

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 potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a survey of the mineral resource potential of the Gallatin Divide Roadless Area in the Gallatin National Forest, Gallatin and Park Counties, Mont. The Gallatin Divide (G1548) and Hyalite (H1548) Roadless Areas were designated wilderness study areas by the 1977 Montana Wilderness Study Act (Public Law 95-150) and were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979; for the purposes of this report, these two areas are combined and referred to as the Gallatin Divide Roadless Area (O1548).

EXPLANATION

- OUTCROP OF SHEDHORN SANDSTONE
- SUBSURFACE EXTENT OF SHEDHORN SANDSTONE--To estimated depth of 1,000 ft (300 m)
- CONTACT
- FAULT--Dotted where concealed; bar and ball on downthrown side
- SAMPLE LOCALITY--On Shedhorn Sandstone (Swanson, 1970, p. 28c)
- SAMPLE LOCALITY--On Shedhorn Sandstone (sample 3 reported by Condit and others, 1928; samples 4-7 collected by U.S. Bureau of Mines for this report)
- PROSPECT
- LEASED LAND--Tracts in the roadless area or within 1 mi (1.6 km) of it that are leased for oil and gas exploration or for which applications for lease have been made, as of 1980
- GALLATIN PETRIFIED FOREST--Approximate location

SUMMARY STATEMENT

The Gallatin Divide Roadless Area is underlain mainly by volcanic rocks of Tertiary age, which overlie Paleozoic and Mesozoic sedimentary rocks and Precambrian metamorphic rocks. No prospecting for mineral deposits is known to have been done in the area, and no mineral production has been reported. The Shedhorn Sandstone of Permian age underlies several square miles in the southern part of the roadless area and contains a small resource of phosphate-bearing rock. The phosphatic beds are thin, low grade, discontinuous, and for the most part, deeply buried. Petrified wood is abundant in the southern part of the roadless area but is widely scattered and of poor quality. A slight potential exists for oil and gas, but possibly productive structures are small and deeply eroded. No significant geochemical anomalies were found for any element, and the potential for geothermal energy is low. Building stone, limestone, and deposits of sand and gravel occur in the roadless area, but all are available and more accessible outside of and near it. No placer deposits containing significant amounts of minerals of economic interest were disclosed by pan sampling.

INTRODUCTION

The Gallatin Divide Roadless Area is in southwestern Montana, just north of the northwest corner of Yellowstone National Park (see index map). From the park boundary it extends north-northeast along the crest of the Gallatin Range for about 35 mi (56 km), and covers an area of approximately 236 mi² (611 km²) or 151,000 acres (61,100 hectares). Most of the area is in Gallatin County, but parts along the east side are in Park County. The entire area is within the Gallatin National Forest.

General access to the roadless area is provided by U.S. Highway 191 along the Gallatin River and U.S. Highway 89 along the Yellowstone River. Unimproved roads extend into all the main canyons, some as far as the boundary of the roadless area, but further access is restricted to stock and foot trails.

The entire roadless area, except for the lowermost parts of Fridley and Big Creek drainages, is above 6,000 ft (1,830 m); Mt. Bole and Mt. Chisholm, in the northern part of the roadless area, are the highest points, 10,333 ft (3,150 m). Both flanks of the range are incised by deep, steep-walled canyons, many of which head in small glacial cirques. Evidence of glaciation--cirques, rock-basin lakes, U-shaped valleys, glacial deposits, and other features--is found throughout the roadless area.

GEOLOGY

The Gallatin Range of southwestern Montana and northwestern Wyoming extends about 60 mi (96 km) northwest from the vicinity of Mt. Holmes in northwestern Yellowstone National Park to Bozeman Pass between Bozeman and Livingston, Mont. The Gallatin Range is geologically part of a Tertiary structural block that also includes the Madison Range to the west. The two ranges are separated geographically, but not geologically, by the Gallatin River. The Gallatin-Madison block consists of a basement of metamorphic rocks of Precambrian W (Late Archean) age, 2,500-3,000 m.y. old (James and Hedge, 1980, p. 13), overlain by a sequence of dominantly carbonate Paleozoic sedimentary rocks 3,000-4,000 ft (915-1,220 m) thick and a sequence of dominantly clastic Mesozoic sedimentary rocks, mainly Cretaceous, perhaps 10,000 ft (3,050 m) or more thick. Volcanic rocks of Eocene and younger age are widespread in the Gallatin Range and underlie nearly 75 percent of the Gallatin Divide Roadless Area.

Prevolcanic rocks of the Gallatin-Madison block were folded and faulted along northerly and northwesterly trends during Laramide deformation (Hall, 1961, p. 184-185). The uplifted rocks were then eroded and in Eocene time were buried by lava flows and volcanoclastic rocks of the Absaroka volcanic field. The Gallatin-Madison block subsequently was tilted gently southeastward during late Cenozoic uplift of the block along a range-front fault that defines the west side of the Madison Range.

GEOCHEMISTRY

The geochemical study of the Gallatin Divide Roadless Area is based on 484 stream-sediment samples, 227 rock samples, and 31 panned concentrates of stream sediments collected by the U.S. Geological Survey, and 76 stream-sediment samples collected by Los Alamos Scientific Laboratory (Bolivar, 1978, 1980). Analytical data and six geochemical anomaly maps are presented by Simons and others (in press).

Anomalous concentrations of 20 elements were detected, but many of these elements (beryllium, bismuth, gold, molybdenum, silver, thorium, tin, and tungsten) were found in very small amounts and in only a few samples, and the others (boron, chromium, cobalt, copper, lanthanum, lead, nickel, niobium, uranium, vanadium, yttrium, and zinc) were mostly in low concentrations and in samples widely scattered over the roadless area. No significant geochemical anomaly was found for any element.

GEOPHYSICS

Aeromagnetic and gravity surveys of the Gallatin Divide Roadless Area were made to obtain geophysical information on subsurface lithology and structure that would assist in the evaluation of mineral resources.

MINERAL COMMODITIES

Mineral commodities in the area are phosphate rock, petrified wood, and construction materials. No oil or gas, coal, geothermal energy sources, placers, or other mineral deposits are known to exist in the area. Locations of deposits of phosphate rock and petrified wood, and of areas under lease or lease application for oil and gas, are shown on the map. Occurrences of construction materials are not shown because they are small or inaccessible, and similar materials are more easily available nearby and outside the roadless area. No prospects or mining claims within the roadless area are known.

Phosphate rock

The Shedhorn Sandstone of Permian age, containing a little phosphate rock, occurs over several square miles in the southwestern part of the roadless area and underlies a much larger area in the subsurface (see map). Swanson's (1970) study of phosphate resources of southwestern Montana included sampling in lower Porcupine Creek in the roadless area and at two other places outside of, but near, the roadless area, one near the mouth of the mouth of Taylor Fork. These localities are shown on the map. At the Porcupine Creek locality (lot 1217 of Swanson, 1970), the section sampled was 8 ft (2.4 m) thick and contained 1 ft (0.3 m) of phosphate rock analyzing 23 percent P₂O₅; the rest of the section had 8 percent or less P₂O₅. The section sampled on West Fork Gallatin River (lot 1216) was 18 ft (5.5 m) thick and contained about 3 ft (0.9 m) of phosphate rock averaging 15 percent P₂O₅; the rest of the section averaged about 3 percent P₂O₅. The Taylor Fork section (lot 1479) contained 2.5 ft (0.75 m) of phosphate rock averaging 19 percent P₂O₅.

A sample of a bed of phosphate rock 0.7 ft (0.2 m) thick from the north side of Elkhorn Creek (no. 3 on map) contained 18.6 percent P₂O₅ (Condit and others, 1928, pl. 2).

Localities of four phosphate rock exposures from which samples were collected by the U.S. Bureau of Mines are shown on the map (nos. 4-7). A 64-foot-thick (20 m) exposure of phosphate-bearing rock between Buffalo Horn and Tepee Creeks averaged 4.1 percent P₂O₅ (no. 4 on map), and a 14-foot-thick (4 m) part of the exposure averages 13.1 percent P₂O₅. The other three sampled exposures each assay less than 2 percent P₂O₅ (nos. 5-7 on map). No metallic commodities were detected in the phosphate samples.

Petrified wood

About 15 mi² (39 km²) of the Gallatin Petrified Forest is in the southern part of the roadless area. Petrified wood occurs in Eocene volcanic rocks and is contained in at least 15 beds. Samples of the best quality of petrified wood available were collected by the U.S. Bureau of Mines and were cut and polished to determine whether an attractive product could be made. The wood was found to be fractured, leached, and discolored, and no slabs larger than 3 in. (8 cm) across could be cut.

Construction materials

Many of the major drainages of the area, particularly Hyalite, Cottonwood, Squaw, Swan, Porcupine, Buffalo Horn, and Tepee Creeks, have small deposits of sand and gravel. However, access to all these deposits except those of Hyalite, Porcupine, and Tepee Creeks is difficult, and extensive and more accessible deposits of suitable material are available along the Gallatin River.

Some welded tuff near the mouth of Porcupine Creek west of the study area has been quarried for building stone (Hall, 1961, p. 175), and the welded tuff around the head of Elkhorn Creek might also be suitable but it is rather inaccessible.

Limestone is abundant in the southwest part of the area, in Moose and Swan Creeks, and between Cottonwood and Hyalite Creeks, but it is equally abundant and much more accessible in places adjoining the area.

Oil and gas

A number of areas within or near the roadless area are under oil and gas lease application; these areas are shown on the map. The geology of the area is shown in Simons and others (in press).

Within the roadless area, possible oil- or gas-bearing structures are concealed over about 73 percent of the area by Tertiary volcanic rocks, and the possible existence of such structures cannot be determined on the basis of surface geologic studies. Another 8 percent of the area is underlain by Precambrian metamorphic rocks in which oil-gas prospects are nil. Within areas underlain by Paleozoic and Mesozoic sedimentary rocks, folds are small and deeply eroded; the Buck Creek anticline, most of which is outside the roadless area, is eroded down to the Three Forks Formation (Devonian), and the Grouse Mountain anticline is eroded down to Madison Limestone (Mississippian). Other folds are too small to be significant as potential traps.

Other mineral commodities

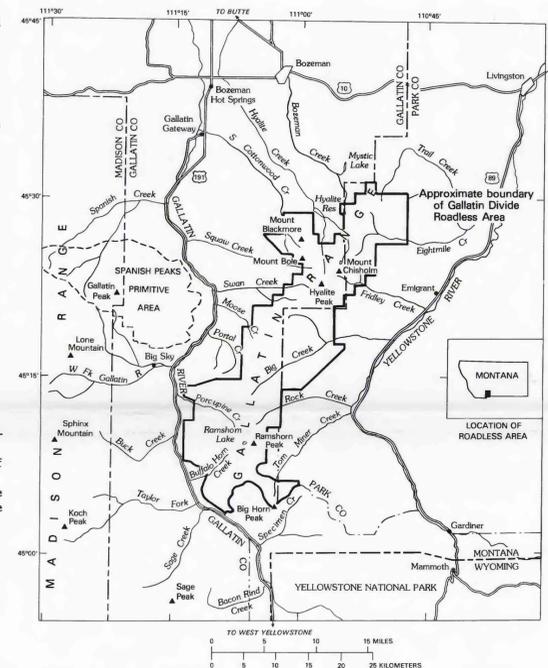
In the 1890's, prospecting for copper was done near the head of Levinski Creek and for calcite near Almart, west of the roadless area boundary (nos. 1, 2 on map, respectively); claims were located, but no production was recorded.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The Gallatin Divide Roadless Area has low potential for mineral and energy resources. The principal mineral commodities of the roadless area are phosphate rock and petrified wood. Deposits of phosphate rock are thin, discontinuous, and low grade, and most are deeply buried. Petrified wood is abundant but is widely scattered and of poor quality. Large deposits of alluvium exist along some drainages, but no placer deposits of economic interest were disclosed by pan sampling. The area has a slight potential for oil and gas, but possibly productive structures are small and deeply eroded. No significant geochemical anomalies were found for any element. No mine workings or mining claims were found. No geothermal energy resources are known. Building stone, limestone, and deposits of sand and gravel occur in the roadless area but are more readily obtained from deposits outside it.

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Index map of the Gallatin Divide Roadless Area (O1548) and vicinity, showing principal drainages, other topographic features, and main access roads. Heavy solid line is approximate boundary of roadless area; dashed line is boundary of previously studied Spanish Peaks Primitive Area (Becraft and others, 1966).

MINERAL RESOURCE POTENTIAL MAP OF THE GALLATIN DIVIDE ROADLESS AREA, GALLATIN AND PARK COUNTIES, MONTANA

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