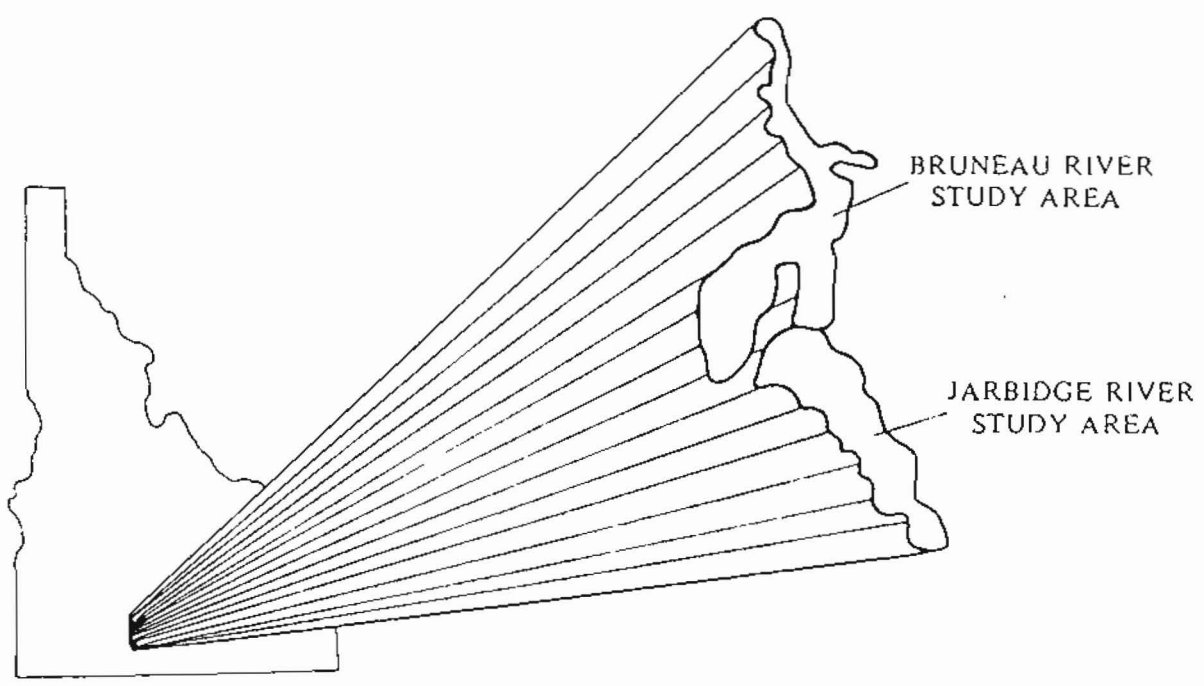


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Mineral Land Assessment/1987
Open File Report

Mineral Resources of the Bruneau River and Jarbidge River Study Areas, Owyhee County, Idaho



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE BRUNEAU RIVER AND JARBIDGE RIVER
STUDY AREAS, OWYHEE COUNTY, IDAHO

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PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land ". . . prior to any recommendation for the designation of an area as wilderness . . . to determine the mineral values, if any, that may be present" Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of portions of the Bruneau River (ID-111-17) and Jarbidge River (ID-17-11) Wilderness Study Areas, Owyhee County, ID.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

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SUMMARY

In 1985 the U.S. Bureau of Mines evaluated the mineral resources of the Bruneau River and Jarbidge River study areas, Owyhee County, ID, for the U.S. Bureau of Land Management. The study areas, separated by a narrow corridor, include 90,000 acres of the 107,020-acre Bruneau River Wilderness Study Area (ID-111-17) and 47,000 acres of the 75,340-acre Jarbidge River Wilderness Study Area (ID-17-11). They lie 26 miles and 55 miles, respectively, due south of Mountain Home, ID.

Approximately 38 placer claims for gold and 182 lode and placer claims for jasper, agate, and limestone were located within and adjacent to the study areas from 1893 to 1981. Currently, there are eight mining claims for jasper at Indian Hot Springs along the corridor between the study areas.

As much as several thousand pounds of gem-quality jasper is mined from the claimed area annually by blasting, bulldozing, and hand-sorting. Select material is marketed worldwide as "Bruneau Jasper." Because demand is high, intermittent mining is expected to continue. Elsewhere, a subeconomic resource of cement-grade limestone, inferred to contain 20 million tons at an average grade of 50.5 percent CaO (calcium oxide), is adjacent to the northern end of the Bruneau River study area. Approximately 100 tons of limestone were quarried from the deposit in the 1950's. The Jarbidge mining district of northern Nevada is probably the source of placer gold which occurs in sand and gravel accretion bars recently deposited by the Bruneau-Jarbidge River system. The highest values detected, \$15.00 per cubic yard and averaging \$1.40 per cubic yard, were in deposits along the Jarbidge River. Sporadic, moderate- to low-gold values and small deposit sizes probably render the placers suitable only for recreational panning, sluicing, and suction dredging. No gold resources were identified.

Geothermal reservoirs, manifested mainly as hot springs, have been identified at three localities near the study areas. The low- to moderate-temperature systems are suitable for direct-use applications (space heating, agriculture, recreation, etc.). Current applications include recreation at Murphy and Indian Hot Springs and a prototype commercial aquaculture operation at Hot Spring, ID. There are no geothermal leases issued within or near the study areas. The northern half of the Bruneau River study area is leased for oil and gas. No geothermal or oil and gas resources were identified in the study area.

INTRODUCTION

Mineral surveys of designated WSA's (Wilderness Study Areas) 1/, or portions of WSA's called study areas, are conducted by the USBM (U.S. Bureau of Mines) and the USGS (U.S. Geological Survey) at the request of the BLM (U.S. Bureau of Land Management). The USBM researches the mining and mineral exploration history and evaluates mines, prospects, and mineralized areas within and adjacent to the WSA's or study areas. The USGS studies the areas by conducting regional geochemical and geophysical surveys and geological mapping. The USBM and the USGS investigations are summarized in a joint report used to help determine the suitability of areas for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM studies is to provide data for the President, Congress, BLM, and the general public for land-use decisions, the long-term objective is to help ensure that the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The Bruneau River and Jarbidge River study areas (also referred to in this report as the Bruneau-Jarbidge River study areas) cover a total of 137,000 acres in Owyhee County, ID (fig. 1), including 90,000 acres of the 107,020-acre Bruneau River WSA (ID-111-17) and 47,000 acres of the 75,340-acre Jarbidge River WSA (ID-17-11). Study area boundaries are commonly located along the precipitous canyon rims or nearby jeep trails (figs. 2-4). The northern half of the Bruneau River study area (fig. 2) is not continuous. Three narrow segments of the study area are separated by State Grant sections. The corridor between the Bruneau River and Jarbidge River study areas contains a jasper mine, and access roads to and around private lands at Indian Hot Springs.

Bruneau, ID, lies about 10 mi (miles) northwest of the Bruneau River study area, and Jarbidge, NV, is about 13 mi south of the Jarbidge River study area (fig. 1). Access to the study areas is by way of unimproved desert roads from State Highway 51, about 10 mi to the west, and the graveled Clover-Three Creek road about 5 mi to the east. Saylor Creek Air Force (bombing) Range lies near the eastern boundary of the Bruneau River study area (fig. 2).

The Bruneau-Jarbidge River study areas are characterized by a broad, north-sloping plateau south of the Snake River. Major north-flowing drainages, such as the Bruneau and Jarbidge Rivers, Clover Creek in East

1/ A WSA is a roadless area or island that has been inventoried by the BLM and found to have wilderness characteristics as described in Section 603 of the Federal Land Policy and Management Act of 1976 (90 Stat. 2785) and Section 2 (c) of the Wilderness Act of 1964 (78 Stat. 891).

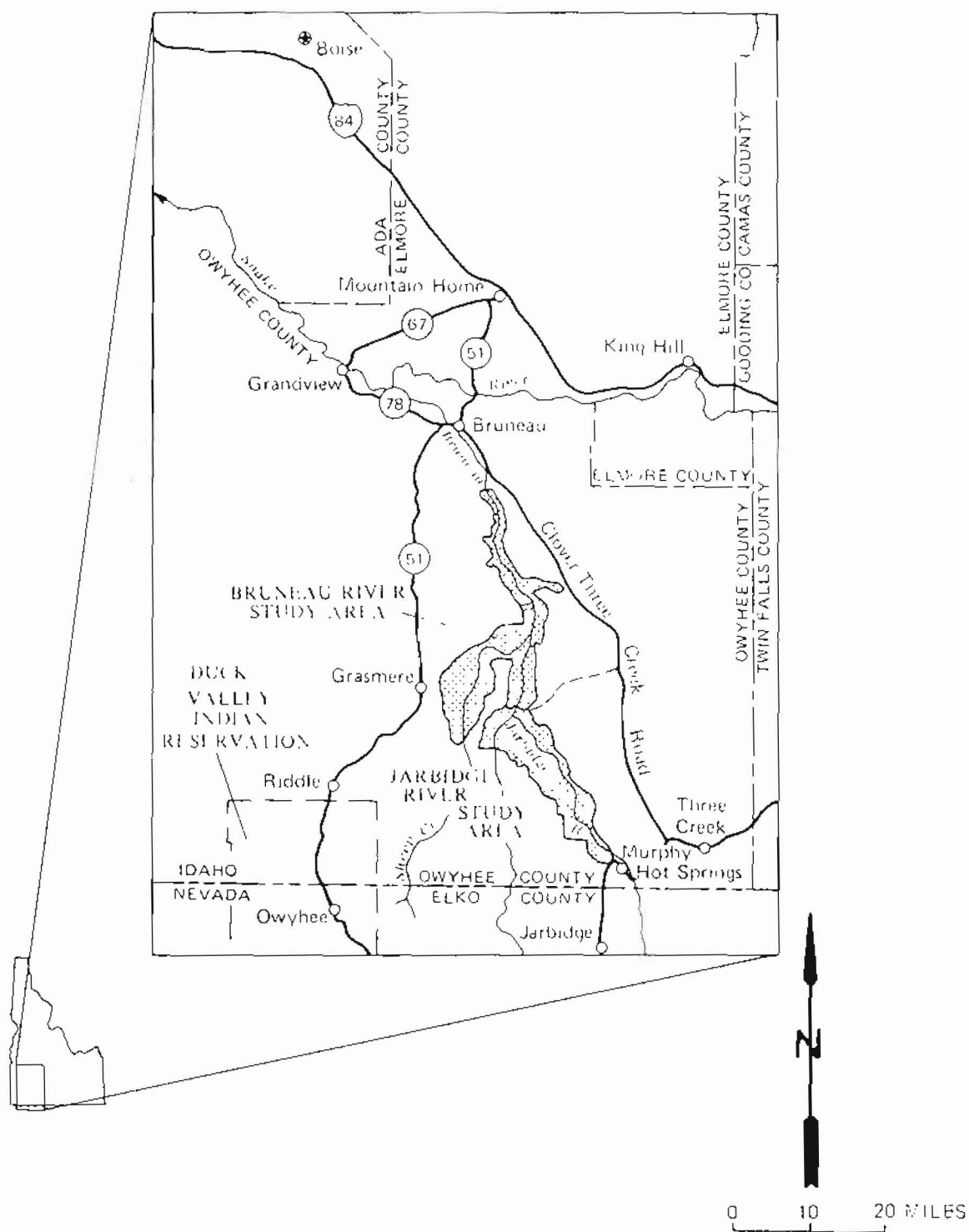


FIGURE 1. - Location of the Bruneau River and Jarbridge River study areas, Owyhee County, ID

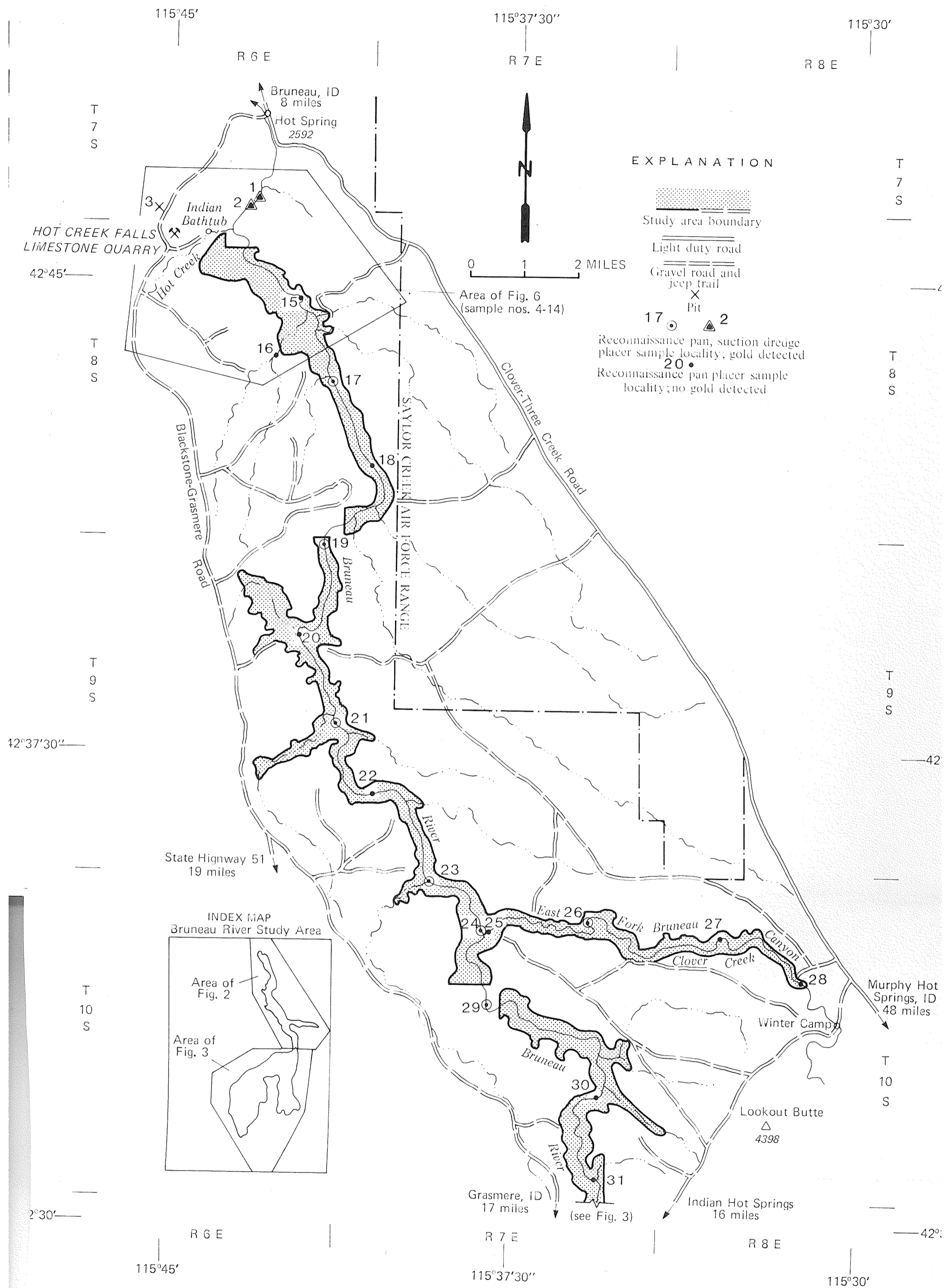


FIGURE 2. — Placer sample localities in the northern half of the Bruneau River study area, Owyhee County, ID

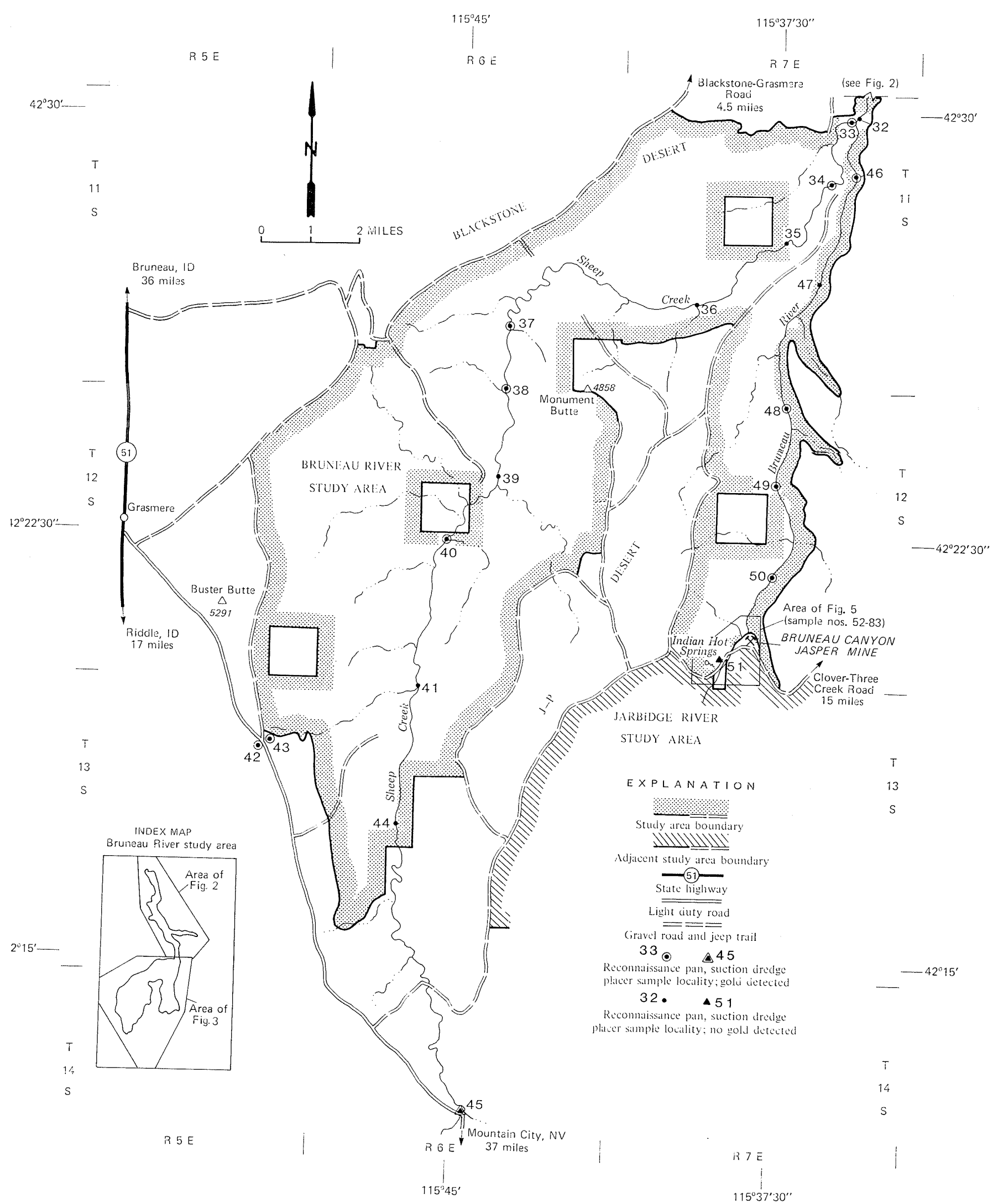
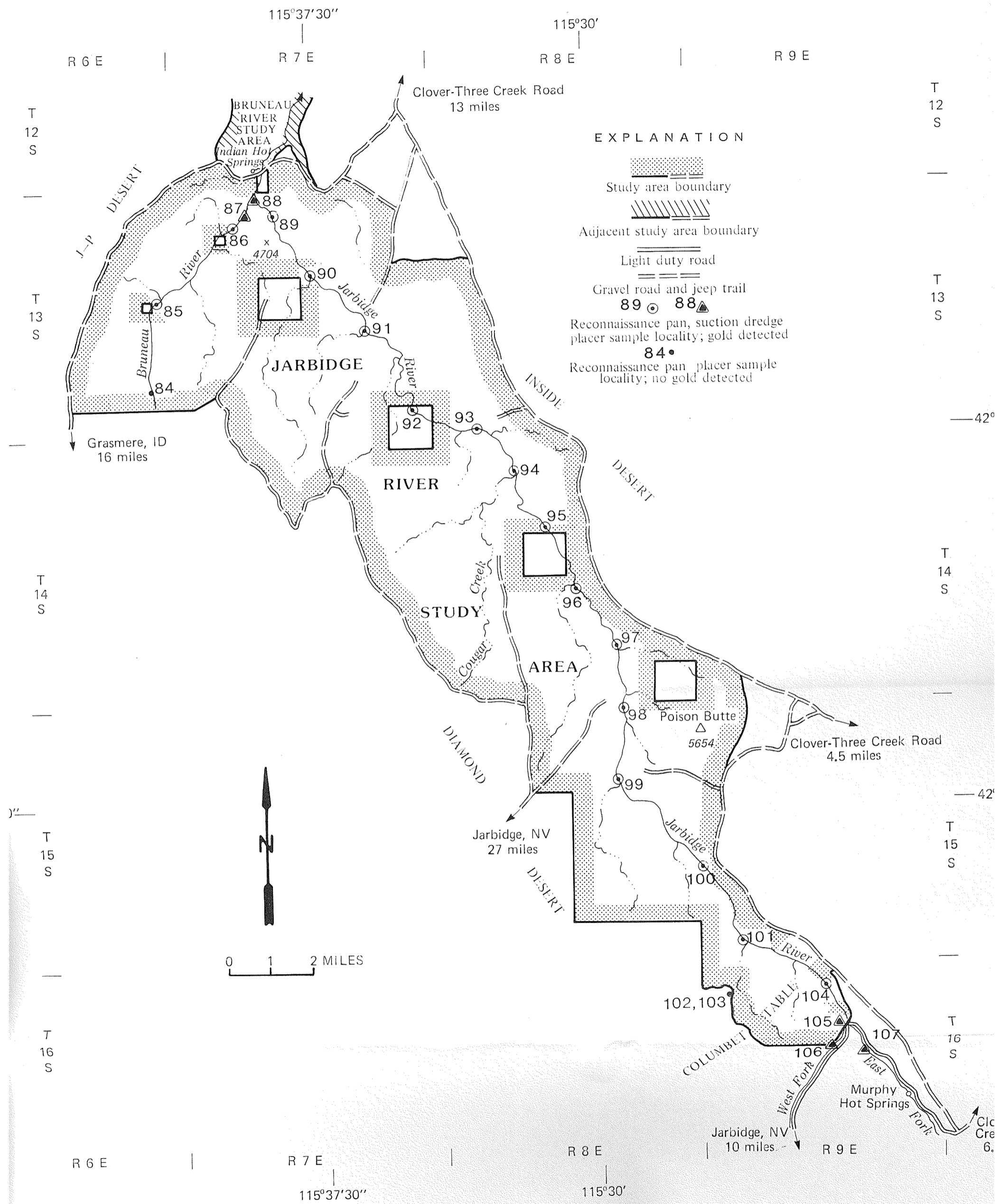


FIGURE 3. — Placer sample localities in the southern half of the Bruneau River study area, Owyhee County, ID



Fork Bruneau Canyon, and Sheep Creek are deeply incised into the plateau; canyons range from 300 to 1,000 ft (feet) deep. Relief in the region is low except in the river canyons. Elevations range from about 2,650 ft at the northern end of the Bruneau River study area to 5,720 ft on Columbet Table at the southern end of the Jarbidge River study area.

The climate is semiarid. Precipitation ranges from 10 to 20 in. (inch) per year of which more than half occurs as winter snowfall. Flora consist predominantly of sagebrush and various grasses; juniper trees sparsely populate the river canyons.

Previous Studies

Russell (1902) conducted the first reconnaissance study of the geology and water resources of the Snake River Plain. Malde and Powers (1962) described the upper Cenozoic stratigraphy, and Malde and others (1963) published a reconnaissance geologic map of the west-central Snake River Plain north of latitude 42°20' N. A geology and water resource study of the Bruneau River basin is reported in Piper (1924), and the ground-water geology of the Bruneau-Grand View area, which includes the northern tip of the Bruneau River study area, is described in Littleton and Crosthwaite (1957). Rember and Bennett (1979) compiled a geologic map of the Twin Falls 2° Quadrangle. Detailed geologic and stratigraphic studies pertinent to lands in and adjacent to the study areas are in Bonnichsen (1982a, 1982b, 1982c), Bonnichsen and Citron (1982), and McIntyre and others (1982).

Studies of the mineral resources of the Bruneau River and Jarbidge River areas are included in Zilka (1973) and Mathews and Blackburn (1983a, 1983b). Strowd and others (1981) inventoried the mines and prospects of the Twin Falls 2° Quadrangle.

Present Study

Work by the USBM entailed prefield, field, and report preparation phases during the years 1985 and 1986. Prefield studies included library research and perusal of Owyhee County and BLM mining and mineral lease records. Bureau of Mines and other production records were searched, and claim owners were contacted for permission to examine properties and publish the results.

Field studies involved searches for all mines, prospects, and claims indicated by prefield studies to be within the study areas. Those found were mapped and sampled. Claims outside, but near the study areas, were studied to determine whether mineralized zones might extend into the areas. Both ground and aerial reconnaissance were used to identify significant geologic structures and zones of alteration related to mineral deposits.

Forty-three hard-rock samples were collected by USBM personnel at mines and prospects within and adjacent to the study areas, including eight limestone samples and two of suspected zeolite. Sixty-four samples of sand and gravel were also taken to determine placer gold concentrations (Figs. 2-4).

Rock samples were of four types: 1) chip--a regular series of rock chips taken in a continuous line across a mineralized zone or other exposure; 2) random chip--a series of chips taken unsystematically from an exposure of apparently homogeneous rock; 3) grab--rock pieces taken unsystematically from a dump, stockpile, or of float (loose rock lying on the ground); and 4) select--pieces of rock chosen, generally, from the apparently best mineralized parts of a pile or exposure, or any particular fraction. Placer samples were of three types:

1) reconnaissance pan--one, level 14-in.-diameter pan containing approximately 0.004 yd³ (cubic yard) of alluvium concentrated to check for the presence of gold and other heavy minerals; 2) channel--a continuous sample of measured cross-section cut perpendicular to bedding and then concentrated; and 3) suction dredge--samples taken by use of a portable, gasoline-powered, 4-in.-diameter suction dredge and washed through a sluice box to concentrate heavy minerals.

Except for the limestone samples, the hard-rock samples were crushed, pulverized, split, mixed, and fire-assayed for gold and silver. Quantitative values of observed or suspected metals were determined by inductively coupled plasma analysis, atomic absorption, radiometric, or colorimetric methods. Various samples were also analyzed by semi-quantitative spectrography for 40 2/ elements. Limestone samples were chemically analyzed for major oxides 3/, and zeolite samples were analyzed by x-ray diffraction. Placer samples, partially concentrated in the field, were further concentrated on a laboratory-sized Wilfley table. Resulting heavy-mineral fractions were scanned with a binocular microscope to determine content. When gold was detected, larger particles were hand picked; fine gold was recovered by amalgamation, and then both fractions were weighed. Concentrates were also checked for radioactivity and fluorescence.

Detailed sample data is available from Western Field Operations Center, E. 360 Third Ave., Spokane, WA 99202.

2/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.

3/ Lime (CaO), magnesia (MgO), ferric oxide (Fe₂O₃), alumina (Al₂O₃), silica (SiO₂), sodium oxide (Na₂O), potassium oxide (K₂O), sulfite (SO₃), titania (TiO₂), and phosphorus pentoxide (P₂O₅).

ACKNOWLEDGEMENTS

Personnel at the BLM Boise District office provided logistical support and information pertinent to the study areas.

GEOLOGIC SETTING

The Bruneau-Jarbridge River study areas lie in the Owyhee Upland subprovince of the Columbia Intermountain physiographic province (Thornbury, 1965). It is a region of complex, bimodal, basalt-rhyolite volcanism. Rhyolite lava flows, welded ash-flow tuffs, and rare basalt lava flows of the Idavada Volcanics are the oldest rocks exposed. These Miocene- to Early Pliocene-age volcanic rocks, containing at least 20 separate flow units (Bonnichsen, 1982b, table 1, p. 247), were erupted from a source area now named the Bruneau-Jarbridge eruptive center. The center is 60 mi long from southeast to northwest and covers the study areas from Murphy Hot Springs on the south (fig. 4) to latitude 42°40' N. near the northern end of the Bruneau River study area. Flows from the eruptive center are exposed on the west, but more than half are covered by flows of Banbury Basalt, especially on the east. At some localities, the Banbury Basalt includes up to several hundred feet of lake and stream deposits which are usually capped by basalt flows. Exposed near the northern end of the Bruneau River study area, in addition to units of Banbury Basalt, is a sequence of Pliocene- to Pleistocene-age, interbedded sedimentary and volcanic units of the Chalk Hills, Glenns Ferry, Tuana Gravel, and Bruneau Formations (Malde and Powers, 1962; Malde and others, 1963; Rember and Bennett, 1979).

Beds of the layered volcanic and sedimentary units generally dip 10° to 80° northward (Littleton and Crosthwaite, 1957, p. 168). Many northwest-trending normal faults, with northeast downthrows, crosscut the study areas (Malde and others, 1963). Most hot springs, including Indian Hot Springs (Rember and Bennett, 1979), and those near Hot Spring (Littleton and Crosthwaite, 1957), are associated with the northwest-trending fault set.

Gem-quality, hot-spring-deposited jasper is associated with altered rocks of the Bruneau Jasper rhyolite (Bonnichsen, 1982b, table 1; 1982c, p. 290), a flow unit of the Idavada Volcanics. Also of economic significance near the Bruneau River study area is the Hot Creek Falls limestone, expressed as a 20-ft-thick, cliff-forming unit at the base of the Glenns Ferry Formation. Placer gold is contained in Quaternary alluvium deposited by the Bruneau River system, especially the Jarbridge River.

MINING HISTORY

Several groups of mining claims have been located since 1955 for gem-quality jasper near Indian Hot Springs, mostly in the corridor between the Bruneau River and Jarbridge River study areas (fig. 3). As much as several thousand pounds is mined each year on an intermittent basis and is marketed worldwide. Eight claims were held in 1986.

A succession of claim groups have been located for agate and for limestone in the vicinity of Hot Creek, near but outside the northern part of the Bruneau River study area. Approximately 100 tons of limestone were produced in the 1950's (Powers, 1956, p. 2). No claims were held in 1986.

The nearest significant lode mining occurred in the Jarbidge mining district of northern Nevada about 10 mi south of the Jarbidge River study area. The district produced mainly gold from epithermal deposits in rhyolitic rocks. East and West Forks of the Jarbidge River drain the northern portions of the district and are probably sources of much of the study area's placer gold. Thirty placer claims were located for gold along the Jarbidge River from 1893 to 1981; a few were also located near Hot Creek in 1972. No placer-gold claims were known to be held in 1986 in the study area.

No lands in or near the study areas were under geothermal lease as of March 1986. Twenty-three placer mining claims for oil and gas were located in 1901 south of Bruneau, 2 to 5 mi north of the study areas. BLM Master Title Plats in 1985 showed 53 mi² (square mile) of oil and gas leases in a large block including the northern half of the Bruneau River study area; significant portions of Tps. 7-9 S., R. 6 E. and Tps. 8-9 S., R. 7 E. are included. Eight square miles of leases are scattered in T. 10 S., R. 6 E. An additional 38 mi² of leases are in two blocks near the southern end of the Bruneau River study area, including portions of Tps. 13-15 S., R. 6 E. Breckenridge (1982) reported that three dry exploration holes, ranging in depth from 2,068 ft to 3,808 ft, were drilled approximately 15 to 20 mi north-northwest of the Bruneau River study area.

MINES, PROSPECTS, AND MINERALIZED AREAS

Gemstone

Bruneau Canyon Jasper Mine

Forty-two mining claims for gem-quality jasper have been located in Bruneau Canyon near Indian Hot Springs (fig. 5) about 1 mi below the confluence of the Jarbidge River and the West Fork Bruneau River. The first claims, the Constitution Nos. 1-3, were located in 1955. Current claims are the Bruneau Canyon Nos. 1-5, Bruneau No. 7, and the Canyon No. 1 claims located by Lowell Fields, Gene Anthis, Clifford Hancock, and Gerald Scarrow from 1958 to 1980, and the White Rind claim located by Marvin Meyer in 1963. Workings consist of 5 large trenches or bulldozer cuts and at least 58 pits on terraces along both sides of the river. The mine workings are about 60 mi south of Bruneau, by way of paved, graveled, and jeep roads, and lie within and along the southern border of the Bruneau River study area.

Several types of common jasper are found in volcanic rocks north of Indian Hot Springs; however, this locality is recognized as the sole source for a unique variety known among gem collectors and dealers as "Bruneau Jasper" (Johnson, Cy, 1966, p. 64; Johnson, R. N., 1969, p. 29; Beckwith, 1972, p. 38; and Walton, 1978). The jasper occurs in veins and vugs typically as much as several inches in diameter (some cavity fillings are 2 ft in diameter) in a red and black vitrophyre named the Bruneau Jasper rhyolite (Bonnichsen, 1982c, p. 308), a flow unit of the Idavada Volcanics. Jasper is concentrated in zones of intensely hydrothermally altered vitrophyre; the alteration is probably associated with the Indian Hot Springs system. The "Bruneau Jasper" variety generally consists of tan jasper with a distinct pattern of concentric or stacked semi-circles and egg shapes likened to stylized clouds. Red, brown, tan, and green varieties of rather featureless jasper are common. Minor occurrences of chalcedony, white opal, fire opal, and calcite crystals are also associated with the zones of alteration. Sampling of the area (fig. 5) was conducted to determine if epithermal gold was deposited by Miocene-Pliocene hydrothermal activity (see Lode Deposits).

Mining of "Bruneau Jasper" consists of drilling and blasting followed by repeated cycles of hand sorting and bulldozing in search of the marketable variety. Massive, unfractured specimens with the distinct "Bruneau Jasper" pattern are suitable for use as jewelry, such as belt buckle mounts and pendants, and as decorative pieces. Market and wholesale price information was gathered from gem and rock dealers in Mountain Home and Boise, ID, and Spokane, WA. "Bruneau Jasper" is well known to dealers and is in moderate demand. Wholesale prices for good quality material range from \$8 to \$20/lb (dollar per pound); \$15/lb is typical. Common jasper from the deposit wholesales for \$1 to \$5/lb. The U.S. Bureau of Land Management (1984c, p. 3-25) estimated annual production at between 5,000 lbs and 12,000 lbs and notes that the material is sold worldwide at prices ranging from \$2 to \$800/lb.

According to some dealers, "Bruneau Jasper" has not been mined regularly for a couple of years; however, demand, resulting in intermittent mining, is expected to continue. Due to the irregular nature of the deposits, the size of the resource cannot be determined without drilling. No other deposits of this variety of jasper were found by the authors in the study areas; however, Bonnichsen (1982c, p. 308) notes that "similar deposits are common in the upper and marginal parts of other rhyolite flows, but the jasper at most other localities is too fractured to be easily worked."

Royal Purple Agate Claims

TF18

Sixty mining claims for agate have been located along and south of Hot Creek in secs. 3, 4, 9, and 10, T. 8 S., R. 6 E. (fig. 6). Clifford Higby located the first claim, the Agatine mine, in 1952. Still current are the Royal Purple 1-3 claims located by David Phelps in 1979 in secs. 9 and 10. Several small pits have been dug in mud-flow breccias and tuffaceous sediments associated with basaltic rocks south of Indian Bathtub. The site is about 12 mi south of Bruneau and lies partially within the northwestern part of the Bruneau River study area.

Beckwith (1972, p. 38) describes the desired material as partially opalized "amethystine agate" and notes that the source was possibly hot springs. Several small pockets and vug-fillings of a purple to brown, slightly translucent agate were observed by the authors. Small fracture-fillings of white opal were also noted. White, black, and brown inclusions are common in the agate, reducing its gem desirability (Beckwith, 1972, p. 38). The occurrences found were widely scattered and of such small size that large-scale commercial interest is not likely; however, sporadic recreational prospecting and mining is expected to continue.

Petrified Wood

Partially petrified wood, along with the remains of fish and mammal bones, are found at two localities west of the Bruneau River study area. The sites are located in secs. 5 and 8 and in sec. 15, T. 8 S., R. 6 E. in a several-foot-thick siliceous sand and gravel horizon stratigraphically above the Hot Creek Falls limestone. R. N. Johnson (1969, p. 29) notes a similar locality, apparently in the same horizon, approximately 6 mi to the west along State Highway 51. The petrified wood is incompletely silicified and only marginally suitable for cut sections. All of the observed localities have been picked over; the number of fossils appears to be insufficient and their condition too poor to support commercial development.

Recreational use of these sites is expected to continue. No petrified wood localities were found in the study areas.

Hot Creek Falls Limestone

TF17

Since about 1910, more than 80 claims have been located for limestone in the vicinity of Hot Creek Falls (fig. 6). Several bulldozed cuts and roads are located north of Hot Creek in sec. 4, T. 8 S., R. 6 E. Some limestone has apparently been quarried; Powers (1956, p. 2) estimated production of about 100 tons.

The limestone occurs as remnants of a tabular, flat-lying deposit of probable lacustrine (lake) origin. It is a light gray to tan, very porous, algal-precipitated limestone with abundant gastropods and algal forms (Littleton and Crosthwaite, 1957, p. 163-164; Savage, 1969, p. 32-33). The deposit overlies tuff and pyroclastic rocks and is mapped at

the base of the Glenns Ferry Formation (Malde and Powers, 1962). Estimates of thickness range from 18 ft (Zilka, 1973, p. 17) to 25 ft (Powers, 1956, p. 1). Thicknesses range from 12 ft to 18 ft at six localities measured by the present authors. Littleton and Crosthwaite (1957, plate 6) showed that the deposit is of limited areal extent. Although once covering 8 to 12 mi², the limestone has been eroded by the Bruneau River and local tributaries; remnants lie to the north, east, and west of the northern end of the Bruneau River study area. Alteration and traces of chalcedony indicate some localized hot-spring activity.

Eight samples were taken from six localities at the deposit. Sample sites are shown on figure 6, and the analyses are listed in table 1. Contained CaO ranged from 48.0 to 52.9 percent and averaged 50.5 percent; equivalent CaCO₃ (calcium carbonate) is calculated to average 90 percent. The samples also contain an average of 0.42 percent MgO, 0.46 percent Fe₂O₃, 1.1 percent Al₂O₃, 5.4 percent SiO₂, and 40.82 percent LOI (loss on ignition; see footnote in table 1). The unusually high LOI is due to the high porosity of the rock.

Estimates of the limestone resource range from 22 million tons (Zilka, 1973, p. 17) to more than 25 million tons (Savage, 1969, p. 33). Remnants of the deposit include three large and seven small blocks (fig. 6) within 1.5 mi of the study area; the total area covered is about 2.3 mi². Based on an average thickness of 20 ft, the deposit is inferred to contain a total of 50 million tons of limestone in the various blocks. A tonnage factor of 24 ft³/ton (cubic feet per ton) is used because the limestone is estimated to contained 50 percent voids. Approximately 100 ft of overburden covers two large blocks to the east and south. The remaining 0.8 mi² of the deposit, which is without substantial overburden, is inferred to contain a resource of 20 million tons of limestone (crosshatched on fig. 6). These blocks are easily accessible from the Blackstone-Grasmere Road and are amenable to direct open-pit mining; however, they are relatively remote, being about 30 mi from Mountain Home, the nearest railroad.

Samples show the limestone is suitable for use in the manufacture of cement and as an agriculture additive (Bowen and Gray, 1973, table 7). Lumijarvi and Peterson (1959) considered use of the deposit as a source of chicken grit food supplement.

It is not within the scope of this report to conduct an economic analysis of the limestone deposit because it lies outside of the study areas. However, the deposit may become economic if the regional demand for limestone increases or if a local market is developed; the surface disturbance caused by mining would visually impact the study areas.

TABLE 1.--Chemical analyses of chip samples from the Hot Creek Falls limestone deposit

| No. | Sample | | CaO % | CaCO ₃ % | MgO % | Fe ₂ O ₃ % | Al ₂ O ₃ % | SiO ₂ % | Na ₂ O % | K ₂ O % | TiO ₂ % | P ₂ O ₅ % | SO ₃ (%) | LOI 1/ (%) |
|-----|----------------|--|----------|------------------------|----------|-------------------------------------|-------------------------------------|-----------------------|------------------------|-----------------------|-----------------------|------------------------------------|------------------------|---------------|
| | Length (ft) | Description | | | | | | | | | | | | |
| 7 | 18 | Tan limestone ranges from resistant to friable----- | 51.2 | 91.4 | 0.47 | 0.37 | 0.88 | 4.8 | 0.47 | 0.13 | 0.043 | 0.27 | 0.59 | 41.22 |
| 8 | 15 | do----- | 49.5 | 88.4 | .47 | .46 | 1.2 | 7.0 | .53 | .13 | .053 | .57 | .35 | 39.79 |
| 9 | 6.0 | Porous to massive, white to tan, fossiliferous limestone; sampled upwards from base--- | 52.4 | 93.5 | .41 | .45 | 1.00 | 5.7 | .10 | .13 | .053 | .60 | .25 | 40.68 |
| 10 | 9.0 | Same as no. 9; punky limestone with abundant gastropods, barely cemented. Sampled from 6.0 ft above base to top of unit----- | 52.9 | 94.4 | .37 | .40 | .94 | 4.5 | .084 | .045 | .041 | .28 | .21 | 41.68 |
| 11 | 17 | Porous to massive, light tan limestone with abundant algal forms and small amounts of gastropods----- | 51.8 | 92.5 | .40 | .42 | 1.1 | 5.5 | .14 | .16 | .051 | .23 | .15 | 40.72 |
| 12 | 4.0 | Lower 4 ft of porous, friable limestone with abundant gastropods----- | 49.9 | 89.1 | .41 | .53 | 1.2 | 5.3 | .48 | .11 | .063 | .27 | .77 | 40.58 |
| 13 | 8.0 | Same as no. 12; upper portion of porous but hard algal limestone----- | 48.2 | 86.0 | .39 | .49 | 1.1 | 4.8 | .36 | .10 | .058 | .14 | .21 | 41.21 |
| 14 | 13 | Porous, tan limestone; gastropods in lower half and algal forms in upper half----- | 48.0 | 85.7 | .42 | .53 | 1.2 | 5.2 | .37 | .099 | .057 | .43 | .25 | 40.68 |

1/ LOI: Loss on ignition; the loss in weight which results from heating a sample to 1000 °C. Loss consists of organic materials and residual water.

Metallic Deposits

Jarbridge River Placer Gold Deposits

Approximately 30 placer mining claims have been located along portions of the Jarbridge River from the confluence of East and West Forks to the mouth at Bruneau River (fig. 4). The earliest placer claim locations were made in 1893; subsequent claim groups in 1936, 1959, 1970, and 1981 cover most of the 25 mi section of the Jarbridge River which lies within the study area. No production of gold has been recorded, no workings are in evidence, and no claims are currently held.

Placer deposits on the river are probably all of recent origin; no elevated gravel bars or terraces from earlier periods of deposition were observed. Most gravel has accumulated as accretion bars on the inside of some river meanders. Gravel bars range from a few feet to several hundred feet long, are as much as 50 ft wide, and as much as several feet thick. Zilka (1973, p. 18) noted that the bars are typically about 400 yd³ (cubic yard) in size and described them as follows:

The gravel is moderately sorted and ranges in size from fine sand to boulders up to 4 ft in diameter. It is composed of rhyolite, rhyolite porphyry, basalt, and minor quartzite and granite. The rhyolitic component decreases in the downstream deposits, while the basaltic component increases.

Gold concentrations probably occur in point or skim bars (on the top of accretion bars) and in cracks in bedrock. Four suction dredge and all but one out of 14 pan samples taken from the main course of the Jarbridge River (fig. 4; appendix, nos. 88-101, 104-107) contained gold. Values ^{4/} of recovered gold ranged from less than \$0.01/yd³ (dollar per cubic yard) to \$15.00/yd³ and averaged \$1.40/yd³. Excluding the highest value pan sample (\$15.00/yd³), the values averaged \$0.57/yd³. No gold was observed in the two samples from Columbet Creek.

Other Placer Gold Deposits

Other portions of the river system which lie within the study areas include 41 mi of the main course of the Bruneau River, 25 mi of Sheep Creek, and about 9 mi of Clover Creek in East Fork Bruneau Canyon. Placer deposits are similar in type to those deposited by the Jarbridge River; however, the basaltic component of the alluvium dominates to the north, away from the sources of rhyolitic rocks. The quartzitic component remains relatively constant; the source of this rock may be from the reworking of ancient siliceous gravels.

^{4/} Calculations are based on an assumed gold price of \$425/oz (dollars per ounce); placer gold is assumed to be 1,000 fine (pure).

Thirty-eight reconnaissance pan and five suction dredge samples were taken from the Bruneau River and tributaries (figs. 2, 3, and 4; appendix, nos. 1, 2, 15-87). Four of the suction dredge samples contained less than \$0.01/yd³ in gold; no gold was detected in the fifth. Twenty of the pan samples contained gold which ranged in value from \$0.01/yd³ to \$4.10/yd³. Excluding the three highest value samples (\$0.85-\$4.10/yd³), the remaining samples ranged from \$0.01/yd³ to \$0.31/yd³ and averaged \$0.07/yd³. A channel sample (fig. 2, no. 3) through siliceous sand and gravel exposed by a bulldozer trench above the Hot Creek Falls limestone contained less than \$0.01/yd³.

In 1972 Carl Adfield and others located the Terry Linn group of mining claims for placer gold in secs. 9 and 10, T. 8 S., R. 6 E. The claims are along Hot Creek west of the Bruneau River study area. The claimants reported high gold values from a ". . . poorly consolidated, tuffaceous, pebbly sandstone which is bounded by basalt flows," according to Zilka (1973, p. 22). Twenty-one bulk samples taken by Zilka (1973, p. 22) contained an average of \$0.05/yd³ (at a gold price of \$425/oz). The claims are no longer actively held, and there are no workings.

Lode Deposits

No lode deposits are known in the Bruneau-Jarbridge River study areas. However, certain localities exhibit geologic characteristics--such as thermal spring activity, felsic volcanic and volcanoclastic sedimentary rocks, high-angle faulting, and proximity to a complex volcanic center--listed by Silberman (1982, p. 133) as associated with hot-spring type (epithermal) gold deposits. Because of the presence of these characteristics and the pervasive silicification and intense alteration of country rock exposed in workings at the Bruneau Canyon jasper mine at Indian Hot Springs and the Royal Purple agate claims at Hot Creek, 35 samples were taken from mineralized zones (figs. 5 and 6). For the rock types sampled, no metallic values significantly above normal crustal abundance were detected.

Two of the samples taken near Indian Hot Springs (fig. 5, nos. 68 and 82) were of green, friable tuff suspected to be zeolitized. Sample no. 68 was analyzed by x-ray diffraction and determined to contain 48 percent clinoptilolite. Clinoptilolite is a common zeolite associated with hydrothermal alteration due to hot-spring activity. The occurrences are too small to comprise a resource.

A small mercury occurrence is located about 14 mi southwest of Indian Hot Springs and about 8 mi from the Jarbridge River study area. Claims were first located in 1940; the occurrence was relocated as the Imperial Mercury claim group in 1960. Zilka (1973, p. 23) examined the deposit and reported that "The best sample taken from the workings contained 0.06 pounds of mercury per ton." He determined that ". . . not more than 100 tons of low-grade, mercury-bearing rock" was present. No mercury occurrences were observed in the study areas by the authors of the present report.

Geothermal Resources

The western Snake River Plain exhibits higher than normal heat flow and is reported to have 32 low-temperature geothermal systems (Mariner and others, 1983, p. 36). Three known geothermal systems occur near or within the boundaries of the study areas; the Bruneau-Grandview system at the northern end of the Bruneau River study area, Indian Hot Springs along the border between the study areas, and Murphy Hot Springs south of the Jarbidge River study area. Currently, geothermal well water is being utilized by Geo-Tech Systems, Inc., to operate a prototype commercial prawn hatchery on private lands west of Hot Spring, about 2 mi north of the Bruneau River study area (fig. 2) (Journal of Business, 1986, p. 1, 18).

The Bruneau-Grandview system contains several wells and hot springs including Indian Bathtub on Hot Creek (fig. 6). Reported surface temperatures range from 99 to 124 °F (degree Fahrenheit) (Mabey, 1983, p. 11; Zilka, 1973, p. 26), flow rates range from 120 to 1,800 gpm (gallon per minute), and estimates of reservoir volume range from 45 to 437 mi³ (cubic mile) (Waring, 1965, p. 30; Zilka, 1973, p. 11, table 2; Breckenridge and others, 1980; Young and Lewis, 1982, p. 5; Mariner and others, 1983, p. 45; and Mabey, 1983, p. 11). Indian Hot Springs produces approximately 1,900 gpm with a surface temperature of 161 °F, and Murphy Hot Springs produces about 80 gpm with a surface temperature of 122 to 131 °F (Young and Lewis, 1982, p. 5). Murphy Hot Springs is estimated to contain a geothermal reservoir of 0.8 mi³ at a mean temperature of 217 °F (Mabey, 1983, p. 11).

With the exception of the aquaculture enterprise, hot springs in the area are used primarily for recreation; a small commercial resort is situated at Murphy Hot Springs. The geothermal systems discussed are in the low- to moderate-temperature range and are best suited for direct-use applications, such as space heating, agriculture, and recreation.

APPRAISAL OF MINERAL RESOURCES

Deposits of gem-quality jasper occur north of Indian Hot Springs, within and near the southern end of the Bruneau River study area. The jasper is sporadically mined. Mining by blasting, bulldozer, and hand-sorting methods is expected to continue.

Recreational prospecting for agate and petrified wood is also expected to continue near the northern end of the Bruneau River study area. In the same area, near Hot Creek, is an inferred subeconomic limestone resource of approximately 20 million tons, which is outside the study area. The limestone averages 50.5 percent CaO and is low in impurities. It could become economic if demand for limestone increases or if a new market is developed locally.

Placer gold occurs throughout most of the river system in the Bruneau-Jarbridge study areas; the highest values are concentrated along the Jarbridge River. The lowest cost domestic placer gold mine known to have operated in recent times (to 1984) had a total unit production cost of \$3.95/yd³ at a production rate of about 100,000 yd³ per year (Schumacher, 1985). This is about seven times the estimated average value of the Jarbridge River deposits. Gold values are too low and the deposits are too small and difficult to access to support large-scale mining at the current price of gold (\$425/oz). The deposits could, however, attract recreational panning, sluicing, and suction dredging.

Occurrences of clinoptilolite in hydrothermally altered tuff at Indian Hot Springs are of low grade and are too small to comprise a zeolite resource.

Geothermal systems which lie near the study areas are currently used for recreation and aquaculture. The low- to moderate-temperature systems are suitable for direct-use applications but not for power generation. Portions of the study areas are included in three parcels classified by the U.S. Bureau of Land Management (1984a) as "valuable prospectively for geothermal resources." According to Robert Detar of the BLM, Boise, ID, (oral commun., 1986), two of the land parcels at Bruneau and Castle Creek (Grandview), formerly classified by the BLM as KGRAs (known geothermal resource areas), are currently being declassified.

The U.S. Bureau of Land Management (1984b) has classified lands encompassed by the Bruneau-Jarbridge River study areas as "prospectively valuable for oil and gas"; however, no favorable "geologic structures" are identified in or near the study areas.

REFERENCES

- Beckwith, J. A., 1972, Gem minerals of Idaho: Caldwell, ID, Caxton Printers, Ltd., 123 p.
- Bonnichsen, Bill, 1982a, Chemical composition of the Cougar Point Tuff and rhyolite lava flows from the Bruneau-Jarbridge eruptive center, Owyhee County, Idaho: Idaho Bureau of Mines and Geology, Open-file Report 82-1, 22 p.
- _____, 1982b, The Bruneau-Jarbridge eruptive center, southwestern Idaho, in Bonnichsen, Bill, and Breckenridge, R. M., eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 237-254.
- _____, 1982c, Rhyolite lava flows in the Bruneau-Jarbridge eruptive center, southwestern Idaho, in Bonnichsen, Bill, and Breckenridge, R. M., eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 283-320.
- Bonnichsen, Bill, and Citron, G. P., 1982, The Cougar Point Tuff, southwestern Idaho and vicinity, in Bonnichsen, Bill, and Breckenridge, R. M., eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 255-281.
- Bowen, O. E., and Gray, C. H., Jr., 1973, Marketing and utilization of carbonate rocks in California, in Bowen, O. E., ed., Limestone and dolomite resources of California: California Division of Mines and Geology Bulletin 194, p. 35-44.
- Breckenridge, R. M., 1982, Oil and gas exploration in Idaho: Idaho Bureau of Mines and Geology Map 4, scale 1:1,000,000.
- Breckenridge, R. M., Bennett, E. H., and Harbour, J. L., 1980, Energy resources of Idaho: Idaho Bureau of Mines and Geology Map 3, scale 1:1,000,000.
- Johnson, Cy, 1966, Western gem hunters atlas: Susanville, CA, Cy Johnson Books - Rockcraft, 95 p.
- Johnson, R. N., 1969, N.W. gem fields and ghost town atlas: Susanville, CA, Cy Johnson Rock Book Distributor, 47 p.
- Journal of Business, 1986, A portfolio of desert prawns: Spokane, WA, v. 1, no. 2, p. 1, 18.
- Littleton, R. T., and Crosthwaite, E. G., 1957, Ground-water geology of the Bruneau-Grand View area, Owyhee County, Idaho: U.S. Geological Survey Water-Supply Paper 1460-D, p. 147-198.
- Lumijarvi, D. H., and Peterson, C. F., 1959, The availability of an Owyhee County limestone deposit as a source of calcium for poultry: Idaho Agricultural Experiment Station Report, 8 p.

- Mabey, D. R., 1983, Geothermal resources of Idaho: U.S. Geological Survey Circular 866, 24 p.
- Malde, H. E., and Powers H. A., 1962, Upper Cenozoic stratigraphy of western Snake River Plain, Idaho: Geological Society of America Bulletin, v. 73, no. 10, p. 1197-1220.
- Malde, H. E., Powers, H. A., and Marshall, C. H., 1963, Reconnaissance geologic map of west-central Snake River Plain, Idaho: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-373, scale 1:125,000.
- Mariner, R. H., Brook, C. A., Reed, M. J., Bliss, J. D., Rapport, A. L., and Lieb, R. J., 1983, Low-temperature geothermal resources in the western United States, in Reed, M. J., ed., Assessment of low-temperature geothermal resources of the United States - 1982: U.S. Geological Survey Circular 892, p. 31-50.
- Mathews, G. W., and Blackburn, W. H., 1983a, Assessment of geology, energy, and minerals (GEM) resources, South Bruneau River GRA (ID-010-07), Owyhee County, Idaho: prepared by TERRADATA, Lakewood, CO, BLM contract YA-553-CT2-1042 in five parts.
- _____, 1983b, Assessment of geology, energy, and minerals (GEM) resources, North Bruneau River GRA (ID-010-08), Owyhee County, Idaho: prepared by TERRADATA, Lakewood, CO, BLM contract YA-553-CT2-1042 in five parts.
- McIntyre, D. H., Bennett, E. H., and Marvin, R. F., 1982, Cenozoic stratigraphy of western Owyhee County, Idaho, in Bonnichsen, Bill, and Breckenridge, R. M., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 215-235.
- Piper, A. M., 1924, Geology and water resources of the Bruneau River Basin, Owyhee County, Idaho: Idaho Bureau of Mines and Geology Pamphlet 11, 56 p.
- Powers, H. A., 1956, Hot Creek Falls limestone deposit: Idaho Bureau of Mines and Geology Summary Report of Examination No. 11, on file at Idaho Bureau of Mines and Geology, Moscow, ID, 3 p.
- Rember, W. C., and Bennett, E. H., 1979, Geologic map of the Twin Falls Quadrangle, Idaho: Idaho Bureau of Mines and Geology Geologic Map Series, Twin Falls 2⁰ Quadrangle, scale 1:250,000.
- Russell, I. C., 1902, Geology and water resources of the Snake River Plains of Idaho: U.S. Geological Survey Bulletin 199, 192 p.
- Savage, C. N., 1969, Distribution and economic potential of Idaho carbonate rocks: Idaho Bureau of Mines and Geology Bulletin 23, 93 p., 9 plates.

- Schumacher, O. L., 1985, Placer gold - production and cost history of a Alaska placer gold mine, in Schumacher, O. L., ed., Mine Costing Service: Spokane, WA, Western Mining Engineering, p. B1-B5.
- Silberman, M. L., 1982, Hot-spring type, large tonnage, low-grade gold deposits, in Ericksen, R. L., comp., Characteristics of mineral deposit occurrences: U.S. Geological Survey Open-File Report 82-795, p. 131-143.
- Strowd, W. B., Mitchell, V. E., Hustedde, G. S., and Bennett, E. H., 1981, Mines and prospects of the Twin Falls Quadrangle, Idaho: Idaho Bureau of Mines and Geology Mines and Prospects Map Series, scale 1:250,000, 5 p.
- Thornbury, W. D., 1965, Regional geomorphology of the United States: New York, John Wiley and Sons, Inc., 609 p.
- U.S. Bureau of Land Management, 1984a, Lands classified as prospectively valuable for geothermal resources - Idaho: Idaho State Office, Division of Mineral Resources, Branch of Solid and Fluid Minerals, August 10, 1984, scale 1:500,000.
- _____, 1984b, Lands classified as prospectively valuable for oil and gas in southwestern Idaho: Idaho State Office, Division of Mineral Resources, Branch of Solid and Fluid Minerals, August 10, 1984, scale 1:500,000.
- _____, 1984c, Draft Jarbidge Resource Management Plan and Environmental Impact Statement: on file with the Boise District Office, Boise, ID, five parts.
- Walton, Muriel, 1978, Bruneau Jasper - a rare gemstone: Gems and Minerals Magazine, November, 1978, p. 72-74.
- Waring, G. A., (revised by Blankenship R. R., and Bentall, Ray), 1965, Thermal springs of the United States and other countries of the world - a summary: U.S Geological Survey Professional Paper 492, 383 p.
- Young, H. W., and Lewis, R. E., 1982, Hydrology and geochemistry of thermal ground water in southwestern Idaho and north-central Nevada: U.S Geological Survey Professional Paper 1044-J, 20 p.
- Zilka, N. T., 1973, Mineral resources of the Bruneau River drainage, Idaho: unpublished report by the U.S. Bureau of Mines prepared for consideration of the drainage in the Wild and Scenic Rivers System, on file at Western Field Operations Center, Spokane, WA, 31 p.

APPENDIX.--Placer samples from the Bruneau River and Jarbidge River study areas and vicinity
(e, estimated; N, no gold detected; --, not applicable; <, less than)

| Sample no. (figs. 2, 3, 4) | Sample type | Sample volume (yd ³) | Running time 1/ (min) | Gold recovered (mg) | Grade 2/ (oz/yd ³) | Value 3/ (\$/yd ³) |
|--|---------------------------------------|--|-----------------------------|---------------------------|-----------------------------------|-----------------------------------|
| Placer samples from the Bruneau River study area | | | | | | |
| 1 | Suction dredge (4 in.)----- | 1.0e | 80 | 0.246 | <0.00001e | <0.01 |
| 2 | do----- | .75e | 90 | .410 | .00002e | <.01 |
| 3 | Channel (6 in. x 6 in. x 48 in.)----- | .037 | -- | .004 | <.00001 | <.01 |
| 15 | Reconnaissance pan (14 in.)----- | .0040 | -- | N | -- | -- |
| 16 | do----- | .0040 | -- | N | -- | -- |
| 17 | do----- | .0040 | -- | .019 | .00015 | .06 |
| 18 | do----- | .0040 | -- | N | -- | -- |
| 19 | do----- | .0040 | -- | .026 | .00021 | .09 |
| 20 | do----- | .0040 | -- | N | -- | -- |
| 21 | do----- | .0040 | -- | .011 | .00009 | .04 |
| 22 | do----- | .0040 | -- | N | -- | -- |
| 23 | do----- | .0040 | -- | .012 | .00010 | .04 |
| 24 | do----- | .0040 | -- | .018 | .00014 | .06 |
| 25 | do----- | .0040 | -- | N | -- | -- |

APPENDIX.--Placer samples from the Bruneau River and Jarbidge River study areas and vicinity--Continued

| Sample no. (figs. 2, 3, 4) | Sample type | Sample volume (yd ³) | Running time 1/ (min) | Gold recovered (mg) | Grade 2/ (oz/yd ³) | Value 3/ (\$/yd ³) |
|-------------------------------------|----------------------------------|--|-----------------------------|---------------------------|-----------------------------------|-----------------------------------|
| 26 | Reconnaissance pan (14 in.)----- | 0.0040 | -- | 0.013 | 0.00010 | 0.04 |
| 27 | do----- | .0040 | -- | N | -- | -- |
| 28 | do----- | .0040 | -- | N | -- | -- |
| 29 | do----- | .0040 | -- | .015 | .00012 | .05 |
| 30 | do----- | .0040 | -- | N | -- | -- |
| 31 | do----- | .0040 | -- | N | -- | -- |
| 32 | do----- | .0040 | -- | N | -- | -- |
| 33 | do----- | .0040 | -- | .004 | .00003 | .01 |
| 34 | do----- | .0040 | -- | .255 | .0020 | .85 |
| 35 | do----- | .0040 | -- | N | -- | -- |
| 36 | do----- | .0040 | -- | N | -- | -- |
| 37 | do----- | .0040 | -- | .013 | .00010 | .04 |
| 38 | do----- | .0040 | -- | .013 | .00010 | .04 |
| 39 | do----- | .0040 | -- | N | -- | -- |
| 40 | do----- | .0040 | -- | .012 | .00010 | .04 |

APPENDIX.--Placer samples from the Bruneau River and Jarbidge River study areas and vicinity--Continued

| Sample no. (figs. 2, 3, 4) | Sample type | Sample volume (yd ³) | Running time 1/ (min) | Gold recovered (mg) | Grade <u>2</u> / (oz/yd ³) | Value <u>3</u> / (\$/yd ³) |
|--|----------------------------------|--|-----------------------------|---------------------------|---|---|
| 41 | Reconnaissance pan (14-in.)----- | 0.0040 | -- | N | -- | -- |
| 42 | do----- | .0040 | -- | 0.052 | 0.00042 | 0.18 |
| 43 | do----- | .0040 | -- | .029 | .00023 | .10 |
| 44 | do----- | .0040 | -- | N | -- | -- |
| 45 | Suction dredge----- | 1.5e | 100 | .676 | .00001 | <.01 |
| 46 | Reconnaissance pan----- | .0040 | -- | .006 | .00005 | .02 |
| 47 | do----- | .0040 | -- | N | -- | -- |
| 48 | do----- | .0040 | -- | .013 | .0001 | .04 |
| 49 | do----- | .0040 | -- | .360 | .0029 | 1.20 |
| 50 | do----- | .0040 | -- | .089 | .00072 | .31 |
| 51 | Suction dredge----- | 1.25 | 100 | N | -- | -- |
| <u>Placer samples from the Jarbidge River study area</u> | | | | | | |
| 84 | Reconnaissance pan----- | .0040 | -- | N | -- | -- |
| 85 | do----- | .0040 | -- | 1.196 | .0096 | 4.10 |
| 86 | do----- | .0040 | -- | .020 | .00016 | .07 |

APPENDIX.--Placer samples from the Bruneau River and Jarbidge River study areas and vicinity--Continued

| Sample no. (figs. 2, 3, 4) | Sample type | Sample volume (yd ³) | Running time 1/ (min) | Gold recovered (mg) | Grade 2/ (oz/yd ³) | Value 3/ (\$/yd ³) |
|-------------------------------------|-------------------------|--|-----------------------------|---------------------------|-----------------------------------|-----------------------------------|
| 87 | Suction dredge----- | 1.5e | 100 | 0.083 | <0.00001e | <0.01 |
| 88 | do----- | 1.3e | 95 | .571 | .00001e | <.01 |
| 89 | Reconnaissance pan----- | .0040 | -- | .004 | .00003 | .01 |
| 90 | do----- | .0040 | -- | .060 | .00048 | .20 |
| 91 | do----- | .0040 | -- | .055 | .00044 | .19 |
| 92 | do----- | .0040 | -- | .151 | .0012 | .51 |
| 93 | do----- | .0040 | -- | .007 | .00006 | .03 |
| 94 | do----- | .0040 | -- | 4.465 | .036 | 15.00 |
| 95 | do----- | .0040 | -- | 1.139 | .0092 | 3.90 |
| 96 | do----- | .0040 | -- | .130 | .0010 | .42 |
| 97 | do----- | .0040 | -- | .443 | .0036 | 1.50 |
| 98 | do----- | .0040 | -- | .045 | .00036 | .15 |
| 99 | do----- | .0040 | -- | .161 | .0013 | .55 |
| 100 | do----- | .0040 | -- | .114 | .00092 | .39 |
| 101 | do----- | .0040 | -- | .063 | .00051 | .22 |

APPENDIX.--Placer samples from the Bruneau River and Jarbidge River study areas and vicinity--Continued

| Sample no. (figs. 2, 3, 4) | Sample type | Sample volume (yd ³) | Running time 1/ (min) | Gold recovered (mg) | Grade 2/ (oz/yd ³) | Value 3/ (\$/yd ³) |
|-------------------------------------|-------------------------|--|-----------------------------|---------------------------|-----------------------------------|-----------------------------------|
| 102 | Reconnaissance pan----- | 0.0040 | -- | N | -- | -- |
| 103 | do----- | .0040 | -- | N | -- | -- |
| 104 | do----- | .0040 | -- | .099 | 0.00080 | 0.34 |
| 105 | Suction dredge----- | 1.5e | 100 | 120.030 | .0026e | 1.10 |
| 106 | do----- | 1.5e | 100 | 6.522 | .00014e | .06 |
| 107 | do----- | 1.5e | 100 | 9.107 | .00020e | .08 |

1/ Actual running time; does not take breakdowns into consideration.

2/ Considering swell, a pan factor of 220 pans/yd³ was used; grade reported to nearest 0.00001 oz/yd³.

3/ Value based on a gold price of \$425/oz; value rounded to nearest \$0.01.