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MINERAL RESOURCE POTENTIAL OF THE PINE CREEK ROADLESS AREA, HARNEY COUNTY, OREGON

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MINERAL RESOURCE POTENTIAL OF THE PINE CREEK ROADLESS AREA, HARNEY COUNTY, OREGON

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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 Pine Creek Roadless Area (6248), Malheur National Forest, Harney County, Oregon. The area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

The Pine Creek Roadless Area, northeastern Harney County, Oreg., is devoid of mines and mineral prospects. Furthermore, the results of this mineral appraisal indicate that there is little likelihood that commercial deposits of metallic minerals will be found in the area. Low value volcanic rock suitable for some construction purposes is present, but better and more accessible deposits are present in adjacent areas.

There is no evidence to indicate that mineral fuels are present in the roadless area. Nearby parts of Harney Basin are characterized by higher-than-normal heat flow, indicating that the region may have some as yet undefined potential for the development of geothermal energy. Data are not available to determine whether this higher-than-normal heat flow extends into the Pine Creek area; lack of thermal springs or other evidence of geothermal anomalies within the Pine Creek area suggest that it probably has a low potential for the development of geothermal energy.

INTRODUCTION

This report describes briefly the geology and mineral resource potential of the Pine Creek Roadless Area (6248), a 9-mi^2 area in Harney County, Oreg., presently being considered for inclusion in the Wilderness System. The roadless area incorporates a remote and undeveloped section of the canyon of

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Pine Creek, which drains forested areas along the northern margin of Harney Basin.

A reconnaissance geologic map was made of the area, and stream-sediment and bedrock samples were collected for both thin-section and X-ray diffraction studies and for chemical analysis (Walker, 1980). Additional geologic mapping and sampling was done in areas marginal to the roadless area in order to better understand the distribution of rock units and metallic elements.

Prior to the present study, the geology of the Pine Creek area was mapped in reconnaissance by Greene and others (1972) as part of a regional study of the Burns 1° by 2° quadrangle. Lithologic units shown on their geologic map are readily equated with units shown on the geologic map prepared for this study (Walker, 1980), although some terminology has been modified and a few additional rock units delineated. A study of the petrography of the prominent and widespread Devine Canyon Ash-flow Tuff (Greene, 1973) and a report on part of the stratigraphy of Harney Basin (Walker, 1979) provide additional background information for this report.

Location and geography

The Pine Creek Roadless Area is located about 22 mi northeast of Burns, Oreg. (fig. 1), along the southern margin of the Malheur National Forest, northeastern Harney County, Oreg. The area consists of about 5,400 acres along a 5-mi-long southeast-trending segment of Pine Creek that includes prominent high bluffs along both sides of the creek. Although Pine Creek drains eastward into the Malheur River, the western and southwestern margins of the Pine Creek Roadless Area are adjacent to the divide with Harney Basin, a large physiographic and structural basin with internal drainage (Piper and others, 1939; Walker, 1979).

Access to the Pine Creek Roadless Area is principally by graded gravel and ungraded poor-quality dirt roads from U.S. Highway 20. The main road to the western margin of the area, which is used for both ranch access and log haulage, intersects U.S. Highway 20 near Harney, about 13 mi east of Burns. The road traverses the lower reaches of Rattlesnake Creek before passing over the divide into the Pine Creek drainage. Other poor-quality good-weather dirt roads and jeep trails, used principally by ranchers and hunters, lead to the margin of the Pine Creek area from the east, north, and south.

GEOLOGY

Rocks in and near the Pine Creek Roadless Area are dominantly Miocene basalt and andesite flows and flow breccias, palagonite tuff and breccia, extrusive rhyolite, rhyolitic air-fall and ash-flow tuffs and tuffaceous sedimentary rocks. They represent part of a faulted and warped monoclinal sequence that dips generally southward toward the central part of Harney Basin. Surficial Quaternary deposits also are present in the area.

Stratigraphy

The stratigraphy and structures present in the area are characteristic of those found in the northeastern part of Harney Basin. The oldest rocks in the roadless area are of middle(?) Miocene age and consist of an interlayered

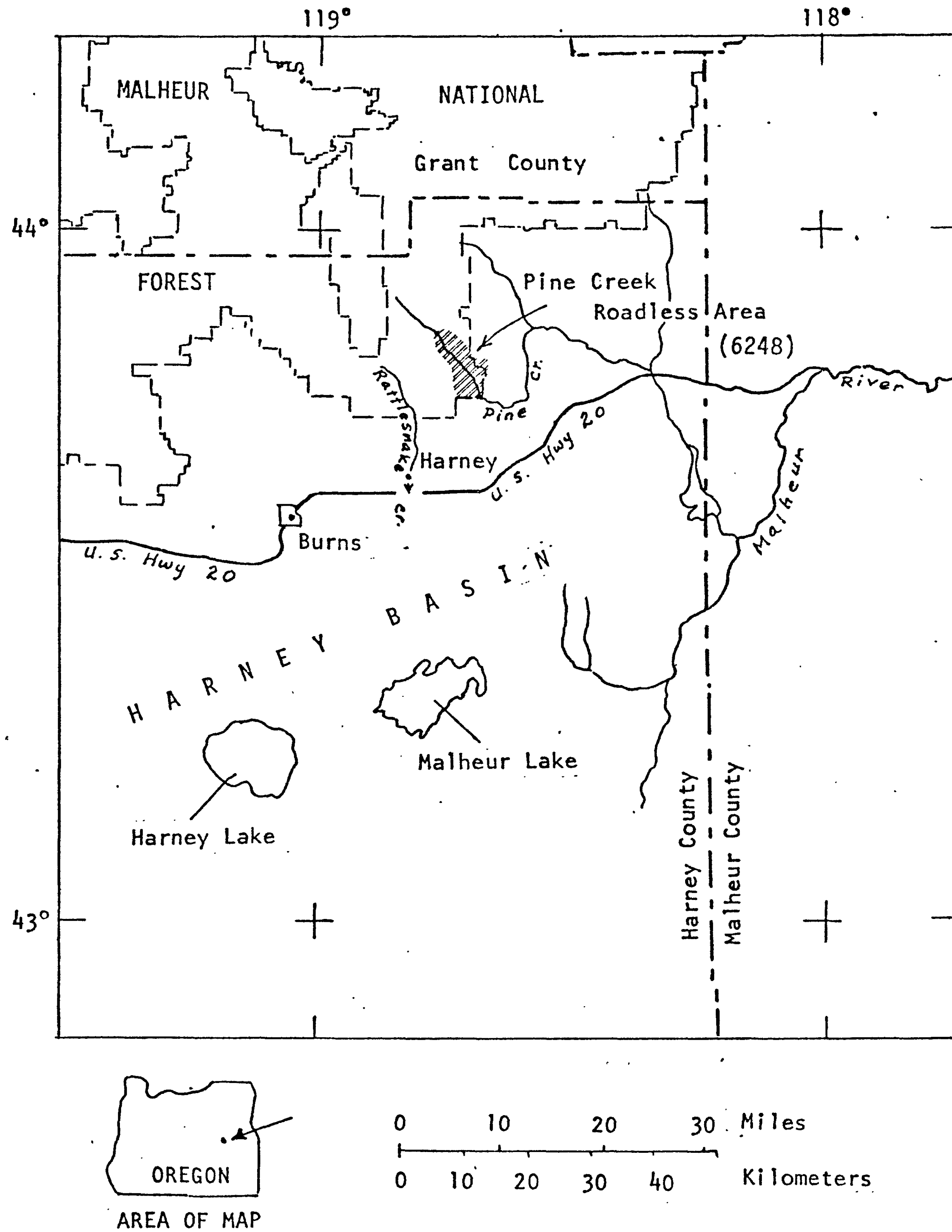

Figure 1.--Location of Pine Creek Roadless Area, Oregon.

sequence of basalt and andesite flows and flow breccias, palagonitic tuff and some palagonitic breccia, and minor interbeds of pumiceous and ashy tuffaceous sedimentary rocks. These rocks are part of a regionally extensive unit (Greene and others, 1972), that has yielded potassium-argon ages in the range of about 19 to 12 m.y. from samples collected over a large region in and adjacent to Harney Basin; most samples yielded ages of about 15 m.y. The precise age of the unit in the Pine Creek area is not known, but probably is about 15 m.y. Because the base of the unit is not exposed, its total thickness is not known, but a section nearly 800 ft thick is exposed within the area along the canyon walls of Pine Creek. A section approximately 3,000 ft thick is exposed in and around the margin of Harney Basin.

Rocks older than middle(?) Miocene are exposed many miles to the northwest, north, and northeast of the Pine Creek area and consist principally of Jurassic volcanic sandstone and mudstone and some lower and middle Cenozoic rhyodacitic to andesitic volcanic rocks. Presumably some or all of these rock types are present at depth in the Pine Creek area, but known total thickness of the basalt and andesite sequences in nearby areas suggests that these older rocks may be at least 1,000-2,000 ft beneath the surface.

In the northern part of the Pine Creek area, as well as on a ridge west of the area, rhyolite flows rest discordantly on the regionally extensive unnamed basalt and andesite flows and palagonitic rocks. The rhyolite, which totals 50 ft or more in thickness, is flow banded, locally lithophysal and spherulitic, but shows little evidence of silicification or alteration. Locations of vents for the rhyolite flows are not known, but inasmuch as the rhyolite must have been extremely viscous at the time of its emplacement, the vent or vents must be nearby and probably buried by the flows. The rhyolite flows have not been isotopically dated, but they overlie middle(?) Miocene rocks dated in the range of 19 to 12 m.y. (B.P.). The rhyolite flows predate an ash-flow tuff that has been dated, from material collected in adjacent areas, at 9.2 to 9.3 m.y. (Greene, 1973; Walker, 1979).

Stratigraphically above the rhyolite is a discontinuous sheet of crystal-rich tuff that locally rests on a somewhat irregular surface eroded in both the basalt and andesite unit and the rhyolite. The tuff, which is part of the Devine Canyon Ash-flow Tuff (Walker, 1979), includes either two separate crystal-rich ash flows or possibly one ash flow with mineralogically distinct zones. The zones both contain abundant crystals of alkali feldspar and some quartz, but can be distinguished by green, iron-rich clinopyroxene in one, and brown, iron-rich biotite in the other. No attempt was made to map these distinctive zones separately. A number of isotopic dates on samples collected in and marginal to Harney Basin indicate an age of about 9.2 or 9.3 m.y. for the Devine Canyon Ash-flow Tuff, or, in other words, a late Miocene age.

The youngest volcaniclastic rock unit in the area is a pumiceous, rhyolitic ash-flow tuff that occurs in discontinuous patches and is usually less than 15 ft thick. Locally it rests with slight discordance on the basalt and andesite unit, but throughout most of the area it lies either directly on the Devine Canyon Ash-flow Tuff or on a thin and discontinuous layer of poorly exposed tuff (not mapped separately) consisting partly of unwelded ash-flow material and partly of air-fall pumice. From its stratigraphic position and lithologic character, it is here correlated with the Prater Creek Ash-flow Tuff (Walker, 1979), which has been dated by potassium-argon methods at about

8.4 m.y. (Parker, 1974, p. 13; Parker and Armstrong, 1972), that is, late Miocene.

Quaternary alluvium, in the form of sand, silt, gravel, and local boulders, is present along segments of Pine Creek, but only at the northern end of the area does it occur in patches sufficiently large to be mapped.

Structure

The Pine Creek area is adjacent to Harney Basin, a broad, downwarped region (Russell, 1903; Waring, 1909; Piper and others, 1939; Walker, 1979) in which most layered units generally dip gently toward the central part of the basin located east and southeast of Burns. Located along the northern margin of this regional downwarp, the Pine Creek area tends to be characterized by gentle southward dips, although northwest-trending normal faults and local small warps have locally disrupted some layered units. Where disrupted, both easterly and westerly dips of up to about 10° are present. Fault displacements of many tens of feet occur along faults that are poorly exposed and seldom exhibit evidence of extensive shearing or brecciation. No evidence of alteration or mineralization is present along the fault zones within the Pine Creek Roadless Area.

MINERAL RESOURCES

The Pine Creek Roadless Area is in a region of low mineral potential for both metallic and nonmetallic mineral resources. There is no past record of either mining or quarrying in the area, nor were any metallic mineral occurrences or prospect pits recognized during the present investigation. Although no prospects or mineralized or altered ground were recognized, the bedrock of the Pine Creek area is similar to that found in nearby areas that contain small deposits of mercury, antimony, and gold. Rhyolite and some tuff in the Pine Creek area are similar to wallrocks of two small mercury prospects, the Valley View prospect located about 14 mi to the south-southeast and the Woodson Long prospect located about 22 mi to the east (Brooks, 1963, p. 203-204). The Red Butte antimony prospect that yielded about 1 ton of fairly massive stibnite from volcanic and volcaniclastic rocks, is located in the same general area as the Woodson Long property (Wagner and Ramp, 1969). Gold has been mined in the Harney (Idol City-Trout Creek) district located about 9 mi west of the Pine Creek area. The district yielded about $50,000 in gold between 1891 and 1916, and placer deposits in the district were being worked in 1981. Most of the gold was taken from placer concentrations in young valley fill, although some was extracted from a northwest-trending shear zone in a Miocene porphyritic andesite along which alteration and bleaching is prevalent (Brooks and Ramp, 1968, p. 160). The porphyritic andesite probably correlates with some of the Miocene basalt and andesite of the Pine Creek area. Exploration was also being done by Noranda Exploration in the Idol City-Trout Creek vicinity for lode gold resources in 1981.

Although bedrock in these mineralized areas shows some similarities in age and lithology to that in the Pine Creek area, there are important differences. Evidence of hydrothermal alteration, including bleaching and the development of clays and secondary silica minerals, is present in the bedrock at the mercury, antimony, and gold prospects, whereas no such bleaching or alteration was found in the Pine Creek Roadless Area. Furthermore, samples of bedrock, as well as stream-sediment samples from areas downstream from major outcrops of different bedrock types, were analyzed and show no anomalous amounts of these or other metals (Walker, 1980). Reconnaissance radiometric surveys of major rock units and of parts of larger fault zones show no abnormal concentration of radioactive minerals.

Volcanic rock materials suitable for construction purposes are present in parts of the Pine Creek Roadless Area, but better quality material is abundant elsewhere and is more readily accessible.

Energy resource potential

Insofar as can be determined from surface geologic features, there is no evidence that the Pine Creek Roadless Area contains deposits of mineral fuels or a potential for development of geothermal energy. There are no thermal springs within the area, although it lies on the margin of Harney Basin, a region characterized by higher-than-normal heat flow[1] (Sass and others, 1976; Riccio, 1978) and numerous thermal springs and wells.

The normal geothermal gradient worldwide is approximately 30°C per kilometer of depth. According to Sass and others (1976) and Riccio (1978), the gradient in and near the Pine Creek area is above this norm, apparently on the order of 60° to 80°C per kilometer, and gradients up to about three times the normal gradient occur 15 to 20 mi to the south in Harney Basin. Within the area of high thermal gradients in Harney Basin are numerous hot springs and thermal wells, the heated waters of which are locally utilized for space heating and to provide heated water to a mill pond (Bowen and others, 1978).

Proximity of the Pine Creek Roadless Area to areas of higher-than-normal heat flow may indicate some undetermined potential for the development of geothermal energy. The comparatively low level of heat flow and the lack of hot springs in the Pine Creek Roadless Area suggest that the potential is probably low, however.

CONCLUSIONS

No metallic deposits of commercial value were recognized in the Pine Creek Roadless Area during the present investigation and evaluation of the geology and of analyses of samples indicates that such deposits are not likely to be found. Surface manifestations indicate that the area is devoid of mineral fuels and, although the heat flow apparently is above normal, the potential for the development of geothermal energy is probably low.

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[1]Heat flow is the product of the geothermal gradient measured in a drill hole and thermal conductivity measured on rock samples taken from the drill hole.

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