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MINERAL RESOURCE POTENTIAL OF THE NORTH FORK JOHN DAY RIVER ROADLESS AREA, GRANT COUNTY, OREGON

SUMMARY REPORT

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STUDIES RELATED TO WILDERESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964), and related acts, 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 in 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 North Fork John Day River Roadless Area (B6253), Umatilla and Wallowa-Whitman National Forests, Grant 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 North Fork John Day River Roadless Area comprises 21,210 acres in the Umatilla and Wallowa-Whitman National Forests, Grant County, Oregon, about 30 mi northwest of Baker, Oregon.

Gold occurs in placer deposits along the North Fork John Day River. Indicated and inferred marginal reserves, estimated at 840,000 yd^3, have a weighted average value of $1.78/$yd^3$ at $500 per troy ounce and constitute about 30 percent of the total gold resources. Indicated and inferred resources, including reserves, total 2.8 million yd^3 and have a weighted average value of $1.00/$yd^3$ in gold.

Twenty-one drainages tributary to the North Fork John Day River have resource potential for gold. On the basis of concentrations of gold in samples, these drainages are ranked as having high (more than 50 parts per million (ppm)), medium (between 10 and 50 ppm) or low (between 0.5 and 10 ppm) potential for the occurrence of gold resources. Drainages that have high gold resource potential are along the southeast border of the study area. Silver may be recoverable with gold.

Fractured basalt and chert for road metal are in the roadless area, along with sand and gravel deposits.

INTRODUCTION

The North Fork John Day River Roadless Area comprises 21,210 acres in Grant County, Oregon, about 50 mi south of Pendleton and 30 mi west-northwest of Baker (fig. 1). Most of the area is in the Umatilla National Forest; a few acres of the northeastern part are in the Wallowa-Whitman National Forest. The irregularly shaped study area extends for about 1 mi on both sides of a 25-mi-long segment of the North Fork John Day River, from Big Creek on the west to North Fork John Day campground on the east (fig. 2). Most of the area is in the northern half of the Desolation Butte 15-minute quadrangle. The eastern end is in parts of the Granite and Trout Meadows 7 1/2-minute quadrangles.

GEOLOGY

Most of the roadless area is underlain by rocks that are known or inferred to be of Paleozoic or Triassic age (Evans, 1984a). The oldest rock in the area may be metamorphosed hornblende diorite in the northeastern part. These rocks are faulted against Elkhorn Ridge Argillite (see below), so that their relation to other rocks of the roadless area is not known. The hornblende diorite could be part of the basement upon which Elkhorn Ridge Argillite was deposited. Age of the hornblende diorite would then be Pennsylvanian or older, although an age as young as Triassic is possible. The unit is tentatively assigned a Paleozoic or Triassic age.

Elkhorn Ridge Argillite, which underlies most of the roadless area, consists mostly of a monotonous assemblage of argillite and chert, which originally must have been several thousand feet thick. East of the roadless area the formation has yielded Pennsylvanian and Permian fusulinids and Early to Middle Triassic pentacrinoids, hydrozoans and hexacorals (Bostwick and D. A. Koch, 1962; Bostwick, in Brooks and others, 1976, p. 4), which establish the age of the formation as late Paleozoic and Triassic.

Brecciated and retrogressively metamorphosed diorite in the southern and western parts of the roadless area underlie an assemblage of pyroclastic and volcanic rocks. One of the diorite bodies, in the northwestern corner of the Granite quadrangle, was dated as Permian (Brooks and others, 1982).

The pyroclastic and volcanic rock assemblage was deposited on the diorite. The assemblage, consisting chiefly of tuff, lapillistone and andesite is about 2,000 ft thick in the northwest corner of the Granite quadrangle. Based on the age of the underlying diorite, the assemblage is Permian or younger and probably no older than Middle Triassic.

Melange in the southernmost part of the roadless area is mostly argillite, most of it possibly from Elkhorn Ridge Argillite. A few serpentinite bodies in the melange, which are probably metamorphosed dunite, are large enough to be mapped. Age of the melange is probably Middle Triassic, based on the occurrence of Upper Triassic Vester Formation unconformably overlying the melange 84 mi southwest of the roadless area (Dickinson and Thayer, 1978; Dickinson, 1979), and the possible inclusion of Elkhorn Ridge Argillite in the melange.

The Elkhorn Ridge Argillite and the pyroclastic and volcanic rock assemblage were juxtaposed by faulting and underwent regional metamorphism in greenschist facies sometime in the Triassic. Ave Lallemant and others (1980) concluded that metamorphism in the region occurred at the end of the Triassic.

Post-tectonic dikes intruding the argillite and the assemblage (diorite and latite in the argillite; hornblende pyroxenite in the assemblage) were partly retrogressively metamorphosed and must have been emplaced prior to the nearly unaltered Jurassic diorite.

Fresh diorite comprises three stocks in the roadless area and the Crane Creek stock (Taubeneck, 1957, p. 185) just east of the roadless area. The stocks may be apophyses of the Bald Mountain batholith exposed still farther to the east. The batholith was dated by Armstrong and others (1977, p. 400) at 147±17 m.y. Although this date covers the range Middle Jurassic to Early Cretaceous, they postulate that the batholith was emplaced during Jurassic time, but remained hot or was reheated in the Early Cretaceous. For this reason, the diorite stocks are assigned a Jurassic age in this report.

Contact metamorphic aureoles around the two western diorite stocks and the Crane Creek stock are approximately 1 mi wide. Mineral assemblages in the country rock up to a few thousand feet from the intrusive contact are characteristic of hornblende hornfels facies.

Leucocratic quartz monzonite is present in the southwestern part of the roadless area. It is probably younger than the Jurassic diorite intrusions because quartz monzonite dikes intrude the diorite and the broad contact-metamorphic aureole around the diorite intrusions in the northwestern part of the roadless area. The quartz monzonite is, therefore, Jurassic or Cretaceous in age.

Tertiary volcanic, pyroclastic and sedimentary rocks overlie the Mesozoic and Paleozoic rocks above an angular unconformity. Lithologies in and near the roadless area include black basalt and andesite, dark to light-gray ignimbrite, arkosic sandstone, and lake bed deposits. Age of the assemblage is Eocene and Oligocene (Brooks and others, 1982).

Alluvium and reworked tephra occur along the canyon bottoms; glacial deposits, undifferentiated regolith and tephra cover parts of the ridges that flank the North Fork John Day River and its tributaries.

GEOCHEMISTRY

Several types of samples were chemically analyzed to provide the basis for determining the mineral resource potential of the roadless area. Stream-sediment samples from 60 sites include silt (60 samples) and pan concentrates (57 samples). Alluvial samples (444) were taken at 285 sites along the North Fork John Day River. Rock samples (60) included quartz and hematite veins, hematite veins, hematite-cemented chert breccia, and greisen. The silt, pan-concentrate and rock samples were analyzed for 31 elements by emission spectrographic methods and for gold by atomic absorption. The alluvial samples were processed in the laboratory to recover placer gold.

Gold occurs in numerous placer deposits along the North Fork John Day River in the roadless area. Some stream-sediment samples from tributaries of the North Fork also contain detectable amounts of gold (lower limit of detection 0.05 ppm). Only one rock sample taken in this study contained detectable amounts of gold.

Gold in the stream-sediment samples occurs in association with silver, tin, tungsten, and zinc in several combinations (Evans, 1984b). The geographic distribution of the gold and associated elements suggests at least three sources for the gold: (1) reworked glacial or fluvioglacial deposits in and near the eastern part of the roadless area; (2) reworked Tertiary placers located mostly outside the area; and (3) mineralized zones in fractured argillite and chert.

MINING DISTRICTS AND MINERALIZATION

The roadless area is in the eastern part of the North Fork mining district and the western part of the Granite district (Conyac, 1983). The region that includes the roadless area has a history of mining that dates from the autumn 1861 discovery of placer gold in Granite Creek, a tributary of the North Fork John Day River, near the present town of Granite (fig. 1; Pardee and Hewett, 1914, p. 9), and from initial mining of placer deposits near McCarty Gulch in 1845 in the North Fork district (Oregon Metal Mines Handbook, 1941, p. 97). Granite Creek and its tributaries have yielded large amounts of placer gold from just outside the roadless area (fig. 2). During the periods 1938-42 and 1946-51, a bucketline dredge was operated on these creeks (Brooks and Ramp, 1968, p. 57).

Other major placer mines, worked mainly with hydraulic equipment, were the Klopp mine, just south of the North Fork John Day campground and outside the roadless area, and the Thornburg mine on the North Fork about 5 mi west-southwest of the Klopp mine (fig. 2). By 1901 the Klopp mine had been worked for many years, with an annual production of \$3,000 to \$6,000[1] (Lindgren, 1901, p. 687). The volume of gravel worked from glacial deposits up to 1916 was estimated at 6.8 million yd^3 yielding \$342,000[1] in gold (Parks and Swartley, 1916, p. 163).

The Thornburg mine (fig. 2), also called the Steuben placers, was worked in the late 1800's. By 1901 the placers had been worked steadily for many years with an annual production of several thousand dollars (Lindgren, 1901, p. 686). The April 28, 1906, edition of the Sumpter, Oregon, <u>Blue Mountain Weekly</u> newspaper reported the Thornburg placer gold value at 8 to 20 cents/yd^3 of gravel.[1]

Several thousand ounces of gold were produced from the Davis and Calhoun placers on the North Fork John Day River just west of the roadless area (fig. 2) by washing plant and dragline during 1940-42 and 1947-50 (Brooks and Ramp, 1968, p. 57).

Thirty-five areas have been identified that contain significant tailing and boulder piles from past placer mining activities. Some of these areas are as large as 10 acres. Remains of at least 10 ditches and flumes, some more than 1,000 ft long, are present. Most mining done in the roadless area entailed working bars and bench deposits down to or near bedrock.

The production of placer gold for the Granite district and North Fork drainage basin was estimated to be \$2,000,000[1] by 1914 (Pardee and Hewett, 1914, p. 10), and, by 1968, was estimated at more than \$5,000,000[2] (Brooks and Ramp, 1968, p. 64).

Approximately 1 million yd^3 of placer gravel has been mined from four or five principal deposits within the roadless area. Total production is unknown, and an estimate of production is not possible due to lack of records. Most output, however, was probably from the Thornburg mine.

Most of the area along the North Fork John Day River in the roadless area is now covered by placer claims. A few placer claims are also present along creeks tributary to the North Fork John Day River. Claims in the roadless area numbered over 200 in 1980; the exact number is difficult to determine because of new claims being located and existing claims being renewed, abandoned, or relocated. There are no patented claims or mineral leases within the roadless area, and no large producing or developing mines. Claimants now work on a small scale, many using portable gasoline-powered

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[1]Dollar value based on gold price of \$20.67 per troy ounce.

[2]This figure is estimated cumulative dollar value at gold prices of \$20.67 and \$35 per troy ounce.

suction dredges. Most of the gold obtained is very fine grained.

Of the hundreds of claims located over the years in the roadless area, only a few have been lode claims; no lode mining is known at the present time. Lode mining in surrounding areas began in the 1870's with discovery of the Monumental mine in 1874 and the La Belleview mine in 1877 (Lindgren, 1901, p. 685), both located east of the map area. The Buffalo mine, the largest mine of the Granite district, is 2.5 mi southeast of the roadless area (fig. 2). It began operation in the mid-1880's and has been active almost continuously to the present. Exploration has been carried on recently at the Cougar-Independence and La Belleview mines (Brooks and Ramp, 1968, p. 64).

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Placer gold resources[3] exist along the North Fork John Day River (Conyac, 1983). The roadless area contains 1.4 million yd^3 of indicated resources and about 1.4 million yd^3 of inferred resources having a weighted average of 0.002 oz/yd^3. Considering only deposits containing gold values[4] over $\$1.00/\text{yd}^3$[4] the study area contains indicated marginal reserves[3] of 510,000 yd^3 and inferred marginal reserves[3] of 330,000 yd^3 with a weighted average gold value of $\$1.78/\text{yd}^3$. These marginal reserves are about 30 percent of the total placer resources.

Of the total volume of deposits composing the marginal reserve base, 670,000 yd^3 averaging $\$1.60/\text{yd}^3$ are at and above the mouth of Granite Creek; 170,000 yd^3 averaging $\$2.48/\text{yd}^3$ are below the mouth of Granite Creek.

The amount of gold actually recoverable during placer mining may differ from the estimates of gold content given above, because some of the extremely fine-grained gold that may have been included in the laboratory analysis of samples from the deposits would probably not be recovered during mining. Gold recovery can also exceed estimated gold content, as suggested by results of 23 alluvial samples taken from just above bedrock in the roadless area, which imply that the deposits may tend to be enriched in gold downward.

An estimate of the economic feasibility of mining the placer gravels, other than by suction dredging, indicates that the deposits in the roadless area are too small to support large placer mines. A hypothetical mining operation for placers along the river would require minimal preparation. Using a minimum grade of $\$1.00/\text{yd}^3$, the 840,000 yd^3 of marginal reserves would take about 6.4 years to mine, assuming a production rate of 500 yd^3 per day and a work schedule of one shift (8 man-hours) per day for 260 days per year using front end loaders and portable gravel washing equipment. In order to realize a 20 percent return in investment, either a value of $\$2.75$ per yd^3, or a 56-percent increase in the gold price to about $\$780$ per troy ounce is required.

The potential for occurrence of gold resources was determined for 21 drainages tributary to the North Fork John Day River (fig. 2). The atomic absorption analyses upon which the potential is based represent total gold content of the samples, and their use in describing gold potential in the roadless area requires explanation. Although much of the gold in the sample is probably free gold, some of it may be incorporated into minerals such as pyrite, which would not be sought in a placer mining operation. In addition, some of the free gold is probably extremely fine grained and would not be recoverable by mining with ordinary separation methods; therefore, the gold values obtained by atomic absorption analysis may be higher than concentrations of gold that can be practically recovered by washing placer gravels.

Twenty-one streams that are tributary to the North Fork contain detectable amounts of gold (lower limit of detection 0.05 ppm). Because crustal abundance of gold is estimated to be 0.003-0.004 ppm (Jones, 1968, p. 3; Lee and Yao, 1970, p. 782), any gold detectable in rock, silt and pan-concentrate samples is considered anomalous, although, as mentioned above, a portion of this gold may not be easily recoverable.

Where gold was found in silt or pan-concentrate samples, the sediments upstream from the sample site are interpreted to constitute a potential gold resource. The tributary drainages have a potential for gold resources in Tertiary and Quarternary placer deposits or in Paleozoic and Mesozoic rocks that underlie the drainage basins.

Some stream-sediment samples that contain gold came from drainages of which large portions lie outside the roadless area (for example, Backout, Glade, Paradise, and Silver Creeks). Therefore, most of the potential gold resources of these drainages lie outside the study area.

Gold found in stream-sediment samples taken from near the mouths of Granite and Crane Creeks probably reflects gold resources that are almost entirely outside the roadless area. Gold in Crane Creek sediments may have been derived from older gold deposits associated with the contact zone of the Crane Creek stock and from reworked Tertiary and Quaternary placers.

The potential for placer and lode gold resources in drainages tributary to the North Fork John Day River is ranked according to the concentrations of gold found in silt and pan-concentrate samples: high (I), gold greater than 50 ppm; moderate (II), gold between 10 and 50 ppm; low (III), gold between 0.5 and 10 ppm (fig. 2). The highest ranked areas (I) are along the southeast border of the study area and extend from the east end of the area to Granite Creek.

Silver may be recoverable with gold in some of the potential gold resources.

Fractured basalt and chert suitable for road metal, and sand and gravel deposits occur in the roadless area, but are also abundant outside the area, where they would be closer to areas of use. No high quality ornamental or building stone occurs in the area. A potential for nuclear or fossil fuels or geothermal resources was not identified in this study.

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[3]See U.S. Bureau of Mines and U.S. Geological Survey (1980) for definition of terms.

[4]Dollar value based on gold price of $\$500$ per troy ounce.

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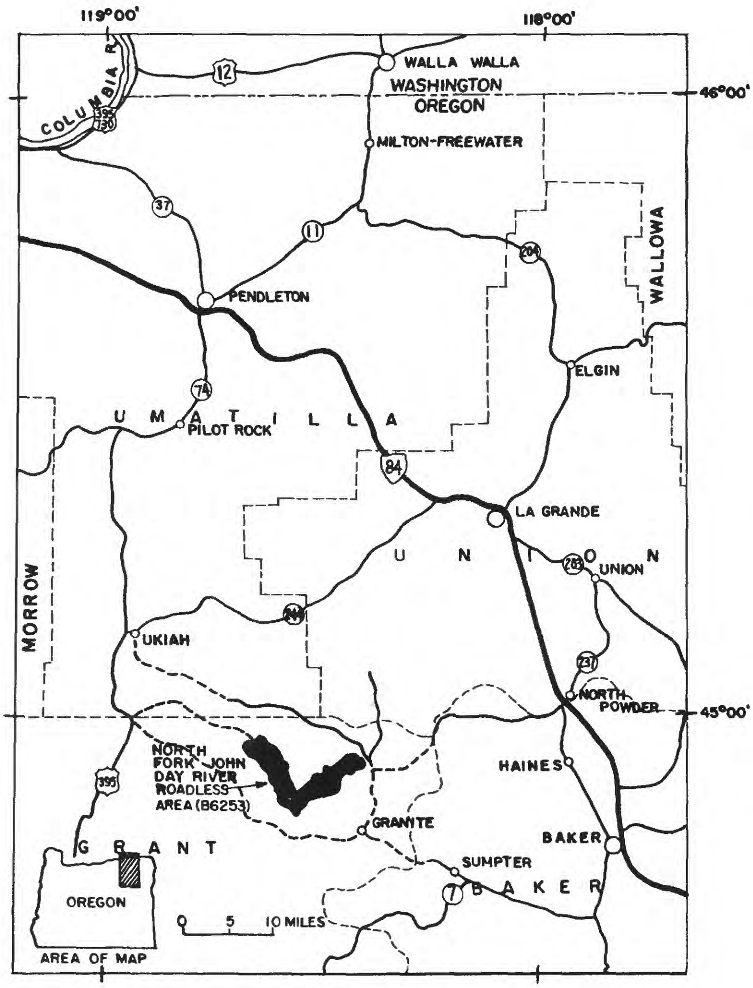

Figure 1.--Index map showing location of North Fork John Day River Roadless Area (B6253), Grant County, Oregon.

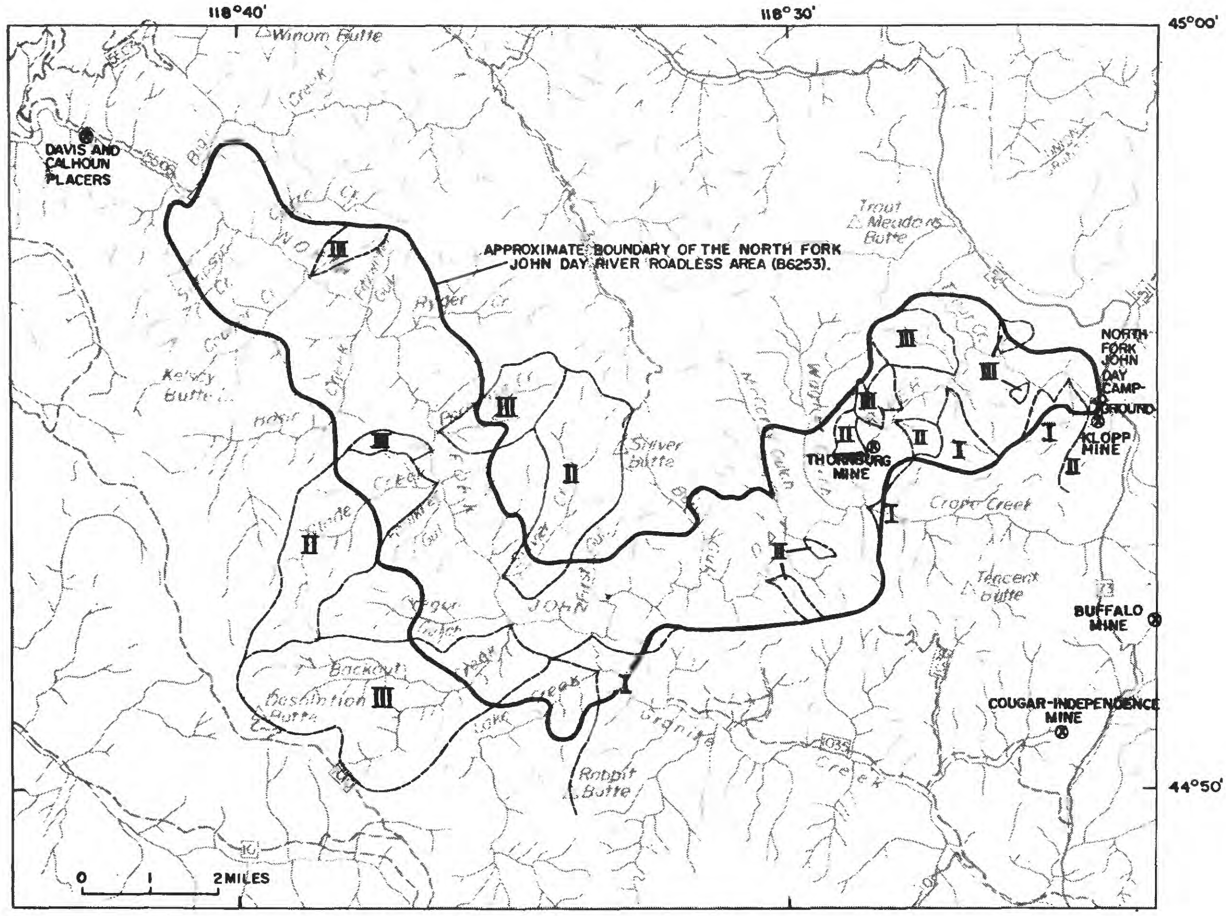

Figure 2.--Map of the North Fork John Day River Roadless Area. Numbered areas have potential for gold lode and placer resources: I, high; II, moderate; and III, low. See text for explanation.