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A SUMMARY OF THE MINERAL RESOURCES OF THE PROPOSED GREAT BEAR WILDERNESS, FLATHEAD, TETON, AND PONDERA COUNTIES, MONTANA

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

The proposed Great Bear wilderness has a good potential for oil and gas (mainly gas), and a moderate potential for submarginal resources of copper and silver in a belt 25 miles (40 km) long and about 1 mile (1.6 km) wide that is partly within the study area along the western boundary. The eastern part of the area may contain small submarginal resources of coal. Sand and gravel, dimension stone, and high calcium limestone are in the area, but they occur in abundance in more accessible areas elsewhere in northwest Montana. The potential for geothermal resources is nil.

A mineral survey of the proposed Great Bear wilderness was made in 1974 and 1976. The work by the U.S. Geological Survey consisted of geologic mapping, and geochemical and geophysical surveys. The U.S. Bureau of Mines made a courthouse search for mining claims, and sampled and mapped prospects.

The proposed wilderness consists of two areas, about 5 miles (8 km) apart, that differ geologically (fig. 1). The eastern area is in the northwestern Montana disturbed belt and contains thrust-faulted Paleozoic and Mesozoic rocks that partly overlie at least two older northeast-trending structures that are inferred from mapping in and east of the proposed wilderness. The thrust faults are closely spaced, trend northerly and dip westerly. The western area contains mostly Precambrian metasedimentary rocks and some younger sedimentary rocks that are repeated by northerly trending normal faults. An older northeast-trending structure is inferred to underlie the central part of the western area. A few sills of Precambrian age are present locally, and they are the only igneous rocks exposed in the proposed wilderness.

The mineral evaluation is based on the results from geologic mapping, prospect mapping and sampling, and geochemical studies; geophysical surveys (aeromagnetic and gravity) did not indicate areas with possible mineral potential. A total of 953 samples were collected mostly from the study area by the U.S. Geological Survey; 619 were rocks and 334 were stream sediments. In addition, on-site analyses for acid-extractable copper were made at 62 localities outside the study area near the western boundary. The U.S. Bureau of Mines collected a total of 226 samples mostly outside, but near, the study area; 87 were rock chips, 87 were soils, 44 were drill cores, and 8 were gravels.

The geochemical results indicate several areas with weakly to moderately anomalous amounts of copper, lead, and silver. The area with best potential is in the extreme western part of the proposed wilderness where copper and silver minerals occur in green to light gray quartzites, siltites, and argillites of the Empire and Spokane Formations (No. 1, fig. 1). Here copper minerals were observed locally in outcrops and prospect workings. Copper was detected by weak geochemical anomalies in rocks and stream sediments over a strike length

of about 25 miles (40 km). The most promising disseminated copper sulfide deposits are in graded bed sequences and in lenses in the Spokane Formation where selected samples contain more than 2 percent copper and 70 ppm silver. Disseminated copper occurrences in the Spokane Formation and, less commonly, in the Empire Formation were examined at scattered localities between Felix and Hoke Creeks (fig. 1). Although these occurrences are mostly outside of the study area, the downdip projection of the mineralized rocks underlies the westernmost part of the area. The copper content of cross-cutting chip samples ranged from 0.13 percent over 60 feet (18.3 m) to 0.35 percent over 6 feet (1.8 m) and 0.52 percent over 2 feet (0.61 m). At least 16 copper bearing occurrences were sampled. One deposit outside of the area near Hoke Creek on the Corkscrew copper claims may contain about 700,000 tons (600,000 t) of resources averaging 0.15 percent copper and 0.1 ounce silver per ton (3.4 g/t). Good potential exists for similar disseminated copper deposits in the Spokane and Empire Formations within the proposed wilderness. These results along with results from rock, stream sediment, and acid-extractable copper analyses suggest that the study area probably does not contain copper deposits that could be mined under present economic conditions; however, the area could contain several million tons of submarginal resources.

A fault in Spokane argillite outside the study area above South Fork Logan Creek on the One Dead Digger claim contains vein calcite and copper minerals. Chip samples from the more mineralized zone, along the hanging wall, contained as much as 1.9 percent copper and 1.1 ounces silver per ton (37.7 g/t). About 2,000 tons (1,800 t) of indicated and inferred submarginal resources, containing 0.32 percent copper and 0.4 ounce silver per ton (13.7 g/t), are estimated in the more mineralized zone and adjacent less mineralized argillite. The mineralized zone averages 9 feet (2.7 m) thick in an open pit (fig. 1). The fault may extend between the pit and a caved adit about 500 feet (150 m) to the southeast on the Half Man claim; copper-bearing calcite vein material similar to the mineralized rock at the pit is stockpiled outside the caved adit. Therefore, an additional 100,000 tons (90,000 t) of similar grade is inferred between the pit and caved adit. Similar vein occurrences were not observed in the study area.

Anomalous amounts of lead and silver are associated with a Precambrian diorite sill about 4 miles (6.4 km) south of Red Plume Mountain (No. 2, fig. 1). The metals are probably derived from small calcite veinlets in the diorite. These and stratabound copper-silver occurrences in green beds of the Missoula Group near Argosy Mountain (No. 3, fig. 1) are too small and low grade to be of economic importance.

Other anomalies and mineral occurrences not shown on figure 1 include: (1) widespread, weak lead anomalies in samples derived from the Helena Formation, (2) lead-silver anomalies mostly associated with black shales of Mesozoic age and possibly, in part, with an unconformity between the Paleozoic and Mesozoic rocks, and (3) minor copper occurrences in prospect pits in Missoula Group rocks near Stanton Lake. These occurrences probably do not indicate potential resources.

Exploratory drilling east of the study area plus the discovery of major gas fields in the Canadian portion of the disturbed belt indicate the proposed wilderness has a good hydrocarbon potential. The structure, stratigraphy, and geologic history of the gas fields in Canada are similar to those in the Montana disturbed belt. Tests of gas wells drilled in the 1950's in Blackleaf Canyon (fig. 1) and the East Glacier Park area (about 25 miles (40 km) northwest of Swift Reservoir) indicated a production capability of as much as 6.3 billion cubic feet (178.3 million m^3) of gas per day from reservoirs in Mississippian and Devonian carbonate rocks.

Prospective hydrocarbon traps are primarily structural and associated with thrust faulting. However, at least two older northeast-trending structures may have controlled later structural development which, in turn, affected the distribution of hydrocarbon accumulations.

A definitive evaluation of the hydrocarbon potential would require detailed geologic studies, seismic and gravity geophysical surveys, and drilling. At present, all but the westernmost part of the Great Bear additions are favorable for exploration because depths to possible traps are moderate. The thickness of overlying non-productive strata increases to the west.

Coal beds from 0.5 to 4.0 feet (0.15 to 1.2 m) thick occur in the Mesozoic rocks near Teton Pass (fig. 1). Coal samples taken west of Teton Pass about 2,500 feet (762 m) outside of the area contained from 10.0 to 74.1 percent ash (moisture free), and heating values ranged from 1,750 to 12,370 Btu per pound (4,070 to 28,772 joules/kg). Uncontaminated samples were not obtained; the coal quality therefore is higher than the samples indicate. Coal beds grade laterally into carbonaceous shale; but, there may be the equivalent of one coal bed 2 feet (0.6 m) thick between two sample points 10,000 feet (3,000 m) apart. If the coal extends 4,000 feet (1,200 m) downdip, about 3 million tons (2.7 million t) of inferred resources are west of Teton Pass. Similar deposits may occur to the southeast along the strike of the coal beds in the study area. The coal is a submarginal resource because (1) it is generally low-quality and would require beneficiation, (2) thickness is erratic and averages less than 30 inches (76 cm), making mining expensive, (3) the dip is about 40°, further increasing the probable cost of mining, and (4) the area is relatively inaccessible.

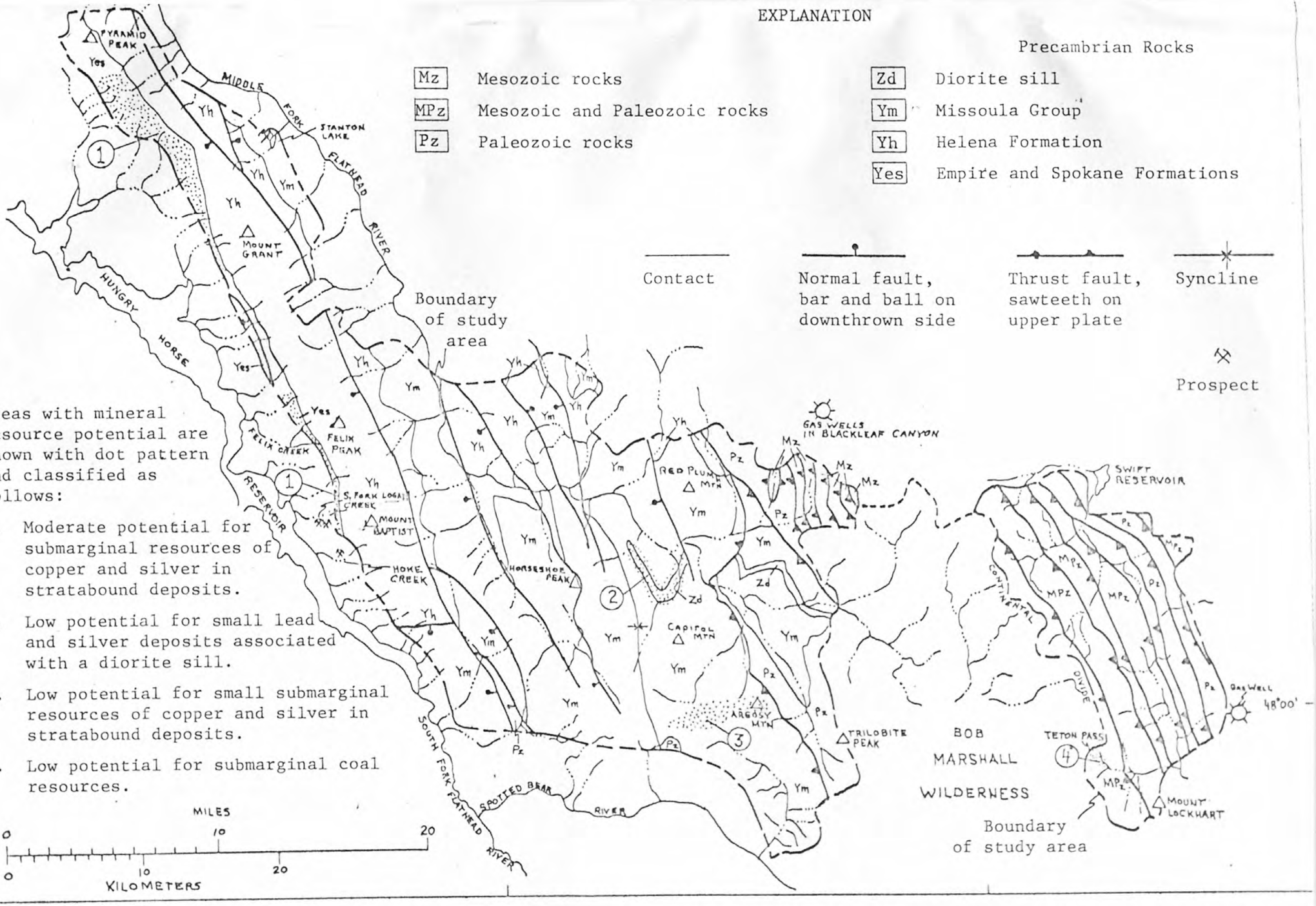

Figure 1. Generalized geologic map of the proposed Great Bear wilderness showing areas with potential mineral resources.