomaly.
7, Copper Creek.	Moderate---	None-------	Au---------	Placer-----	1. Anomalous gold values in panned-concentrate samples from Copper Creek. 2. Occurrence of stream and glacial deposits. 3. Occurrence of metal-bearing veins upstream in drainage area.
8, Area north of 45°55' and west of 113°36'.	Low--------	None-------	Au, Ag, Cu, Mo, W.	Disseminated stockwork or porphyry, skarn, mesothermal vein, replacement zones.	1. Occurrence of prospects. 2. Sporadic geochemical anomalies for rock and stream-sediment samples. 3. Areas of hydrothermal alteration indicated by limonite mapping. 4. Occurrence of favorable rock units in contact zones of intrusives. 5. Occurrence of favorable structural zones of fracturing. 6. Presence of favorable magnetic anomalies.
9, Logger No. 1 claim area.	Low-------	None-------	Au, Ag, Mo, Be.	Mesothermal vein.	1. Occurrence of prospect. 2. Occurrence of zone of sheared rock.
10, Remainder of study area.	Low---	None-------	Various----	Various-----	1. Occurrence of weak and sporadic geochemical anomalies in stream-sediment samples.

MINERAL RESOURCE POTENTIAL MAP OF THE ANACONDA-PINTLAR WILDERNESS AND CONTIGUOUS ROADLESS AREA, GRANITE, DEER LODGE, BEAVERHEAD, AND RAVALLI COUNTIES, MONTANA

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STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potentials. Results must be made available to the public and be submitted to the President and the Congress. This mineral survey covers the Anaconda-Pintlar Wilderness and contiguous roadless area, 1-0018, Beaverhead, Bitterroot, and Deerlodge National Forests, Granite, Deer Lodge, Beaverhead, and Ravalli Counties, Mont. The Anaconda-Pintlar Wilderness was established by Public Law 88-577, 1964. The contiguous roadless area was recommended for wilderness designation during the Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY STATEMENT

A mineral survey of the 250-sq-mi (160,000-acre) Anaconda-Pintlar Wilderness in southwestern Montana was conducted by the U.S. Bureau of Mines from mid-1980 to January 1984. The area was also studied by the U.S. Geological Survey during 1980 and 1981. All samples were analyzed for 31 elements using a six-step, semiquantitative emission spectrographic procedure (Grimes and Marranzino, 1968), for zinc and antimony by atomic-absorption techniques (Ward and others, 1969; Welsch and Chao, 1975), and for arsenic using a colorimetric technique (Welsch, 1975).

Results of the geochemical survey indicate anomalous concentrations of several elements in rock, stream-sediment, and panned-concentrate samples from the study area. The stream-sediment and panned-concentrate anomalies form much broader patterns than do those from rock samples and helped to locate areas of hydrothermal alteration. The rock sample anomalies are more restricted to areas of hydrothermally altered rocks and mineral occurrences and are more direct indicators of particular trace-element suites associated with particular rock types and with various types of mineral deposits.

MINING DISTRICTS AND PRODUCTION HISTORY

Located in one of the most mineral-rich regions of the northern Rocky Mountains, the study area is near many highly productive mining districts where the geology is grossly similar to that of the study area. The Flint Creek Range, next range to the north, has many districts, including the highly productive Philipsburg district. The "richest hill on earth," Butte, with multi-billion dollar production, is about 35 mi east of the study area. The Pioneer Mountains, the next range to the southeast of the study area, has many productive districts and is currently the focus of much exploration for deposits of molybdenum, tungsten, gold, and other metals. Beaverhead County, south of the study area, has had a long history of mineral production. One prospect, the Barbara Ann (no. 14 on map), produced 3 tons of ore in 1942 with a value of about $150, mainly in silver.

Three mining districts that have produced minor amounts of ore are within a few miles of, or are partly in, the study area; these are the Frogpond Basin, Moose Lake, and Silver Lake districts. The Frogpond Basin district, about 5 mi northwest of the Senate mine (no. 11 on map), and west of Copper Creek, produced about 1,400 tons of ore during 1910-1968 from mesothermal quartz veins in Cretaceous granodiorite and Belt quartzite. Production records show that 1,103 oz of gold, 4,282 oz of silver, 2,409 lb of copper, 83,115 lb of lead, and 22,291 lb of zinc were recovered (Wallace and others, 1984). The Senate mine, which is the largest producer in the study area, is a gold mine, and about 30 prospects in the study area that are concentrated mainly near Warren Peak and in a belt trending south from the Senate mine. The Banner mine near Moose Lake has produced 1,379 oz of gold, 5,896 oz of silver, and 20,920 lb of copper from ore mined prior to 1937 and from the reworking of mine dumps during the 1970's (Wallace and others, 1984). Gold was the principal value in this ore mined from mesothermal quartz veins in Belt quartzite. In the Silver Lake district, tungsten and silver were the principal metals in ore from mesothermal fissure veins, replacement veins, and replacement deposits in Paleozoic carbonate rocks. Ore mined during 1884-1918 contained 91,670 lb of tungsten, 15,881 oz of silver, 175 oz of gold, and 1,000 lb of copper (Wallace and others, 1984). About 95,000 Tb of zinc (compiled from USBM Mineral Resource Data System records).

Mining claim records show that at least 90 lode claims have been located in the study area. One patented claim--the Clipper lode (no. 3 on map)--is within the wilderness boundary at the head of Copper Creek. Forty mines, prospects, and occurrences were examined during the mineral resource study of the area. The majority of these are in the Moose Lake mining district, which extends up the Middle Fork Rock Creek and its tributaries.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Areas of mineral resource potential in the study area are located almost entirely in the northwest two-thirds of the Anaconda-Pintlar Wilderness; they include two areas that have moderate to high potential, five that have moderate potential, and three that have low potential (table 1).

The two areas that have moderate to high potential are the Senate mine-Kelly Lake area (area 1) and the Warren Peak area (area 2). At the Senate mine, a structurally controlled zone of sheared rock, quartz veins, and replacement of quartzite by ankerite, barite, and sulfide minerals is present. Sparse ore minerals, mainly chalcopyrite, pyrite, and galena, occur in veins and disseminated in the wallrocks and constitute a low-grade resource of silver and copper. This zone extends into the Anaconda-Pintlar Wilderness and includes the Ivanhoe Lake prospects, which have 4,000 tons of identified resources of silver and lead. That part of area 1 that has high potential for additional resources of gold, silver, lead, and zinc is based on anomalous amounts of copper, silver, lead, antimony, arsenic, molybdenum, and tungsten in rock samples from a zone of highly fractured Belt quartzite. This fracturing has promoted a high degree of secondary permeability and permitted access by ore-forming hydrothermal fluids. An area surrounding the Senate mine and extending to the vicinity of Kelly Lake has moderate potential for resources of silver, copper, and lead in deposits similar to those in the Senate mine area.

In the Warren Peak area (area 2) mesothermal fissure quartz veins occur in a granodiorite stock and in quartzite or carbonate rocks that border the stock. The occurrence of two deposits and several prospects indicate that the area has a high potential for additional resources of silver, lead, copper, zinc, and molybdenum. The deposits have 19,000 tons of identified resources of silver, lead, and copper. This part of area 2 coincides with a positive magnetic anomaly. Extending west and northeast from Warren Peak and from the area of high potential is an area that has moderate potential for resources of silver, lead, copper, zinc, and molybdenum in deposits similar to those in the area of high potential.

Other localities that have moderate potential for mineral resources are Beaverhead Mountain (area 3), Mount Mount-Mount Evans (area 4), Lower Seymour Lake (area 5), One Hundred Acre Meadow (area 6), and Copper Creek (area 7). Beaverhead Mountain (area 3) has moderate potential for molybdenum, copper, silver, tungsten, and tin resources in porphyry (or stockwork), mesothermal vein, and skarn deposits. The core of the area has a concentration of quartz veins with borders of altered rock and several altered rhyolite dikes, all of which cut granodiorite. The area is geochemically anomalous, has widespread limonite staining related to hydrothermal alteration, and is situated on the flank of a positive magnetic anomaly. Mount Mount-Mount Evans (area 4) has moderate resource potential for molybdenum and copper in mesothermal veins and porphyry (or stockwork) deposits. Geochemically anomalous amounts of many elements occur in contact-metamorphosed quartzites and amphibolites, and quartz veinlets occur in contact-metamorphosed rocks. The area has abundant porphyry dikes, widespread altered rock, and locally intense limonite staining and is situated on the flank of a positive magnetic anomaly. At Lower Seymour Lake (area 5) a poorly exposed zone of sheared and altered rock and veins in granodiorite is geochemically anomalous in many elements. This area is on the flank of a positive magnetic anomaly. It has moderate potential for resources of molybdenum, silver, and tungsten in porphyry (or stockwork) deposits. Favorable factors are the occurrence of highly fractured host rocks and location on the flank of a positive magnetic anomaly. One Hundred Acre Meadow (area 6) has potential for silver, tungsten, and copper in mesothermal vein and replacement deposits in Paleozoic carbonate rocks. This area is near an area of low magnetic intensity in the Anaconda-Pintlar Wilderness, and known deposits occur near the boundary of the wilderness. Copper Creek (area 7) is a stream valley with deposits of alluvium and glacial till and outwash that has potential for gold resources in placer deposits. The stream drains an area of metal-bearing veins, and several panned-concentrate samples from the streambed contain anomalous gold values.

Areas 8, 9, and 10 have low potential for mineral resources. On the basis of the occurrence of a few prospects, sporadic geochemical anomalies, limonite related to hydrothermal alteration, favorable geology and structure, and magnetic anomalies, area 8 has low potential for resources of gold, silver, copper, lead, and molybdenum in deposits similar to those in areas of sheared rock and one prospect that contains anomalous values of gold, silver, copper, lead, and zinc. Logger No. 1 claim (area 9) has low potential for commodities. Area 10 lacks, in general, favorable evidence of hydrothermal alteration and mineralization and has low potential for undiscovered resources of metallic minerals.

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