STUDIES RELATED TO WILDERNESS

# WILDERNESS AREAS

# EAGLE CAP, OREGON

GEOLOGICAL SURVEY BULLETIN 1385 - E

# MINERAL RESOURCES OF THE EAGLE CAP WILDERNESS AND ADJACENT AREAS, OREGON

View north from the crest of Eagle Cap, July 3, 1971. Broad U-shaped valley on left is upper East Lostine River; valley in right center is upper Hurricane Creek. Light-colored peak to the right of Hurricane Creek is the Matterhorn. Lake Basin with ice-covered Mirror Lake in right foreground.

# Mineral Resources of the Eagle Cap Wilderness and Adjacent Areas, Oregon

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*With a section on* AEROMAGNETIC SURVEY
*By* W. E. DAVIS, U.S. GEOLOGICAL SURVEY

STUDIES RELATED TO WILDERNESS—WILDERNESS AREAS

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*An evaluation of the mineral potential of the area*

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## STUDIES RELATED TO WILDERNESS

# WILDERNESS AREAS

Under the Wilderness Act (Public Law 88–577, Sept. 3, 1964) certain areas within the National forests previously classified as "wilderness," "wild," or "canoe" were incorporated into the National Wilderness Preservation System as wilderness areas. The act provides that the Geological Survey and the Bureau of Mines survey these wilderness areas to determine the mineral values, if any, that may be present. The act also directs the results of such surveys are to be made available to the public and submitted to the President and Congress.

This bulletin reports the results of a mineral survey of the Eagle Cap Wilderness and adjacent areas, Oregon.

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# MINERAL RESOURCES OF THE EAGLE CAP WILDERNESS AND ADJACENT AREAS, OREGON

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## SUMMARY

A mineral survey of the Eagle Cap Wilderness, proposed additions, and adjoining areas in northeastern Oregon was made in 1970, 1971, and 1972 by the U.S. Geological Survey and U.S. Bureau of Mines. An aerial magnetic survey of the area was made by the U.S. Geological Survey in 1970. The study area encompasses the heart of the rugged Wallowa Mountains, part of the Blue Mountains geologic province. It consists of approximately 345 $mi^2$ (1005 $km^2$) of the officially designated wilderness, plus an additional 211 $mi^2$ (554 $km^2$) in adjoining areas. The fieldwork was accomplished by traverses on foot. Helicopters and horses were used to supply base camps and to transport personnel. Approximately 33 man-months were spent in field investigations.

The mineral survey consisted of reconnaissance geologic mapping, compilation of previous geologic mapping, geochemical sampling, and studies of known mineral occurrences and areas considered favorable for mineral deposits. Stream sediment samples were collected from all the principal streams and most tributaries. Panned concentrate samples of streambed material were also collected at regular intervals to check for heavy minerals. All representative rock types were sampled. In addition, stained or altered samples were collected from contacts, joints, fractures, shear zones, and material that showed any indication of mineralization. Quartz veins in natural exposures and from accessible mines and prospects were sampled, as were the dumps of many mines and prospects. More than 1,950 samples were analyzed by semiquantitative spectrographic, atomic absorption, and colorimetric methods. Approximately 485 Bureau of Mines samples from veins, contact zones, and shear zones were tested by fire assay and chemical assay methods. Over 70 samples from placer claims and gravel deposits were analyzed to determine free gold and heavy mineral content.

The Eagle Cap Wilderness is at the northern margin of a belt of metalliferous deposits that extends from central Grant County, Oreg., eastward to Hells Canyon and beyond into Idaho. The principal metals in these deposits are gold, copper, and silver, with minor lead. Part of the Cornucopia mining district lies inside the southeast corner of the wilderness area, and four other mining districts are adjacent to the south boundary. Only the Cornucopia district was producing ore at the time of the study. County records

show that more than 1,500 mining claims have been located in the wilderness area, although the only production is from the Granite Mountain veins in the Cornucopia district.

Gold occurs in small amounts in many places in the area, but significant concentrations have been found only in the Cornucopia district. This district has produced more than $15 million in gold, silver, and copper, most of which came from the Granite Mountain veins mined by the Cornucopia Gold Mines Co. During 1938–41, the last 4 years of operation, 156,424 tons (141,910t) of ore averaging 0.48 oz of gold per ton (12 g/t) was mined. The workings are now inaccessible, so a resource estimate could not be made, but existing maps and records suggest that significant resources of gold may be present.

Silver and lead occur in a quartz vein on the Joseph Mountain mine property just beyond the north boundary of the area (pl. 2). This vein is estimated to contain 68,000 tons of material with 0.03 oz gold per ton (0.79/t), 0.71 oz silver per ton (18 g/t), and 2.90 percent lead. Within the study area silver also occurs in anomalous quantities in several tactite zones.

Copper, the most abundant metallic mineral commodity in the study area, is found in tactite zones along granodiorite-limestone contacts, disseminated in limy horizons in the Hurwal Formation, in quartz lenses in granodiorite, and in some quartz veinlets in greenstone. The tactite zone in Aneroid Basin contains copper. The tactite zone in the Frazier prospect on Hawkins Pass contains an estimated 24,000 tons of material averaging 0.84 percent copper, 0.06 percent molybdenum, 0.02 percent tungsten, and 0.1 oz silver per ton (2.6 g/t). Copper-bearing tactites occur also in areas between the Royal Purple prospect and Transvaal mine. Significant concentrations of copper in argillite may occur at the McCully Basin prospect, but the deposit is not sufficiently exposed to determine quantity. Copper also occurs in argillite on the Contact group prospect, but the deposit is too low grade to be a resource in the foreseeable future. Copper-bearing quartz lenses in grandiorite are exposed on the Dotson and Rainbow lode prospects. The lenses are estimated to contain about 130,000 tons (117,936 t) of material with 2 percent copper, and minor silver and molybdenum.

The older Triassic rocks in a cirque on the northeast side of Red Mountain are cut by many copper-bearing quartz veinlets. The copper minerals also occur scattered over an area of as much as 4 $mi^2$ (10.5 $km^2$) around the cirque. The average grade, however, of the best mineralized rock is too low to be a resource. Chip samples taken across quartz veins at a prospect in the cirque and other prospect pits in the area contained a maximum of 0.016 percent copper. This occurrence is not unique; parts of the older Triassic rock sequence contain anomalous amounts of copper.

Anomalous amounts of molybdenum and tungsten occur as small, sometimes high-grade concentrations in tactite zones. Placers contain small quantities of gold. Limestone suitable for lime and cement is abundant in the area and is the largest resource of high-grade limestone in Oregon. Some lime has been produced from a quarry just north of the area. Other limestone deposits are, however, more accessible elsewhere at localities closer to markets.

The area has no potential for combustible fuels and appears not to have any potential for geothermal energy. Surficial indicators of geothermal activity, such as hot springs, were not observed, and the region has not been classified as valuable for geothermal steam or associated resources by the Geological Survey.

## INTRODUCTION

In accordance with provisions of the Wilderness Act of 1964 and related Conference Report, and at the request of Senator Mark O. Hatfield and Congressman Al Ullman of Oregon, the U.S. Geological

Survey and the U.S. Bureau of Mines made a survey to determine the mineral potential of the Eagle Cap Wilderness, Oreg., and a number of areas proposed as additions thereto. The work was begun in 1970 by the U.S. Geological Survey and in 1971 by the Bureau of Mines.

In the report that follows, the term "study area" refers to the existing wilderness area plus the areas proposed as additions. The term "wilderness" refers only to the already established Eagle Cap Wilderness as it existed in 1970. The term Wallowa Mountains is intended to designate the entire range, both within and beyond the limits of the study area.

## LOCATION AND GEOGRAPHY

The Eagle Cap Wilderness covers much of the Wallowa Mountains, an isolated range that occupies parts of Baker, Union, and Wallowa Counties in northeastern Oregon (fig. 1), is approximately 40 mi (64 km) long by 20 mi (32 km) wide and trends almost exactly northwest.

The existing wilderness comprises 220,416 acres, or about 345 mi$^2$ (845 km$^2$). In 1970 and 1971, 10 areas totaling about 120,300 acres, or approximately 187 mi$^2$ (491 km$^2$) (table 1; pl. 1), were proposed as additions to the wilderness. At the request of Senator Mark O. Hatfield and Congressman Al Ullman of Oregon, an open-file report concerning the mineral potential of these 10 proposed additions was prepared and made available to the public in December 1971.

In 1972, some 20 more parcels of land were proposed as additions. Their total area is about 16,400 acres, or about 25 mi$^2$ (66 km$^2$). This brought the total study area to 357,000 acres, or about 557 mi$^2$ (1,462 km$^2$). These last proposed additions were studied in the summer of 1972.

The Wallowa Mountains are roughly dome shaped, with relatively gentle slopes to surrounding lowlands except on the northeast where the range front rises abruptly to crests a mile higher than the adjoining Wallowa Valley. The range has a strikingly well developed radial drainage pattern (fig. 2). The Minam River, the two forks of the Lostine River, Hurricane Creek, two forks of the Wallowa River, three forks of the Imnaha River, and three forks of Eagle Creek all head within an area approximately 2 by 3 mi (3.2 by 4.8 km), centered around Eagle Cap, the prominent peak for which the wilderness is named.

Maximum local relief is almost a mile—5,234 ft (1595 m) from Wallowa Lake to Chief Joseph Mountain—in a horizontal distance of 2¼ mi (3.6 km). Most of the glaciated valleys lie 2,500–3,000 ft (760–910 m) below adjacent ridge crests. The highest peaks are 9,800–9,900 ft (2,990–3,020 m) above sea level.

Summer days often reach 75°F (24°C), even at highest elevations, though freezing nighttime temperatures occur at almost any time.

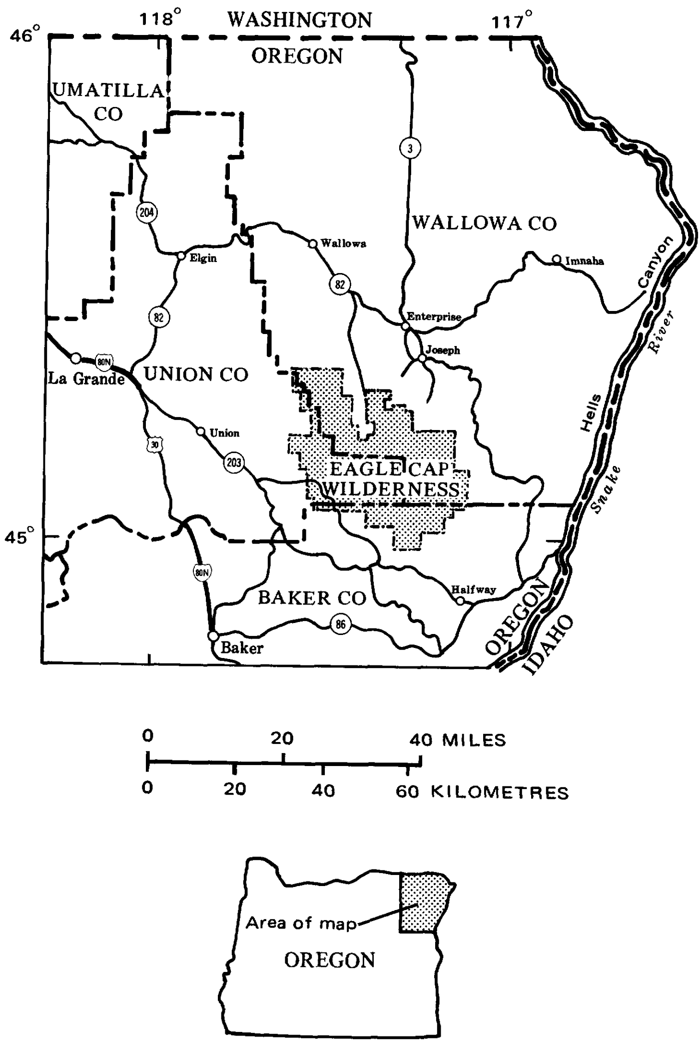


FIGURE 1.—Northeastern Oregon, showing location of the Eagle Cap Wilderness.

Snow begins in September and eventually accumulates to depths that restrict travel across the higher passes until middle or late July (see, for example, frontispiece). Snowfields remain on protected north-facing slopes throughout many summers. No true glaciers exist in the range, but a small body of stagnant ice occupies part of a cirque basin on the northeast side of Little Eagle Cap.

The range is readily accessible on all sides, although most visitors generally enter from the north and south. Principal nearby towns are

TABLE 1.—*Areas proposed as additions to the Eagle Cap Wilderness, Oreg., in 1970 and 1971*

[Numbers identify individual areas shown on pls. 1 and 2]

| Area number | Size | | |
|---|---|---|---|
| | Acres | Square miles | Square kilometres |
| 1 | 89,715 | 140.18 | 367.83 |
| 2 | 960 | 1.5 | 3.94 |
| 3 | 320 | .5 | 1.81 |
| 4 | 5,062 | 7.91 | 20.76 |
| 5 | 640 | 1.00 | 2.62 |
| 6 | 2,560 | 4.00 | 10.50 |
| 7 | 1,280 | 2.00 | 5.85 |
| 8 | 14,566 | 22.26 | 58.41 |
| 9 | 1,920 | 3.00 | 7.87 |
| 10 | 3,264 | 5.10 | 13.38 |

Baker on the south, La Grande on the west, and Enterprise on the north. Oregon State Highway 82, from La Grande, extends through Enterprise and Joseph to Wallowa State Park at the south end of Wallowa Lake. Most other valleys have unsurfaced roads leading into the range to within a short distance of the wilderness boundary. This road access, together with the excellent and extensive trail system that is maintained along all major valleys, makes the Eagle Cap not only one of the most accessible but one of the most heavily used wildernesses in the West. Visitor use has in fact become so great (150,000 man-days in 1970) that it has become necessary to prohibit the use of horses on some trails and in some camping areas.

The Wallowa Mountains are exceptionally scenic. Intense alpine glaciation has shaped the ridges and carved the valleys into striking U-shaped troughs with steep sides and broad, flat valley floors. The highest ridges are jagged and picturesque, with dozens of lakes scattered along them in the many cirque basins. Grassy meadows dot the valley floors. The lowest slopes on the south side of the range bear sagebrush, bunchgrass, and scattered ponderosa pine, but most of the lower parts of the mountains are thickly timbered with ponderosa pine, lodgepole pine, Douglas fir, spruce, and tamarack. Near timberline are extensive stands of whitebark pine, often with gnarled and twisted trees. Highest parts of the range, mostly above about 8,500 feet (2,590 m) contain broad areas of alpine tundra that bears a profusion of tiny flowers in summer months.

Despite heavy visitor use, the Wallowa Mountains contain many wild animals. Rocky Mountain goats can often be seen on Chief Joseph Mountain and the Matterhorn. Herds of elk spend summer and early fall in many of the high cirque basins. Mule deer can be found almost anywhere. Salmon spawn in the Minam, Lostine, and Imnaha Rivers in August and September.


FIGURE 2.—Physiographic map of the Wallowa Mountains and vicinity, northeastern Oregon.

## PREVIOUS WORK

The earliest significant work in the Wallowa Mountains was by

Lindgren (1901), who made a reconnaissance of the Blue Mountains, with particular attention to the gold deposits. Other studies include Parks (1914) and Williams (1914), information on limestones; Swartley (1914), description of ore deposits and distribution of igneous and sedimentary rocks in the range; Livingston (1928) and Wheeler and Cook (1954), discussion of drainage changes suggested by structure and geomorphology; Moore (1937), description and mapping of carbonate rocks in the northern part of the Lostine and Hurricane Valleys; Ross (1938), mapping of part of the southern Wallowas; Lorain (1938), description of major gold veins and mining and milling methods at Cornucopia; Oregon Department of Geology and Mineral Industries (1939), systematic cataloging of known mines and prospects in the Wallowa Mountains; Goodspeed (1939, 1941), description of the geology of Cornucopia gold veins; Smith and Allen (1941, p. 39–52), mapping of the northern Wallowa Mountains and description of glaciation and economic mineral deposits; Krauskopf (1943), the Wallowa batholith; Smedes (1959), the northern and northeastern parts of the range; Wetherell (1960), mapping of part of the southern Wallowa Mountains; Taubeneck (1964a, 1967; unpub. data), mapping of Cornucopia stock and Wallowa batholith in great detail and petrographic studies in progress; Bostwick and Koch (1962), investigation of problems in dating and correlation of the Clover Creek Formation in and near the Wallowa Mountains; Nolf (1966), the structure and stratigraphy of the northern Wallowa Mountains; Brooks and Ramp (1968), description of the gold deposits of the Cornucopia district. In 1969, at the request of Senator Mark O. Hatfield, a report on the mineral and water resources of Oregon was prepared by the U.S. Geological Survey in collaboration with other Federal agencies and the Oregon Department of Geology and Mineral Industries. A section of the report describes the general geology and mineral deposits of the area (U.S. Geological Survey and others, 1969). Finally, the U.S. Geological Survey released in open file a report prepared jointly with the U.S. Bureau of Mines (1971) describing the geology and mineral resources of 10 areas proposed as additions to the Eagle Cap Wilderness.

## PRESENT WORK

U.S. Geological Survey work began in the area in July 1970 by Paul L. Weis and J. L. Gualtieri, assisted by Hal Owens. Analytical support was provided by A. J. Toevs, Carl Forn, and R. C. Hutchens. In 1971, Weis continued the work with the help of William F. Cannon and field assistants David Carpenter and Tom Gill. Chemical spectrographic and atomic absorption analyses were made by Carl Forn and A. J. Toevs, assisted by R. N. Babcock, C. A. Curtis, John Seward, and R. C. Hutchens. A. J. Toevs assisted in the field investigation of geochemical anomalies. Weis did additional work in more recently proposed additions in 1972. Analytical work in 1972 was by Charles Withington and Carl Forn.

Investigations by the Bureau of Mines dealt mainly with the economic aspects of the mineral resource potential of the study area and adjoining areas. As used in this text, "mineral resource potential" indicates a potential for mineral deposits minable in the foreseeable future. The Bureau searched for records of mining claims in the courthouses of Wallowa, Union, and Baker Counties during the spring of 1971 and again during 1972. This work was done by Ernest T. Tuchek and Arel B. McMahan. Additional information was obtained from the U.S. Forest Service. Mineral production data were obtained from Bureau of Mines records and from reports by the Oregon Department of Geology and Mineral Industries.

Fieldwork by the Bureau of Mines was conducted in the claimed and mineralized areas in and near the study area during the summers of 1971 and 1972. In 1971, investigations were made by Ernest T. Tuchek and Arel B. McMahan assisted by Francis E. Federspiel, and by Tuchek and McMahan in 1972. Heavy metal analysis was done by Dean C. Holt. Approximately 18 man-months were spent by the Bureau of Mines personnel in field investigations.

Fieldwork was done on foot, on horseback, and with the aid of helicopters. Existing geologic maps were checked and areas not previously mapped were mapped in reconnaissance. Samples of rocks, stream sediments, panned concentrates, veins, and altered rocks were collected for geochemical study. Areas of known mineralization were examined and sampled in greater detail.

## ACKNOWLEDGMENTS

The authors have borrowed heavily from many earlier workers, especially in preparing the geologic map. Although it is impossible to indicate credit by area, much of the geologic map includes data derived from work by Smedes, Nolf, Weatherell, and Taubeneck. Final responsibility for its accuracy, of course, is ours.

Conversations with T. L. Vallier, George Walker, and Bruce O. Nolf were also of much help. Particular thanks are given Professor Taubeneck, who generously allowed us to use his unpublished maps and to draw freely from his intimate knowledge of the area, both in conversations and in visits with him to various features in the field.

The mineral appraisal was facilitated by the cooperation of many local residents, resort operators, mine owners, and country and State officials. We thank Frances N. Stangel and Robert Hultse, in particular, for their help.

## GEOLOGY

The Wallowa Mountains consist of a core of Triassic and Jurassic volcanic and sedimentary rocks that were intruded and deformed by Cretaceous (?) granodiorite intrusive rocks. After uplift and erosion unroofed the Cretaceous (?) batholith, the area was covered by Miocene basalt flows of the Columbia River Group. Further uplift and erosion, including intense sculpture by alpine glaciation, removed basalt from about a third of the range and gave it its present form (pl. 1).

Pre-Tertiary rocks are known to exist to the south in the Powder River and Burnt River valleys (Gilluly, 1937), to the east in Hells Canyon and the Seven Devils Range of Idaho (Brooks and Vallier, 1967), and probably to the north at the mouth of the Grande Ronde in Washington (Mills, 1962). The relation of pre-Teritary rocks in these surrounding regions to those in the Wallowa Mountains is not well established. Elsewhere to the north, west, and south, and in some areas to the east as well, pre-Teritary rocks are covered by Miocene basalt.

### OLDER TRIASSIC ROCKS

The oldest formally recognized formation in the Wallowa Mountains is the Late Triassic Martin Bridge Formation. Conformably beneath the Martin Bridge Formation is a group of older rocks whose identity and correlatives are in doubt. In places these pre-Martin Bridge rocks contain Triassic fossils (Smith and Allen, 1941, p. 56; Nolf, 1966, p. 29); accordingly, for convenience they are referred to in this report by the informal term "older Triassic rocks."

In the northern and southern parts of the study area, the older Triassic rocks consist of metavolcanic rocks overlain by coarse clastic material. In the east-central part sedimentary rocks are absent or very sparingly represented in the unit. Previous workers offered a variety of interpretations of the exposures in the Wallowa Mountains (fig. 3). In the southern part, Ross (1938) and Smith and Allen (1941) mapped the volcanic rocks as Clover Creek Greenstone, separating it from the overlying sedimentary rocks. Both reports complicated the picture considerably, however. In some places the older Triassic rocks and the stratigraphically higher Hurwal Formation were both identified as the lower sedimentary series and in other places both of the units were included in the Hurwal Formation. Understandably these misidentifications resulted in some unusually complex structural interpretations, which are incorrect. Smith and Allen (1941) also included both the older Triassic sedimentary rocks and the Hurwal in their lower sedimentary series in parts of the northern Wallowa Mountains, notably in the valleys of Hurricane Creek and the lower Lostine.

Smedes (1959) mapped only in the northern Wallowas, where he

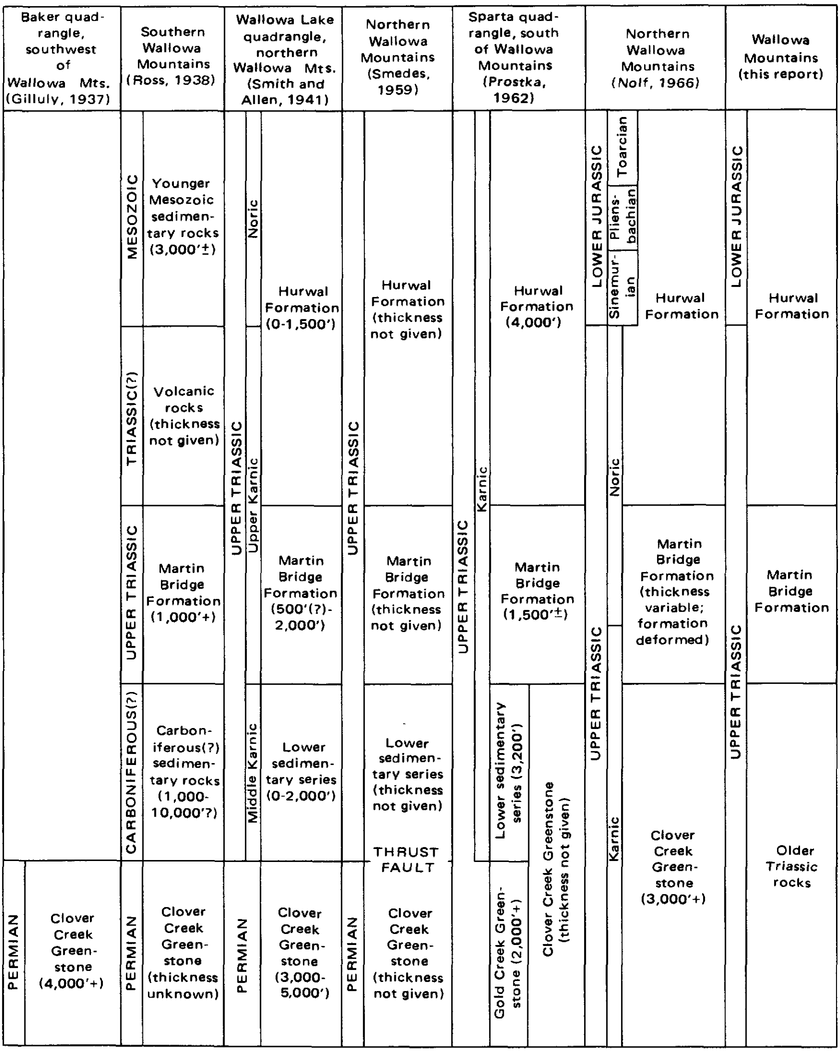


FIGURE 3.—Formation names and ages used in the Wallowa Mountains and vicinity.

interpreted volcanic rocks as Clover Creek Greenstone. The volcanic rocks were shown as being separated from the overlying sedimentary rocks by a décollement. Prostka (1962), mapping in the Sparta quadrangle, which joins the Eagle Cap quadrangle on the south, stated (p. 4) that the Clover Creek Greenstone and sedimentary rocks in that area are on opposite sides of a synclinorium, that they contained Triassic fossils, that they were both conformably overlain by the Martin Bridge Formation, and that therefore they were facies equivalents of the type

Clover Creek. Nolf (1966) divided the pre-Martin Bridge rocks into three parts with different lithologies but on the basis of fossil evidence considered them all parts of a single formation.

From the above it can be seen that rocks that have been called Clover Creek Greenstone present a complicated picture. Difficulties arise from abrupt facies changes, lack of fossils or key marker horizons in many places, and poor exposures and structural complications in some parts of the area. The greatest difficulty, however, arises from lack of detailed mapping between the Clover Creek's type area, the Powder River valley, and the Wallowa Mountains. The problem requires detailed and intensive study, over an area much larger than that of this report. We therefore made no attempt to solve the many stratigraphic problems that exist. For the purposes of convenience, in this report we lump all the volcanic rocks and all the pre-Martin Bridge sedimentary rocks into one unit.

In the southern part of the Wallowa Mountains, the lower part of the map unit is a dark-green to gray-green to black rock composed largely of altered mafic to intermediate volcanic material. The rocks include flows, breccias, tuffaceous sedimentary rocks, and lenses of gray fossiliferous limestone. The clastic units are discontinuous, widely scattered, and appear to be confined to the upper third of the dominantly volcanic section. Bedding or layering in the flows, breccias, agglomerates, and related rock is obscure or absent, making attitudes impossible to recognize in many places, despite excellent exposures.

Many of the flows are porphyritic. An especially distinctive porphry is exposed in the upper parts of the Imnaha drainage, on Mount Howard, and near Sugarloaf Mountain. It consists of a fine-grained black groundmass studded with 1–3-inch plagioclase phenocrysts, commonly as penetration twins or clumps with radiating structure.

The upper, predominantly sedimentary section of the map unit is generally gray to brown, with poorly sorted to well-sorted beds ranging from coarse conglomerate to fine siltstone. Most of the grains are sand size or larger. Crossbedding and graded bedding are widespread. Most clasts are derived from volcanic rocks, and in coarser grained rocks the fragments vary considerably in color and texture. In places the fragments are angular to subangular, but in most exposures they are well rounded. Tuffaceous beds are also present. The clastic section of the unit is especially well exposed on the ridge between East Eagle Creek and Trail Creek in the southern part of the range.

Part of the sedimentary section consists of brown, dark-gray, or black well-bedded siltstone or mudstone. Color contrasts on weathered surfaces are apparently due to variations in abundance of syngenetic pyrite. These rocks are well exposed on Red Mountain east of Trail Creek, between the mainly volcanic and mainly coarse clastic beds.

In the northern part of the range, the older Triassic rocks consist of a lower part that is dominantly volcanic breccia (fig. 4), an intermediate member that is dominantly marine mudstone, sandstone, and conglomerate, and an upper member that is predominantly conglomerate with clasts of volcanic rock. These three divisions are similar to but not directly correlative with facies in the southern part of the mountains (Nolf, 1966, p.11–28).

In the central part of the mountains, in the headwaters of the Imnaha River and Big Sheep Creek, the older Triassic sedimentary rocks are markedly less abundant than at the northern or southern parts of the mountains.

We did not measure the thickness of the older Triassic rocks. Prostka (1962, p. 4) estimated his Gold Creek Greenstone to be at least 2,000 ft (610 m) thick and the lower sedimentary series to be 3,200 ft (980 m) thick. He correlated the two formations with the type Clover Creek which Gilluly (1937, p. 8) estimated to be over 4,000 ft (1,220 m) thick. Nolf (1966) reported that the rocks have a minimum thickness of 3,000 ft (915 m), with the base not exposed, in the northern part of the range.

Preintrusive metamorphism to greenschist facies has converted the volcanic section to a chlorite- and epidote-bearing rock, produced local schistosity, and obscured original igneous textures in many places. Saussuritization has converted much of the lavas to monotonous massive chlorite-epidote-plagioclase rock with no discernible internal structure. Sedimentary rocks were apparently less affected.

### MARTIN BRIDGE FORMATION

The Martin Bridge Formation was defined by Ross (1938 p. 32–36) as the sequence of limestone and calcareous shales exposed at Martin Bridge, located on Eagle Creek at the mouth of Paddy Creek in sec. 21 (projected), T. 7 S., R. 44 E., Sparta quadrangle (Prostka, 1962, p. 4). The Martin Bridge Formation is dominantly a black to dark-gray fossiliferous limestone with minor interbedded calcareous shale (Prostka, 1962). Exposed thickness of the Martin Bridge ranges from less than 100 ft (30 m) to more than 5,000 ft (1,525 m), but these extremes are in places where deformation has been extensive. Where it is not deformed, the formation is typically 1,000–1,500 ft (300–460 m) thick (Prostka, 1962; Nolf, 1966).

The Martin Bridge Formation conformably overlies the older Triassic rocks. In many parts of the study area, the contact is a fault, but in places along Hurricane Creek and on Chief Joseph Mountain, conformable contacts are recognized (Nolf, 1966, p. 40).

Outside of the study area, other exposures also show conformable contacts. Prostka (1962) reported undeformed conformable contacts in the Sparta quadrangle. Vallier (written commun., 1972) believes that

FIGURE 4.—Northeast face, Chief Joseph Mountain. Volcanic and sedimentary facies of the older Triassic rocks overlain by light-colored Martin Bridge Formation (upper left) and capped by a small dark remnant of Picture Gorge Basalt (center).

the Martin Bridge Formation is conformable over older rocks in Hells Canyon, east of the Wallowas.

In the Wallowa Mountains most exposures of the Martin Bridge Formation show some degree of recrystallization and deformation related to the emplacement of the Wallowa batholith. As a result, few exposures contain recognizable fossils, layering is typically highly contorted, in places recrystallization has produced very coarse textures, and in most of the range the color is white to light gray, rather than the black to dark gray shades that characterize the relatively undisturbed rock elsewhere nearby. Disharmonic folding is extensive and in places is spectacularly exposed (fig. 5).

The recrystallized coarsened rocks apparently undergo very little chemical weathering. Little or no soil forms, and vegetation is sparse or absent. Mechanical disaggregation of the marble produces fine calcite gravel that is rapidly eroded from the steep glaciated valley walls. As a result, some of the largest exposures of bare rock in the Wallowa Range are of this formation (fig. 6).

Fossil evidence indicates that the Martin Bridge Formation is of

FIGURE 5.—Disharmonic folding in Martin Bridge Formation on the north valley wall, headwaters of the South Fork of the Middle Fork, Imnaha River.

FIGURE 6.—Sacajawea Peak, a large bare unweathered exposure of the Martin Bridge Formation. View south.

Late Triassic (Karnic and Norian) age (Prostka, 1962, p. 5; Nolf, 1966, p. 54).

### HURWAL FORMATION

The Hurwal Formation was named by Smith and Allen (1941, p. 13–14) for argillaceous sedimentary rocks conformably overlying the calcareous Martin Bridge Formation in the Wallowa Lake 30-minute quadrangle. It was named for exposures on Hurwal Divide in secs. 25, 26, 35, and 36, T. 3 S., R. 44 E., and in secs. 1, 2, 11, and 12, T. 4 S., R. 44 E.

In the study area the Hurwal Formation overlies the Martin Bridge Formation. In many places the disharmonic folding of the Martin Bridge Formation has resulted in fault contacts between the two formations, but in parts of Hurricane Creek Canyon and on the divide between East Fork Wallowa River and Middle Fork Sheep Creek a conformable contact can be seen. Where conformable contacts are exposed, the dark limestone of the Martin Bridge grades upward into calcareous mudstones of the Hurwal Formation over distances of 10–50 ft (3–15 m).

The Hurwal Formation is dominantly a black, dark-gray, or dark-brownish-gray thin-bedded siliceous or limy mudstone. Syngenetic pyrite is locally abundant as isolated blebs or fine particles concentrated along bedding planes. Where pyrite is abundant, the weathered surfaces are generally some shade of rusty brown. Thermal metamorphism related to the Wallowa batholith has recrystallized the rock on a microscopic scale, producing a facies that looks like normal Hurwal but which breaks with sharp conchoidal fractures into fragments that ring when struck.

In the Wallowa Mountains the original thickness of the formation is unknown because the upper limit of the Hurwal is either an erosion surface or an intrusive contact with the batholith. Nolf (1966, p. 61) reported that it is more than 6,500 ft (1,980 m) thick on Hurwal Divide, the ridge between Hurricane Creek and the Wallowa River.

The Hurwal Formation is considered Late Triassic and Early Jurassic in age (fig. 3). Nolf (1966, p. 61–64) reported abundant Triassic fossils in the lower and middle parts of the formation and Lower Jurassic fossils in the upper part.

### TERTIARY GRAVEL

Coarse boulder gravel occurs at several places in the Wallowa Mountains. Most outcrop areas cover only a few hundred square feet; a notable exception is on Jim White Ridge, where more than a square mile is underlain by gravel. All deposits are on a pre-Miocene erosion surface that was preserved beneath basalt flows of the Columbia River

Group until Holocene erosion exhumed the underlying rock. Most deposits are on weathered and disaggregated batholithic rock at the edges of scattered basalt remnants along ridge crests.

The boulders are as much as 2 ft (60 cm) in diameter and are typically very well rounded. Many show abundant percussion marks, indicating transport in a torrential stream. Several lithologies are represented. An exposure on the ridge south of Cached Lake contains representatives of most of the rock types found in the older Triassic rocks. In most deposits, however, more than 90 percent of the boulders are quartzite. F. C. Armstrong, who visited some of the occurrences with Weis during the fieldwork, pointed out the striking similarity between some of these quartzites and some lower Paleozoic quartzites that have been mapped in southeastern Idaho (oral comm., 1971). No nearby source for the quartzite has been recognized. Other lithologies present include gneisses that resemble metamorphic rocks in west-central Idaho, but these are only sparingly represented.

Placer gold has been reported in association with some of the gravel deposits, but with the exception of the one on Jim White Ridge, the deposits contain insufficient yardage.

## BASALT FLOWS OF THE COLUMBIA RIVER GROUP

Basalt flows of the Columbia River Group unconformably overlie the Tertiary gravels, Wallowa batholith and related rocks, and the Triassic and Jurassic volcanic and sedimentary rocks of the Wallowa Range. The basalt covers the flanks of the range and occurs as scattered remnants on ridge crests in the central part. Flows of both pre-Yakima basalt and Yakima Basalt of the Columbia River Group are present but were not mapped separately in this study. The greatest exposed thickness is in the valleys of Bear Creek and Minam River, where as much as 3,000 ft (915 m) of section is exposed in the steep canyon walls.

The Columbia River Group consists almost entirely of lava flows, generally from 30–100 ft (9 to 30 m) thick. No intercalated sedimentary material or buried soils were seen. Yellow friable palagonite deposits, mostly less than 300 ft (90 m) long and less than 25 ft (8 m) thick, crop out in a few places. Boulders of palagonite occur in talus at the north end of Frances Lake in the Lostine drainage.

The lava apparently first flowed around and then over an already existing topographic high that continued to rise while the flows were erupted. The earliest flows poured out on a surface with at least a thousand feet of relief in places (fig. 7), and as volcanism continued, the

FIGURE 7.—Basalt remnant (dark rocks at upper left) on Brown Mountain, overlying Wallowa batholith (light rocks) near the head of Minam River. Note relief on basalt-batholith contact.

flows lapped up to eventually cover even the highest pre-Miocene rocks, while forming a cover of increasing thickness around the flanks of the range.

In places the basalt preserved deeply disaggregated granodiorite of the Wallowa batholith. Where these pre-Miocene surfaces are now being exhumed, erosion produces rounded outcrops that are strikingly different from the angular shapes that characterize the glaciated ridges.

### INTRUSIVE ROCKS

Granitic rocks of the Wallowa batholith are extensively exposed in the southern, eastern, and central parts of the Eagle Cap Wilderness. Sparse aplite and pegmatite dikes occur in the near granitic plutons. Mafic dikes of two ages occur in the area; the older ones cut only the Mesozoic layered rocks, whereas the young ones probably were feeders for the basalt flows.

The Wallowa batholith is a composite granitic intrusive body of Early Cretaceous(?) age made up of four major plutons and a variety of smaller bodies (Taubeneck, 1964a, b; 1967). Each pluton is zoned with a tonalite margin and granodiorite interior. Individual plutons were not distinguished during this study. Two satellitic intrusive bodies, the Sawtooth stock on the north and the Cornucopia stock on the south, are thought to be genetically related to the batholith.

In most exposures the granitic rock is light gray to medium gray, medium crystalline, and composed of light-gray quartz, white plagioclase, and lustrous black hornblende and biotite. In some places the biotite occurs as sharp diamond-shaped euhedral crystals. Most exposures are glaciated fresh rock (fig. 8). In a few places, however, unglaciated exposures remain which are typically light yellow to yellowish brown owing to iron-oxide stain from weathered hornblende.

The batholith is cut by several widely spaced joint sets. As a result, most exposures appear to be made up of neatly assembled somewhat irregular angular blocks.

Only the eastern and southeastern contacts of the batholith with older rocks are exposed. Younger rocks overlap the batholith on the south, west, and north. A pronounced northeast-trending salient of the batholith, called the McCully Prong by Taubeneck (1964a) and Nolf (1966), projects more than 4 mi (6.4 km) beyond the main part of the batholith in the southeastern part of the study area.

Exposed contacts between the batholith and older rocks are sharp, with contact metamorphic zones a hundred to a few hundred feet (30–90 m) thick and severe deformation of older rocks for distances of

FIGURE 8.—Outcrops of granitic rock of the Wallowa batholith at Eagle Cap. View south.

1–3 mi. Nolf (1966, p. 114–115) attributes the deformation, and in particular the pronounced thickening of the Martin Bridge Formation, to forcible emplacement of the batholith.

Aplite and pegmatite dikes, genetically related to the plutons of the Wallowa batholith, intrude granitic rocks and adjacent layered rocks. The dikes are commonly a few inches to a few feet (8–90 cm) wide and a few tens to hundreds of feet (10–150 m) long. Some pegmatites are zoned, such as the one near Cheval Lake, and contain border zones rich in feldspar and cores rich in quartz.

The older mafic dikes are in Mesozoic layered rocks. Folded and deformed remnants of the dikes are particularly evident in the more intensely contorted parts of the Martin Bridge Formation, where boudins, complexly folded segments, or scattered and drawn-out fragments are especially visible in the light-gray marble.

Basalt dikes occur in all parts of the Wallowa Mountains and cut all rock types, including earlier flows of basalt. They are generally 30–75 ft (9–23 m) thick and have a northerly strike and near-vertical dip. Some dikes in the batholith can be traced for several miles. Nolf (1966) reported more than 200 dikes in the area that he mapped.

## SURFICIAL DEPOSITS

Glacial deposits are found on the walls and floors of canyons and valleys, on or near some ridges, and in some cirques. Alluvial deposits exist on the floors of some valleys, and colluvial deposits mantle the lower parts of some slopes.

The Wallowa Mountains were intensely glaciated during late Pleistocene time. Valley glaciers of considerable size eroded strongly U-shaped valleys and carved dozens of basins that now contain cirque lakes. Glacial erosion in the higher parts of the mountains was so intense that relatively little detritus now remains in most of the glaciated valleys within the range. In some places the eroded material was carried out away from the range front. The most spectacular example of this is the well-known lateral and terminal moraines that enclosed Wallowa Lake (fig. 9).

Small patches of lateral moraine can also be recognized in the interior of the range. At the junction of the forks of the Imnaha, morainal material forms a thick veneer along the north wall of the valley. Small recessional moraines are also present in most cirques.

No glaciers remain in the Wallowa Mountains today, but a body of stagnant ice on the northeast side of Little Eagle Cap is a remnant of a formerly active glacier. Many of the higher peaks have more or less permanent snowfields at altitudes above about 9,000 ft (2,740 m).

Thin alluvial deposits, mostly coarse, occur locally along the floors of

FIGURE 9.—Lateral and terminal moraines enclosing Wallowa Lake. The view is toward the south, across the town of Joseph. Wallowa State Park is at the far end of the lake.

canyons and valleys. Almost all the colluvial deposits are talus, containing mostly angular and subangular boulder-size rock fragments that mantle the lower slopes of escarpments from which they were derived. Only a few such deposits, as near East Peak in the eastern part of the Eagle Cap Wilderness, were mapped.

## STRUCTURE

At least three, and possibly four, distinct episodes of deformation can be recognized in the Wallowa Mountains. The first took place before intrusion of the Wallowa batholith and affected only prebatholith rocks. The second was produced by forcible intrusion of the batholith. The third occurred before, during, and after extrusion of basalt flows of the Columbia River Group. Normal faulting along the northeast edge of the range may be either a part of the deformation that affected the basalts or a separate, later episode.

The preintrusive rocks in and near the Wallowa Mountains were folded and regionally metamorphosed to greenschist facies before the Wallowa batholith was emplaced. The nature of prebatholith folding is best recognized in the south. In the Sparta quadrangle, on the southern border of the Eagle Cap quadrangle, Prostka (1962) recognized a plunging synclinal fold with an S-shaped axial trace. In the Eagle Cap and Cornucopia quadrangles, the extension of that fold trends approximately northeast and is overturned to the northwest (fig. 10). The overturned east limb is in contact with the Wallowa batholith. Somewhat similar relationships were described by Nolf (1966) along the

FIGURE 10.—East-dipping overturned prebatholith formations along East Eagle Creek. View is approximately north. Dark rocks on left are Hurwal Formation. Light rocks in center are Martin Bridge Formation. Older Triassic rocks make up the dark unit on the right.

northeast contact of the batholith, which lies along the overturned east limb of a northwest-trending syncline. Thus in both the southern and northern part of the exposed batholith the older rocks were apparently folded down against the intrusive contact, with the Hurwal Formation nearest the batholith. Only in the south, where the character of the folding is maintained for miles beyond the batholith, is there evidence that the folding is not related to the emplacement of the igneous rocks.

Between the northern and southern areas of downfolded sedimentary rocks the preintrusive structure is obscured by deformation related to emplacement of the batholith. Three to five mi (5 to 8 km) east of the batholith, where deformation was apparently less intense, the rocks are relatively flat lying.

The major plutons of the Wallowa batholith were emplaced after the folding described above. The intrusion was accompanied by intense deformation of the host rocks within 1–4 mi (1.6–6.4 km) of the batholith, especially in the northern and central parts of the range (Nolf, 1966, p. 88–118). The most prominent aspect of the deformation was the extreme disharmonic folding in the Martin Bridge Formation, which in places was squeezed into highly crumpled masses thousands of feet thick. In places the contortion resulted in thickening due to plastic flow (fig. 6); elsewhere it displaced and deformed separate masses of Martin Bridge Formation, as in the South Fork of the Middle Fork Imnaha River (see fig. 5). Only in the southern part of the range, along East Eagle Creek, are the preintrusive rocks relatively undeformed near the batholith contact.

The third period of structural disturbance is difficult to define with precision. Broad arching of the range apparently began some time in the early or middle Tertiary. By early Miocene time it had progressed far enough to result in erosional unroofing of the batholith and the formation of a surface with at least 1,000 ft (305 m) of relief. Arching continued during extrusion of lavas of the Columbia River Group, as evidenced by offlap relations of the earlier flows and a gentle angular discordance between pre-Yakima and the overlying Yakima Basalt (W. H. Taubeneck, oral commun., 1971). Deformation continued after the last of the lavas was deposited, as demonstrated by the fact that the basalt flows dip away from the center of the range all around its periphery.

The prominent scarp that marks the northeast face of the Wallowas was produced by normal faulting. Displacement of basalt flows indicates a minimum vertical displacement of more than 5,000 ft (1,520 m), and indirect evidence suggests that the maximum vertical movement might be closer to 8,000–9,000 ft (2,440–2,740 m). Chief Joseph Mountain is capped by a remnant of a pre-Yakima flow, the base of which is about 9,750 ft (2,970 m) above sea level (see fig. 4). The nearest basalt in Wallowa Valley to the north is at an elevation of about 3,940 ft (1,200 m), in an outcrop between Joseph and Enterprise. However, the Wallowa Valley outcrop is of Yakima Basalt. The nearest exposures of thick sections of basalt north of the Wallowa Mountains are in the Imnaha and Grande Ronde Canyons. In both places, more than 1,500 ft (460 m) of Yakima Basalt is present (G. W. Walker, oral commun., 1971). Maximum thickness of underlying pre-Yakima flows is not known but may well exceed 1,000 ft (305 m) near the Wallowas.

Movement on the range-front fault occurred after the Yakima Basalt was erupted but before the late Pleistocene, as shown by the smooth surface of glacial moraines deposited across the fault trace (fig. 9).

## AEROMAGNETIC SURVEY

By W. E. Davis, U.S. Geological Survey

An aerial magnetic survey of the region between lat. 45°00′ N. and 45°24′ N. and long. 117°03′W. and 117° 39′W., which more or less corresponds to the area of the Eagle Cap Wilderness, was made by the

U.S. Geological Survey to help evaluate the mineral potential of the area. Total intensity magnetic data were obtained by means of a continuously recording fluxgate magnetometer installed in a fixed-wing aircraft. East-west flight lines about 1 mi (1.6 km) apart were flown at an average barometric elevation of 10,000 ft (3,050 m) above sea level. The data were reduced to an arbitrary datum and compiled at a scale of 1:62,500 and have contour intervals of 20 and 100 gammas. Rock samples were not tested to determine local contrasts in magnetic properties of the country rock. The interpretation of magnetic features is based on (1) general knowledge of the magnetic properties of the sorts of rocks found in the study area and (2) results of geologic mapping.

### MAGNETIC FEATURES

The magnetic pattern (pl. 1) consists mostly of narrow northwest-trending anomalies that correspond to the topographic and structural grain of the region. Positive anomalies reaching amplitudes generally more than 200 gammas occur over the main ridges. These features contain two or more maximums over the mountain crests and are associated mostly with granitic and basaltic rocks. Obviously, the anomalies are augmented by topography. Low magnetic intensity coincides with the river valleys and in places reveals the nonmagnetic response of sedimentary rocks.

West of Joseph, a positive anomaly with two maximums overlies a stock that is exposed between the Lostine River and Hurricane Creek. The main maximum has an amplitude of about 400 gammas and seems to be associated with granitic rocks and basalt in the southern part of Traverse Ridge and Ruby Peak. The other maximum, of 200 gammas less amplitude, overlies similar rocks near Sawtooth Peak. Along flanks of the anomaly, undulations in the contours indicate narrow anomalous extensions that are associated with basalt in the northern part of Traverse Ridge, the southeast end of Sheep Ridge, and the northern part of Hurricane Divide south of Twin Peaks. A south-trending arm of the anomaly extends over granitic rocks on Hurricane Divide between Lostine River and the head of Hurricane Creek. The magnetic anomaly is probably caused by the intrusive rocks whose magnetic response is supplemented locally by basalt of the overlying Columbia River Group.

To the east, a narrow magnetic high trends southward from Spring Creek to the South Fork Imnaha River. Superimposed on the high are magnetic maximums near Chief Joseph Mountain, Petes Point, and Sentinel Peak. Other maximums that seem to be related to the high are near Craig Mountain and east of Eagle Cap. North of Bonneville Mountain the anomaly mostly overlies older Triassic rocks and the

Martin Bridge Formation, considered essentially nonmagnetic rocks. The maximum near Chief Joseph Mountain includes basalt on the peak and plutonic rocks exposed about a mile to the south. The highest magnetic intensity seems to be caused by the basalt. Very likely the source of the main magnetic high consists of batholithic rocks that extend northward from Bonneville Mountain and underlie the older rocks. South of Bonneville Mountain, the anomaly overlies an exposed part of the batholith and older Triassic rocks. The maximum, over the mountain crest, near Petes Point, is attributed mainly to the plutonic rocks. Small masses of basalt on the crest contribute to the feature. Southward over Triassic sedimentary rocks, the magnetic high continues along much of the crest to Marble Mountain. This part of the high suggests that the batholith extends eastward into the sedimentary rocks underlying the upland. The sharp maximum near Sentinel Peak indicates that mafic rock lies near the surface in the northward-trending thrust zone. To the west, magnetic maximums south of Craig Mountain and east of Eagle Cap are associated with plutonic rocks. These features are attributed to the magnetic response of the granitic rocks at high elevations nearest the magnetic detector.

A zone of high magnetic intensity overlies the mountains east of the East Fork Wallowa River and North Fork Imnaha River in the eastern part of the mapped area. Within the zone are narrow positive anomalies over the upland between Mount Howard and Mount Nebo and over Wing Ridge. The anomalous part between East Fork Wallowa River and McCully Creek is ascribed to the plutonic rocks and overlying basalt on the mountain crest. Near East Peak and to the south, basaltic rocks along the crest cause a sharp narrow magnetic maximum. Northward the anomaly suggests that granitic rocks underlie the metasedimentary rocks and basalt on Mount Howard. Southeast of Aneroid Mountain, the high magnetic intensity is caused by basaltic rocks. The strongest magnetic response in the area was observed over the flows on Aneroid Mountain, indicated by a high-gradient maximum of more than 500 gammas. Owing mainly to the difference in elevation, the response of basalt on Mount Nebo is considerably less. The positive anomaly over Wing Ridge is obviously caused by basalt flows. Northeastward, the basalt-covered slopes on either side of Little Sheep Creek are indicated by a weaker part of the high-intensity zone.

The southeastern part of the mapped area shows moderate magnetic relief. Low magnetic intensity is associated with the sedimentary rocks bordering East Fork Eagle Creek. To the east, a positive anomaly overlies sedimentary rocks on Red Mountain. This anomaly has an amplitude of about 200 gammas and is probably caused by a narrow intrusive mass in the older Triassic rocks along the mountain crest.

The anomaly may represent a concealed northeastward extension of the Cornucopia stock. Trend of the feature suggests that the east part of the anomaly source swings north and then westward across Cliff Creek. High magnetic intensity of more than 300 gammas over the upland to the south is attributed to batholitic rocks and basalt exposed along the southern margin of the area. Near Cornucopia Peak, a narrow extension of the high suggests that a dikelike mass continues northeastward into the upland beyond Pine Creek. Eastward on the border, the older Triassic rocks along South Fork Imnaha River and the lake country south of Russel Mountain show low magnetic intensity. The low intensity indicates the weak magnetic response of these sedimentary rocks and suggests the absence of underlying batholithic rocks in this part of the area.

Passing through the central and western parts of the area, narrow zones of low magnetic intensity mark the Lostine River and Minam River valleys. West of the Pole Bridge Forest Camp in the northern part of the Lostine River valley, a small magnetic minimum is associated with basalt at the head of Goat Creek. This feature may represent abnormally directed remanent magnetization in part of the basalt flows.

In the northwestern part of the area, a magnetic high of more than 200 gammas occurs over the upland between North Minam River and the head of Bear Creek. The high is associated mainly with plutonic rocks, though maximums near Lookout Mountain and Sandy Saddle seem to be caused partly by basalt flows. Flows near Bear Creek also contribute to the northern part of the anomaly. Near Bald Mountain a weak magnetic low forms a narrow reentrant on the anomaly flank. This feature may be caused by abnormal magnetization in basalt near the mountain crest, or it may represent considerable alteration in rocks along a fault zone. The adjoining low over basalt to the north probably does not indicate a change in magnetic properties of the flows. It seems to be controlled by weak magnetic responses where widely spaced flight lines passed over low parts of the basalt surface. Very likely the feature is caused by topography.

To the south, positive anomalies of moderate intensity overlie the mountains northeast of the Minam River. The anomalies are produced by granitic rocks and small patches of basalt whose high points are marked by magnetic maximums near Hazel Mountain, Katy Mountain, Glacier Mountain, and Brown Mountain.

Along the northwest border of the area, small changes in magnetic gradient reflect the general low topographic relief of igneous rocks and the nonmagnetic effect of scattered sedimentary rock exposures.

Elsewhere over the batholith, the anomalies can be accounted for by topography. Beyond the Minam River, a narrow zone of high intensity overlies mountains along the southwestern margin of the area. A maximum of more than 300 gammas occurs over plutonic rocks that form Squaw Butte in the northwest part of the zone. Southeastward the high-intensity zone includes granitic and basaltic rocks on Burger Butte, Sand Pass, and Mule Peak. Beyond Granite Butte, a magnetic maximum indicates batholithic rocks near the mountain crest. Another maximum that is attributed to batholithic rocks lies in the southern end of the zone between Eagle Creek and the head of Velvet Creek. Near the south edge of the area, weak magnetic highs over the upland crests on either side of Eagle Creek are thought to be produced by the granitic rocks.

### MAGNETIC FEATURES AND MINERAL DEPOSITS

None of the surface magnetic anomalies in the area appears to be directly indicative of metalliferous deposits. Most features can be accounted for by rocks on the batholith surface. However, a few anomalies whose sources are not evident suggest localities that may have economic significance.

The maximum near Sentinel Peak overlies sedimentary rocks in a fault zone. Perhaps the anomaly represents a metamorphic contact containing metalliferous deposits.

West of Cornucopia, the copper deposits lie in older Triassic rocks along the edge of a pluton expressed by a magnetic high. A northeastward extension of the anomaly indicates that a narrow body of intrusive rock continues across Pine Creek. The Queen mine is on the northwest flank of the extension and possibly the rocks included by the feature are favorable targets for prospecting.

The anomaly over Red Mountain may represent a narrow intrusive mass in the older Triassic rocks. Metallic mineral deposits might be found in rocks along the margin of the inferred mass indicated by steep flanks of the anomaly.

In the northwest part of the area, the magnetic maximum over Lookout Mountain extends southward over Wilson Basin. A mine near the south end of the basin lies along the flank of the anomaly, apparently in rocks of the batholith. Steep gradients and an inferred fault zone on the east flank of the anomaly suggest that shear zones may occur near the basin. The possibility of metalliferous deposits here seems worth further investigation.

Near Bald Mountain, the locality indicated by a magnetic low and its northwestward extension may warrant further investigation. Association of low intensity with rocks in the fault zone suggests widespread alteration in a deformed belt where the country rock may contain metalliferous lodes.

# MINERAL RESOURCES

## REGIONAL SETTING

The Wallowa Mountains lie on the north edge of a belt of metalliferous deposits that extends from central Grant County in Oregon eastward to Hells Canyon and beyond into Idaho. Principal metals found in the area are gold, copper, and silver, with minor amounts of lead. The gold-bearing deposits in Oregon make up the Blue Mountains gold belt (Brooks and Ramp, 1968, p. 42). Total gold production from the Blue Mountains belt before 1942 is estimated to be more than $54 million. More than $10 million of this is from the Cornucopia district in the southeastern part of the Wallowa Mountains.

The Blue Mountains gold belt also roughly coincides with the area of productive copper deposits, which extend from Quartzburg in Grant County to the Seven Devils district east of Hells Canyon in Idaho. The Keating and Homestead districts lie along the southeast edge of the Wallowas, but outside the Eagle Cap study area (Bowen, 1969, p. 122).

Gold deposits in northeastern Oregon are in quartz veins cutting a variety of rocks in and near granitic plutons. Most of the productive copper deposits are in sheared greenstone.

High-calcium limestone occurs in several places in northeastern Oregon. It constitutes a major resource because of its scarcity elsewhere in Oregon and in large parts of adjacent states. The Wallowa Mountains contain a significant percentage of the known limestone resources of Oregon. Limestone has been quarried in the Lostine Valley and on Murray Creek, just outside the wilderness area boundary. Major reserves are in Lostine Valley, Hurricane Creek Valley, East Eagle Creek valley, and the headwaters of the Imnaha River.

Within the Wallowa Mountains, the most productive mineral deposits are the lode and placer gold of the Cornucopia district, part of which is in the southeastern part of the study area. The principal gold production came from veins along the west side of Pine Creek, about 1–2 mi northwest of the town of Cornucopia. The most productive veins were the Union-Companion and Last Chance veins. Cornucopia Gold Mines, Inc., operated the mine from 1930–1941, when they were forced to shut down as a result of the War Production Board Order L–208. At that time, additional ore was known to be present (Brooks and Ramp, 1968, p. 90). There are approximately 36 mi (60 km) of underground workings, and some extend northwestward to positions beneath existing or proposed wilderness area boundaries. Recovery of gold from placer deposits on Pine Creek between Cornucopia and Halfway started in the fall of 1972 (Engdahl, 1972).

The Eagle district is south of the study area and includes mines 3–11 mi (5–18 km) southwest of Cornucopia. At least 10 properties have been worked in the district. Lode gold production from the district was mainly from the Sanger mine, whose output is estimated at $1.5 million. The Sanger was discovered in 1870, and production ceased in 1897. The Mother Lode copper mine produced a limited amount of gold from 1935 through 1938. Production from other lode deposits in the Eagle Creek district has been small. Some of the better known prospects are the Basin, East Eagle, Amalgamated, Lily White, and Dolly Vardon. Other mining districts within 20 mi (32 km) of the study area include Homestead, Medical Springs, and Sparta.

The history of mining in the northern part of the Wallowa Mountains is sketchy. There have been several enterprises dating from early days, but the details of these are obscure. According to Joe Lagore, a retired prospector-miner, there was some mining interest and activity as early as 1862. The first recorded mining claim was about 1885 (Smith and Allen, 1941, p. 39).

Smith and Allen (1941) reported that in the middle 1880's, a shipment of 1,350 lbs (613 kg) of silver ore was made from the Williams mine. This property is about 1 mi (1.6 km) outside the east boundary of the study area. In the late 1880's, Dr. J. T. Dean built a small smelter at the head of Wallowa Lake. It was said to be unsuccessful and later burned down. In 1904 or 1905 the Tenderfoot episode took place—a mining promotion scheme financed by the sale of stock. Camps were built and preparation made to extract ore, but according to the best examination, the samples had been salted and the project was abandoned. During the 1920's, there was substantial development at the Black Marble quarry (pl. 2, No. 5). Kilns were built, and crystalline limestone was burned for some years. The black marble of the quarry has been classified by stone cutters as equal to any of the imported marbles. The jet black groundmass carries blebs and small lenses of white calcite that give the polished rock its pleasing appearance.

Copper, molybdenum, and tungsten, with local gold and silver, are known in quartz veins and tactite zones in the Wallowa batholith or along its margins. Many localities have been prospected, many have been claimed, but none have produced.

## METHODS OF STUDY

Principal methods of study by the U.S. Geological Survey involved geologic mapping and geochemical sampling. Traverses were made along ridges to provide a reconnaissance check on geology, to obtain representative samples of fresh rock, and to search for evidence for rock alteration or mineralization. Geochemical studies concentrated on the results obtained from stream sediment samples that were collected and analyzed in the field. Most samples were collected from tributary streams near their junctions with main streams, and some were collected from main streams. Areas from which anomalous stream samples were collected were further investigated during the geologic work that followed.

Known mineral deposits were visited to determine their potential and to note the nature of their geologic environment. Recognition of such environments could be applied to search for deposits elsewhere. Panned concentrates were collected from all major streams for analysis for recoverable heavy metals.

Bureau of Mines personnel searched Baker, Union, and Wallowa Counties claim records and examined the claims and related mineralized areas.

In appraising the mineral resources, special attention was given to all known mineral deposits and to hydrothermally altered areas and contact zones considered favorable for mineral deposition both within the wilderness area and in adjacent areas. These areas were examined, mapped, and sampled extensively. Also a brief mining and marketing analysis was made of the mineral commodities of the area.

## SAMPLING

The U.S. Geological Survey collected approximately 1,500 samples, including more than 800 stream sediment samples and more than 500 rock samples. Sample localities and sample types are shown on plate 2. Analytical results from samples judged to contain anomalous amounts of certain metals are shown in table 4, at the end of the report. For the purpose of this report, anomalous rock, stream sediment, or panned concentrate samples are considered to be those that had one or more of the following: 1 ppm (part per million) or more gold; 10 ppm or more silver; 100 ppm or more copper, molybdenum, or tungsten; 500 ppm or more lead or zinc. Samples of basalt from the Columbia River Group are excepted. The background content of copper in basalt commonly runs from 100–300 ppm; copper at this level in basalt is, therefore, not considered anomalous. Stream sediment and panned concentrate samples are also considered anomalous if they contain 10 ppm or more citrate-soluble heavy metals.

Anomalous amounts of one or more metals were found in 221 samples. Of those, 69 are stream sediments, 150 are rock, and 2 are panned concentrates. Fifty-four of the rock samples are selected samples of veins, mineralized rock, or altered rock.

The samples listed in table 4 are classified according to source. The three major types of samples—rock, panned concentrates, and active stream sediments—form the major categories. Within those classes, rocks and stream sediment samples are further divided. The classes of rock used are veins, mineralized rock, and altered rocks; older Triassic rocks; Martin Bridge Formation; Hurwal Formation; Wallowa batholith and related rocks; basalt; and other rocks. Stream sediment sample classification refers to the bedrock drained by the stream providing the sample. Thus all the major rock types are represented. In this group of samples, the category "other sources" refers to all stream sediments from streams draining more than one rock type.

One panned concentrate sample and stream sediment sample listed in table 4 contained traces of gold, but we believe that the sediments as a whole contain too little gold to be of economic interest.

Anomalous samples listed under veins, mineralized rocks, and altered rocks are almost entirely hand-picked specimens from known prospects, selected for maximum ore mineral content. They do not represent typical rock at those localities or typical grade of the ores. They were collected in order to check on the metals present, rather than as a means of discovering deposits.

The Bureau of Mines collected 487 samples from veins, tactite zones, and altered rocks that might contain valuable concentrations of economic minerals. All samples were routinely analyzed for gold and silver and analyzed spectrographically. Samples which contained anomalous amounts of valuable elements were further analyzed chemically. In addition, 73 samples were taken from unconsolidated gravels for indications of gold and other heavy minerals.

Copper and copper-molybdenum is associated with skarn near the margins of the Wallowa batholith (Smith and Allen, 1941, p. 41–52). The batholith and older rocks are cut by small quartz veins that locally contain significant amounts of copper, lead, and zinc, and in places silver and gold.

A few unusually high copper anomalies in the Wallowa batholith rocks, as in samples OG242 and OG267, are actually from specimens taken from copper-bearing quartz veins. Samples high in silver and the one sample containing gold (1W247) are also of this type.

Most mineralized rock samples are from older prospects. Some of the prospects may be of economic interest as a potential future resource.

Stream sediment samples from streams draining the cirque on the northeast side of Red Mountain contained as much as 1,000 ppm copper (pl. 2). Rocks in the cirque are mostly volcanic flows and breccias, with some fine-grained dark-colored sedimentary rocks, part of the older Triassic rock sequence. They have been cut by many quartz veins, mostly less than 1 inch (2.5 cm) wide. Many of the veins contain copper minerals, and in places the host rocks are also copper stained. The average grade of copper-bearing rock is low. Chip samples from veins at a prospect in the cirque and other prospects in the area contained a maximum of 0.016 percent copper. A similar occurrence of copper minerals, apparently somewhat smaller in size, is at the west end of Boner Flat.

A single float boulder of batholithic rock in a gravel bar on the Little Minam River contained commercial quantities of copper. Its unknown source is presumably the watershed.

Samples containing 50–200 ppm copper and 100–300 ppm zinc were collected from the Hurwal Formation. All are from beds that also contain 2–10 percent pyrite that is believed to be syngenetic. The association and occurrence suggests the kupferschiefer black shale deposits of Germany, but base-metal content of the Hurwal does not appear great enough to be of economic interest.

Some general conclusions can be drawn from the stream sediment anomalies. Anomalies in stream sediments from the batholith are all believed to be related to known veins. The highest copper anomalies from older Triassic rocks, as pointed out above, came from the Red Mountain area. Two samples from areas underlain by the Martin Bridge Formation show anomalies in copper and heavy metals; the sources were not found. None of the samples from streams draining areas underlain by several rock types can be related to areas of significant discoveries.

## APPRAISAL OF MINERAL POTENTIAL

In the Eagle Cap Wilderness area, metalliferous deposits are found in veins and near igneous contacts and in metamorphic and sedimentary rocks.

Veins occur in sheared and fractured granitic rock and metamorphic rock near the border areas of granitic plutons. They contain precious metals in a gangue of quartz. The known deposits are of low tenor and have yielded little ore. The structures along which veins occur are minor, and no large deposits are known on the mapped faults. In contrast, gold-bearing quartz veins in the Cornucopia district, adjacent to the study area on the southeast, were of sufficient size and grade to have been mined. These appear to be related to the Cornucopia stock, a small part of which extends into the Eagle Cap Wilderness. Veins similar to those in the Cornucopia district were not found in or around the other stocks which make up the Wallowa batholith.

Base and precious metal deposits are found near contacts between granitic rocks and thermally metamorphosed rocks in the Eagle Cap

Wilderness. They are small, low grade, and have yielded little ore. Other similar unknown deposits probably exist.

An area about three-fourths of a mile (1.2 km) square on the northeast side of Red Mountain contains disseminated copper minerals in greenstone. The area is about a mile (1.6 km) from the boundary of a phase of the Cornucopia stock and may be related to a subsurface extension of that body. Similar disseminated deposits may exist around other intrusives, but none have been found.

Extensive high-calcium limestone deposits in Hurricane Creek, East Eagle Creek, Lostine Valley, and Imnaha River valley constitute a major nonmetallic mineral resource.

In summary, the greatest potential for mineral deposits is in the southern, eastern, and northeastern parts of the Eagle Cap Wilderness, near the contacts of granitic plutons with older rocks; the potential is much less in the central and western parts of the area, where granitic rocks are in contact with younger rocks.

Tertiary gravel underlying Miocene basalt flows may contain placer gold in the northwestern part of the area.

## ECONOMIC APPRAISAL OF MINERAL POTENTIAL

The principal known mineral commodities in the study area are gold, silver, copper, and limestone. Molybdenum, tungsten, lead, and zinc are minor byproducts in some deposits.

### GOLD

Gold is present in detectable amounts at many localities in the study area, principally in association with hydrothermally altered rocks. Only those deposits in the Cornucopia mining district outside the wilderness are considered a significant metallic resource. At Cornucopia, gold was mined from large well-defined quartz veins in both greenstone and granodiorite. Between $10 million and $18 million in gold is reported to have been produced from the district (Brooks and Ramp, 1968, p. 89); $15 million is believed to be a realistic figure. Nearly all underground workings are inaccessible, and the amount of ore remaining cannot be determined.

Consumption of gold has increased in recent years, especially in industrial and defense applications. An estimated 7.5 million troy oz. (98.3 million g) was used in arts and industrics of the United States in 1972, but domestic mines produced only 1.45 million oz (19 million g) (U.S. Bureau of Mines, 1973, p. 60 and 61). The floor price of gold is $42.22 per troy ounce ($1.35/g); however, the world market price reached $90 per troy ounce (2.88/g) during February 1973. Domestic consumption of gold in the arts and industries has exceeded domestic mine production since 1957, and the gap continues to widen.

### SILVER

Like gold, silver is found in detectable amounts throughout the study area associated with hydrothermally altered rocks and tactite zones. Significant concentrations of silver associated with lead and zinc are found in quartz veins at the Joseph Mountain mine. Silver may also be an important byproduct from copper-enriched tactite zones.

Domestic mine production of silver in 1972 was estimated at 37.9 million troy oz (1,179 million g). Imports exceeded exports by an estimated 33.8 million oz (1,051 million g), and consumption, including that for coinage, was 137.1 million oz. (4,264 million g). About two-thirds of the silver produced was a byproduct of base metal production, 32 percent came from silver ores, and 2 percent from gold-silver ores. The average New York silver price during 1972 was $1.67 per troy ounce ($0.053/g). Average New York price for January 1973 was $2.01 per troy ounce ($0.064/g).

### COPPER

Copper, the most abundant metal in the study area, is found in anomalous quantities throughout the area. Significant concentrations are in Aneroid Lake Basin, McCully Basin prospect, Dotson prospect, Contact group prospect, Frazier prospect, and Rainbow prospect. The major occurrences are in tactite zones along granodiorite-limestone contacts. Copper minerals are also disseminated in limy beds in the Hurwal Formation. Some shears and quartz veins in greenstone contain anomalous amounts of copper.

United States copper production, an estimated 1.658 million short tons (1.504 t), was the largest in the world in 1972; nevertheless, substantial amounts were still imported. Copper prices averaged 51.2 cents per pound during 1972 ($1.13/kg) (U.S. Bureau of Mines, 1973, p. 42, 43). Domestic copper demand is forecast to increase at an annual rate of about 4 percent, and the price should follow. Long-term copper requirements may result in greater reliance on imports and stimulate technology so that former unprofitable domestic deposits can be mined.

### LIMESTONE

The only important nonmetallic resource within the study area is limestone in the Martin Bridge Formation, a potential source of calcium carbonate for lime and cement. The Martin Bridge Formation is exposed over an area of about 15 mi$^2$ (39 km$^2$) in the northern part of the study area and about the same area in the southern part. It makes up the white cliffs on the east wall of the Lostine River valley at Lapover, Sacajawea Peak and the Matterhorn on Hurricane Creek, and Cusick and Marble Mountains on the Imnaha River.

During the 1920's, several square miles of limestone and marble of the Martin Bridge Formation were staked in the northern part of the study area. There are patented claims in the Hurricane Creek drainage owned by the Wallowa Cement and Lime Co. Periodic interest has been shown in reactivating the Black Marble quarry near the north boundary of the study area. This quarry was operated intermittently from the 1920's until the early 1950's but has been inactive since then.

The only limestone producer operating in northeastern Oregon in 1972 was the Oregon Portland Cement Co.'s plant at the town of Lime, which has been in operation since the 1920's. The quarries near Lime supplied limestone to the company's cement plant in the Portland metropolitan area and to sugar refineries in southern Idaho. However, since 1962 the cement plant has used lime from sources outside Oregon because of lower transportation costs.

Because of small local demand and high freight rates, the limestone-cement industry in northeastern Oregon will not expand in the foreseeable future; more likely any expansion of the limestone industry will take place in the southern part of Baker County, which is more favorably located.

## MINING CLAIMS

Examination of county records showed approximately 1,500 mining claims in the study area. The earliest claims were located in the 1880's. Many mineralized areas were staked more than once; thus courthouse records show a great many more claims than actually exist on the ground.

Five groups of patented claims are in the area: the Contact group near Lapover on the Lostine River, the Seeber (Walla Walla) group near Aneroid Lake, the Frazier group on Hawkins Pass, the Valley View group near Cornucopia, and a group of limestone placer claims along Hurricane Creek. Only the mineral rights are patented on the placer claims; the surface is administered by the U.S. Forest Service.

## MINES, PROSPECTS, AND MINERALIZED AREAS

Property descriptions and evaluations are divided into two sections: the Cornucopia mining district and the Wallowa unorganized mining district. The location of samples taken by the U.S. Geological Survey is shown on plate 2. U.S. Bureau of Mines samples are keyed to individual property maps.

Nine lode properties in the Wallowa unorganized district and two in the Cornucopia district have some mineral resource potential and are described in detail. The remaining 68 lode properties of apparent low potential are tabulated. Also, four placer areas are reported. Mines and prospects are shown on plate 2.

## CORNUCOPIA MINING DISTRICT

Mines and prospects in the Cornucopia district are all within 4 mi (6.4 km) of the town of Cornucopia, located in the upper Pine Creek drainage at the southeast end of the Wallowa Mountains (pl. 2, Nos. 65 through 73). Productive gold veins are all located on Granite Mountain (Cornucopia Mountain), 2–3 mi (3–5 km) north and west of the town of Cornucopia and 1,000–3,000 ft (300–910 m) above it. Many lode prospects are on the east and south sides of Granite Mountain and on Red Mountain, Simmons Mountain, and in Norway Basin; there are also placers on Pine Creek.

Gold was discovered at Cornucopia in the late 1870's and produced intermittently until 1903. The production during this period was $1,008,000. The Union-Companion mill was built in 1913 and the Baker mine's mill in 1914. There was almost steady production until 1941, when the major mines operated by the Cornucopia Gold Mines Co. shut down. The entire production from 1870 to 1941 is estimated to be at least $15 million, most of which came from the properties owned by the Cornucopia Gold Mines Co.

### GRANITE MOUNTAIN VEINS

Goodspeed (1941) mapped seven veins on Granite Mountain (pl. 2, No. 71; fig. 11). The veins are related to an irregular granodiorite intrusion, the Cornucopia stock, which is 3–4 mi (5–6 km) wide and intrudes schist and greenstone. The major veins from east to west are Whitman, Union-Companion, Last Chance, Wallingford, and Valley View. These veins are approximately 1,500–2,000 ft (460–610 m) apart, strike about N. 20° E., and dip 30°–45° NW. (fig. 12). The vein fillings are lenticular and discontinuous; in some places they consist of a seam of fault gouge devoid of quartz; at other places they are composed of milky-white quartz several feet thick, with pyrite, chalcopyrite, tetrahedrite, and minor sphalerite and galena. Thicknesses of up to 20 ft (6 m) were reported on the Union-Companion. Highest gold values are usually associated with chalcopyrite. The veins cut granodiorite, schist, and greenstone.

Numerous dikes of granodiorite porphyry, basalt, and aplite also intrude all three rock types. The basalt dikes strike in several directions and commonly follow the shear planes occupied by the quartz

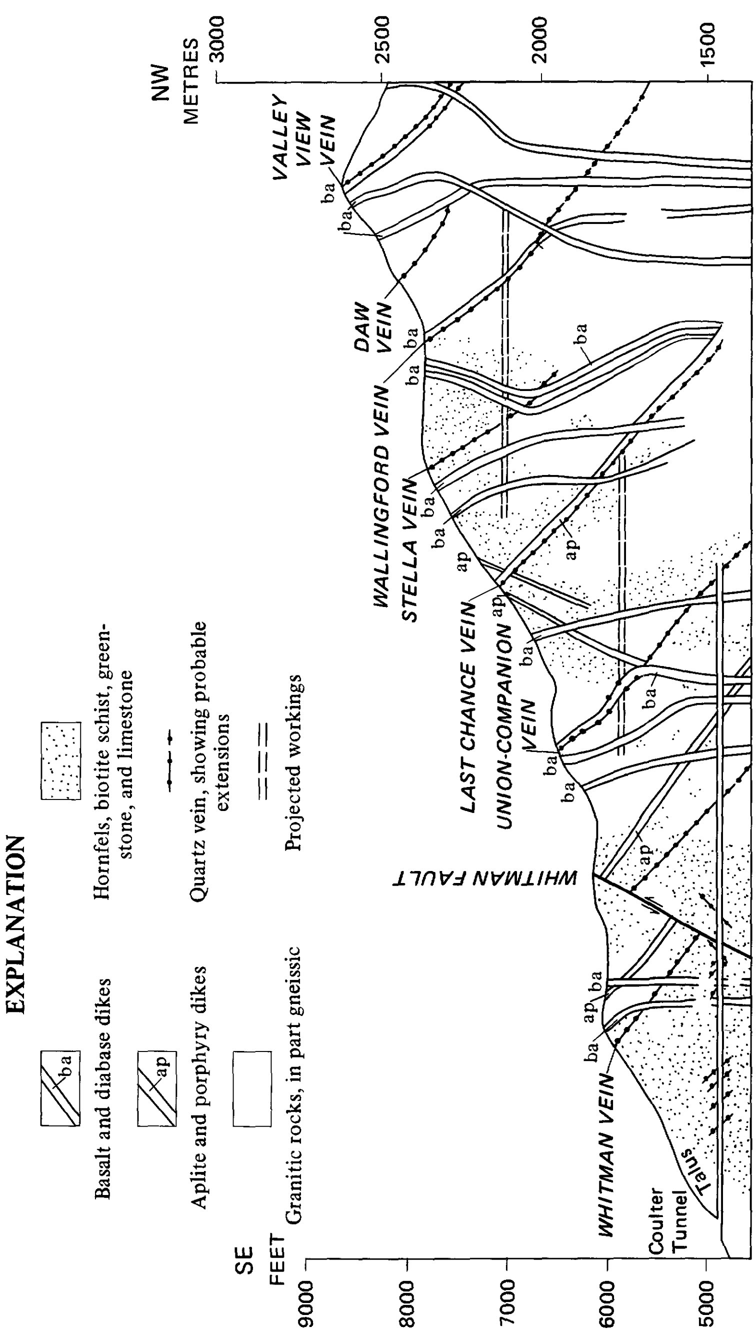


FIGURE 11.—Generalized cross section showing principal veins of Cornucopia mining district, viewed from the northeast. (Modified from Goodspeed, 1941).

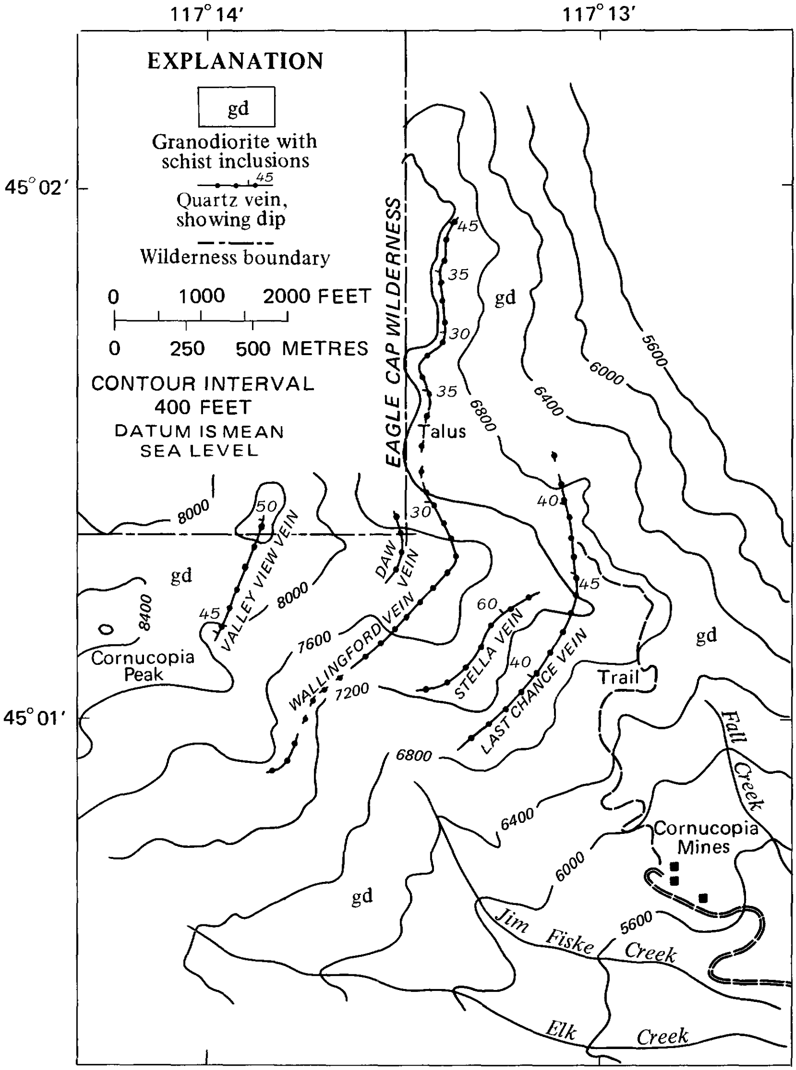


FIGURE 12.—Selected Granite Mountain veins, Cornucopia mining district.

veins. The quartz may be on either or both sides of the dikes.

Most lode-gold production from the district was from veins of the Cornucopia Gold Mines group. Largest production, $9 million, was from the Union-Companion vein. Three other important veins of the group are the Last Chance, Wallingford, and Valley View. The Last Chance vein is the second largest gold producer in the group.

Underground workings at the Cornucopia Gold Mines in 1939 to-

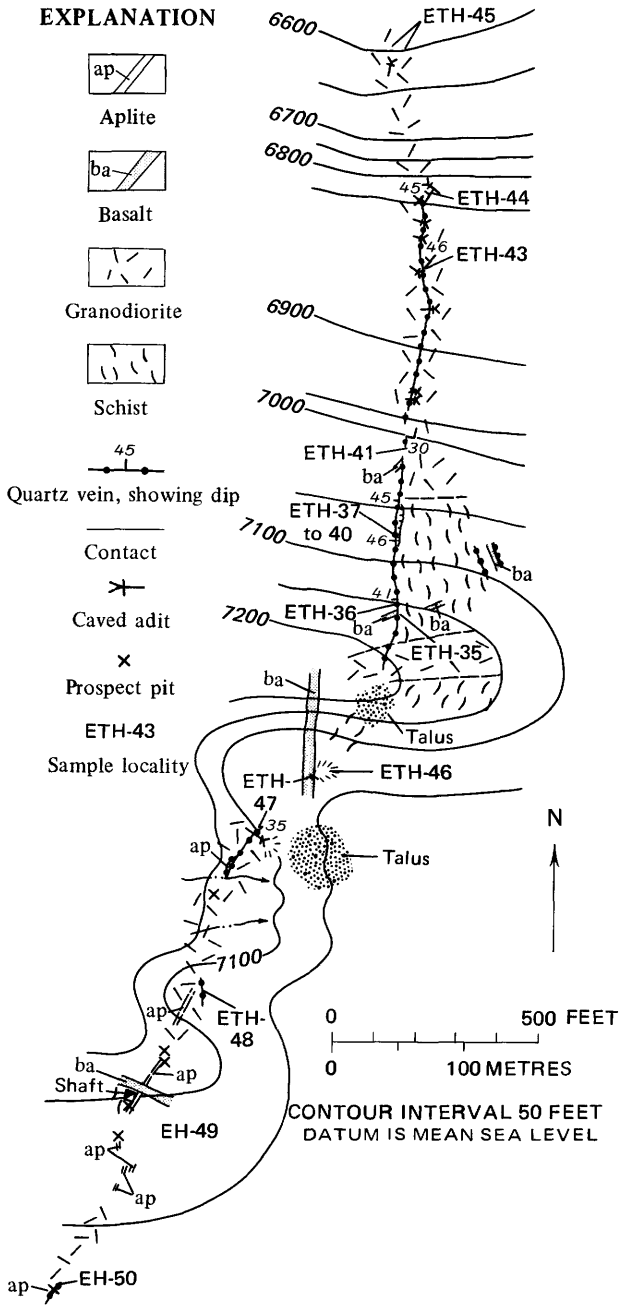


FIGURE 13.—Surface geology, Last Chance vein, Cornucopia district.

taled about 32 mi (51 km). They ranged in elevation from 4,800 to over 8,000 ft (1,460 to over 2,440 m). Nineteen levels were developed on the Union-Companion and Last Chance veins. Workings on the Last Chance vein and veins to the west are inaccessible; therefore, only the surface exposures were mapped and sampled. The Whitman and Union-Companion veins were not examined because they are outside the wilderness.

The veins mapped and sampled are the Last Chance, Stella, Wallingford, Daw, and Valley View. Forty samples were taken: 28 were chipped from rock exposures, and 12 were selected samples taken from mine dumps.

### LAST CHANCE VEIN

The Last Chance vein is intermittently exposed for 3,200 ft and ranges in thickness from 0.5 to 4 feet (0.2 to 1.4 m) (fig. 13). The vein is lenticular and cuts granodiorite and schist. In places the vein follows an aplite dike on both sides. Workings consist of 10 caved adits and numerous sloughed pits. The vein has been stoped on 19 levels (Oregon

| Sample | | | Description | Gold (ounce per ton) | Silver (ounce per ton) |
|---|---|---|---|---|---|
| No. | Type | Locality or length (ft) | | | |
| ETH-35-- | Chip-- | 3.0 | Iron oxide-stained white quartz---- | 0.06 | 1.4 |
| ETH-36-- | --do-- | 4.0 | --do------------------------ | Tr | N |
| ETH-37-- | --do-- | 1.5 | Iron oxide-stained, vuggy white quartz-------------------- | Tr | 1.8 |
| ETH-38-- | --do-- | 8.5 | Aplite dike------------------ | .13 | Tr |
| ETH-39-- | --do-- | .5 | Iron oxide-stained white quartz---- | .03 | .2 |
| ETH-40-- | --do-- | 4.0 | Iron oxide-stained silica-rich argillite | .04 | .3 |
| ETH-41-- | --do-- | 2.0 | Iron oxide-stained, vuggy white quartz vein---------------- | .23 | 1.4 |
| ETH-43-- | --do-- | 2.0 | --do------------------------ | .01 | N |
| ETH-44-- | --do-- | 2.0 | Iron oxide-stained, vuggy white---- | Tr | N |
| ETH-45-- | Select | Dump | Iron oxide-stained white quartz with disseminated pyrite and chalcopyrite---------------- | .22 | 1.1 |
| ETH-46-- | --do-- | -do- | Iron oxide-stained, vuggy white quartz-------------------- | .36 | 1.1 |
| ETH-47-- | Chip-- | 3.5 | --do------------------------ | Tr | .1 |
| ETH-48-- | Select | Dump | --do------------------------ | .16 | 1.1 |
| EH-49--- | Select grab- | Dump | Iron oxide-stained white quartz with <1 percent pyrite--------- | .18 | 2.0 |
| EH-50--- | --do-- | -do- | Iron oxide-stained white quartz---- | .91 | 2.5 |

FIGURE 13.—Continued.

Department of Geology and Minerals Industries, 1939), and an undetermined amount of mineralized rock remains. Chip samples taken

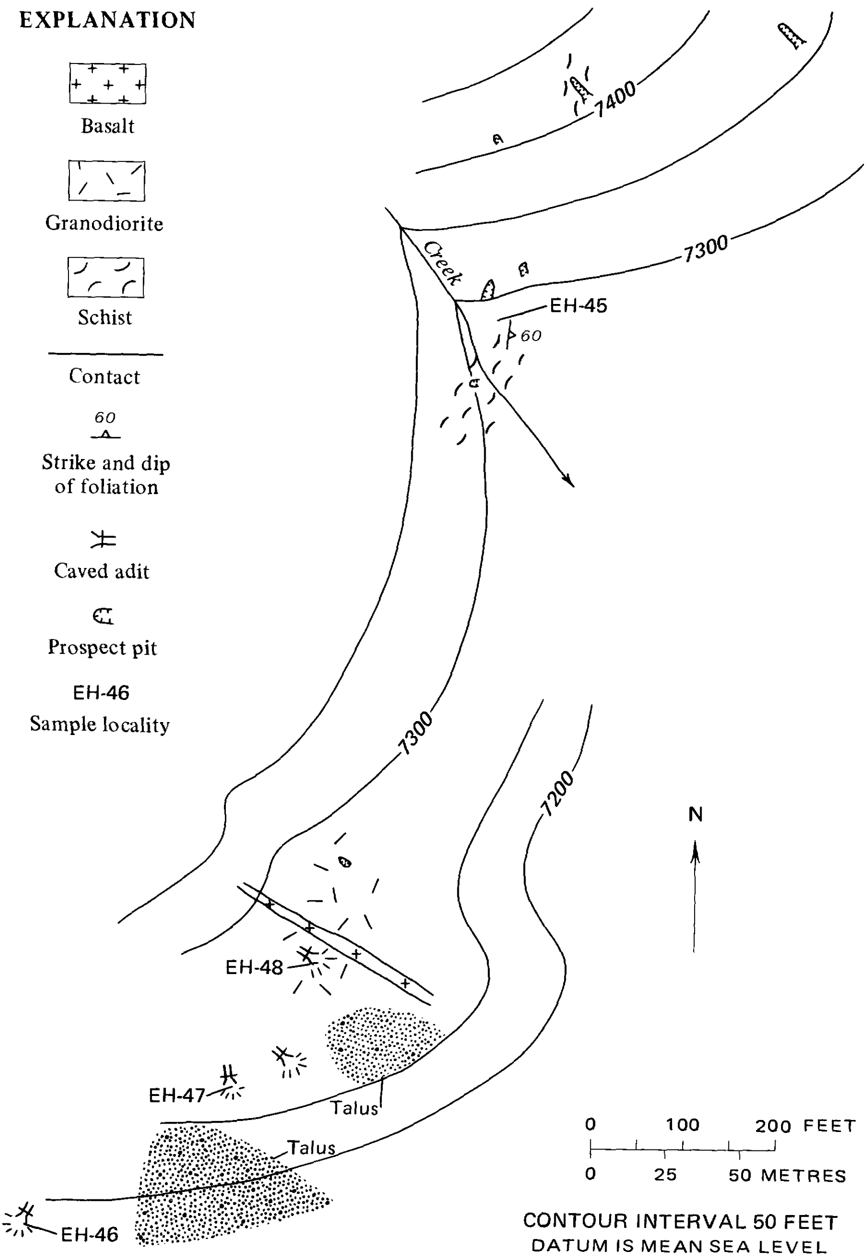


FIGURE 14.—Surface geology, Stella vein, Cornucopia district.

across the remaining vein exposures contain a trace to 0.23 oz gold per ton (5.9 g/t) and as much as 1.8 oz silver per ton (46.3 g/t). Sample ETH–38, an 8.5-foot (2.6-m) aplite dike dividing two essentially barren segments of quartz vein, contains 0.13 oz gold per ton (3.3g/t). It is not known what tonnage this dike represents.

### STELLA VEIN

The Stella vein has a surface strike length of at least 1,600 ft (490 m) based on float and old workings (fig. 14). Some pieces of quartz float are as much as 1.5 ft (0.46 m) long. Workings consist of four caved adits and eight sloughed pits. Four select samples of quartz, taken from dumps, contained from 0.03 to 0.45 oz (0.8 to 11.6 g/t) gold and 0.3 to 0.9 oz silver per ton (7.7 to 23.1 g/t).

### WALLINGFORD VEIN

The Wallingford vein is intermittently exposed on the surface for more than 7,000 ft (2,130 m) and is up to 6.5 ft (2 m) thick (figs. 15, 16). It is lenticular and discontinuous. Basalt dikes cut the vein or are adjacent to it in many places. Workings consist of 10 caved adits and numerous pits. The northern part of the vein has been extensively stoped to the surface. Chip samples across remaining quartz vein exposures contained from 0.01 to 0.48 oz gold per ton (0.2–12.3 g/t) and a trace to 1.2 oz silver per ton (30.9 g/t). The higher grade samples probably indicate the values contained in the ore produced from this mine.

### DAW VEIN

The Daw vein is discontinuous and poorly exposed, ranging in character from gouge to quartz. Workings consist of one sloughed

| Sample | | | Gold (ounce per ton) | Silver (ounce per ton) |
|---|---|---|---|---|
| No. | Type | Description | | |
| EH-45- - | Select, dump | Iron oxide-stained white quartz with 15 percent disseminated pyrite- - - - - - - - - - - - - - - - - - - | 0.37 | 0.9 |
| EH-46- - | - -do- - - - - - | Iron oxide-stained white quartz with <1 percent disseminated pyrite- - - - - - - - - - - - - - - - - - - | .45 | .7 |
| EH-47- - | - -do- - - - - - | Iron oxide-stained white quartz- - | .03 | .3 |
| EH-48- - | - -do- - - - - - | Iron oxide-stained white quartz with <5 percent disseminated pyrite- - - - - - - - - - - - - - - - - - - | .05 | .4 |

FIGURE 14.—Continued.

trench. A chip sample taken across a 1.5-ft (0.46–m)-wide exposure contained 0.06 oz gold per ton (1.5 g/t) and a trace of silver.

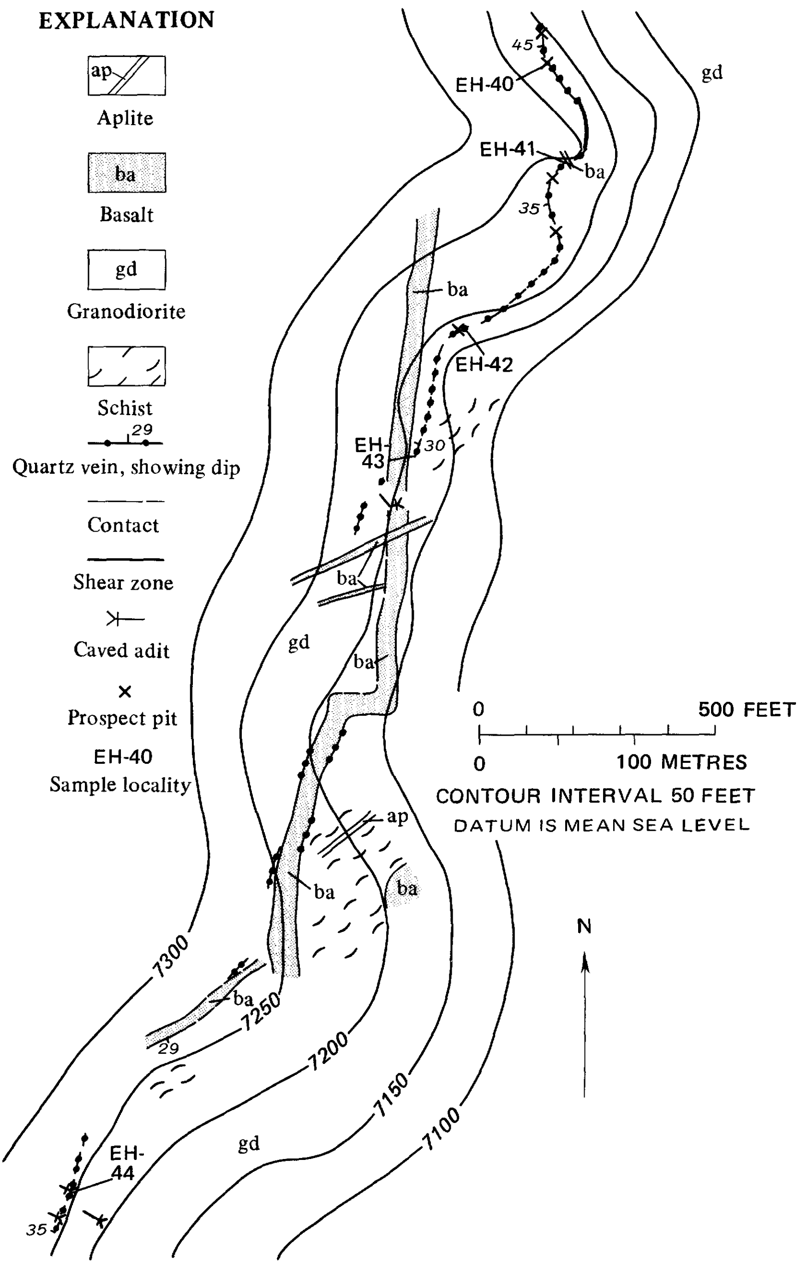


FIGURE 15.—Surface geology, Wallingford vein (north half), Cornucopia district.

VALLEY VIEW VEIN

The Valley View vein lies along a shear zone adjacent to a basalt dike. The zone is more than 1,600 ft (490 m) long, but the vein is exposed for only about half its length (fig. 17). The shear ranges in thickness from 0.5 ft (0.15 m) where filled with gouge and devoid of quartz to as much as 6.5 ft (2 m) where filled with quartz. Quartz-filled segments of the shear average 3 ft (0.9 m) in thickness. At the surface, the vein is exposed either on the footwall or hanging-wall side of a basalt dike. Caved workings consist of an adit, shaft, and numerous pits. There is evidence of some stoping. Chip samples contained from a trace to 0.02 oz gold per ton (0.5 g/t) and from 0 to 0.4 oz silver per ton (10.3 g/t).

SIMMONS MINE

The Simmons mine is on Simmons Mountain 2 mi (3.2 km) north of Cornucopia and 2,000 ft (610 m) above the West Fork of Pine Creek (pl. 2, No. 69). Although the property is nearly a mile outside the study area, future mine development may be affected by wilderness classification. An aerial tram from the side of the Queen of the West mill to the prospect remains intact.

Country rock is metabasalt and greenstone. A quartz vein about 1 ft (0.3 m) thick was traced for more than 2,000 ft (610 m) on the west and north sides of the mountain. Numerous pits and trenches, short inclined shafts, and crosscut adits explore the vein. The vein strikes N. 25°–30°W., dips 10°–30° NE., and ranges in thickness from less

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) |
|---|---|---|---|---|---|
| No. | Type | Locality or length (ft) | Description | | |
| EH-40-- | Chip-- | 3.0 | Iron oxide-stained, vuggy white quartz. Some crystals line cavities------------------ | 0.10 | 0.4 |
| EH-41-- | --do-- | 1.2 | Iron oxide-stained, vuggy white quartz------------------- | .05 | .5 |
| EH-42-- | Select- | Dump | Iron oxide-stained white quartz with stringers and blebs of pyrite, chalcopyrite, and galena------------------- | 1.08 | 6.1 |
| EH-43-- | Chip-- | 2.2 | Iron oxide-stained white quartz with 5 percent disseminated pyrite------------------ | .16 | .8 |
| EH-44-- | --do-- | 1.3 | Iron oxide-stained, highly sheared, silica enriched quartz monzonite | .01 | .4 |

FIGURE 15.—Continued.

than 1–4 feet (0.3 to 1.2 m). The principal quartz lens, explored by three adits, is about 350 ft (105 m) long and ranges in thickness from 1.5–4 feet (0.5 to 1.2 m). The vein consists chiefly of white quartz with some feldspar. Chalcopyrite and galena occur as thin lenses near the center of the vein.

Potential resources of gold- and silver-bearing rock, assuming a dip distance of 1,000 ft (300 m)—one-half the strike length—are estimated at 175,000 tons (159,000 t). Four samples taken across the vein aver-

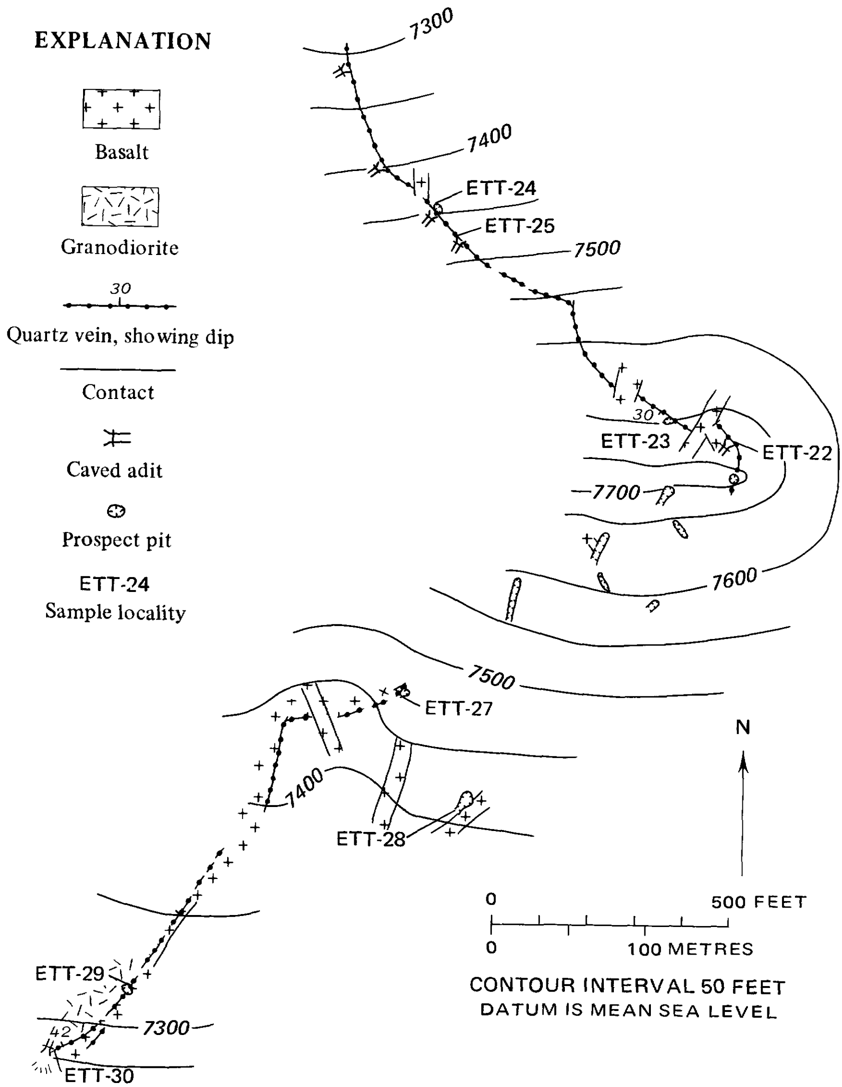


FIGURE 16.—Surface geology, Wallingford vein (south half), Cornucopia district.

aged 0.09 oz gold (2.3 g/t) and 1 oz silver per ton (25.7 g/t). The property is a potential source of gold and silver resources.

### MISCELLANEOUS LODE PROSPECTS

Several prospects in the district were examined that have little or no economic potential or are not sufficiently exposed to indicate their potential. They are listed in table 2.

## WALLOWA UNORGANIZED MINING DISTRICT

The Wallowa district includes all the study area except for the southeast corner, which is in the Cornucopia district. Mineralized rock occurs throughout the district. The prevalent metallic commodity is copper, which is found in shears in greenstone and in tactites at granodiorite-limestone contacts. At places molybdenite occurs in the tactite and in the main body of granodiorite. A potential silver-lead resource with minor gold, copper, and zinc values is located on Chief Joseph Mountain.

### JOSEPH MOUNTAIN MINE (McCULLY MINE)

The project on the east slope of Chief Joseph Mountain has been called the Joseph Mountain mine and the McCully mine (pl. 2, No. 15). The first mining claims were recorded in 1919. In recent years, four lode claims were located on and adjacent to the earlier prospects. There is no record of mineral production.

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) |
|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | |
| ETT-22-- | Chip-- | 3.1 | Iron oxide-stained, vuggy, white quartz. Sericite at basalt contact------------ | 0.01 | 0.5 |
| ETT-23-- | --do-- | 6.3 | Massive white quartz vein----- | .06 | .4 |
| ETT-24-- | --do-- | 1.5 | Bleached, sericitized, iron oxide-stained granodiorite adjacent to quartz vein------ | .01 | .2 |
| ETT-25-- | --do-- | 4.5 | Iron oxide-stained, vuggy white quartz------------------ | .48 | 1.2 |
| ETT-27-- | --do-- | 2.3 | Iron oxide-stained, vuggy white quartz. Sericite at basalt contact---------------- | .02 | .5 |
| ETT-28-- | --do-- | 2.7 | Iron oxide-stained, vuggy white quartz. Zones of sericite---- | .01 | Tr |
| ETT-29-- | --do-- | 3.7 | Iron oxide-stained white quartz | .02 | 1.2 |
| ETT-30-- | --do-- | 3.5 | Iron oxide-stained white quartz with some sericite zones---- | .12 | .6 |

FIGURE 16.—Continued.

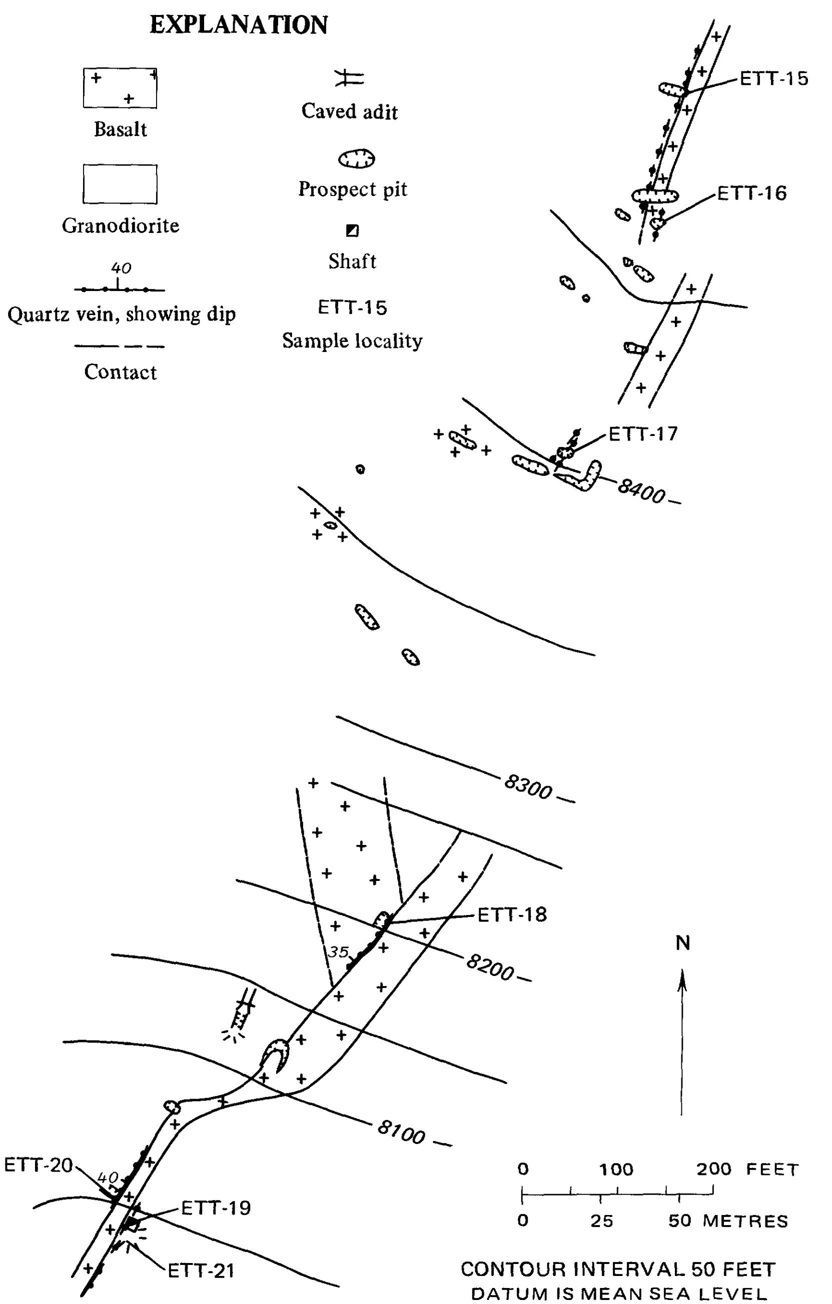


FIGURE 17.—Surface geology, Valley View vein, Cornucopia district.

TABLE 2.—*Miscellaneous lode prospects, Cornucopia district*

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 65 | Deer-Elk | Greenstone is intruded by basalt dikes and quartz veins. Quartz-filled shear zones trend northwest and dip 30° to 70° SW. Quartz veins are from 1 to 13 ft (0.3 to 4.0 m) thick, average 2.8 ft (0.9 m) in thickness and are exposed over an area 500 ft wide and more than 2,000 ft (610 m) long. About 2 percent of the area is composed of massive white quartz veins containing inclusions of greenstone and mica schist. The veins contain pyrite, as disseminations and fracture fillings, and are iron-oxide stained. Greenstone is slightly altered a few inches (8 cm) away from the quartz contact. | Two adits, 2 shafts and 1 pit. | Twelve chip samples across quartz veins; average a trace of gold and 0.2 oz silver per ton. One of the samples from a 3.8-ft (1.2m) thick quartz vein; 0.07 oz (1.8 g/t) gold and 0.3 oz (7.7 g/t) silver per ton. One chip sample; traces copper and molybdenum. |
| 66 | Cliff Creek | Greenstone and argillite is sheared and intruded by quartz veins 1 to 14 inches (3 to 36 cm) thick. The largest quartz vein strikes north, dips vertically, is 12–14 inches (30–36 cm) thick, and is exposed 50 ft vertically and 120 ft long. The quartz contains 2–3 percent disseminated pyrite; surrounding greenstone and argillite contains 1–5 percent pyrite. The quartz and adjacent country rock is malachite stained. | One shaft. 30 ft (9 m) deep. | Three chip samples across the vein; average 0.3 oz silver per ton (1.8 g/t) and trace gold and copper. |
| 67 | Carnahan | A 6-ft (1.8-m) wide fractured zone in metabasalt trends N. 50° W. The zone is siliceous, pyritized, and iron-oxide stained. | One 10-ft (3-m) diameter sloughed pit. | One chip sample across fractured zone; a trace of silver. |

| Sample No. | Sample Type | Sample Locality or length (ft) | Sample Description | Gold (ounce per ton) | Silver (ounce per ton) |
|---|---|---|---|---|---|
| ETT-15-- | Chip-- | 1.5 | Iron oxide-stained white quartz vein------------------- | 0.02 | 0.1 |
| ETT-16-- | --do-- | 3.5 | Iron oxide-stained, vuggy white quartz vein with 1 percent disseminated pyrite-------- | Tr | N |
| ETT-17-- | Select- | Dump | Iron oxide-stained, vuggy white quartz----------------- | .05 | .1 |
| ETT-18-- | Chip-- | 1.2 | Altered and silicified, granitic contact with basalt dike. Iron oxide-stained------------- | Tr | .2 |
| ETT-19-- | --do-- | 6.5 | Iron oxide-stained, vuggy white quartz vein------------- | .02 | .4 |
| ETT-20-- | --do-- | 4.2 | Iron oxide-stained white quartz vein------------------- | .01 | .4 |
| ETT-21-- | Select- | Dump | Iron oxide-stained, vuggy white quartz, <5 percent pyrite | .03 | .3 |

FIGURE 17.—Continued.

TABLE 2.—*Miscellaneous lode prospects, Cornucopia district*——Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 68 | Norway mine | A shear zone in greenstone containing quartz lenses trends north and dips steeply to the east (Oregon Department of Geology and Mineral Industries, 1939, p. 30). The lenses range from a few inches (8 cm±) to a few feet (60 cm±) thick. Swartley (1914, p. 61) reported these ore shoots were explored. | One caved adit reported 1,000 ft (300 m) long with short crosscuts. | A select sample of pyritized white quartz from dump; 0.10 oz gold per ton (2.6 g/t) and trace silver. |
| 70 | Red Mountain | Granodiorite of the Cornucopia stock is in contact with argillite and schist. Quartz veins roughly parallel to the contact strike N 80° E. and dip 50° NW. (Oregon Department of Geology and Mineral Industries, 1939, p. 31). The veins have a maximum thickness of 5 ft (1.5 m) and consist of white-banded quartz with sericite and pyrite. Some malachite stain was noted. | One caved inclined shaft on the vein was reported about 100 ft (30m) long; a crosscut 600 ft (185 m) below the vein was reported 1,000 ft (335 m) long (Oregon Department of Geology and Mineral Industries, 1939, p. 31). | Four chip samples of altered granodiorite, schist-argillite, and quartz; 0.1 to 0.9 oz silver per ton (2.6 to 23.1 g/t), trace gold and copper. |
| 72 | E and M (Smith claims) | A shear zone in granodiorite trends east and contains quartz veins. It is not well exposed on the surface. Vein quartz on prospect dumps is vuggy and pyritized. | Three caved crosscut adits; the most extensive is estimated at 150 ft (45 m) long. | A stockpile grab sample of vuggy quartz; 0.5 oz gold (1.3 g/t) and 1.2 oz silver per ton (30.9 g/t). A chip sample across shear zone; 0.2 oz (5.1 g/t) silver. |
| 73 | Little Eagle Creek | Quartz veins from 1 inch to 2 ft (3 to 61 cm) thick are in sheared argillite. The quartz is vuggy; contains pyrite and minor chalcopyrite, malachite, and azurite. | One caved shaft, 7 caved adits, and 18 pits and trenches. | A select sample of vuggy quartz from dumps; 0.23 oz gold (5.9 g/t) and 0.2 oz silver per ton (5.1 g/t). Two select samples of quartz; trace gold, 0.2 and 0.4 oz silver per ton (5.1 and 10.3 g/t), trace and 0.94 percent copper. |

Country rock is mostly greenstone and minor siliceous limestone. A quartz vein intrudes a bedding plane of the limestone. The vein is exposed in several places for a total strike length of 780 ft (240 m) (fig. 18). It trends N. 60° W., but locally it strikes N. 5°–10° W. and dips 20°–40° W. It ranges in thickness from 1.5 to 7 ft (0.5 to 2.1 m). Disseminated galena forms pods as much as 1 inch (2.5 cm) across. Molybdenite is sparsely disseminated. Malachite and azurite coat the surfaces of fractures. The vein also contains silver, probably associated with the galena, minor amounts of gold, and a trace of zinc. Galena is the most abundant metallic mineral in the vein.

Prospect workings consist of six adits and two pits (fig. 18). Adit 1, in greenstone and siliceous limestone, was not driven far enough to crosscut the downdip projection of the quartz vein. Adit 2 follows the quartz vein for 80 ft (24 m). Adit 3 follows the general strike of the vein for 30 ft (9 m). Three other adits on the vein are caved. Shallow prospect pits are located on the vein and in the adjoining siliceous limestone. Samples were chipped across the quartz vein and adjacent limestone.

The limestone contains only trace amounts of metallic minerals. Samples from the quartz vein contain a weighted average of 0.03 oz gold and 0.71 oz silver per ton (0.8 and 18.3 g/t), 2.90 percent lead, minor copper, and traces of molybdenum and zinc over an average width of 2.5 ft (0.8 m).

The prospect contains an estimated 68,000 tons (61,700 t) of quartz with the average metal content shown above. The estimate is based on an outcrop length of 780 ft (240 m), an inferred dip distance of 390 ft (120 m) (half the outcrop length), and average thickness of 2.7 ft (0.8 m).

### ROYAL PURPLE PROSPECT

The Royal Purple prospect is near Royal Purple Creek and the East Fork of the Wallowa River (pl. 2, No. 26). Two lode claims were recorded in 1954. The property is presently inactive, and there is no record of mineral production.

Locally, greenstone, argillite, and crystalline limestone are in contact with granodiorite. All four rock types are cut by aplite dikes. A tactite zone, 40–50 ft (12–15 m) wide, occurs at the contact of grandiorite with other rocks. The zone trends northeast and dips southeast about 85°. Much of it has been eroded by Royal Purple Creek and is covered by alluvium. One continuous exposure is 15 ft (4.6 m) wide, 200 ft long (60 m), and 50 ft (15 m) deep. The tactite is composed of quartz, garnet, and epidote. Malachite and azurite were the only valuable minerals seen, and copper, silver, lead, and gold were detected in samples from the zone. The richest mineralized rock is in the tactite zone along the hanging wall of the contact (pl. 1).

An adit crosscuts the hanging wall of the tactite south of Royal Purple Creek. Another adit, 116 ft (36 m) long, is in argillite and greenstone north of the creek. A prospect pit on the north side of the creek is on a shear zone in greenstone. Seven samples were taken, four from the tactite hanging wall and three in greenstone and argillite. A section of the tactite 8.5 ft (2.6 m) thick contains 1.5 percent copper; 5 ft (1.5 m) of the section contains 2.1 oz silver per ton (54 g/t) and a trace of gold and lead. Limited exposures did not allow a tonnage estimate to be made for this area. The argillite and greenstone on the north side of Royal Purple Creek contain only traces of metals. However, a minable copper-silver deposit might be discovered here if extensions of the tactite zone can be found along the granodiorite contact (pl. 1) or if assay values similar to those in the tactite zone can be found under the alluvium cover.

### McCULLY BASIN PROSPECT

The McCully Basin prospect is on the west side of McCully Basin (pl. 2, No. 29). Three adits, two of which are caved, one inclined shaft, and two pits explore tactite zones near a granodiorite-argillite contact (fig. 19). Locally, the zones and adjacent argillite and granodiorite are overlain by basalt. The argillite is thinly bedded, blue gray to light green, and stained with iron oxide. The iron oxide is derived from finely disseminated pyrite that constitutes less than 1 percent of the rock. The argillite strikes N. 70°–85° W. and dips 45°–50° S. At places it

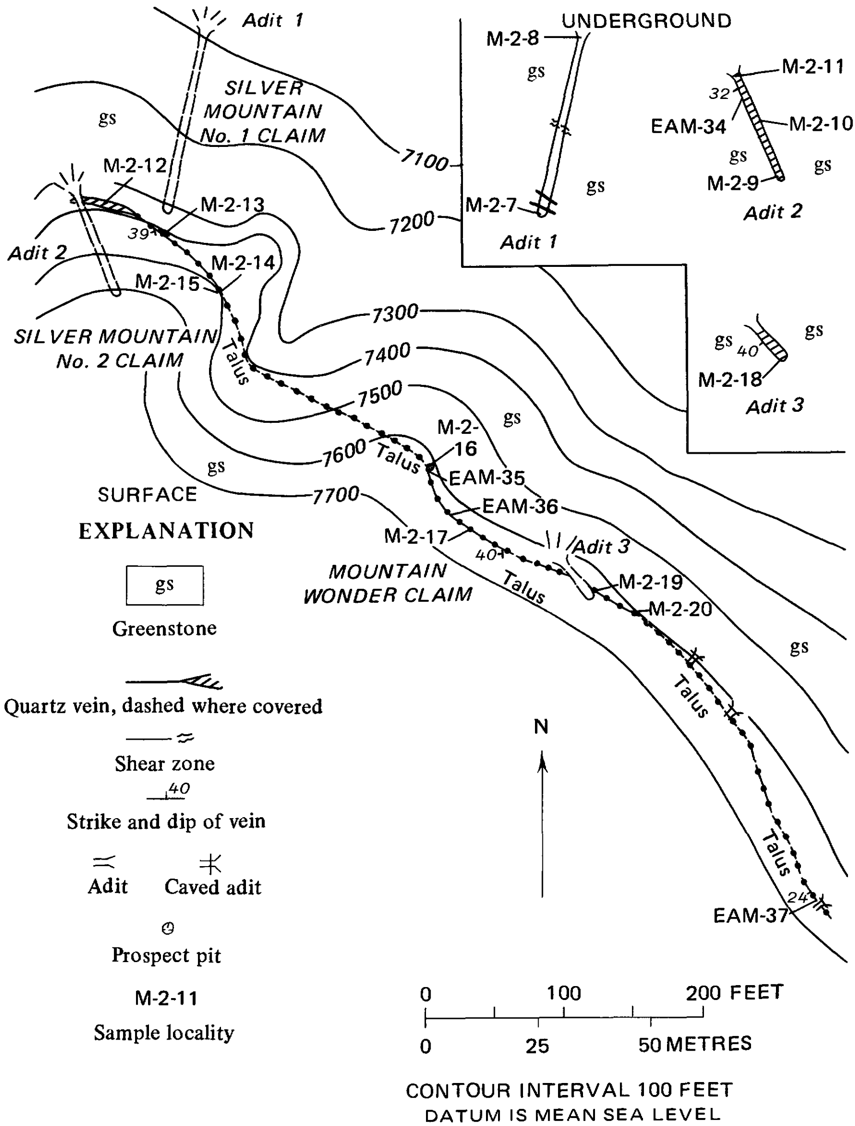


FIGURE 18.—Surface geology and workings, Joseph Mountain mine.

contains thin interbeds of mica schist. The granodiorite is cut by narrow aplite dikes. Granodiorite dikes cut the argillite near the contact. Tactite zones are in the argillite near the contact and in a few places as much as 120 ft (37 m) from the contact. The tactite zones are composed of 50–80 percent massive garnet, varying amounts of quartz, calcite, and epidote, and minor amounts of chalcopyrite, chalcocite, and bornite. The tactite zones are covered by basalt and talus beyond the mapped area.

Four tactite zones are exposed by the inclined shaft and adit at the western end of this prospect area (fig. 20). The adit was driven due west for 53 ft (16 m), into a tactite zone in argillite. The tactite conforms to the attitude of the argillite and is cut off by a fault 39 ft (12 m) in from

| Chip samples | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Lead (percent) | Molybdenum (percent) | Zinc (percent) |
|---|---|---|---|---|---|---|---|---|
| No. | Length (ft) | Description | | | | | | |
| EAM-34-- | 2.2 | Quartz vein with disseminated galena------------------ | 0.09 | Tr | -- | 10.00 | -- | -- |
| EAM-35-- | 1.7 | Iron oxide-stained, vuggy quartz vein with disseminated galena | .01 | Tr | -- | .18 | -- | -- |
| EAM-36-- | 2.5 | Quartz vein with disseminated galena------------------ | .10 | 0.10 | -- | 10.20 | -- | -- |
| EAM-37-- | 1.5 | --do-------------------- | Tr | .80 | -- | 2.20 | -- | -- |
| M-2-7--- | 4.5 | Blue-gray limestone with calcite stringers---------------- | N | .10 | Tr | N | Tr | N |
| M-2-8---- | 5.0 | Shear zone in blue-gray limestone----------------- | N | N | Tr | Tr | Tr | N |
| M-2-9---- | 3.5 | Quartz vein, 3 feet thick and 0.5 feet of limestone------ | N | .20 | 0.2 | 1.00 | Tr | N |
| M-2-10--- | 4.0 | Quartz vein, 3 feet thick and 1 foot of limestone------- | .03 | 2.60 | .10 | 5.00 | Tr | N |
| M-2-11--- | 3.0 | Quartz vein--------------- | Tr | .30 | .08 | 1.55 | Tr | N |
| M-2-12--- | 7.0 | --do------------------- | N | Tr | Tr | Tr | Tr | N |
| M-2-13--- | 3.0 | 1.5 feet across quartz vein and 1.5 feet of highly altered limestone----------------- | Tr | .20 | .14 | .30 | Tr | N |
| M-2-14--- | 2.0 | Iron oxide-stained quartz vein containing disseminated galena in pods up to 1 inch in diameter-------------- | Tr | 2.00 | .06 | 7.40 | Tr | N |
| M-2-15--- | 2.0 | Altered, iron oxide-stained limestone with quartz and calcite in fractures-------------- | N | N | Tr | Tr | Tr | .30 |
| M-2-16--- | 2.0 | Iron oxide-stained quartz vein with disseminated galena---- | N | .80 | .10 | 2.70 | Tr | N |
| M-2-17--- | 2.5 | Iron oxide-stained limestone with quartz and calcite veins, adjacent to main quartz vein- | N | Tr | Tr | Tr | Tr | .50 |
| M-2-18--- | 1.5 | Quartz vein with disseminated galena, and malachite-azurite | .02 | .80 | .18 | 1.50 | Tr | .74 |
| M-2-19--- | 2.5 | Quartz vein with disseminated galena, and azurite and malachite in fractures------ | .07 | 1.40 | .25 | 2.95 | Tr | N |
| M-2-20--- | 2.5 | 2-foot-wide quartz vein with disseminated galena; 0.5 foot of weathered limestone----- | .11 | 2.40 | .06 | 5.60 | Tr | N |

FIGURE 18.—Continued.

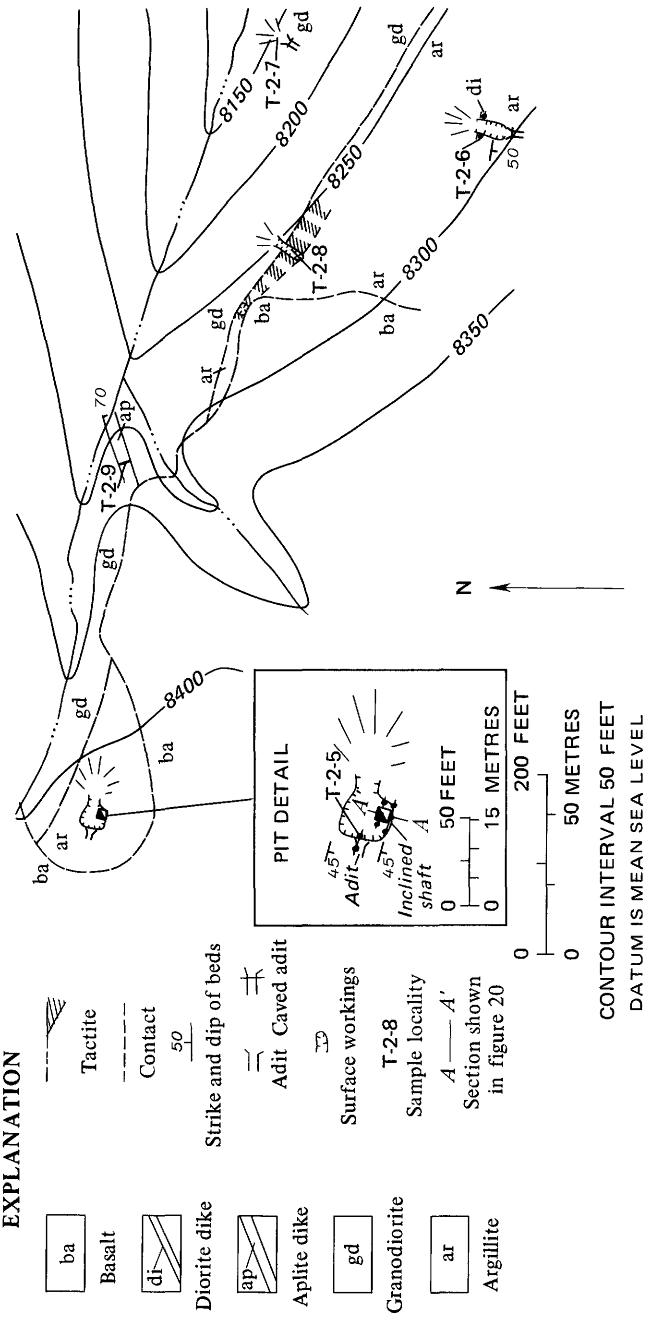


Figure 19.—Surface geology and workings, McCully Basin prospect.

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Molybdenum (percent) |
|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | |
| T-2-5- - | Chip- - | 3.5 | Tactite- - - - - - - - - | N | N | 1.4 | Tr |
| T-2-6- - | | 4.5 | - -do- - - - - - - - - - - | N | Tr | Tr | Tr |
| T-2-7- - | Grab (dump) | | Granodiorite- - - - - | N | N | Tr | Tr |
| T-2-8- - | Chip- - | 26.0 | Tactite- - - - - - - - - | Tr | N | .3 | Tr |
| T-2-9- - | - -do- - | 13.5 | Aplite dikes and granodiorite- - - - | N | N | Tr | Tr |

FIGURE 19.—Continued.

the portal. It ranges in thickness from 1 to 3.5 feet (0.3 to 2.7 m) and consists of 80 percent garnet, 15–20 percent quartz, and less than 5 percent chalcopyrite and malachite. Samples taken across the tactite zone (T–2–5 and T–2–10) contain an average of 1.8 percent copper, 0.15 oz silver per ton (3.8 g/t), and a trace of molybdenum.

The inclined shaft is 10 by 10 ft (3 by 3 m) at the collar and follows the dip of the argillite for about 50 ft (15 m) (fig. 20). Rock slough and rotten timber fill the bottom 10–15 ft (3–4.6 m) of the shaft. Three tactite zones exposed near the shaft collar appear to pinch out within 30 ft (9 m) downdip. Each of the three contains 85–90 percent garnet, minor amounts of quartz, calcite, and epidote, and less than 1 percent malachite. Sample T–2–12 taken from 1.8 ft (0.5 m) across the stratigraphically highest tactite zone exposed by the shaft contained 0.1 oz silver per ton (2.6 g/t) and trace amounts of copper and molybdenum. Sample T–2–11 was taken for 3.7 ft (1.1 m) across a stratigraphically

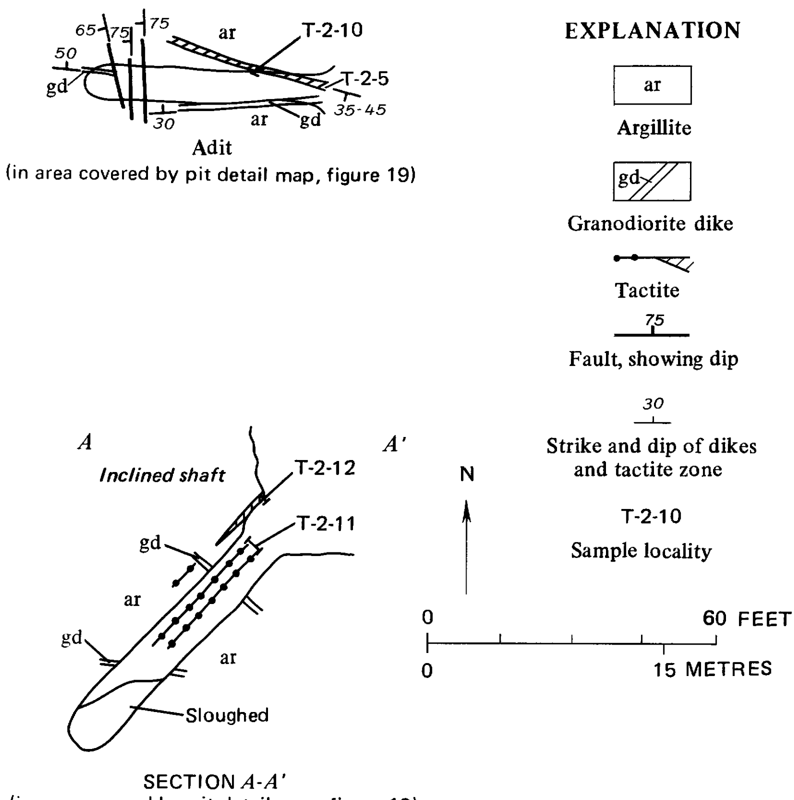


FIGURE 20.—Underground geology, adit and inclined shaft, McCully Basin prospect.

lower section that contains two narrow tactite zones with argillite between them. Sample analysis showed 0.1 oz silver per ton (2.6 g/t), 0.24 percent copper, and a trace of molybdenum.

Numerous narrow aplite dikes cut iron oxide-stained granodiorite 400 ft (120 m) east from the inclined shaft (fig. 19). The dikes range in thickness from ½ to 6 inches (1.3 to 15 cm) and are spaced from 10 inches to 4 ft (25 to 122 cm) apart. They strike N. 70° E. and dip 70°–80° N. Sample T–2–9, taken from 13.5 ft (4 m) across five aplite dikes including the granodiorite country rock, contains trace amounts of copper and molybdenum.

A 10 by 10-ft (3 by 3 m) pit and 36-ft (11-m)-long trench expose massive garnet tactite on the argillite-granodiorite contact (fig. 19). Tactite exposed in the trench is 26 ft (8 m) thick and composed of 85–90 percent garnet, 10 percent calcite, epidote, and quartz, and less than 5 percent chalcopyrite in thin lenses and blebs. Sample T–2–8 across the tactite zone contained 0.3 percent copper. Possible extensions of the tactite zone are obscured by basalt and talus.

Near the portal of a 40-ft (12-m)- long sloughed trench, which may be the surface expression of a caved adit or inclined shaft, a 4.5-ft-(1.4 m)-thick tactite zone is adjacent to a 6-ft-(1.8 m)- wide granodiorite dike (fig. 19). The dike and tactite zone strike N. 80° W. and dip south. The tactite consists of 80–85 percent garnet, 15 percent quartz, calcite, and epidote, and less than 1 percent malachite.

An adit (fig. 19), now caved, was driven in granodiorite below the argillite-granodiorite contact, probably to intersect the tactite zone at depth. The adit dump is composed of granodiorite, indicating that the contact was not reached.

Samples from the tactite zones contain a trace to 2.2 percent copper, minor silver, and trace amounts of gold and molybdenum. Samples taken at depth normally carry higher copper-silver values than those taken from leached outcrops. The tactite zones explored at the McCully Basin prospect are too small to be mined at a profit. Further exploration and development, however, might disclose additional copper resources beneath the basalt capping and talus.

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Molybdenum (percent) |
|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | |
| T-2-10 | Chip | 3.5 | Tactite | N | 0.3 | 2.2 | Tr |
| T-2-11 | do | 3.7 | do | N | .1 | .24 | Tr |
| T-2-12 | do | 1.8 | do | N | .1 | Tr | Tr |

FIGURE 20.—Continued.

### ANEROID LAKE BASIN

Prospecting began in the Aneroid Lake basin (pl. 2, No. 30) before 1914 (Swartley, 1914). County records show that four lode mining claims and two millsite claims were located from 1916 to 1922 and were patented in 1924. There is no record of production from the basin.

The country rock—granodiorite, limestone, and argillite—is intruded by numerous basalt dikes; alluvium covers the valley floor. A tactite zone follows the contact of the granodiorite with limestone and argillite. The zone is sinuous and crops out for about 4,700 ft (1,430 m) along strike. The tactite trends east-west and dips 30°–80° SE. along the Aneroid syncline (fig. 21).

Sampling information on the patented claims in the basin is withheld by the owner, and the sample data accompanying figure 21 are for samples taken from U.S. National Forest land contiguous to the patented claims. These samples indicate that the zone contains copper and silver.

### CONTACT GROUP PROSPECTS

The Contact group of 13 patented claims is on the east side of the Lostine River above Lapover (pl. 2, No. 39) and comprises the Iron Dike, Peacock, White Eagle and Dr. Scott claims. Elevations range from 5,280 ft (1,610 m) at Lapover to 9,049 ft (3,080 m) at the crest of the ridge on the east end of the claims. The property was discovered in 1906, and Smith and Allen (1941) reported that $30,000 was spent on development primarily between 1909 and 1912. There is no record of production from the property.

The country rock is limestone of the Martin Bridge Formation, overlain by siliceous argillite, schist, and thin-bedded limestone of the Hurwal Formation. The formations are cut by numerous basalt and granitic dikes. Mineralized rocks occur in the argillite and along dike contacts.

Observed prospect workings consist of five adits and five pits (fig. 22). Adit 1 was driven for 375 ft (114 m), N. 25° E. The first 160 ft (49 m) is in granitic rock; the remainder is in highly siliceous argillite, schist, and thinly bedded black limestone. Occasional small blebs and disseminated flakes of molybdenite occur in 1–4-inch (2.5-10 cm)-thick white siliceous argillite beds in the metasedimentary rocks. These mineralized beds compose less than 5 percent of the metasedimentary rocks exposed by the adit. Fifty feet (15 m) from the adit face, a 15-ft(4.6 m)-long east-trending drift exposes a 2–5-ft(0.6–1.5 m)-thick lens of black limestone surrounded by several 2–4-inch (5 to 10 cm)-thick white siliceous argillite beds. The thin argillite beds contain blebs and disseminations of molybdenite, pyrite, and chalcopyrite. A sample (E–1) taken across the face of the short drift assayed 0.2 oz silver per ton (5.1 g/t), 0.08 percent copper, and less than 0.03 percent molybdenum. Samples of granitic dike and metasedimentary wallrock from the main drift contained only trace amounts of metals.

Adit 2 was driven for 63 ft (19 m) southeast along the contact between limestone of the Martin Bridge Formation and a granitic dike. The contact is irregular but generally strikes N. 70° W. with a vertical dip. The limestone is altered in a zone 6 inches to 2 ft (15 to 61 cm) wide along the contact. This contact zone contains bands of epidote and garnet, as much as 10 percent pyrite, and is heavily limonite stained. Granitic rock along the contact is bleached, silicified, and sericitized and contains sparsely disseminated pyrite in a zone 2–3 ft wide. Two samples (S–18 and S–19) from the contact zones contained 0.2 percent copper.

Four small pits and adit 5, a working about 15 ft (4.6 m) long, are in the Hurwal Formation above adit 1. Locally, the formation is composed of interbedded siliceous argillite, schist, and black crystalline limestone. Siliceous argillite zones exposed by the pits and adit 5 contain disseminated pyrite and minor chalcopyrite and are heavily stained with hematite and malachite. Samples (S–3, S–5, S–6, E–2, E–9, and E–11) cut from this argillite average 0.35 percent copper and 0.29 oz silver per ton (7.4 g/t) over an average width of 10 ft (3 m). Samples (S–4, E–8, and E–10) taken from siliceous argillite outcrops near the workings average 0.35 percent copper and 0.15 oz silver per ton (3.8 g/t). Samples (E–3 and E–4) taken across the entire argillite exposure average only 0.025 percent copper and 0.05 oz silver per ton (1.3 g/t).

About 1,500 ft (460 m) northeast of adit 1, a basalt dike in limestone has been prospected by several cuts and adit 3, a working about 20 ft (6 m) long. The dike ranges from 5 to 40 ft (1.5 to 12 m) in width, strikes N. 75° W., and dips nearly vertically. Copper minerals are disseminated in the basalt along both contacts. The adjacent limestone is only slightly metamorphosed. Adit 3 was driven southeastward along the north contact. At the face of the adit, a sample (S–11) was taken across 4.4 ft (1.3 m) of bleached silicified basalt and 0.2 ft (0.06 m) of iron-rich tactite. It contains 5 percent disseminated pyrite and minor chalcopyrite. Another sample (S–12) was taken across an 8-ft (2.4-m)-wide fractured oxidized zone in basalt that contains small lenses and fracture fillings of calcite, epidote, and garnet. The samples contained not more than 0.04 percent copper and only traces of lead and gold.

About 100 ft (30 m) southeast from the portal of adit 3, an aplite dike in limestone strikes due north, dips 75° E., and cuts the basalt dike. A pit explored the basalt, aplite, and limestone contacts. A sample (S–9) was cut across the basalt-limestone contact zone, which contained disseminated pyrite and malachite along fracture surfaces. Another sample (S–10) was cut across the aplite dike. No significant concentra-

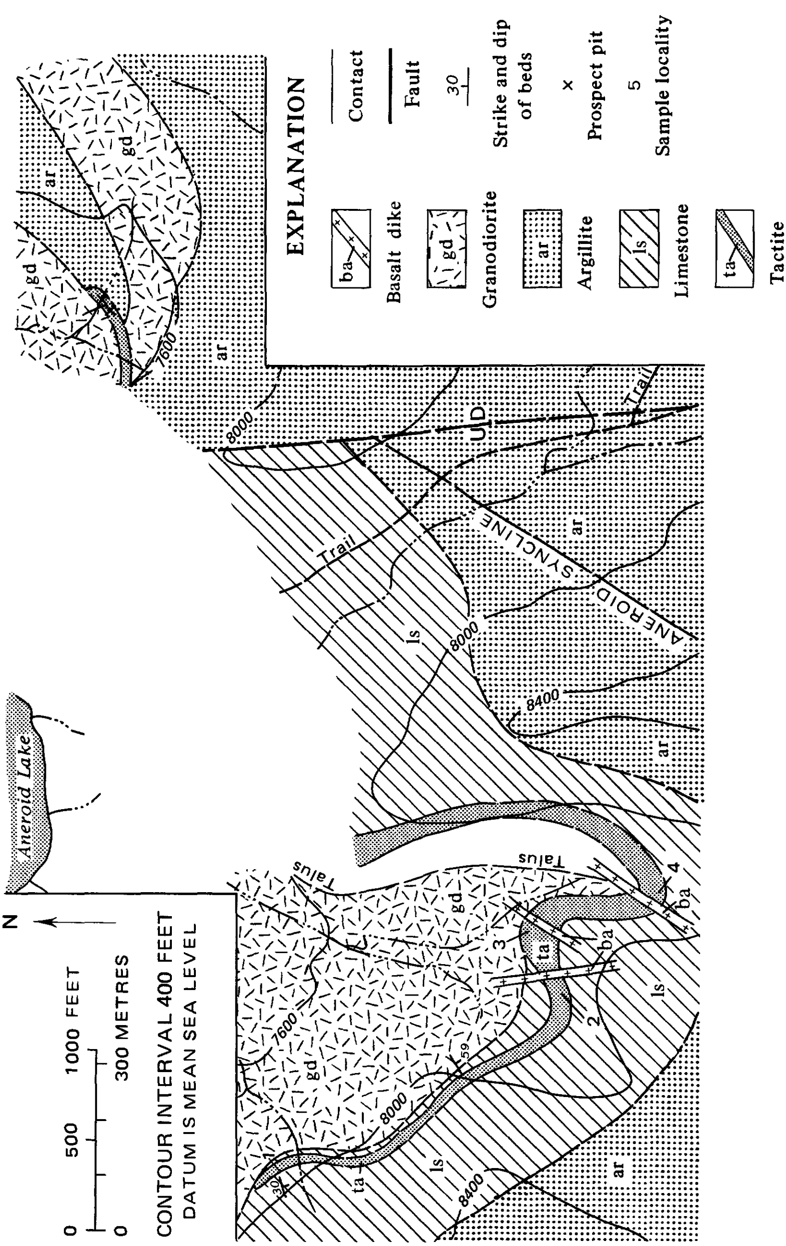


FIGURE 21.—Surface geology, Aneroid Lake basin.

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Molybdenum (percent) |
|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | |
| 1---- | Chip-- | 8 | Tactite--------- | N | N | 0.01 | Tr |
| 2---- | --do-- | 15 | --do----------- | N | 0.11 | .08 | Tr |
| 3---- | --do-- | 47 | --do----------- | N | Tr | .02 | Tr |
| 4---- | --do-- | 29 | --do----------- | N | N | .01 | Tr |
| 5---- | Dump grab | --- | Limestone------ | N | N | .03 | Tr |

FIGURE 21.—Continued.

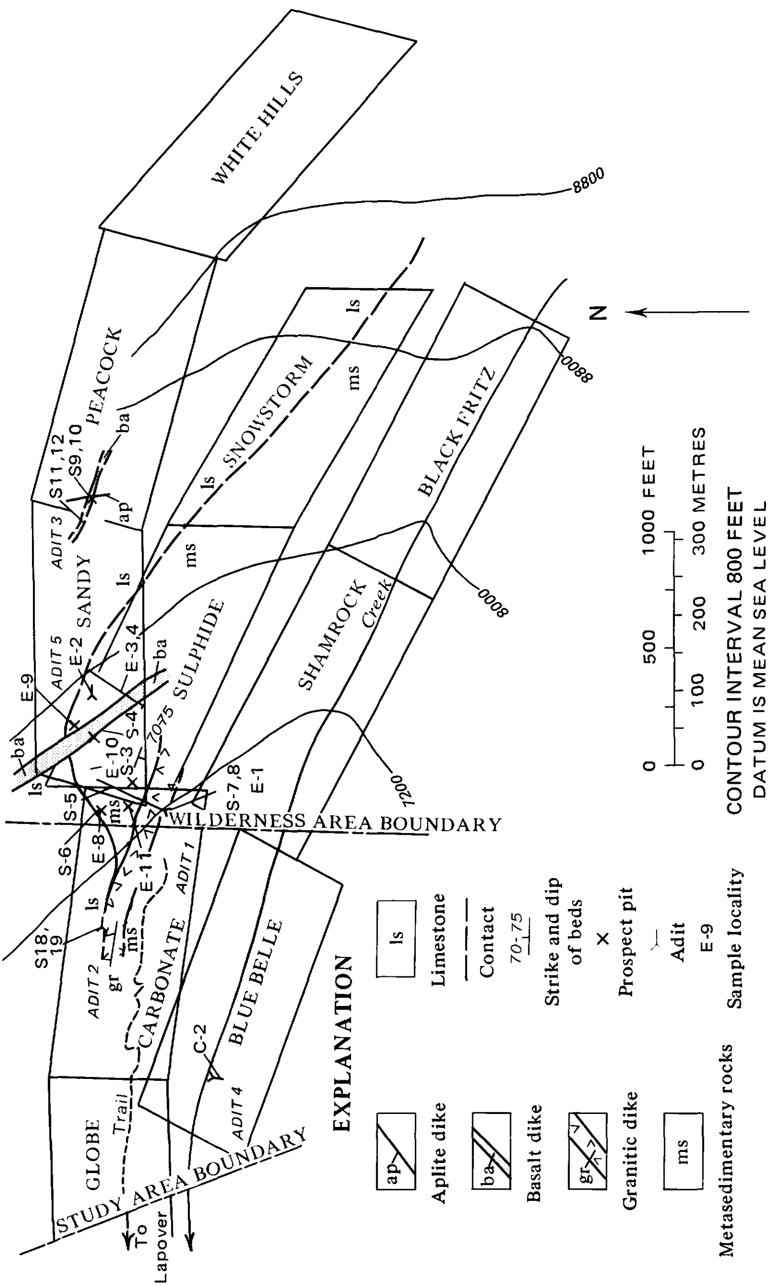


FIGURE 22.—Surface geology and workings, Contact group prospect within the study area boundary.

| Sample No. | Type | Length (ft) | Description | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Molybdenum (percent) | Tungsten (percent) |
|---|---|---|---|---|---|---|---|---|
| S-3 | Chip | 17 | Siliceous argillite zone with disseminated sulfides | Tr | 0.3 | 0.4 | 0.02 | N |
| S-4 | do | 6 | do | N | .1 | .7 | Tr | N |
| S-5 | do | 5 | do | Tr | 1.0 | 2.0 | Tr | N |
| S-6 | do | 4 | do | Tr | .3 | 1.06 | N | N |
| S-7 | Random chip | 160 | Granitic dike (adit 1) | -- | -- | Tr | Tr | N |
| S-8 | do | 215 | Interbedded limestone and argillite (adit 1) | N | N | Tr | Tr | N |
| S-9 | Chip | 5.8 | Basalt-limestone contact zone | Tr | .1 | .03 | .03 | N |
| S-10 | do | 8.6 | Aplite dike | N | Tr | .02 | .03 | N |
| S-11 | do | 4.6 | Altered basalt and tactite (adit 3) | Tr | N | .04 | .03 | N |
| S-12 | do | 8 | Altered basalt (adit 3) | N | N | .02 | .03 | N |
| S-18 | do | 4.5 | Contact zone; tactite with disseminated pyrite (adit 2) | N | N | .2 | Tr | N |
| S-19 | do | 3.7 | do | N | N | .2 | N | Tr |
| F-1 | do | 4 | Black limestone and thin beds of argillite with disseminated sulfides (adit 1) | N | .2 | .08 | .03 | -- |
| E-2 | do | 6.3 | Siliceous argillite zone with disseminated sulfides (adit 5) | N | .3 | .28 | .03 | N |
| E-3 | Random chip | 200 | Outcrops of Hurwal Formation, predominantly argillite | N | .1 | .03 | .03 | N |
| E-4 | do | 200 | do | Tr | N | .02 | .03 | N |
| E-8 | Chip | 25 | Siliceous argillite zone with disseminated sulfides | N | .2 | .27 | .03 | -- |
| E-9 | do | 15 | do | N | .2 | .26 | .03 | -- |
| E-10 | do | 20 | do | Tr | .1 | .34 | .03 | -- |
| E-11 | do | 12 | do | Tr | .1 | .03 | .03 | -- |
| C-2 | do | 26 | Argillite with disseminated pyrite (adit 4) | N | .3 | .01 | N | N |

FIGURE 22.—Continued.

tion of metals was detected in either sample.

Adit 4 is 26 ft (8 m) long and follows a fracture in thinly bedded red

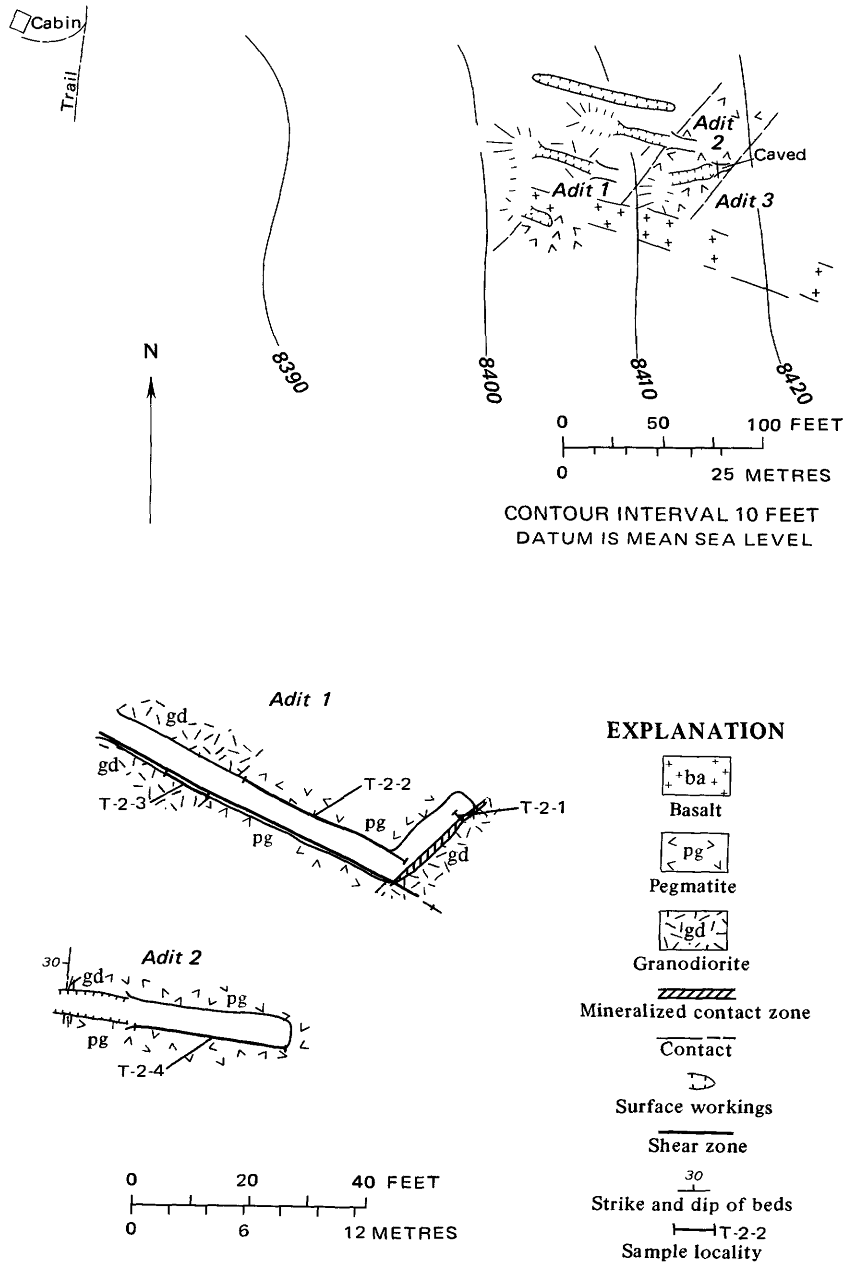


FIGURE 23.—Surface and underground geology and workings, Cheval lode prospect.

argillite containing finely disseminated pyrite. A sample (C–2) from the east wall of the adit contained 0.3 oz silver per ton (7.7 g/t) and 0.01 percent copper.

The highest copper values were found in the Hurwal Formation above adit 1. Mineralized zones of siliceous argillite appear to conform to bedding. These zones range from 6 to 25 ft (1.8–7.6 m) in width but are discontinuous and separated by tens of feet (10 m±) of non-mineralized argillite. Chip samples from the mineralized zones contained up to 2 percent copper but averaged less than 0.5 percent. The exposed mineralized zones are too low grade to be mined at a profit by either selective underground or open-pit methods.

### CHEVAL LODE PROSPECT

The Cheval lode prospect is in a pegmatite vein northeast of Cheval Lake on the rim of Cheval Lake cirque at 8,400 ft (2,560 m) elevation (pl. 2, No. 50). Workings, consisting of a trench, three adits (one caved), and a pit, explore a 33-ft (10-m)-thick pegmatite dike in granodiorite (fig. 23). The workings are confined to an area 80 by 120 ft (24 by 37 m). A small cabin is about 250 ft (75 m) west from the workings. A basalt dike 15–20 ft (4.6–6 m) thick separates offset segments of the pegmatite (fig. 23).

Adit 1 is L-shaped (fig. 23). It starts in granodiorite, crosscuts the pegmatite for 33 ft (10 m), then follows the pegmatite-granodiorite contact northeast for 17 ft (5 m). Metallic minerals appear to be confined to this contact zone.

The pegmatite is zoned and consists mostly of massive white glassy quartz and pink orthoclase. Orthoclase is more abundant along the border zones. A zone 2 ft (0.6 m) thick along the northwest border and 15 ft (4.6 m) thick along the southeast border contains 80–90 percent orthoclase and less than 5 percent biotite and sericite. The central zone or core of the pegmatite is mostly quartz. A sample taken across the pegmatite dike contained trace amounts of copper and lead (T–2–2).

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Lead (percent) | Zinc (percent) |
|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | | |
| T-2-1 | Chip | 1.5 | Contact zone (quartz) | Tr | 0.4 | 1.30 | Tr | Tr |
| T-2-2 | do | 33 | Pegmatite dike | N | N | Tr | Tr | N |
| T-2-3 | do | 8 | Altered granodiorite | N | N | Tr | Tr | N |
| T-2-4 | do | 27 | Pegmatite dike | N | N | Tr | Tr | Tr |

FIGURE 23.—Continued.

Chalcopyrite and malachite are found along the southeast contact zone as disseminated blebs and in small pockets in quartz. Minor amounts of molybdenite are associated with the copper minerals. The heavily iron-stained contact zone is 1.5–2 ft (0.4–0.6 m) thick. A sample taken across the zone contained 0.4 oz silver per ton (10.3 g/t), 1.30 percent copper, and trace amounts of gold, lead, and molybdenum.

Granodiorite along the northwest contact is bleached and sericitized over a width of 8 ft (2.4 m). A sample taken across the altered granodiorite contained trace amounts of copper and lead.

Adit 2 is entirely in pegmatite, which consists of massive quartz and orthoclase with less than 1 percent biotite. The quartz-orthoclase ratio is 2:3. A sample taken along the south wall of the adit contained trace amounts of copper and lead.

A 75-ft (24-m)-long trench in granodiorite and a 12-ft (3.6-m)-long pit in basalt and pegmatite have exposed no copper minerals.

### FRAZIER PROSPECT

The Frazier property consists of three patented claims on Hawkins Pass at 8,400 ft (2,550 m) elevation (pl. 2, No. 57). The pass is the divide between the West Fork Wallowa River and South Fork Imnaha River. The claims were located by Irwin Frazier in 1905, surveyed for patent in 1914 (Mineral Survey Plat 783), and patented in 1916.

County records show that numerous claims were located in the vicinity of Hawkins Pass; however, workings were found only on the Frazier group. The property has been described by Swartley (1914), Hess and Larsen (1921, p. 308), and Smith and Allen (1941). Swartley (1914, p. 77) described the local geology as a block of limestone or marble several hundred feet long, entirely surrounded by granodiorite with an elliptical contact-metamorphic (tactite) zone around the limestone block. The northern exposure of the tactite zone is the most highly mineralized. Development had begun on the zone a year before Swartley examined it.

Workings consist of seven adits, seven pits, and one shaft (fig. 24). Three of the adits are caved, and four are open but partly caved at the portals. The prospect pits are open except for minor amounts of slough. The shaft is filled with debris to within 5 ft (1.5 m) of the surface.

The longest adit, near the top of the tactite zone, was driven 35 ft (11 m). A 6-ft (1.8 m) long adit in granodiorite crosscuts the lower contact of the tactite zone. Two other adits, both about 6 ft (1.8 m) long, are in tactite.

Four prospect pits from 6 to 10 ft (1.8 to 3 m) deep are on the north exposure of the tactite zone; two pits are on basalt and aplite dikes on the east end of the tactite zone. A shaft, reported to be 8 ft (2.4 m) deep (Mineral Survey Plat 783), was sunk in tactite on the north exposure.

A tactite zone from 20 to 50 ft (6–15 m) wide lies along the granodiorite-limestone contact. The tactite underlies an area about 300 by 900 ft (90 by 275 m) and averages about 36 ft (11 m) thick. It may extend to the southeast (fig. 24).

Fine disseminations, small pods, and discontinuous veins of chalcopyrite, malachite, molybdenite, scheelite, and pyrite are erratically distributed in the tactite zone. Gangue minerals are garnet, calcite, quartz, and fine-grained epidote. Garnet makes up about 15 percent of the zone. An irregular quartz vein cuts the tactite zone on the ridge crest (fig. 24). Minor fractures in the quartz contain tabular crystals of molybdenite and fine-grained epidote.

Twenty-eight chip samples were taken from 13 sections cut across the tactite zone. Six of the sections cut in the northern part of the zone contained appreciable amounts of metals, whereas sections cut in the southern part of the zone, which is more bleached and weathered, contained only trace amounts of metals. At one place in the northern part of the tactite zone, a sample width of 8 ft (2.4 m) contained 2.44 percent copper and 0.2 oz silver per ton (5.1 g/t) with minor amounts of molybdenum and tungsten.

A few samples contained a trace of gold and lead. No zinc was detected. Samples with the highest metal values were taken from the northern part of the tactite. A high-grade zone within the tactite is 200 ft (60 m) long by 14 ft (4 m) average thickness. Assuming a 100-ft (30-m) extension under the limestone, indicated potential resource for this body is 24,000 tons (21,770 t) averaging 0.84 percent copper, 0.06 percent molybdenum, 0.03 percent tungsten, and 0.1 oz silver per ton (2.6 g/t).

## DOTSON PROSPECTS

The Dotson prospects are in Copper Creek Basin (pl. 2, No. 83). County records show that 45 claims were located in the basin between 1887 and 1969. The Dotson prospects were first described in 1939 (Oregon Department of Geology and Minerals Industries, 1939). Current activity is limited to assessment work. There is no record of mineral production.

The country rock is granodiorite with a dominant northeast-trending joint system. The joints are nearly vertical and are from 5 to 10 feet (1.5–3 m) apart. The granodiorite has been intruded by quartz veins and masses from a few feet (1 m±) to over 100 ft (30 m) in thickness (fig. 25). The quartz intrusions are sparsely exposed for more than 600 ft (180 m) in an east-west direction and dip south and southwest 15°–70°. Numerous basalt dikes intrude the granodiorite in the general area. A north-trending basalt dike 10–14 ft thick has intruded both the quartz masses and granodiorite. The massive quartz is sheared and fractured. The shears trend both north and east and dip vertically, and many show minor displacement. Granodiorite along the quartz contact is bleached and altered in a zone about 3 ft (0.9 m) wide. Shear zones, fractures, and bleached granitic contacts are mineralized.

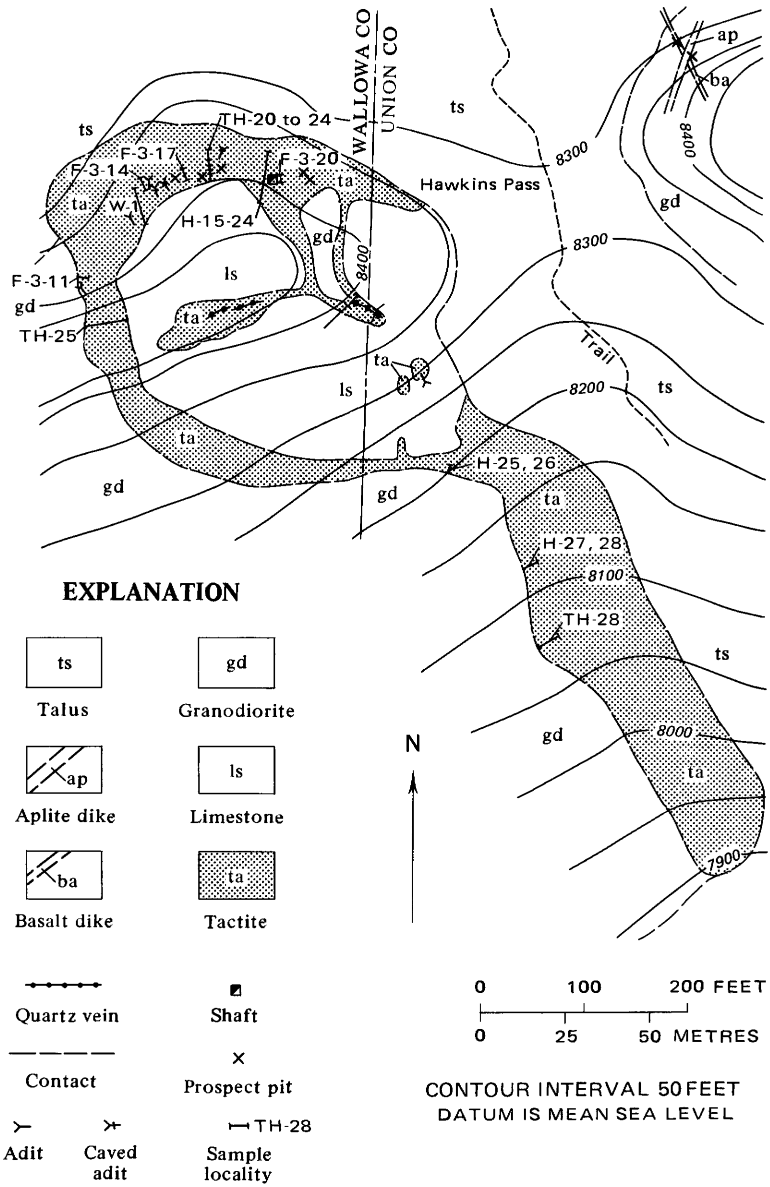


FIGURE 24.— Surface geology and workings, Frazier prospect.

Chalcopyrite, malachite, azurite, and molybdenite are the most abundant ore minerals. Galena and magnetite are present in small amounts. Chalcopyrite occurs in fractured and shattered zones in the quartz and is finely disseminated in altered granodiorite. Malachite and azurite form halos on chalcopyrite crystals and a coating on quartz in weathered zones. A few high-grade copper-bearing pods and pockets are present in the quartz. Molybdenite occurs in narrow veinlets and small pods in sheared and fractured quartz.

| Chip Samples | | | Gold (ounce per ton) | Silver (ounce per ton) | Copper (percent) | Molybdenum (percent) | Tungsten (percent) |
|---|---|---|---|---|---|---|---|
| No. | Length (ft) | Description | | | | | |
| F-3-11 | 10 | Tactite near granodiorite contact | N | 0.1 | 0.74 | 0.02 | N |
| F-3-14 | 8 | Tactite | N | .2 | 2.44 | .05 | N |
| F-3-17 | 10 | --do | N | N | .38 | .23 | N |
| F-3-20 | 5 | --do | N | .2 | .17 | .04 | .04 |
| W-1 | 34 | --do | -- | -- | .86 | .06 | .06 |
| TH-20 | 7 | Tactite near contact with limestone | N | .1 | .3 | N | N |
| TH-21 | 5 | Tactite with massive garnet | N | .1 | .5 | .01 | .06 |
| TH-22 | 5 | Tactite with 50 percent garnet and 5 percent quartz | Tr | .2 | .5 | .01 | .06 |
| TH-23 | 5 | Tactite with 50 percent quartz pods and 25 percent garnet | Tr | .1 | .5 | .05 | N |
| TH-24 | 8 | Tactite near contact with granodiorite | N | N | .84 | N | N |
| TH-25 | 33 | Tactite composed mainly of garnet with calcite, epidote, and quartz | N | .1 | .03 | .01 | N |
| TH-26 | 16 | Tactite with quartz vein; 60 percent garnet, 40 percent quartz | N | N | .02 | .05 | .06 |
| TH-27 | 12 | Tactite with massive garnet and 10 percent quartz | N | .1 | Tr | N | N |
| TH-28 | 21 | Bleached tactite | Tr | .1 | Tr | N | N |
| H-15 | 4.6 | Tactite near contact with limestone, mainly quartz | N | .01 | Tr | Tr | -- |
| H-16 | 4.9 | Tactite, mainly quartz | N | .02 | Tr | -- | -- |
| H-17 | 4.4 | --do | N | .02 | Tr | -- | -- |
| H-18 | 3.1 | Tactite with quartz, garnet, and epidote | N | N | Tr | Tr | .03 |
| H-19 | 7 | Tactite | N | .01 | Tr | -- | -- |
| H-20 | 4.5 | Tactite with 85 percent garnet | N | N | Tr | Tr | .06 |
| H-21 | 4.9 | Tactite with massive garnet | N | N | Tr | -- | -- |
| H-22 | 7.7 | --do | N | N | Tr | Tr | .03 |
| H-23 | 6 | Tactite with minor chalcopyrite | N | Tr | .12 | -- | -- |
| H-24 | 2.3 | Tactite near contact with granodiorite | N | .1 | .03 | N | N |
| H-25 | 2.5 | Tactite with 85 percent garnet | N | .1 | Tr | N | .03 |
| H-26 | 4 | --do | N | Tr | Tr | -- | -- |
| H-27 | 5.9 | Bleached silicified granodiorite | N | .03 | Tr | -- | -- |
| H-28 | 8.1 | Bleached tactite with epidote, garnet, and quartz | N | N | Tr | -- | -- |

FIGURE 24.—Continued.

Prospect workings consist of two adits, a pit, and a shaft (fig. 25). Adit 1 follows a shear zone and minor fault and then crosscuts two other shears and a 40-ft (12-m) thickness of quartz. Adit 2 crosscuts a shear and penetrates 33 ft (10 m) into a 100-ft (30-m)-thick quartz mass. The pit and shaft are in fractured quartz near a contact with a basalt dike. Fourteen samples were taken from quartz veins and masses, from shear zones in quartz, and from altered granodiorite. Four samples contained a trace of gold, and six samples contained a trace to 1.8 oz silver per ton (46.3 g/t). Only minor amounts of lead were detected. The highest copper values were found in small high-grade zones.

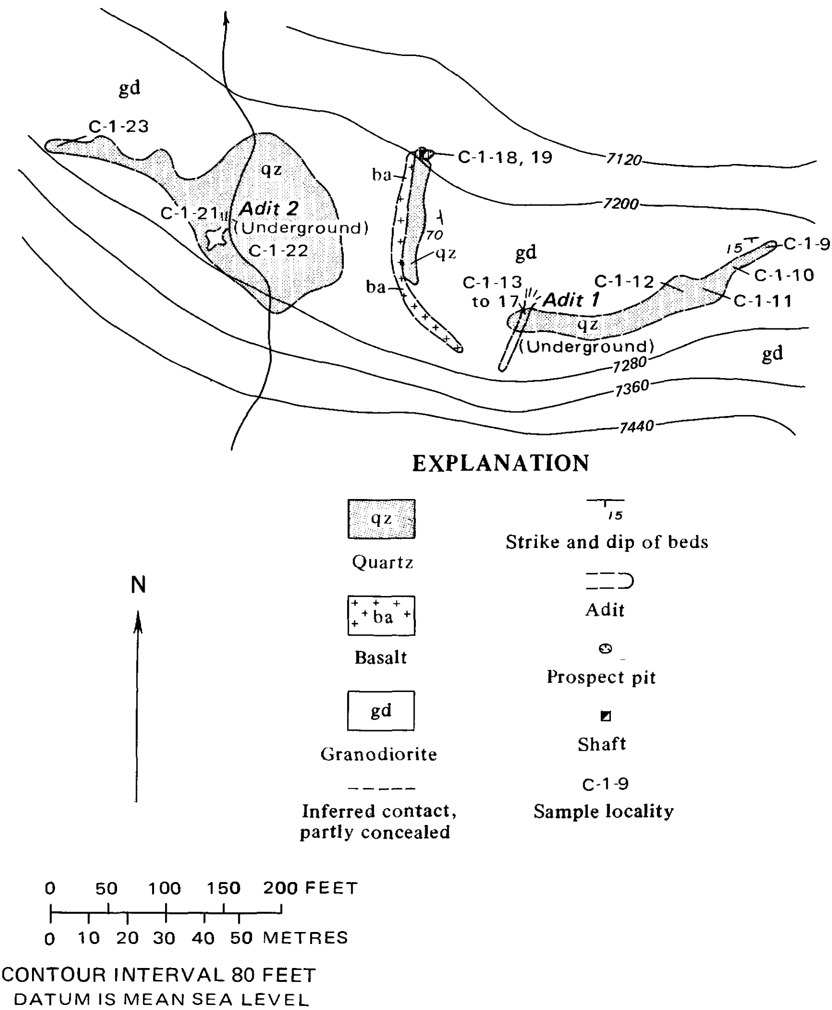


FIGURE 25.—Surface geology and workings, Dotson prospects.

The exposed mineralized zones within the quartz veins and masses are erratic and discontinuous. Collectively, they may represent a small potential resource of about 100,000 tons (90,720 t), ranging from 1 to 2 percent copper. Additional copper resources might be discovered here.

### RAINBOW PROSPECT

The Rainbow prospect is on the southwest side of Copper Creek Basin west of the Dotson prospects (pl. 2, No. 84). County records show the claim was located in 1969. The area has been prospected since 1887, and a total of 45 claims were located in the general area. Only assessment work is being done at present.

Country rock is granodiorite intruded by a massive quartz body that trends northwest. Numerous basalt dikes intrude granodiorite, but none intrude the quartz. The quartz is sheared and fractured. The shear zones are vertical and trend east. Fractures are associated with the shear zones and granodiorite-quartz contacts. Metallic minerals are found along shear and fracture zones. Chalcopyrite, bornite, malachite, cuprite, and molybdenite occur along fractures and in pods and pockets in the massive quartz. Chalcopyrite and bornite are present in pods from ½–2 inches (1.3–5 cm) in diameter, and malachite and

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Lead (percent) | Molybdenum (percent) | Copper (percent) |
|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | | |
| C-1-9 | Chip | 5 | Iron oxide-stained shear zone | Tr | Tr | Tr | Tr | 0.06 |
| C-1-10 | do | 5 | Iron oxide-stained and fractured quartz | N | N | N | Tr | .02 |
| C-1-11 | do | 2 | Sheared and fractured quartz | Tr | 0.10 | N | 0.18 | .20 |
| C-1-12 | do | 10 | Iron oxide-stained quartz with minor molybdenite | N | N | N | .03 | .04 |
| C-1-13 | do | 5 | Altered and sheared granodiorite in adit 1 | N | N | 0.03 | Tr | .06 |
| C-1-14 | do | 2 | Quartz with iron oxide and malachite in adit 1 | N | N | N | .10 | 1.20 |
| C-1-15 | do | 3 | Altered granodiorite, near quartz contact, in adit 1 | N | N | Tr | .01 | .42 |
| C-1-16 | Grab | -- | Quartz and altered granodiorite from dump of adit 1 | N | N | N | .01 | .03 |
| C-1-17 | Chip | 2 | Quartz-granodiorite contact at portal of adit 1 | N | N | N | Tr | .82 |
| C-1-18 | do | 2 | Quartz near contact of basalt dike | N | N | N | Tr | .52 |
| C-1-19 | do | 10 | Iron oxide-stained quartz vein at caved shaft | Tr | .10 | Tr | .13 | 2.00 |
| C-1-21 | do | 4 | Quartz at portal of adit 2 | N | N | N | Tr | .42 |
| C-1-22 | do | 2 | Shear zone in quartz in adit 2 | N | 1.80 | Tr | .01 | 12.00 |
| C-1-23 | do | 1 | Mineralized lens in quartz vein | Tr | 1.30 | Tr | .01 | 8.00 |

FIGURE 25.—Continued.

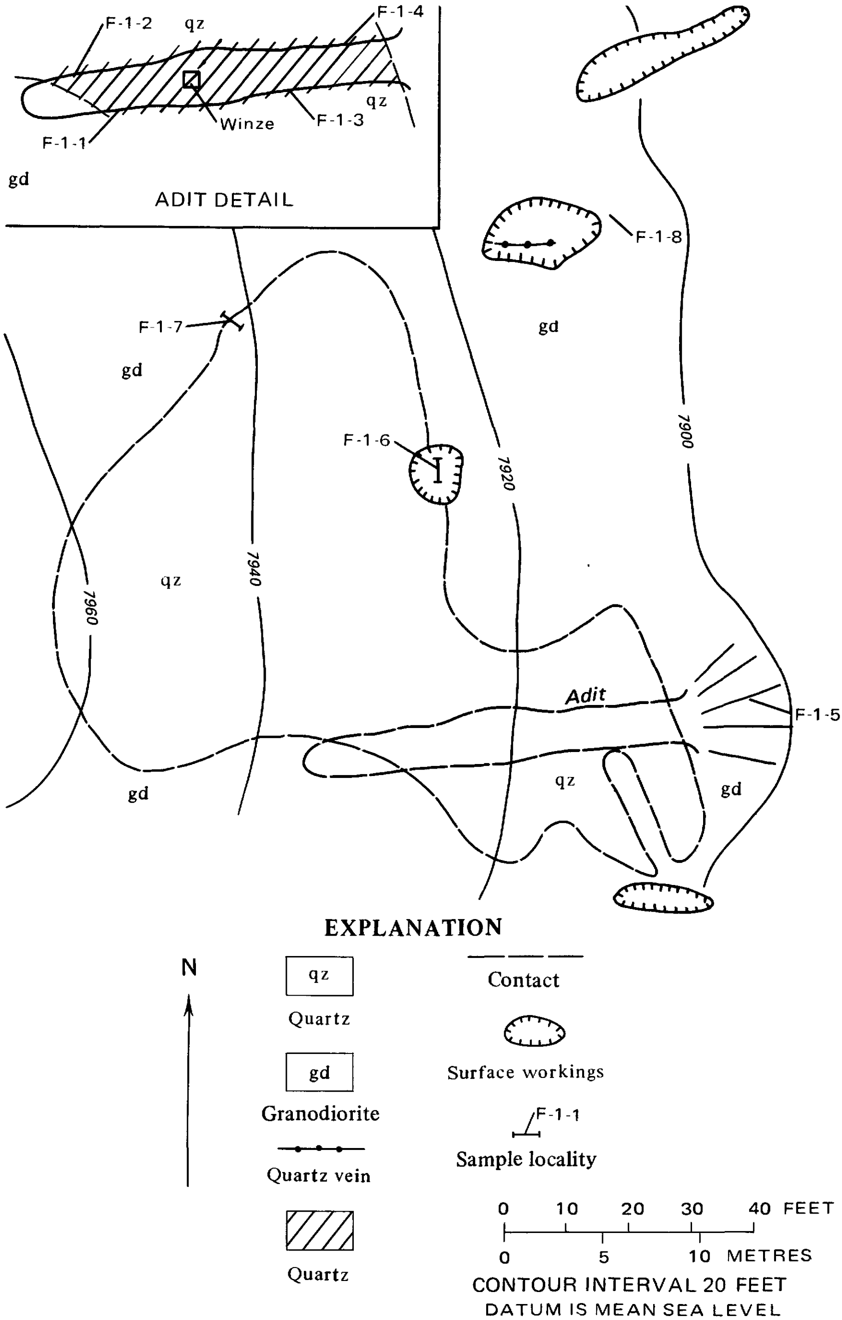


FIGURE 26.—Surface geology and workings, Rainbow prospect.

azurite form halos around sulfide minerals in oxidized zones. Molybdenite is associated with the copper minerals.

Prospects workings consist of four pits and one adit. The adit is 62 ft (25 m) long and crosscuts 46 ft (15 m) of quartz (fig. 26). One pit is on the quartz-granodiorite contact. Three pits are in granodiorite; one of these exposes a narrow quartz vein. Eight samples were taken from the quartz and the quartz-granodiorite contact.

The quartz body is exposed in an area of about 5,200 ft$^2$ (485 m$^2$). Assuming a depth of 70 ft (21 m), the indicated potential resource of the body is estimated at 30,000 tons (27,200 t). Samples from the quartz body and contact zone average about 2 percent copper, 0.15 percent molybdenum, 0.60 oz silver per ton (18.7 g/t), and a trace of gold and lead.

## MISCELLANEOUS LODE PROSPECTS

Many prospects in the district were examined that have little or no economic potential or are not sufficiently exposed to indicate their potential. These prospects are listed in table 3.

## PLACER DEPOSITS

Four placer claim areas were examined for gold and other valuable heavy detrital minerals. Old pits were cleaned out, and new ones dug. A vertical channel sample, 6 inches (15 cm) square, was cut down the side of each pit. The sample was then concentrated by a mechanical-vibrating sluice box and further concentrated by a laboratory-size Wilfley table. Reconnaissance pan samples were taken at some sites, and these were concentrated directly with a gold pan.

| Sample | | | | Gold (ounce per ton) | Silver (ounce per ton) | Lead (percent) | Molybdenum (percent) | Copper (percent) |
|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | | | | | |
| F-1-1-- | Chip-- | 6 | Shear zone in quartz in adit | N | 0.80 | 0.01 | 0.01 | 4.00 |
| F-1-2-- | --do-- | 5 | Sheared quartz-granodiorite contact zone in adit------ | N | .10 | N | .01 | .80 |
| F-1-3-- | --do-- | 6 | --do------------------ | Tr | 1.70 | .01 | .30 | 4.00 |
| F-1-4-- | --do-- | 1.5 | Quartz with pods of molybdenite--------------- | N | .40 | .01 | 1.00 | .02 |
| F-1-5-- | Grab-- | 6 | Quartz and granodiorite from prospect dump----- | Tr | 3.20 | .01 | .30 | 4.00 |
| F-1-6-- | Chip-- | 6 | Quartz-granodiorite contact zone in pit------------ | N | .10 | N | .10 | .40 |
| F-1-7-- | --do-- | 4 | Quartz-granodiorite contact zone----------------- | Tr | .02 | .01 | .07 | .20 |
| F-1-8-- | Grab-- | -- | Quartz and granodiorite from prospect dump--------- | Tr | .05 | .01 | .07 | 3.00 |

FIGURE 26.—Continued.

TABLE 3—*Miscellaneous lode prospects, Wallowa unorganized district*

[*Prospects which are not sufficiently exposed to determine potential]

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 4 | Gillespie | Dark gray to black iron-stained argillite contains 50 percent disseminated pyrite. No outcrops were observed. | Six sloughed pits | Three grab samples from dumps; trace gold and silver. |
| 6 | Chalco gold and silver. | Joints are formed in fine-grained hornblende granodiorite. Two joint sets strike S. 25° E. and S. 65° E. and dip 60° W. and 66° S., respectively. The walls show a little alteration; they are iron-stained and bleached to a depth of one-fourth inch (6 mm). | A shallow trench 2–5 ft (0.6–1.5 m) wide and 45 ft (14 m) long. | One chip sample across the bleached zone; trace copper and lead. |
| 7 | Cold Springs Contact. | Limestone and argillite are intruded by numerous andesite dikes and granodiorite. A garnetiferous tactite zone adjacent to the granodiorite trends northeast for 120 ft (37 m). The argillite contains 15 percent pyrite. | Three pits on granodiorite-metasediment contact; one pit on andesite-argillite contact. | Four chip samples across contact zones; trace gold and silver. |
| *8 | Legore | Tactite zones, averaging 7 ft (2 m) in thickness, lie on the contact of granodiorite with limestone and argillite. The tactite zones are intermittently exposed for 1,600 ft along strike. [length.] The tactite is composed mainly of garnet with minor amounts of epidote, quartz, and calcite and a trace of scheelite. Pyrite, chalcopyrite, and molybdenite occur in narrow veins, pods and pockets. Limonite, azurite and chrysocolla occur as coatings on sulfide minerals and as fracture filling. | Four adits (one caved) and 20 prospect pits. One adit and three pits are in tactite; the remainder are along limestone-argillite contacts. | Five samples of tactite; average 0.75 percent copper, 0.2 oz (5.1 g/t) silver per ton, and a trace of gold, lead, molybdenum, and tungsten. Samples from the limestone-argillite contacts contained only trace amounts of metals. |
| 9 | Metzger | A tactite zone 2 ft (0.6 m) thick containing fine-grained quartzose material, garnet, and epidote is on a granodiorite-limestone contact. The zone reportedly contained spotty molybdenite and scheelite (Oreg. Dept. Geol. and Mineral Industries Bull. 14–A, 1939, p. 118). The zone is covered by talus, but dump material indicates penetration of the granodiorite-limestone contact. | Two caved prospect trenches in talus. | Two select dump samples; 0.1 oz (2.6 g/t) silver per ton, trace copper, lead, zinc, and molybdenum; tungsten not detected. |
| 10 | Vancouver | An iron oxide-stained limestone outcrop contains disseminated pyrite. The exposure is greater than 500 ft (150 m) thick and 1 mile (1,610 m) long. | One prospect pit | One chip sample and a grab sample; trace copper, lead, molybdenum, and zinc. |
| 11 | Hard Climb. | Three minor shear zones in limestone. The largest is 6 inches (15 cm) thick, strikes N. 70° E. and dips 85° NW. | A 30-ft (9-m)-long cut along the shear zones and a caved crosscut adit. | One chip sample across the zones; trace gold, silver, copper, and lead. A grab from the adit dump: 0.6 oz (15.4 g/t) silver per ton, 0.92 percent lead, 1.34 percent zinc, trace gold and copper. |
| *12 | Good Enough. | Two shear zones and a quartz vein are in massive limestone. The most prominent shear zone strikes N. 20° W., dips northeast; the other strikes north and dips vertically. The quartz vein is 1 ft (0.3 m) thick, strikes N. 30° W., dips 60° NE. Both shear zones and the quartz vein contain sphalerite and are iron oxide stained. Massive fractured limestone 120 ft (37 m) south of the shears and 200 ft (60 m) southwest contains sphalerite. | One 20-ft (6-m) adit on shear zones and the quartz vein; two pits on fractured limestone. | Two chip samples across 1 ft (0.3 m) of quartz and 2 ft (0.6 m) of sheared limestone; average 3.28 percent zinc, trace silver, copper and lead. A grab sample; 0.6 oz silver per ton (15.4 g/t) 1.34 percent zinc, 0.92 percent lead, and trace gold and copper. |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 13 | Falls Creek Forest Camp. | Minor shear zones and fractures are exposed in argillite. Calcite veins and quartz pods occur in the fractures. Quartz pods are as much as 1 by 4 ft (0.3 by 1.2 m). The calcite contains sphalerite and galena; the argillite contains pyrite. | One 10-ft (3-m)-long adit on a shear zone in argillite. | Two chip samples and a grab sample; 0.1 oz silver per ton (2.6 g/t), trace gold, copper, lead, and zinc. |
| 14 | Saddle | An aplite dike in gray to black argillite has 1–4 inch-thick quartz veins along the dike contacts. The dike strikes northwest, is 3 ft thick and is exposed for 2,000 ft (610 m). Quartz and alteration zones on each side of the dike are 1 ft (0.3 m) thick; malachite occurs as stains and fracture fillings. | A sloughed pit, 30 ft (9 m) long, 10 ft (3 m) wide, and 3 ft (0.9 m) deep. | One chip sample across the dike, quartz veins, and alteration zones; 0.5 oz silver per ton (12.9 g/t). 0.28 percent copper, 0.19 percent zinc, and trace lead. |
| 16 | Gyllensburg. | Limestone is intruded by aplite and basalt dikes and quartz veins. Aplite dikes range from 0.5 to 1.5 ft (0.15 to 0.45 m) in thickness, quartz veins are as much as 2 ft (0.6 m) thick. The limestone is marbleized along contacts with the aplite and quartz. Chalcopyrite is sparsely disseminated in the dikes and adjacent to marbleized limestone. | Two adits, 8 ft and 13 ft (2.4 and 4 m) long on a quartz vein and an aplite dike. | Four chip samples; trace copper and molybdenum. |
| 17 | Red Cloud | Marbleized limestone is intruded by minor quartz and calcite veins. The veins are iron-oxide stained. | Two caved adits, reportedly 40 ft (12 m) and 225 ft (68 m) long (Mining World, No. 13, v. 34, 1911, p. 708) and two sloughed pits. | A select sample of iron oxide stained quartz and calcite from dumps; trace copper, lead, and molybdenum. |
| 18 | Miners Basin. | Limestone is intruded by quartz veins as much as 4 inches (8 cm) thick. | One pit. | One grab sample; trace silver and copper. |
| 19 | Kipp-Freeman. | Dark-brown hard argillite with fractures thinly coated with pyrite and calcite. Pyrite content is less than 2 percent. | One 4-ft (0.6 m)- long adit. | One chip sample across face of adit; trace copper and molybdenum. |
| 20 | Gold Nugget | Argillite and limestone is intruded by numerous aplite and basalt dikes and quartz veins. Quartz veins are as much as 3 ft (0.9 m) thick with bands of aplite, disseminated pyrite, and limonite. | Four pits | Two chip samples across quartz veins, one select sample of quartz from dump; trace gold, silver, copper, lead, molybdenum, and zinc. |
| 21 | Bumper | Limestone with interbedded quartz. The quartz contains up to 5 percent limonite and hematite as fracture filling. | One pit | One grab sample from dump; trace copper and molybdenum. |
| 22 | Old Timer | Greenstone intruded by a quartz vein about 1 ft (0.3 m) thick. Iron oxide stain is on greenstone and quartz. | One sloughed pit 25 ft (8 m) long. | One grab sample from dump; 0.1 oz silver per ton (2.6 g/t) and trace copper. |
| 23 | Gold | Shear zones in argillite trend N. 80° E. and dip vertically. Cross fractures at 2–6-ft (0.6–1.8 m) intervals trend N. 45° W. Chalcopyrite is disseminated in the argillite and occurs in fractures. Azurite and malachite form halos around chalcopyrite crystals. Three zones are 2–3 ft (0.6–0.9 m) thick and are 20–30 ft (6–9 m) apart. | None | One 4-ft (1.2-m) chip sample; 0.22 percent copper and trace silver and molybdenum. |
| 24 | Buck Horse | A contact zone between crystalline limestone and granodiorite strikes N. 54° E. and dips 50° NW. The limestone is slightly altered 1 ft (0.3 m) from the contact; the granodierite is siliceous and bleached 4 ft (1.2 m) from the contact. Garnet, epidote, mica, and pyrite occur along the contact zone. | One 15-ft (4.6 m)-long pit. | One chip sample taken 5 ft (1.5 m) across contact zone; 0.3 oz silver per ton, trace copper. |
| 25 | Independence. | A contact zone between crystalline limestone and granodiorite strikes | One 12-ft (3.6-m)-long pit. | One chip sample taken 4 ft (1.2 m) |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 25 | Independence—Continued. | N. 30° E. and dips vertical. The contact shows little alteration. Thin iron oxide-stained quartz and calcite veins follow bedding in limestone and joints in granodiorite. | | across the contact zone; trace copper. |
| *27 | Transvaal mines. | A contact zone between crystalline limestone and granodiorite porphyry contains quartz stringers. Fractures are filled with garnet and epidote and stained with malachite. The quartz contains small flecks of chalcopyrite and molybdenite. | Two caved adits, probably several hundred feet long, and one pit on the contact zone. | Two grab samples from dumps; 0.69 and 2.1 percent copper, 0.03 percent molybdenum, and 1.1 oz silver per ton (283 g/t). A chip across the contact zone; 0.07 percent copper, trace gold. |
| 28 | Grandview | Iron oxide-stained fractured basalt. | Two sloughed pits | Two grab samples from dumps; trace gold, silver, and copper. |
| 31 | Green group. | The contact between thinly bedded light-gray limestone and granodiorite forms a tactite zone 1–1.5 ft (0.3–0.46 m) thick. The limestone contains bands of garnet parallel to the bedding. Granodiorite, near the contact, is siliceous and bleached and contains scattered pods of epidote and garnet. The tactite is mainly fine-grained epidote and garnet with disseminated pyrite. chalcopyrite, and molbydenite. Pegmatite, aplite, and basalt dikes and quartz have intruded limestone and granodiorite. | Three prospect pits on the contact zone and a 25-ft (8-m)-long adit. | One chip sample taken 6.3 ft (1.9 m) across the granodiorite-limestone contact zone and pegmatite dike; trace copper and molybdenum. A chip sample across a 4-inch (8-cm)-thick quartz vein; trace copper, lead, and zinc. |
| 32 | Golden Eagle. | A granodiorite-limestone contact trends northwest and dips vertical. Little alteration of granodiorite and limestone was noted. | None | One 10-ft (3-m) chip sample across the contact zone; trace silver. |
| 33 | Silver Bullet. | A limestone-granodiorite contact strikes northwest and dips southwest. A 1-ft (0.3 m)-thick iron oxide-stained tactite zone along the contact contains epidote, garnet, pyrite, and chalcopyrite. | A 15-ft (4.6-m)-long pit follows the contact. | One chip sample across the tactite and a grab sample from the dump; trace copper and molybdenum. |
| 34 | Copper King. | A granodiorite-argillite contact was explored. | One sloughed pit | One grab sample from the dump; trace copper, lead, molybdenum and zinc. |
| 35 | Ice Lake group. | A 6-inch (0.15-m)-thick quartz vein crosscuts a pegmatite dike near a limestone-argillite contact. A second quartz vein 4 ft (1.2 m) thick follows the granodiorite-argillite contact. The quartz veins are exposed for 10 and 50 ft (3 and 15 m), respectively. | One pit on the 6-inch (0.15-m)-wide quartz vein. | One chip sample across the 6-inch quartz vein and dike; trace copper, lead, and molybdenum. A chip sample across the 4-ft (1.2 m) quartz vein; trace copper, molybdenum, and tungsten. One chip sample across the granodiorite-argillite contact; trace copper. |
| *36 | Matterhorn | A tactite zone along the contact of granodiorite with limestone and argillite trends north, dips 70°–80° E. and is exposed sporadically for more than 1 mile (1.6 km). Locally, the tactite zone is exposed for 200 ft (60 m) and ranges from 5 to 20 ft (1.5 to 6 m) in thickness. Limestone adjacent to the zone is marbleized. Numerous basalt dikes intrude the country rock. Pyrite, chalcopyrite, and molybdenite is finely disseminated in the tactite and marbleized limestone. | Four pits and one adit in the tactite zone. | Seven chip samples across the tactite zone; trace copper and molybdenum. A grab sample from a dump; trace copper and 1 percent molybdenum. |
| 37 | Discovery | An aplite dike 40–50 ft (12–15 m) | Three pits | Two chip samples |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 37 | Discovery—Continued. | thick has intruded crystalline limestone. The dike is exposed for 500 ft (150 m). Basalt dikes crosscut the aplite. A few quartz veins occur on and near the contact between limestone and aplite. Pyrite is disseminated along the contact. | | taken from the prospect pits; trace gold and 0.2 oz silver per ton (5.1 g/t). A chip sample across the aplite dike-limestone contacts; trace gold and 0 3 oz silver per ton (7.7 g/t). |
| 38 | Frances Lake Ridge. | Mineralized zones, 6–14 ft (1.8–4 m) wide, are traceable for 400 ft (120 m) in thin-bedded limestone and argillite. A basalt dike intrudes the argillite. Finely disseminated pyrite and malachite stains occur in the zone. | Three pits | Three chip samples across the mineralized zones; trace gold and silver and average 0.25 percent copper. A chip sample across the basalt dike–argillite contact; trace silver. |
| 40 | Lost Creek | Tactite zones occur in limestone in contact with granodiorite. The tactite zones reach a maximum thickness of 70 ft (21 m) and contain blocks of unaltered limestone, garnet, quartz, calcite, epidote, and disseminated pyrite. Massive garnet composes 60–70 percent of the tactite. Chalcopyrite, bornite, malachite, pyrite, and iron and manganese oxides were identified. | Two caved adits and 13 pits. | Twenty chip samples from the tactite zone and associated quartz veins; trace gold, silver, copper, molybdenum, and tungsten. One chip sample across a 1–3-inch (2.5–7.5-cm)-thick quartz vein; 0.3 oz (22 g/t) silver per ton, 0.54 percent copper, and trace gold and tungsten. |
| 41 | Old Frances Lake Trail prospects. | Limestone-argillite contacts and basalt dike–limestone contacts are heavily iron oxide stained. Pyrite is disseminated along the contacts and into the adjacent rock for 1.5–3.5 ft (0.46–11 m). | Five pits | Five samples from contact zones; trace silver, copper, and lead. |
| 42 | Peritite | An iron oxide-stained granodiorite-argillite contact zone. | One pit | A chip sample across the contact zone; trace gold and silver. |
| 43 | Bluebird group. | An aplite zone in granodiorite is more than 100 ft (30 m) wide, composed of quartz, orthoclase and plagioclase. Some zones contain 10 percent large flaked biotite. | One pit | One grab sample from the dump; 0.1 oz silver per ton (2.6 g/t) and trace copper. |
| 44 | Last Chance. | A 2-inch (5-cm)-wide pegmatite dike in granodiorite strikes N. 60° W and dips 50° N. | One pit | One chip sample across the pegmatite dike; 0.1 oz silver per ton (2.5 g/t) and trace copper |
| 45 | Spangled Treasure. | An inclusion in granodiorite is composed of black and gray banded hornblende gneiss. Part of the inclusion is composed of heavily iron oxide-stained thin limy beds. A 20-ft (6 m) width of the inclusion is exposed; possible extensions covered by thick overburden. | Two pits and a 45-ft (13.7 m)-long trench. | One chip sample across 3.2 ft (1 m) of the limy beds; trace copper. |
| 46 | Wilson "Mine". | A roof pendant of black and gray banded gneiss contains granodiorite injections and numerous granitic dikes. It is exposed 450 ft (135 m) long, 250 ft (75 m) wide, and 100 ft (30 m) vertically. The gneiss is contorted and sheared, with garnet tactite zones as much as 15 ft (4 6 m) thick and quartz lenses to 2.5 ft (0.8 m) thick. Some metasedimentary beds contain up to 10 percent disseminated pyrite | Three open adits, 47, 55 and 123 ft (14.3, 16.8, and 37.5 m) long and one caved adit. | Five chip samples across shear zones, dikes, pyritized beds, and tactite; trace copper. |
| 47 | Brown Lead | A 25-ft (7.6 m)-thick basalt dike in granodiorite strikes N 50° W. | One pit | One grab sample of basalt; trace copper. |
| 48 | Oregon | Banded brown argillite, possibly a | One pit | One chip sample |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 48 | Oregon—Continued. | roof pendant in granodiorite, contains a quartz lens 2.5 ft (0.8 m) thick. The lens contains 10 percent biotite and feldspar. | | across the quartz lens; 0.1 oz silver per ton (2.6 g/t) and trace copper. |
| 49 | Molybdenum-copper occurrence. | An outcrop of granodiorite contains disseminated molybdenite and chalcopyrite along fractures. | None, exposed by trail construction. | One grab sample; 0.2 oz silver per ton (5.6 g/t), 0.1 percent copper, trace molybdenum and gold. |
| 51 | Great Northern mine. | Three narrow parallel shear zones in granodiorite strike N. 70°–75° W. and dip 55°–70° S. One shear zone is exposed 2,300 ft (700 m) long and 350 ft (105 m) vertically; another is exposed 1,100 ft (335 m) long and 400 ft (120 m) vertically. The third shear zone is exposed for only a few feet. Average thickness of the shear zones is 0.8 ft (0.24 m). Fracture fillings of quartz are 1–14 inches (2.5–36 cm) thick. The quartz contains hairlike veinlets, blebs, and disseminations of pyrite, chalcopyrite, bornite, and specular hematite; some fractures are stained with malachite. | Two caved adits and 11 pits. | Five grab samples from dumps averaged 0.02 oz (0.56 g/t) gold and 1.8 oz silver per ton, (46.3 g/t), and 4.0 percent copper. Six chip samples across shear zones averaged 0.3 oz silver per ton (7.7 g/t) and 0.8 percent copper and trace gold. All samples contained trace lead. |
| 52 | Donelly (Blue Lake) mine. | A quartz vein 4–6 inches (10–15 cm) thick crosscuts a shattered andesite porphyry dike. The dike is 20–40 ft (6–12 m) thick, strikes N. 20° E., and dips vertically. The porphyry dike intrudes granodiorite and is intruded by numerous basalt dikes. The quartz vein strikes N. 20°–40° W., dips 70°–80° NE., and can be traced for about 250 ft (75 m). Fractures in the quartz are coated with malachite. Malachite stain also occurs along a granodiorite-basalt dike contact. | Five pits on the quartz vein and one pit on the granodiorite-basalt dike contact. | Three chip samples across the quartz vein averaged a trace of gold, silver, and copper. One chip sample across a 0.2-ft (6 cm)-thick portion of quartz; 0.11 oz gold per ton (2.6 g/t) and trace silver and copper. A 0.8-ft (0.24-m)-wide chip sample of malachite-stained basalt; 4.9 oz silver per ton (12.6 g/t) and 0.13 percent copper. |
| 53 | Lostine copper group. | Aplite and pegmatite dikes in granodiorite contain narrow discontinuous quartz veins with malachite and iron oxide stain. The dikes are exposed over an area about 400 ft (120 m) wide and 1,100 ft (335 m) long. | Three 10-ft (3-m)-diameter pits; two trenches, 5 ft (1.5 m) wide and 20 and 35 ft (6 and 10.7 m) long. | Two chip samples 1.5 ft (0.46 m) long across quartz veins averaged 0.65 percent copper, 0.15 oz silver per ton (4.7 g/t), and a trace of lead and molybdenum. Six chip samples; trace copper and molybdenum. One sample contained a trace of gold, silver, copper, lead, and molybdenum. |
| 54 | Mountain Sheep. | A north-trending shear zone in granodiorite is exposed for 70 to 200 ft (21 to 60 m) wide and 1,800 ft (550 m) long. The zone is capped by gossan and intruded by aplite dikes. Several quartz-pyrite veins ranging from 0.2 to 3.5 ft (0.06 to 1.4 m) in thickness occur in the shear zone. Vein material is milky white quartz containing from less than 1 to more than 15 percent of disseminated pyrite. | One shaft, one adit and 11 pits. | One select dump sample; 0.4 percent copper. One 0.3-ft (9-cm) long chip sample across a quartz vein contained 0.34 percent molybdenum. Eleven other chip samples; trace amounts of metals. |
| 55 | Hidden Lake. | A quartz vein in sheared granodiorite is 2 ft (0.6 m) thick, 300 ft (90 m) long, and is exposed 100 ft (30 m) vertically. The vein parallels a basalt dike, strikes northwest, and dips 55°–85° NE. The quartz is vuggy and contains pyrite. | Three small prospect pits. | Four chip samples across the quartz vein averaged 0.3 oz silver per ton (7.7 g/t) and a trace of gold. |
| *56 | Frazier Lake. | A tactite zone, 10–20 ft (3–6 m) thick, extends for 3,000 ft (915 m) along a | Six pits and one adit. | Two chip samples across 5- and 12-ft |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 56 | Frazier Lake—Continued. | granodiorite-limestone contact. The zone strikes N. 35° E. and dips 60° SE. The tactite contains epidote, garnet (some massive) and quartz in pods and stringers. Minor disseminated chalcopyrite and pyrite; malachite, azurite, and limonite occur as fracture coatings. Granodiorite along the contact is bleached but contains no metallic minerals. | | (1.5 and 3.6 m) thicknesses of tactite; 0.86 and 0.66 percent copper, respectively. Eight other chip samples across the tactite zone; trace gold, silver, copper, lead, zinc, and molybdenum. |
| 58 | Tenderfoot "Mine". | Folded and contorted limestone and argillite has been intruded by numerous basaltic dikes. The argillite is sheared along the crests of folds and near dike contacts. Limestone–basalt dike contacts and shear zones in argillite contain pods and stringers of quartz and calcite veinlets. Dikes and shear zones contain as much as 2 percent pyrite and are stained with limonite. | Three adits crosscut limestone-dike contacts; 19 pits are on shear zones and dikes. | Fourteen chip samples; trace copper and molybdenum. Three of the samples contained 0.1–0.3 oz silver per ton (2.6–7.7 g/t). |
| 59 | Twin Ledge | A quartz vein 12–13 ft (3.6–4 m) thick is exposed for 200 ft (60 m) along the hanging wall of a basalt dike in greenstone. The vein strikes northeast and dips 60° SE. The quartz contains minor disseminated chalcopyrite. | One pit in the quartz vein. | Two samples across the quartz vein; 0.2 oz silver per ton (5.1 g/t) and trace gold. |
| 60 | Silver Site | A 4-inch (10-cm)-thick quartz vein and a basalt dike in limestone. | Two pits | Two chip samples across quartz vein and baked zone on basalt contact; 0.1 oz silver per ton (2.6 g/t) and trace copper. |
| 61 | Boner Flat | Quartz-filled shear zones in metabasalt strike N. 20°–45° W. and dip steeply both northeast and southwest. Three shear zones are 70–100 ft (21–30 m) apart and are exposed along strike for more than 300 ft (90 m). Massive white vitreous quartz occurs in lenses as much as 4 ft (1.2 m) thick and 40–90 ft (12–27 m) long. The quartz is iron oxide stained. | Three pits, one on each shear zone. | Three chip samples across shear zones; trace gold, silver, and copper. |
| 62 | Happy Jack | A 3-ft (0.9 m)-thick quartz vein in greenstone trends east and dips 80° N. Two 1-ft (0.3 m)-thick quartz veins trend north and dip 40° W. The quartz is white and massive with minor fractures. Chalcopyrite is sparsely disseminated in the quartz; fractures contain scales of azurite. | One pit 20 ft (6 m) long on the 5-ft (1.5 m)-wide vein and an adit crosscutting the two 1-ft (0.3-m) veins. | Three chip samples across the quartz veins; trace gold, silver, copper, and molybdenum. One chip sample across a 5-ft (1.5 m) thick quartz vein; 0.1 oz silver per ton (2.6 g/t). |
| 63 | Clear Creek Reservoir. | Sheared greenstone intruded by basalt and granitic dikes; four generations of dikes were noted. The shear zone contains epidote and calcite and disseminated pyrite. | None | A sample across a granitic dike and shear in greenstone contained 0.1 oz silver per ton (2.6 g/t). |
| 74 | Poor Man | Narrow quartz stringers in greenstone float. The source of the quartz-bearing greenstone is covered by talus. | Two small pits in talus. | Two select samples of quartz; 0.1 oz silver per ton (2.6 g/t) and trace gold. |
| 75 | Platinum King. | A quartz vein in limestone ranging from 0.2 to 3.0 ft (0.06 to 0.9 m) in thickness is exposed for 275 ft (85 m) along strike. The vein is irregular and lenticular, strikes N. 65° E., dips 70° SE. The quartz contains as much as 5 percent disseminated pyrite. | Five small pits on the quartz vein, eight small pits in limestone. | Three samples across quartz vein; trace gold and silver. |
| 76 | French Creek. | Argillite with shale beds and mica schist is in contact with granodiorite. The contact is slightly altered and contains small amounts of pyrite and molybdenite in fractures. | One small pit and one short adit. | One sample of argillite across face of adit and two samples across the altered contact 11 and |

TABLE 3.—*Miscellaneous lode prospects, Wallowa unorganized district*—Continued

| Map No. (pl. 2) | Prospect name | Summary | Number and type of workings | Sample data |
|---|---|---|---|---|
| 76 | French Creek—continued | | | 40 ft (3.3–12 m); 0.1–0.2 oz silver per ton (2.6–5.1 g/t) and trace gold and copper. |
| 77 | Love and Kelly. | An irregular quartz vein in argillite and granodiorite ranges from 0.2 to 1.0 ft (0.06 to 0.3 m) in thickness and is exposed for 200 ft (60 m). It averages 0.5 ft (0.15 m) in thickness and strikes N. 80° E. and dips 75° SE. | One 12-ft (3.6 m)-deep shaft and three small pits. | Two samples across the quartz vein; averaged 0.42 oz gold and 0.1 oz silver per ton (10.8 and 2.6 g/t). |
| 78 | Lazy No. 1 and 2. | Limestone with a greenstone remnant is intruded by a fine-grained andesite dike. The dike is 10–25 ft (3–7.6 m) wide, strikes N. 70° E., and dips 60° E. Fractures in the dike are filled with epidote. The greenstone remnant is 3 ft (0.9 m) wide and 15 ft (4.6 m) long. The remnant is pyritized. | One pit on the andesite dike and one on pyritized greenstone. | One sample across the dike; trace gold and silver. One sample across the greenstone; 0.2 oz silver per ton (5.1 g/t) and trace gold. |
| 79 | D and D No. 1 and 2, and C.O.D. | An aplite dike has intruded limestone that overlies greenstone. The greenstone is fractured on the surface and is sheared on the limestone contact. Fractured areas in the greenstone contain as much as 10 percent pyrite. The shears are filled with quartz from one-half to 1 inch (1.2 to 2.5 cm) thick and are from 0.5 to 3 ft (0.15 to 0.9 m) apart. | One pit on the aplite dike in limestone, two small pits on fractured greenstone, and one pit across limestone-greenstone contact. | Two samples from the dike and fractured greenstone; a trace of gold and silver. One sample across the limestone-greenstone contact; trace silver. |
| 80 | Griffin group. | Pyritized greenstone, as much as 30 ft (9 m) thick, crops out for several hundred feet. The greenstone contains as much as 10 percent disseminated pyrite. | Three pits on greenstone. | Four samples from the pits and a stockpile contained trace gold and silver. |
| 81 | Laurel Wonder. | Granodiorite and argillite is intruded by numerous aplite, basalt, and granitic dikes in an area 500 ft (150 m) wide and 2,000 ft (610 m) long. Quartz veins, 1–4 inches (2.5–10 cm) thick, occur at intervals of 5–10 ft (1.5–3 m) in joints in granodiorite. The argillite contains a 15-ft (4.6-m) thick limy bed and a lens of pegmatite. A shear zone striking S. 45° W. and dipping 70° W. is 1 ft (0.3 m) thick and contains clinozoisite and epidote. Numerous aplite dikes intrude both metasediments and granodiorite. | One trench and one pit. | Two samples across a 4–5-inch (10–13 cm) quartz-filled shear in granodiorite; 2 percent and 0.8 percent copper and trace gold, silver, lead, and molybdenum. Samples from a shear in argillite; trace copper. Four samples across aplite dikes; trace copper, lead, and molybdenum. One sample across a pegmatic lens; trace copper. |
| 82 | Hummingbird Mountain | Argillite and limestone in contact with granodiorite is intruded by numerous basalt and aplite dikes. Augen gneiss and granite gneiss along the contact grade to argillite and limestone. Quartz veins 1–4 inches (2.5–10 cm) thick occur in joints in granodiorite and shear planes in argillite and limestone near the contact. The quartz contains finely disseminated chalcopyrite. | Three small pits and three trenches. | One 1.5 ft (0.46 m) sample across a quartz vein and shear; 0.38 percent copper. On a 2.4-ft (0.7 m) sample; trace copper. Two select samples of quartz; trace gold, silver, and copper. |

## BONE RIDGE PLACER

The 160-acre (0.64 km$^2$) Bone Ridge placer claim is near the center of sec. 1, T. 3 S., R. 41 E. (pl. 2, No. 1). Sixty percent of the potential placer ground lies east of the placer claim boundary (fig. 27).

Glacial debris of unsorted boulders and decomposed granitic material composes two hummocky hills that are 50 ft (15 m) high and cover

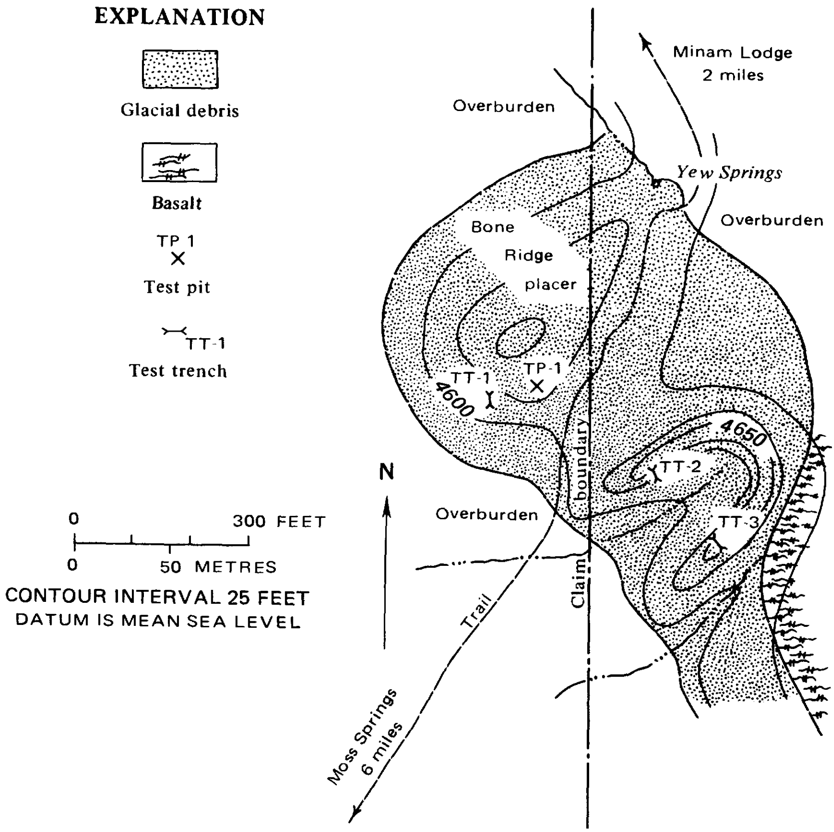


FIGURE 27.—Bone Ridge placer.

about 10 acres (0.04 km$^2$). This isolated deposit rests on basalt and is perched near the top of Backbone Ridge at an elevation of about 4,600 ft (1,400 m). The most notable features of the alluvium are the abundance of well-rounded quartzite boulders up to 2 ft (0.6 m) across and the near absence of pebbles. Angular pebble- and sand-sized fragments are quartz, feldspar, and biotite: decomposed granodiorite of the Wallowa batholith.

Three trenches and one pit were dug and sampled; none reached bedrock. No significant concentrations of valuable heavy detrital minerals were found (fig. 27).

### BOULDER CREEK PLACER

The Boulder Creek placer claim is at the junction of Boulder Creek and the Little Minam River (pl. 2, No. 2). Minor amounts of predominantly basaltic gravel have accumulated behind boulders in the stream channels. Eight reconnaissance samples from the stream gravel contained no gold and only a trace of black sand (fig. 28).

### JIM WHITE RIDGE PLACER

Tertiary boulder gravel caps part of Jim White Ridge at an elevation of about 6,800 ft (2,100 m) (pl. 2, No. 3; fig. 29). The gravel was deposited on granodiorite of the Wallowa batholith and capped by basalt. Locally, erosion has removed the basalt and exposed the Tertiary gravel. The gravel at the Jim White Ridge placer is exposed along the ridge for a length of about 2 mi (3.2 km), a width of 1,000–1,500 ft (300–460 m), and a measured depth of up to 180 ft (55 m). Well-rounded quartzite boulders were seen in the talus along 4 mi (6.4 km) of the trail from the mouth of Boulder Creek to Jim White Ridge, indicating that the gravel deposit probably extends an additional 2 mi (3.2 km) north.

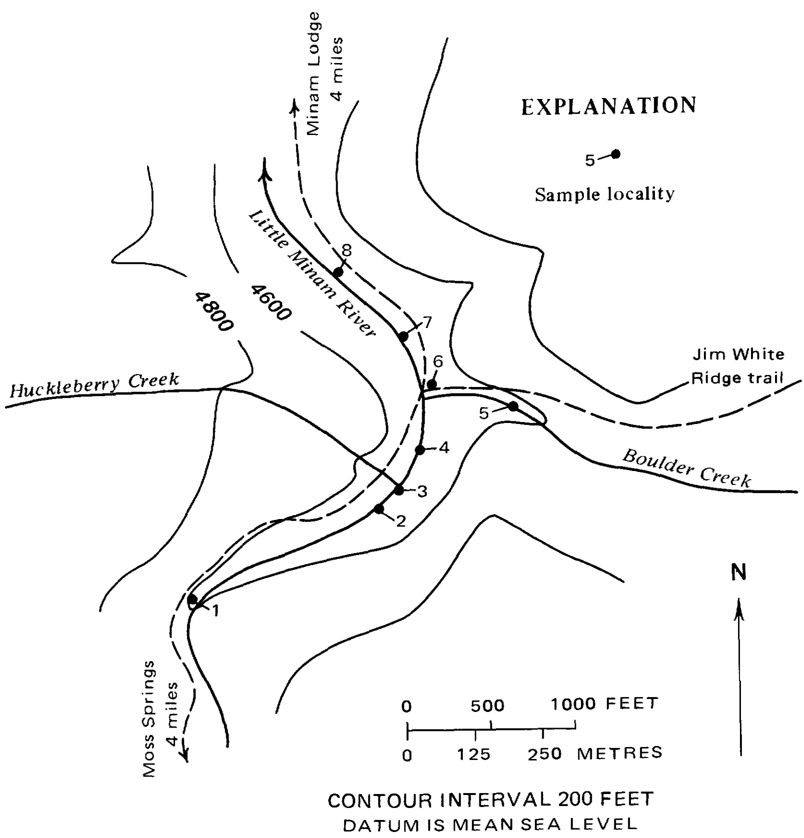


FIGURE 28.—Boulder Creek placer.

The dominant features of the gravel are the abundance (40 percent) of well-rounded quartzite boulders up to 2½ ft (0.75 m) in diameter and the near absence of rounded pebbles. Granitic rock of the batholith and porphyritic boulders of unknown origin each comprise about 10 percent of the material. The remaining 40 percent consists of angular material and sand. The gravel is relatively free of clay.

Placer workings include a water-washed trench 600 ft (180 m) long, up to 100 ft (30 m) wide, and 30 ft (9 m) deep, and the sloughed remains

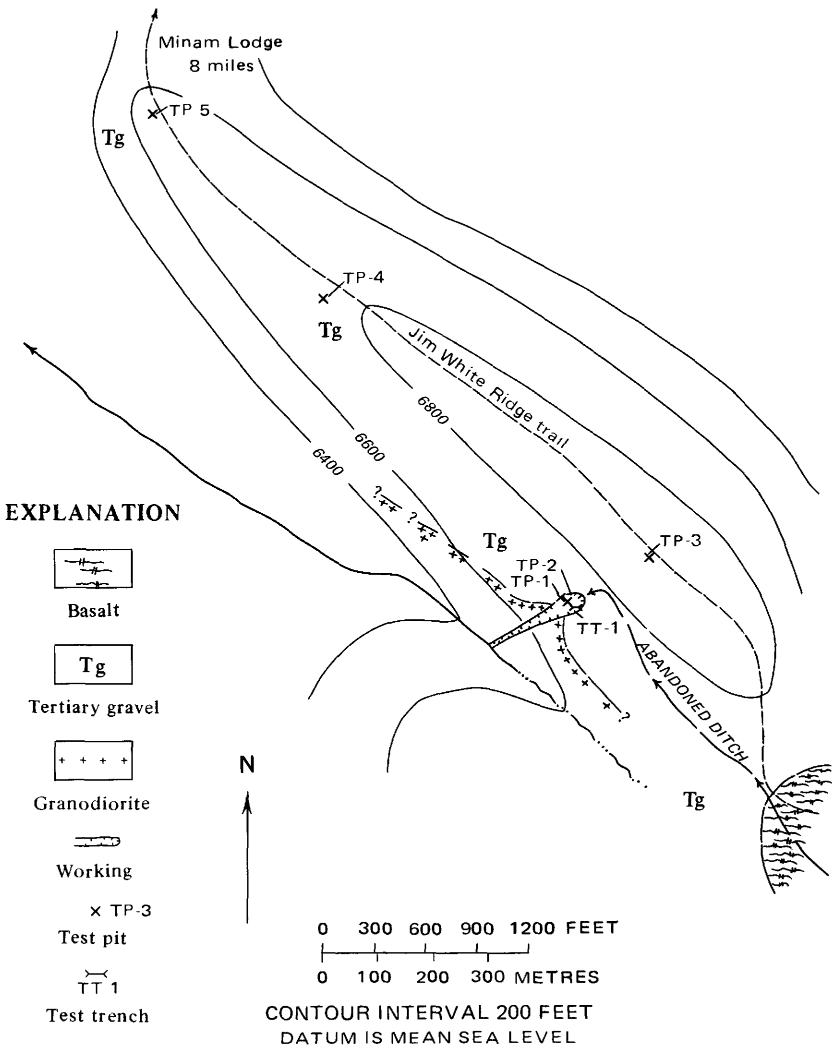


FIGURE 29.—Jim White Ridge placer.

of a ditch, used to carry water to the trench. Granodiorite bedrock is exposed near the upper end of the trench.

A vertical channel was dug along the side of the water-washed trench, and a 17.5-ft (5.3 m) vertical section of boulder gravel was sampled to near bedrock (TT–1). Gravel was sampled to bedrock at two other sites in the trench. Three additional pits ranging from 7 to 8 ft (2.1 to 2.4 m) deep spaced over a distance of 4,000 ft (1,215 m) along the ridge top were excavated and sampled (fig. 29).

The gold recovered is fine (200 mesh) and not well rounded. The predominant mineral in the black sand, magnetite, composes up to 45 percent of the concentrate. No significant concentrations of economic minerals were found in the black sand concentrates.

### IMNAHA PLACERS

Eight placer claims were located in 1907 along the Imnaha River between Blue and Cliff Creeks, and up the two creeks to the vicinity of the Wallowa-Baker County line (pl. 2, No. 64; fig. 30).

Thirteen reconnaissance pan samples and 21 channel samples were taken from 18 potential placer sites. In addition to sampling the claimed areas, four samples were taken near the confluence of the South and North Forks of the Imnaha River (site 18, fig. 30).

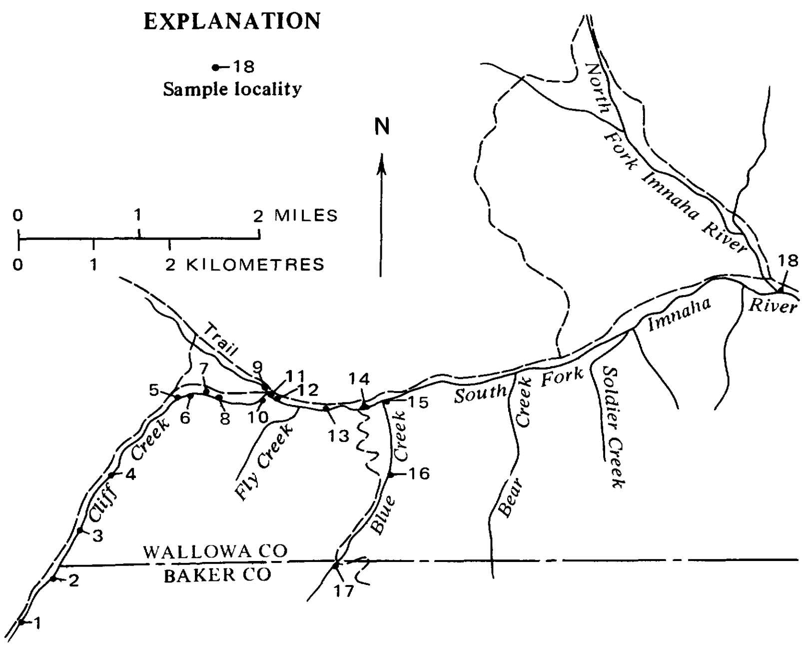


FIGURE 30.—Imnaha placers.

In 16 samples no gold was detected; 14 samples contained less than 1 cent gold per cubic yard ($0.013/m$^3$), and 4 samples contained between 1 and 4 cents gold per cubic yard ($0.013-$0.065/m$^3$). The samples averaged 5.2 lbs of black sand concentrate per cubic yard (3.0 kg/m$^3$). Forty-eight percent of the black sand concentrate is magnetite. No significant concentrations of economic minerals were found (fig. 30).

### APPRAISAL OF FINDINGS

Gold, copper, and silver are the principal metallic mineral commodities found in the area studied. Silver and molybdenum of secondary importance might be produced as a byproduct from potential copper ores.

The Granite Mountain gold veins, although extensively mined in the past, are reported not exhausted. Gold will probably be produced from these veins again under more favorable economic conditions.

Tactite zones, although they contain low-grade copper and minor silver and molybdenum, constitute a large potential mineral resource. Of particular importance is the Aneroid Lake basin area, Royal Purple prospect, and Transvaal mine area. The Frazier prospect contains copper- and molybdenum-bearing tactite, but the tonnage is low.

Low-grade copper associated with quartz stringers on Red Mountain occurs in a sizable area and may be a potential mineral resource. Low-grade copper that occurs in select beds in argillite, such as in the Contact Group and McCully Basin prospect, may be a potential mineral resource, but inferred tonnages are low to moderate. Small copper resources are also present on the Dotson and Rainbow lode prospects. Here, copper is associated with quartz lenses in granodiorite.

The Joseph Mountain mine has potential as a moderate-size silver-lead producer under favorable conditions.

The area has no potential for combustible fuels. The Wallowa Mountains have the largest high-grade limestone reserves in Oregon; however, limestone is more accessible elsewhere at localities closer to markets.

No evidence for potential geothermal energy resources is known in the study area. The only rock units that could be considered potential sources of geothermal energy, the Wallowa batholith and basalt of the Columbia River Group have been in place for so long that their geothermal gradients approach crustal norms; they are not therefore considered favorable sources of geothermal energy.

## ANALYTICAL DATA

Rock samples were analyzed by six-step semiquantitative spectroanalysis (Grimes and Marranzino, 1968) for a group of 30 elements, and the samples were further checked by atomic absorption (Ward and others, 1969) for copper, gold, silver, and zinc. Stream sediment samples were analyzed by the citrate-soluble heavy metal colorimetric test (Ward and others, 1963) for combined zinc, cobalt, copper, and lead. The sediment samples were further tested by six-step semiquantitative spectroanalysis and checked for copper, gold, silver, and zinc by atomic absorption.

Table 4 is separated into three categories: rock samples, stream sediment samples and panned concentrate samples. Under the heading rocks, the samples are further divided into (a) veins, mineralized rocks, and altered rocks; (b) older Triassic rocks; (c) Martin Bridge Formation; (d) Hurwal Formation; (e) Wallowa batholith and related rocks; (f) other rocks. Stream sediment samples are classified according to the formations underlying the waterbeds; divisions are (a) older Triassic rocks; (b) Martin Bridge Formation; (c) Hurwal Formation; (d) Wallowa batholith; (e) Columbia River Group; and (f) other sources. The category "other sources" for stream sediments includes all samples from areas containing more than one rock type.

For the purposes of this report, anomalous samples are those that were found to meet one or more of the following criteria:

Contained 1 ppm or more gold (not detected by spectrographic method)
10 ppm or more silver
100 ppm or more copper[1] [or] molybdenum, or tungsten
500 ppm or more lead or zinc
10 ppm or more citrate soluble heavy metals (CxHM)

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[1]Basalt samples are not represented; 100 ppm or more of copper is considered normal for the rock.

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# TABLE 4

[The letter symbols shown at the head of the columns indicate the following: S, six-step semiquantitative spectrographic analysis; AA, atomic absorption; P, partial digestion; CM-CX-HM, citrate-soluble heavy metals colorimetric test. The letter symbols at the right of values indicate the following: L, detected but below the determination value shown; N, looked for but not detected at determination limit shown; G, detected in quantities greater than value shown; B, not determined. The elements determined are reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, and so forth, which represent approximate midpoints of group data on a geometric scale. All elements are reported in parts per million, except iron, magnesium, calcium, and titanium, which are reported in percent (%); citrate-soluble heavy metals are reported in parts per million. See also description of table 4 in section "Analytical Data"]

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROCKS - VEINS, MINERALIZED ROCKS, AND ALTERED ROCKS | | | | | | | | | | | | | | | | |
| 1C0174 | 1.00 | 0.20 | 0.20 | .050 | 500 | 100.0 | 200 N | 10 N | 10 N | 70 | 1.0 L | 30 | 20 N | 5 | 10 L | 20000 G |
| 1C0227 | 1.50 | 0.10 | 0.07 | .015 | 50 | 30.0 | 200 N | 10 N | 10 N | 20 L | 1.0 L | 20 | 20 N | 5 | 10 L | 20000 |
| 1D0021 | 7.00 | 3.00 | 7.00 | 1.000 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 50 | 70 | 150 |
| 1G0074 | 1.00 | 0.05 | 0.07 | .015 | 70 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 | 10 L | 100 |
| 1G0085 | 7.00 | 3.00 | 15.00 | .100 | 1500 | 20.0 | 200 N | 10 N | 10 L | 20 L | 1.0 L | 10 N | 20 N | 10 | 20 | 10000 |
| 1W0099 | 15.00 | 0.02 L | 0.70 | .003 | 20 | 300.0 | 700 | 10 N | 10 L | 20 | 1.0 N | 10 N | 30 | 5 N | 10 L | 20000 |
| 1W0100 | 20.00 G | 0.02 | 0.15 | .002 L | 10 N | 200.0 | 1000 | 10 N | 30 | 20 | 1.0 N | 10 N | 20 N | 5 N | 10 L | 3000 |
| 1W0101 | 3.00 | 1.00 | 5.00 | .300 | 1000 | 100.0 | 200 N | 10 N | 10 | 200 | 1.0 N | 10 N | 20 N | 7 | 70 | 700 |
| 1W0102 | 2.00 | 0.30 | 0.15 | .100 | 70 | 0.5 N | 200 N | 10 N | 50 | 700 | 1.0 | 10 N | 20 N | 5 L | 10 L | 3000 |
| 1W0103 | 5.00 | 0.03 | 0.05 L | .020 | 50 | 5.0 | 200 N | 10 N | 10 L | 30 | 1.0 L | 10 N | 20 N | 5 L | 10 L | 1500 |
| 1W0147 | 5.00 | 0.20 | 0.20 | .050 | 300 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 | 10 N | 20 N | 5 L | 20 | 150 |
| 1W0150 | 3.00 | 0.10 | 0.50 | .015 | 300 | 1.0 | 200 N | 10 N | 10 N | 200 | 2.0 | 10 N | 20 N | 5 | 10 L | 70 |
| 1W0154 | 2.00 | 0.15 | 0.30 | .015 | 150 | 1.5 | 200 N | 10 N | 10 N | 150 | 1.0 L | 10 N | 20 N | 5 | 10 L | 1000 |
| 1W0155 | 3.00 | 0.02 | 0.05 L | .010 | 50 | 10.0 | 200 N | 10 N | 10 N | 100 | 1.0 L | 10 N | 20 N | 5 | 10 L | 7000 |
| 1W0192 | 2.00 | 0.70 | 0.05 L | .300 | 200 | 0.7 | 200 N | 10 N | 10 N | 300 | 1.0 N | 10 N | 20 N | 5 | 10 L | 2000 |
| 1W0193 | 7.00 | 0.07 | 0.07 | .010 | 150 | 100.0 | 200 N | 10 N | 10 L | 20 L | 1.0 L | 20 | 20 N | 200 | 10 L | 20000 G |
| 1W0194 | 0.05 L | 0.02 L | 0.05 L | .005 | 10 L | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 N | 10 L | 100 |
| 1W0195 | 1.50 | 0.02 L | 0.05 L | .050 | 10 N | 700.0 | 200 N | 10 N | 10 N | 1000 | 1.0 N | 1000 G | 20 N | 5 N | 10 L | 20000 G |
| 1W0197 | 20.00 | 0.02 L | 0.05 L | .003 | 10 L | 100.0 | 200 N | 10 N | 10 | 20 | 1.0 N | 10 N | 20 N | 20 | 10 L | 20000 G |
| 1W0199 | 10.00 | 0.10 | 0.10 | .005 | 30 | 300.0 | 200 N | 10 N | 10 L | 20 L | 1.0 L | 200 | 20 N | 30 | 50 | 20000 G |
| 1W0200 | 20.00 G | 0.02 | 0.05 L | .200 | 300 | 0.5 N | 200 N | 10 N | 50 | 20 | 1.0 N | 10 N | 20 N | 100 | 10 L | 500 |
| 1W0201 | 1.00 | 0.02 L | 0.05 L | .005 | 20 | 10.0 | 200 N | 10 N | 10 N | 20 L | 1.0 L | 20 | 20 N | 5 L | 20 | 2000 |
| 1W0209 | 15.00 | 1.50 | 15.00 | .300 | 1500 | 0.5 N | 200 N | 10 N | 10 | 50 | 1.0 N | 10 N | 20 N | 15 | 10 L | 150 |
| 1W0246 | 0.50 | 0.05 | 0.05 | .015 | 50 | 30.0 | 200 N | 10 N | 10 N | 30 | 1.0 N | 10 L | 20 N | 5 L | 10 L | 15000 |
| 1W0248 | 2.00 | 0.50 | 0.15 | .100 | 200 | 70.0 | 200 N | 10 N | 10 L | 150 | 1.0 N | 30 | 20 N | 5 L | 20 | 20000 G |
| 1W0249 | 2.00 | 0.30 | 0.20 | .030 | 200 | 200.0 | 200 N | 10 N | 10 N | 30 | 1.0 N | 150 | 20 N | 5 | 20 | 20000 G |
| 1W0250 | 5.00 | 0.10 | 0.05 | .020 | 100 | 10.0 | 200 N | 10 N | 10 N | 20 | 1.0 N | 20 | 20 N | 5 L | 20 | 15000 |
| 1W0253 | 15.00 | 0.70 | 3.00 | .030 | 700 | 150.0 | 200 N | 10 | 10 L | 100 | 1.0 N | 10 N | 20 N | 100 | 10 L | 150 |
| 1W0260 | 7.00 | 7.00 | 10.00 | .300 | 1000 | 1.5 | 200 N | 10 N | 10 L | 700 | 1.0 L | 10 N | 20 N | 50 | 700 | 150 |
| 1W0261 | 7.00 | 0.02 L | 0.05 L | .010 | 50 | 30.0 | 200 N | 10 N | 10 L | 20 | 1.0 N | 10 N | 20 N | 5 | 10 L | 5000 |
| 1W0262 | 1.50 | 0.05 | 0.05 L | .050 | 50 | 3.0 | 200 N | 10 N | 10 N | 500 | 1.0 N | 10 N | 20 N | 5 | 10 L | 500 |
| 1W0264 | 3.00 | 0.30 | 0.05 L | .100 | 100 | 1.0 | 200 N | 10 N | 10 N | 300 | 1.0 N | 10 N | 20 N | 5 | 10 L | 200 |
| 1W0265 | 2.00 | 0.02 | 0.05 L | .015 | 20 | 0.5 N | 200 N | 10 N | 10 N | 50 | 1.0 N | 10 N | 20 N | 5 L | 10 L | 15 |
| 1W0266 | 5.00 | 0.30 | 0.15 | .100 | 150 | 30.0 | 200 N | 10 N | 10 L | 700 | 1.0 N | 10 N | 20 N | 5 | 10 L | 10000 |
| 1W0267 | 3.00 | 0.03 | 0.10 | .015 | 100 | 7.0 | 200 N | 10 N | 10 N | 150 | 1.0 N | 10 N | 20 N | 5 L | 10 L | 7000 |
| 1W0275 | 2.00 | 0.15 | 0.07 | .005 | 70 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 7 | 10 L | 150 |
| 1W0279 | 3.00 | 0.70 | 0.15 | .500 | 700 | 7.0 | 200 N | 10 N | 10 | 200 | 1.0 L | 10 N | 20 N | 30 | 70 | 10000 |
| 1W0302 | 1.00 | 0.03 | 0.10 | .010 | 30 | 1.5 | 200 N | 10 N | 10 | 30 | 1.0 L | 10 N | 20 N | 5 | 10 L | 700 |
| 1W0305 | 2.00 | 0.70 | 1.00 | .150 | 1500 | 1.5 | 200 N | 10 N | 10 | 700 | 1.5 | 10 N | 20 N | 7 | 20 | 30 |
| 2W0003 | 5.00 | 2.00 | 7.00 | .300 | 500 | 0.5 N | 200 N | 10 N | 10 L | 50 | 1.0 N | 10 N | 20 N | 20 | 20 | 150 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-LA | S-MO | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROCKS - VEINS, MINERALIZED ROCKS, AND ALTERED ROCKS | | | | | | | | | | | | | | | | | | |
| 1C0174 | 20 N | 5 N | 10 N | 7 | 10 | 100 N | 5 N | 10 N | 100 N | 50 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 38000 | 40 | 110.0 |
| 1C0227 | 20 N | 300 | 10 N | 5 | 10 L | 100 N | 5 | 10 N | 100 N | 20 | 50 N | 10 L | 200 N | 10 N | 1.50 | 25000 | 20 | 0.2 L |
| 1D0021 | 20 L | 5 N | 10 N | 100 | 10 L | 100 N | 30 | 10 N | 500 | 300 | 50 N | 20 | 200 N | 70 | 0.02 L | 300 | 60 | 0.2 L |
| 1G0074 | 20 N | 5 N | 10 N | 7 | 10 N | 100 N | 5 N | 10 N | 100 N | 100 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 200 | 10 | 0.2 L |
| 1G0085 | 20 N | 70 | 10 N | 15 | 10 L | 100 N | 10 | 10 N | 500 | 200 | 50 N | 10 L | 200 N | 20 | 0.02 L | 5000 | 70 | 0.2 L |
| 1W0099 | 20 N | 5 N | 10 N | 15 | 500 | 100 L | 5 N | 10 N | 100 N | 10 L | 50 N | 10 N | 3000 | 10 N | 0.02 L | 16000 | 2200 | 3.5 |
| 1W0100 | 20 N | 5 N | 10 N | 10 | 700 | 200 | 5 L | 10 N | 100 N | 10 L | 50 N | 10 L | 5000 | 10 N | 0.02 L | 2300 | 2000 | 4.0 |
| 1W0101 | 20 N | 5 N | 10 N | 20 | 150 | 100 N | 20 | 10 N | 200 | 150 | 50 N | 10 | 2000 | 30 | 0.02 L | 450 | 2200 | 1.5 |
| 1W0102 | 20 N | 5 N | 10 N | 15 | 10 L | 100 N | 5 L | 10 N | 100 N | 10 | 50 N | 10 L | 3000 | 70 | 0.02 L | 4900 | 3800 | 0.2 L |
| 1W0103 | 20 N | 5 N | 10 N | 5 | 300 | 100 N | 5 N | 10 N | 100 N | 20 | 50 N | 10 L | 1500 | 10 | 0.02 L | 1200 | 1000 | 4.5 |
| 1W0147 | 20 N | 150 | 10 N | 5 | 10 L | 100 N | 5 | 10 N | 100 N | 70 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 170 | 30 | 0.2 L |
| 1W0150 | 20 N | 1500 | 10 N | 5 L | 10 L | 100 N | 5 N | 10 N | 100 N | 30 | 50 N | 10 N | 200 N | 10 N | 0.02 L | 85 | 10 | 0.2 L |
| 1W0154 | 20 N | 70 | 10 N | 5 | 10 N | 100 N | 5 N | 10 N | 100 N | 20 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 2000 | 40 | 2.0 |
| 1W0156 | 20 N | 30 | 10 N | 5 | 10 L | 100 N | 5 N | 10 N | 100 N | 50 | 50 N | 10 L | 200 N | 10 L | 0.02 L | 4700 | 70 | 2.0 |
| 1W0192 | 20 N | 15 | 10 N | 15 | 10 L | 100 N | 7 | 10 N | 100 N | 50 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 2300 | 40 | 0.2 L |
| 1W0193 | 20 N | 300 | 10 N | 70 | 10 L | 100 N | 5 N | 10 N | 100 N | 300 | 50 N | 30 | 200 N | 10 N | 0.02 L | 100000 G | 180 | 0.2 L |
| 1W0194 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 N | 10 N | 100 N | 10 | 50 N | 10 N | 200 N | 10 L | 0.02 L | 200 | 20 | 0.2 L |
| 1W0195 | 20 N | 1500 | 10 N | 5 | 50 | 100 N | 5 N | 20 | 200 | 20 | 50 N | 10 N | 200 N | 10 N | 3.00 | 100000 G | 10 | 0.2 L |
| 1W0197 | 20 N | 300 | 10 N | 100 | 10 L | 100 N | 5 N | 10 N | 100 N | 50 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 100000 G | 60 | 0.2 L |
| 1W0199 | 20 N | 200 | 10 N | 150 | 20 | 100 N | 5 N | 10 N | 100 N | 500 | 50 N | 15 | 200 N | 10 L | 2.00 | 100000 G | 130 | 0.2 L |
| 1W0200 | 20 N | 700 | 10 N | 50 | 10 N | 100 N | 5 | 10 N | 100 N | 700 | 50 N | 10 | 200 N | 10 | 0.02 L | 300 | 25 | 0.2 L |
| 1W0201 | 20 N | 2000 G | 10 N | 7 | 10 N | 100 N | 5 N | 70 | 100 N | 20 | 50 N | 10 N | 200 N | 10 N | 8.00 | 4700 | 15 | 0.2 L |
| 1W0209 | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 20 | 10 N | 150 | 300 | 50 N | 15 | 200 N | 20 | 0.02 L | 120 | 80 | 0.2 L |
| 1W0246 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 L | 10 N | 100 N | 15 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 21000 | 5 | 0.2 L |
| 1W0248 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 L | 10 N | 100 N | 70 | 50 N | 10 L | 200 N | 300 | 5.00 | 45000 | 5 | 0.2 L |
| 1W0249 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 L | 10 N | 100 N | 200 | 50 N | 10 N | 200 N | 30 | 0.02 L | 85000 | 10 | 0.2 L |
| 1W0250 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 N | 10 N | 100 N | 70 | 50 N | 10 N | 200 N | 10 | 0.02 L | 8000 | 5 | 0.2 L |
| 1W0253 | 20 N | 5 N | 10 N | 50 | 10 N | 100 N | 5 | 10 N | 100 N | 20 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 800 | 20 | 0.2 L |
| 1W0260 | 20 N | 5 N | 10 N | 150 | 10 L | 100 N | 30 | 10 N | 700 | 200 | 50 N | 10 | 200 N | 30 | 0.02 L | 500 | 20 | 0.2 L |
| 1W0261 | 20 N | 2000 | 10 N | 5 | 10 N | 100 N | 5 N | 20 | 100 N | 10 L | 50 N | 10 N | 200 N | 10 N | 0.02 L | 2800 | 35 | 0.2 L |
| 1W0262 | 20 N | 2000 G | 10 N | 5 L | 10 N | 100 N | 5 L | 50 | 100 N | 30 | 50 N | 10 N | 200 N | 30 | 0.02 L | 600 | 35 | 0.2 L |
| 1W0264 | 20 N | 500 | 10 N | 5 L | 10 N | 100 N | 5 | 10 | 100 N | 150 | 50 N | 10 N | 200 N | 100 | 0.02 L | 35 | 65 | 0.2 L |
| 1W0265 | 20 N | 700 | 10 N | 5 L | 10 N | 100 N | 5 N | 10 L | 100 N | 20 | 50 N | 10 N | 200 N | 10 | 0.02 L | 5 | 25 | 0.2 L |
| 1W0266 | 20 N | 300 | 10 N | 5 | 10 N | 100 N | 5 | 10 | 100 | 70 | 50 N | 10 N | 200 N | 10 N | 0.02 L | 1400 | 40 | 0.2 L |
| 1W0267 | 20 N | 2000 | 10 N | 5 | 10 N | 100 N | 5 N | 20 | 100 N | 30 | 50 N | 10 N | 200 N | 10 N | 0.02 L | 1600 | 65 | 0.2 L |
| 1N0275 | 20 N | 5 N | 10 N | 10 | 10 N | 100 N | 5 N | 10 N | 100 N | 10 | 50 N | 10 N | 200 N | 10 N | 0.02 L | 400 | 20 | 0.2 L |
| 1W0279 | 20 N | 70 | 10 N | 70 | 10 L | 100 N | 15 | 10 N | 100 N | 150 | 50 N | 10 L | 200 N | 70 | 0.02 L | 5000 | 60 | 0.2 L |
| 1W0302 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 N | 10 N | 100 N | 10 L | 50 N | 10 L | 200 N | 10 L | 0.02 L | 1100 | 5 L | 0.2 L |
| 1W0305 | 20 N | 5 N | 10 N | 5 | 15 | 100 N | 7 | 10 N | 100 | 70 | 300 | 15 | 200 N | 30 | 0.30 | 30 | 40 | 0.2 L |
| 2W0003 | 20 N | 5 N | 10 N | 10 | 10 L | 100 N | 30 | 10 N | 300 | 150 | 50 N | 20 | 200 N | 50 | 0.00 B | 0 B | 30 | 0.5 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2W0005 | 15.00 | 0.30 | 0.07 | .070 | 100 | 70.0 | 200 N | 10 N | 10 L | 50 | 1.0 L | 30 | 200 | 7 | 10 L | 20000 |
| 2W0008 | 3.00 | 0.10 | 7.00 | .002 | 1500 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 L | 10 N | 20 N | 10 | 10 L | 100 |
| 2W0009 | 20.00 | 0.05 | 0.05 | .002 L | 300 | 70.0 | 200 | 10 N | 30 | 20 L | 1.0 N | 10 N | 150 | 15 | 10 L | 10000 |
| 2W0015 | 10.00 | 0.30 | 0.07 | .500 | 50 | 3.0 | 200 N | 10 N | 50 | 300 | 1.0 L | 10 N | 20 N | 5 L | 30 | 100 |
| 2W0016 | 5.00 | 0.02 L | 0.05 L | .002 | 10 N | 300.0 | 200 N | 10 N | 10 | 20 L | 1.0 N | 10 L | 20 N | 5 N | 10 L | 1500 |
| 2W0017 | 15.00 | 1.50 | 0.20 | .700 | 700 | 7.0 | 200 N | 10 N | 10 | 100 | 1.0 L | 10 N | 70 | 70 | 70 | 15000 |
| 2W0018 | 2.00 | 0.02 | 0.05 L | .002 | 15 | 30.0 | 200 N | 10 N | 10 N | 20 L | 1.0 L | 10 L | 20 N | 5 L | 10 L | 700 |
| DG302 | 2.00 | 0.02 L | 0.05 | .030 | 150 | 10.0 | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 L | 10 N | 15000 |
| DG365A | 1.50 | 0.02 L | 0.05 L | .015 | 30 | 3.0 | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 L | 10 N | 500 |
| DG365B | 1.50 | 0.20 | 0.05 | .030 | 150 | 3.0 | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 | 10 N | 10000 |
| DG365C | 0.70 | 0.02 | 0.05 L | .010 | 50 | 100.0 | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 L | 10 N | 500 |
| DG374C | 0.70 | 0.70 | 3.00 | .200 | 300 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 | 10 N | 20 N | 5 N | 30 | 70 |
| DG453A | 0.15 | 0.03 | 0.50 | .010 | 300 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 L | 10 N | 20 N | 5 N | 10 N | 5 |
| DG459 | 1.50 | 0.05 | 0.05 L | .015 | 30 | 0.5 | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 N | 10 N | 200 |
| ROCKS - OLDER TRIASSIC ROCKS | | | | | | | | | | | | | | | | |
| 1G0061 | 10.00 | 3.00 | 7.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 20 | 70 | 150 |
| 1G0064 | 10.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 30 | 50 | 70 |
| 1G0067 | 7.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 20 | 70 | 100 |
| 1G0079 | 10.00 | 7.00 | 7.00 | .700 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 70 | 50 | 150 |
| 1G0081 | 10.00 | 7.00 | 7.00 | 1.000 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 50 | 100 | 100 |
| 1W0001 | 7.00 | 1.50 | 5.00 | 1.000 G | 1000 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 L | 10 N | 20 N | 30 | 50 | 150 |
| 1W0006 | 7.00 | 3.00 | 7.00 | .700 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 N | 10 N | 20 N | 30 | 70 | 500 |
| 1W0090 | 5.00 | 3.00 | 2.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 L | 10 N | 20 N | 10 | 50 | 150 |
| 1W0148 | 5.00 | 2.00 | 1.50 | .300 | 2000 | 0.5 N | 200 N | 10 N | 10 N | 200 | 1.5 | 10 N | 20 N | 10 | 20 | 300 |
| 1W0149 | 7.00 | 3.00 | 3.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 | 10 N | 20 N | 30 | 50 | 150 |
| 1W0156A | 7.00 | 2.00 | 3.00 | .700 | 2000 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 50 | 70 | 150 |
| 1W0163 | 7.00 | 3.00 | 7.00 | .300 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 N | 10 N | 20 N | 70 | 200 | 150 |
| 1W0185 | 7.00 | 2.00 | 7.00 | .700 | 2000 | 0.5 N | 200 N | 10 N | 10 | 200 | 1.0 N | 10 N | 20 N | 30 | 50 | 100 |
| 1W0203 | 7.00 | 3.00 | 7.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 N | 100 | 1.0 N | 10 N | 20 N | 15 | 70 | 150 |
| 1W0205 | 7.00 | 2.00 | 3.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 N | 150 | 1.0 N | 10 N | 20 N | 15 | 50 | 150 |
| 1W0206 | 5.00 | 2.00 | 5.00 | .700 | 700 | 0.5 N | 200 N | 10 N | 10 N | 100 | 1.0 N | 10 N | 20 N | 10 | 70 | 150 |
| 1W0208 | 7.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 N | 500 | 1.0 N | 10 N | 20 N | 20 | 70 | 100 |
| 1W0229 | 10.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 30 | 50 | 150 |
| 1W0231 | 15.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 | 50 | 1.0 N | 10 N | 20 N | 50 | 70 | 70 |
| 1W0232 | 10.00 | 3.00 | 7.00 | .700 | 1500 | 0.5 N | 200 N | 10 N | 10 | 200 | 1.0 N | 10 N | 20 N | 30 | 30 | 100 |
| 1W0281 | 3.00 | 2.00 | 10.00 | .300 | 1000 | 1.5 | 200 N | 10 N | 15 | 200 | 1.0 N | 10 N | 20 N | 10 | 10 L | 5000 |
| 1W0282 | 10.00 | 3.00 | 0.70 | .700 | 1500 | 0.5 N | 200 N | 10 N | 10 | 300 | 1.0 N | 10 N | 20 N | 5 | 30 | 100 |
| 1W0291 | 3.00 | 1.50 | 7.00 | .300 | 1500 | 0.7 | 200 N | 10 N | 15 | 200 | 1.5 | 10 N | 20 N | 20 | 20 | 200 |
| 1W0306 | 3.00 | 2.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 | 50 | 1.0 N | 10 N | 20 N | 30 | 30 | 150 |
| DG0018 | 3.00 | 1.00 | 3.00 | .700 | 1000 | 1.5 | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 10 | 30 | 100 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-LA | S-MO | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2W0005 | 20 N | 5 N | 10 N | 15 | 200 | 100 N | 5 | 10 N | 100 N | 50 | 50 N | 10 L | 10000 G | 10 N | 0.00 B | 0 B | 12000 | 100.0 |
| 2W0008 | 20 N | 5 N | 10 N | 7 | 10 N | 100 N | 5 N | 10 N | 100 L | 50 | 50 N | 10 | 200 L | 10 N | 0.00 B | 0 B | 80 | 0.5 N |
| 2W0009 | 100 | 20 | 10 N | 50 | 10 N | 100 N | 5 | 10 N | 100 L | 10 L | 50 N | 200 | 10000 G | 10 N | 0.00 B | 0 B | 20000 | 86.0 |
| 2W0015 | 20 N | 5 N | 10 N | 5 | 15 | 100 N | 30 | 10 N | 100 N | 300 | 50 N | 15 | 200 L | 50 | 0.00 B | 0 B | 70 | 2.5 |
| 2W0016 | 20 N | 5 N | 10 N | 5 L | 20000 G | 300 | 5 N | 10 N | 100 N | 10 L | 50 N | 10 L | 300 | 10 N | 0.00 B | 0 B | 500 | 400.0 |
| 2W0017 | 20 N | 5 N | 10 N | 50 | 700 | 100 N | 30 | 10 N | 100 N | 300 | 50 N | 20 | 10000 G | 70 | 0.00 B | 0 B | 30000 | 5.5 |
| 2W0018 | 20 N | 5 N | 10 N | 5 L | 15000 | 100 L | 5 N | 10 N | 100 N | 10 L | 50 N | 10 N | 1000 | 10 N | 0.00 B | 0 B | 1000 | 52.0 |
| DG302 | 20 N | 5 N | 10 N | 7 | 10 L | 100 N | 5 L | 10 N | 100 N | 30 | 50 N | 10 L | 200 N | 10 N | 0.30 | 15000 | 15 | 10.0 |
| DG365A | 20 N | 5 N | 10 N | 5 | 500 | 100 N | 5 | 10 N | 100 N | 10 | 50 N | 10 N | 700 | 10 N | 0.02 L | 630 | 700 | 4.0 |
| DG365B | 20 N | 5 N | 10 N | 10 | 150 | 100 N | 7 | 10 N | 100 N | 30 | 50 N | 10 L | 7000 | 10 N | 0.02 L | 8000 | 6500 | 4.0 |
| DG365C | 20 N | 5 N | 10 N | 5 L | 20000 G | 100 N | 5 L | 10 N | 100 N | 20 | 50 N | 10 N | 200 L | 10 N | 0.06 | 350 | 400 | 96.0 |
| DG374C | 20 | 700 | 10 N | 5 | 10 L | 100 N | 7 | 10 N | 1500 | 70 | 50 N | 10 | 200 N | 100 | 0.02 | 150 | 50 | 1.0 |
| DG453A | 20 L | 5 N | 10 N | 5 | 10 L | 100 N | 5 N | 10 N | 100 N | 10 | 50 N | 10 N | 200 N | 10 N | 1.10 | 10 | 10 | 0.6 |
| DG459 | 20 L | 5 N | 10 N | 5 L | 10 L | 100 N | 5 N | 10 N | 100 N | 10 L | 50 N | 10 N | 200 N | 10 N | 0.02 L | 230 | 140 | 0.8 |
| ROCKS - OLDER TRIASSIC ROCKS | | | | | | | | | | | | | | | | | | |
| 1G0061 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 30 | 10 N | 500 | 300 | 50 N | 15 | 200 N | 30 | 0.02 L | 90 | 110 | 0.2 L |
| 1G0064 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 150 | 500 | 50 N | 30 | 200 N | 50 | 0.02 L | 110 | 70 | 0.2 L |
| 1G0067 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 30 | 0.02 L | 140 | 55 | 0.2 L |
| 1G0079 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 50 | 10 N | 200 | 500 | 50 N | 20 | 200 N | 70 | 0.02 L | 75 | 70 | 0.2 L |
| 1G0081 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 50 | 10 N | 200 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 60 | 60 | 0.2 L |
| 1W0001 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 50 | 10 N | 150 | 500 | 50 N | 70 | 200 N | 150 | 0.02 L | 130 | 30 | 0.2 L |
| 1W0006 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 50 | 0.02 L | 450 | 25 | 0.2 L |
| 1W0090 | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 30 | 10 N | 200 | 200 | 50 N | 15 | 200 N | 70 | 0.02 L | 120 | 100 | 0.2 L |
| 1W0148 | 20 N | 7 | 10 N | 10 | 10 L | 100 N | 20 | 10 N | 100 | 100 | 50 N | 15 | 300 | 70 | 0.02 L | 270 | 170 | 0.2 L |
| 1W0149 | 20 N | 7 | 10 N | 20 | 10 L | 100 N | 30 | 10 N | 200 | 300 | 50 N | 20 | 200 L | 70 | 0.02 L | 90 | 80 | 0.2 L |
| 1W0156A | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 50 | 200 N | 70 | 0.02 L | 150 | 40 | 0.2 L |
| 1W0163 | 20 N | 5 N | 10 N | 100 | 10 N | 100 N | 50 | 10 N | 300 | 300 | 50 N | 15 | 200 N | 20 | 0.02 L | 85 | 40 | 0.2 L |
| 1W0185 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 200 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 80 | 75 | 0.2 L |
| 1W0203 | 20 N | 20 | 10 N | 15 | 10 L | 100 N | 30 | 10 N | 200 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 60 | 40 | 0.2 L |
| 1W0205 | 20 N | 15 | 10 N | 15 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 100 | 100 | 0.2 L |
| 1W0206 | 20 N | 5 | 10 N | 15 | 10 L | 100 N | 30 | 10 N | 500 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 90 | 55 | 0.2 L |
| 1W0208 | 20 N | 5 | 10 N | 15 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 50 | 0.02 L | 75 | 45 | 0.2 L |
| 1W0229 | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 30 | 10 N | 200 | 300 | 50 N | 20 | 200 N | 30 | 0.02 L | 100 | 80 | 0.2 L |
| 1W0231 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 100 | 300 | 50 N | 20 | 200 N | 50 | 0.02 L | 110 | 100 | 0.2 L |
| 1W0232 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 30 | 10 N | 200 | 300 | 50 N | 20 | 200 N | 30 | 0.02 L | 80 | 80 | 0.2 L |
| 1W0281 | 20 N | 5 N | 10 N | 15 | 10 L | 100 N | 30 | 10 N | 150 | 200 | 50 N | 10 | 200 N | 30 | 0.02 L | 3600 | 150 | 0.2 L |
| 1W0282 | 20 N | 5 L | 10 N | 15 | 10 L | 100 N | 50 | 10 N | 100 N | 500 | 50 N | 20 | 200 N | 100 | 0.02 L | 60 | 140 | 0.2 L |
| 1W0291 | 20 N | 50 | 10 N | 15 | 10 L | 100 N | 15 | 10 N | 200 | 150 | 50 N | 30 | 200 N | 100 | 0.02 L | 400 | 45 | 0.2 L |
| 1W0306 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 50 | 10 N | 200 | 150 | 50 N | 20 | 200 N | 30 | 0.02 L | 180 | 60 | 0.2 L |
| DG0018 | 20 N | 5 N | 10 N | 30 | 10 | 100 N | 30 | 10 N | 500 | 300 | 50 N | 20 | 200 N | 50 | 0.02 L | 100 | 20 | 0.2 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DG445A | 3.00 | 1.00 | 5.00 | 1.000 | 1000 | 1.5 | 200 N | 10 N | 10 L | 70 | 1.0 L | 10 N | 20 N | 15 | 150 | 1500 |
| DW002 | 3.00 | 1.50 | 3.00 | .700 | 700 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 N | 10 N | 20 N | 10 | 50 | 150 |
| DW035 | 5.00 | 2.00 | 5.00 | .500 | 1000 | 0.5 N | 200 N | 10 N | 10 | 30 | 1.0 N | 10 N | 20 N | 5 | 30 | 300 |
| DW155 | 3.00 | 2.00 | 7.00 | .500 | 700 | 0.5 L | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 15 | 70 | 150 |
| DW157 | 3.00 | 1.50 | 7.00 | .500 | 300 | 0.5 L | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 15 | 150 | 150 |
| DW158 | 3.00 | 1.00 | 7.00 | .500 | 300 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 10 | 70 | 100 |
| DW180 | 3.00 | 1.50 | 2.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 50 | 1.0 N | 10 N | 20 N | 10 | 50 | 150 |
| DW241 | 3.00 | 1.50 | 7.00 | .300 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 30 | 1.0 N | 10 N | 20 N | 10 | 20 | 150 |
| | | | | | ROCKS - MARTIN BRIDGE FORMATION | | | | | | | | | | | |
| 1W0202 | 0.30 | 3.00 | 20.00 G | .015 | 50 | 0.5 N | 200 N | 10 N | 10 L | 20 L | 1.0 N | 10 N | 20 N | 5 N | 10 L | 150 |
| DG270 | 3.00 | 0.15 | 7.00 | .300 | 5000 | 0.5 N | 200 N | 10 N | 10 L | 20 L | 1.0 N | 10 N | 20 N | 5 | 10 | 2000 |
| DG374A | 5.00 | 3.00 | 7.00 | .200 | 3000 | 5.0 | 200 N | 10 N | 10 | 20 L | 1.0 | 10 N | 20 N | 15 | 100 | 3000 |
| DG374B | 3.00 | 2.00 | 7.00 | .010 | 3000 | 1.0 | 200 N | 10 N | 10 L | 20 L | 1.5 | 50 | 20 N | 10 | 10 N | 1000 |
| DW120 | 3.00 | 0.70 | 3.00 | .300 | 300 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 10 | 10 L | 300 |
| DW121 | 2.00 | 1.50 | 7.00 | .500 | 200 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 5 | 10 L | 200 |
| | | | | | | ROCKS - HURWAL FORMATION | | | | | | | | | | |
| 1C0228 | 7.00 | 10.00 | 7.00 | .500 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 70 | 700 | 100 |
| 1C0237 | 7.00 | 3.00 | 7.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 | 500 | 1.0 N | 10 N | 20 N | 30 | 150 | 100 |
| 1W0085 | 2.00 | 1.50 | 5.00 | .300 | 500 | 1.5 | 200 N | 10 N | 70 | 500 | 1.0 N | 10 N | 20 N | 7 | 150 | 70 |
| 1W0135 | 3.00 | 5.00 | 10.00 | .300 | 700 | 0.5 N | 200 N | 10 N | 10 | 300 | 1.0 L | 10 N | 20 N | 10 | 150 | 100 |
| 1W0170 | 5.00 | 3.00 | 7.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 30 | 100 | 150 |
| 1W0171 | 7.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 30 | 200 | 150 |
| 1W0172 | 7.00 | 3.00 | 7.00 | .500 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 150 | 150 |
| 1W0274 | 7.00 | 1.50 | 7.00 | .300 | 1500 | 0.5 N | 200 N | 10 N | 10 L | 700 | 1.0 L | 10 N | 20 N | 15 | 70 | 700 |
| DG002A | 3.00 | 0.70 | 7.00 | .300 | 300 | 2.0 | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 20 | 150 | 100 |
| DG006A | 7.00 | 2.00 | 3.00 | 1.000 | 1000 | 1.0 | 200 N | 10 N | 10 | 150 | 1.0 N | 10 N | 20 N | 15 | 30 | 150 |
| DG037B | 10.00 | 1.00 | 7.00 | .500 | 5000 | 1.0 | 200 N | 10 N | 50 | 20 L | 1.0 N | 10 N | 20 N | 10 | 20 | 500 |
| DG054A | 3.00 | 2.00 | 7.00 | .300 | 300 | 1.0 | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 20 | 150 | 150 |
| DG058A | 3.00 | 2.00 | 5.00 | .300 | 700 | 0.5 N | 200 N | 10 N | 10 L | 100 | 1.0 N | 10 N | 20 N | 10 | 100 | 150 |
| DG200A | 3.00 | 1.50 | 5.00 | .700 | 700 | 0.5 N | 200 N | 10 N | 10 L | 20 L | 1.0 L | 10 N | 20 N | 15 | 10 N | 150 |
| DG220A | 3.00 | 3.00 | 7.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 50 | 500 | 100 |
| DG278A | 3.00 | 2.00 | 7.00 | .300 | 700 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 20 | 200 | 100 |
| DG291A | 1.50 | 1.50 | 1.50 | .300 | 300 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 10 | 70 | 100 |
| DG326 | 5.00 | 2.00 | 1.50 | .700 | 1500 | 0.5 N | 200 N | 10 N | 100 | 100 | 1.0 N | 10 N | 20 N | 5 | 30 | 150 |
| DG329 | 5.00 | 3.00 | 3.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 70 | 1000 | 150 |
| DG355 | 5.00 | 1.50 | 3.00 | 1.000 | 1000 | 0.5 N | 200 N | 10 N | 10 | 70 | 1.0 N | 10 N | 20 N | 5 L | 20 | 200 |
| DG369A | 5.00 | 3.00 | 7.00 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 | 30 | 1.0 N | 10 N | 20 N | 10 | 50 | 100 |
| DG441A | 3.00 | 1.50 | 2.00 | .700 | 700 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 5 L | 20 | 100 |
| DW166 | 2.00 | 1.00 | 7.00 | .300 | 300 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 10 | 70 | 100 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-LA | S-MO | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OG445A | 20 N | 5 | 10 N | 30 | 10 L | 100 N | 30 | 10 N | 200 | 300 | 50 N | 15 | 200 L | 50 | 0.02 L | 2000 | 380 | 1.5 |
| OW002 | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 70 | 0.02 L | 70 | 40 | 0.4 |
| OW035 | 20 N | 5 N | 10 N | 15 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 15 | 200 N | 20 | 0.02 L | 190 | 20 | 0.8 |
| OW155 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 20 | 10 N | 700 | 300 | 50 N | 15 | 200 N | 30 | 0.02 L | 65 | 65 | 0.2 L |
| OW157 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 20 | 10 N | 1000 | 500 | 50 N | 15 | 200 | 20 | 0.02 L | 80 | 160 | 0.5 |
| OW158 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 20 | 10 N | 1000 | 300 | 50 N | 10 | 200 N | 20 | 0.02 L | 80 | 65 | 0.2 L |
| OW180 | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 30 | 10 N | 150 | 300 | 50 N | 20 | 200 N | 30 | 0.02 L | 70 | 15 | 0.2 L |
| OW241 | 20 N | 5 L | 10 N | 15 | 10 N | 100 N | 20 | 10 N | 700 | 200 | 50 N | 10 | 200 N | 15 | 0.02 L | 120 | 5 | 0.2 L |
| ROCKS - MARTIN BRIDGE FORMATION | | | | | | | | | | | | | | | | | | |
| 1W0202 | 20 N | 100 | 10 N | 5 | 10 L | 100 N | 5 N | 10 N | 2000 | 10 | 50 N | 10 N | 200 N | 10 N | 0.02 L | 55 | 40 | 0.2 L |
| OG270 | 20 N | 5 N | 10 N | 5 | 10 N | 100 N | 5 L | 10 N | 200 | 300 | 50 N | 10 | 200 N | 20 | 0.02 L | 2000 | 80 | 1.0 H |
| OG374A | 20 N | 70 | 10 N | 20 | 10 | 100 N | 10 | 15 | 100 | 100 | 50 N | 10 | 200 | 10 | 0.02 L | 4000 | 340 | 10.0 H |
| OG374B | 20 N | 20 | 10 N | 20 | 10 | 100 N | 5 | 10 N | 100 | 70 | 3000 | 10 N | 200 N | 10 N | 0.04 | 480 | 140 | 2.0 H |
| OW120 | 20 N | 5 L | 10 N | 30 | 10 N | 100 N | 10 | 10 N | 300 | 70 | 50 N | 10 L | 200 N | 30 | 0.02 L | 240 | 30 | 1.0 |
| OW121 | 20 N | 5 N | 10 N | 15 | 10 L | 100 N | 30 | 10 N | 500 | 300 | 50 N | 15 | 200 N | 30 | 0.02 L | 150 | 30 | 0.6 |
| ROCKS - HURWAL FORMATION | | | | | | | | | | | | | | | | | | |
| 1C0228 | 20 N | 5 N | 10 N | 150 | 10 L | 100 N | 30 | 10 N | 200 | 300 | 50 N | 20 | 200 N | 50 | 0.02 L | 35 | 100 | 0.2 L |
| 1C0237 | 20 N | 5 N | 10 N | 50 | 10 L | 100 N | 30 | 10 N | 700 | 300 | 50 N | 20 | 200 N | 70 | 0.02 L | 75 | 80 | 0.2 L |
| 1W0085 | 20 N | 70 | 10 N | 150 | 10 L | 100 N | 15 | 10 N | 1500 | 1000 G | 50 N | 15 | 1500 | 30 | 0.02 L | 75 | 240 | 0.2 L |
| 1W0135 | 20 N | 7 | 10 N | 100 | 10 N | 100 N | 20 | 10 N | 1000 | 300 | 50 N | 30 | 200 N | 50 | 0.02 L | 55 | 110 | 0.2 L |
| 1W0170 | 20 N | 5 N | 10 N | 50 | 10 L | 100 N | 30 | 10 N | 700 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 95 | 45 | 0.2 L |
| 1W0171 | 20 N | 5 N | 10 N | 50 | 10 | 100 N | 30 | 10 N | 700 | 300 | 50 N | 20 | 200 N | 30 | 0.02 L | 110 | 30 | 0.2 L |
| 1W0172 | 20 N | 5 N | 10 N | 70 | 15 | 100 N | 30 | 10 N | 1000 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 90 | 20 | 0.2 L |
| 1W0274 | 20 N | 7 | 10 N | 70 | 10 L | 100 N | 30 | 10 N | 1000 | 300 | 50 N | 30 | 200 N | 30 | 0.02 L | 600 | 80 | 0.2 L |
| OG002A | 20 L | 7 | 10 N | 70 | 10 | 100 N | 20 | 10 N | 700 | 200 | 50 N | 30 | 200 L | 50 | 0.02 L | 70 | 280 | 1.5 H |
| OG006A | 20 N | 5 N | 10 N | 50 | 10 L | 100 N | 50 | 10 N | 200 | 500 | 50 N | 50 | 200 L | 150 | 0.02 L | 110 | 100 | 0.2 |
| OG037B | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 30 | 10 N | 100 | 300 | 50 N | 15 | 200 | 30 | 0.02 L | 230 | 30 | 1.0 |
| OG054A | 20 N | 5 N | 10 N | 50 | 10 | 100 N | 20 | 10 N | 1500 | 200 | 50 N | 15 | 200 N | 20 | 0.02 L | 100 | 220 | 1.8 |
| OG058A | 20 N | 5 N | 10 N | 20 | 10 N | 100 N | 30 | 10 N | 700 | 500 | 50 N | 15 | 200 N | 50 | 0.02 L | 130 | 20 | 0.4 |
| OG200A | 20 L | 7 | 10 N | 50 | 10 L | 100 N | 15 | 10 N | 700 | 50 | 50 N | 30 | 200 N | 70 | 0.02 L | 85 | 30 | 1.0 |
| OG220A | 20 N | 5 N | 10 N | 100 | 10 L | 100 N | 30 | 10 N | 500 | 300 | 50 N | 10 | 200 N | 20 | 0.02 L | 75 | 20 | 0.6 |
| OG278A | 20 N | 5 N | 10 N | 50 | 10 N | 100 N | 30 | 10 N | 1500 | 300 | 50 N | 15 | 200 N | 30 | 0.02 L | 75 | 20 | 0.8 |
| OG291A | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 15 | 10 N | 700 | 150 | 50 N | 10 | 200 | 30 | 0.02 L | 75 | 320 | 1.0 |
| OG326 | 20 N | 5 N | 10 N | 10 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 80 | 90 | 0.6 |
| OG329 | 20 N | 5 N | 10 N | 150 | 10 N | 100 N | 30 | 10 N | 200 | 200 | 50 N | 10 L | 200 N | 20 | 0.02 L | 65 | 75 | 1.0 |
| OG355 | 20 N | 10 | 10 N | 7 | 10 N | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 70 | 0.02 L | 110 | 50 | 0.4 |
| OG369A | 20 N | 5 N | 10 N | 15 | 70 | 100 N | 30 | 10 N | 500 | 200 | 50 N | 10 | 200 N | 20 | 0.02 L | 55 | 100 | 1.0 H |
| OG441A | 20 N | 5 N | 10 N | 5 | 10 L | 100 N | 30 | 10 N | 200 | 300 | 50 N | 10 | 200 N | 50 | 0.02 L | 55 | 110 | 0.6 |
| OW166 | 20 N | 5 N | 10 N | 30 | 10 N | 100 N | 15 | 10 N | 700 | 150 | 50 N | 10 | 200 N | 50 | 0.02 L | 85 | 10 | 0.2 L |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OW167 | 3.00 | 1.50 | 7.00 | .500 | 500 | 1.5 | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 30 | 150 | 150 |
| | | | | | ROCKS - WALLOWA BATHOLITH AND RELATED ROCKS | | | | | | | | | | | |
| 1C0148 | 5.00 | 2.00 | 5.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 10 | 70 | 200 |
| 1C0151 | 15.00 | 2.00 | 5.00 | .300 | 700 | 7.0 | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 7 | 500 | 700 |
| 1C0163 | 7.00 | 3.00 | 7.00 | 1.000 | 1000 | 0.5 N | 200 N | 10 N | 10 L | 500 | 1.0 L | 10 N | 20 N | 50 | 50 | 100 |
| 1C0185 | 7.00 | 7.00 | 5.00 | .500 | 2000 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 70 | 70 | 150 |
| 1C0192 | 1.50 | 0.50 | 1.00 | .200 | 700 | 0.5 N | 200 N | 10 N | 10 N | 300 | 1.0 L | 10 N | 20 N | 5 | 10 L | 150 |
| 1C0213 | 0.70 | 0.05 | 0.20 | .003 | 20 | 0.5 N | 200 N | 10 N | 10 N | 20 L | 1.0 N | 10 N | 20 N | 5 L | 10 L | 300 |
| 1C0284 | 3.00 | 1.50 | 5.00 | .200 | 700 | 3.0 | 200 N | 10 N | 10 N | 500 | 1.0 L | 10 L | 20 N | 5 | 20 | 500 |
| 1C0288 | 2.00 | 1.00 | 3.00 | .200 | 700 | 0.5 N | 200 N | 10 N | 10 N | 700 | 1.0 L | 10 N | 20 N | 5 | 20 | 300 |
| 1G0086 | 5.00 | 5.00 | 3.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 N | 300 | 1.0 L | 10 N | 20 N | 7 | 20 | 150 |
| 1W0061 | 3.00 | 3.00 | 7.00 | .300 | 700 | 10.0 | 200 N | 10 N | 10 L | 700 | 1.0 L | 10 N | 20 N | 10 | 70 | 3000 |
| 1W0211 | 5.00 | 2.00 | 5.00 | .300 | 1500 | 0.5 N | 200 N | 10 N | 10 N | 300 | 1.0 L | 10 N | 20 N | 10 | 50 | 500 |
| 1W0212 | 3.00 | 1.50 | 5.00 | .300 | 500 | 0.5 N | 200 N | 10 N | 10 N | 300 | 1.0 L | 10 N | 20 N | 70 | 30 | 100 |
| 1W0218 | 3.00 | 3.00 | 5.00 | .300 | 1000 | 0.5 N | 200 N | 10 N | 10 N | 500 | 1.0 L | 10 N | 20 N | 7 | 50 | 150 |
| 1W0247 | 3.00 | 1.50 | 0.70 | .700 | 500 | 3.0 | 200 N | 10 N | 50 | 500 | 1.0 L | 10 N | 20 N | 7 | 20 | 2000 |
| 1W0268 | 5.00 | 1.50 | 3.00 | .200 | 1500 | 3.0 | 200 N | 10 N | 10 L | 700 | 1.0 L | 10 N | 20 N | 20 | 30 | 5000 |
| 1W0270 | 5.00 | 1.50 | 5.00 | .300 | 1000 | 0.5 | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 15 | 30 | 200 |
| DG057A | 3.00 | 2.00 | 3.00 | .500 | 300 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 20 | 150 | 150 |
| DG115A | 1.50 | 1.00 | 1.50 | .150 | 700 | 0.5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 7 | 30 | 150 |
| DG176 | 0.70 | 0.70 | 1.50 | .300 | 700 | 1.5 | 200 N | 10 N | 10 L | 500 | 1.0 L | 10 N | 20 N | 5 L | 10 N | 5000 |
| DG242 | 5.00 | 2.00 | 7.00 | .700 | 1500 | 15.0 | 200 N | 10 N | 10 | 50 | 1.0 N | 10 N | 20 N | 30 | 150 | 15000 |
| DG243 | 3.00 | 1.50 | 7.00 | .500 | 1000 | 7.0 | 200 N | 10 N | 10 L | 50 | 1.0 L | 15 | 20 N | 5 | 20 | 7000 |
| DG267 | 7.00 | 0.70 | 7.00 | .100 | 5000 G | 10.0 | 200 N | 10 N | 10 | 20 L | 1.0 L | 15 | 20 N | 10 | 15 | 15000 |
| DG303A | 3.00 | 1.50 | 1.50 | .500 | 700 | 0.5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 7 | 30 | 10000 |
| DG371 | 1.50 | 0.50 | 2.00 | .300 | 1000 | 2.0 | 200 N | 10 N | 10 N | 200 | 1.0 L | 10 N | 20 N | 5 L | 10 N | 7000 |
| DG375 | 0.50 | 0.15 | 1.00 | .070 | 150 | 0.5 | 200 N | 10 N | 10 N | 200 | 1.0 L | 10 N | 20 N | 5 L | 10 L | 100 |
| OW109 | 1.50 | 0.70 | 2.00 | .300 | 300 | 0.5 N | 200 N | 10 N | 10 L | 70 | 1.0 N | 10 N | 20 N | 10 | 50 | 700 |
| | | | | | | ROCKS - OTHER ROCK | | | | | | | | | | |
| 1W0210 | 7.00 | 0.70 | 7.00 | .300 | 700 | 1.5 | 200 N | 10 N | 10 N | 30 | 1.0 N | 10 N | 20 N | 30 | 20 | 1000 |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-LA | S-MO | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DW167 | 20 N | 15 | 10 N | 100 | 10 L | 100 N | 20 | 10 N | 1000 | 300 | 50 N | 20 | 200 N | 50 | 0.02 L | 65 | 120 | 1.0 |
| ROCKS - WALLOWA BATHOLITH AND RELATED ROCKS | | | | | | | | | | | | | | | | | | |
| 1C0148 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 20 | 10 N | 700 | 200 | 50 N | 15 | 200 N | 50 | 0.02 L | 160 | 20 | 0.2 L |
| 1C0151 | 20 N | 30 | 10 N | 20 | 10 L | 100 N | 20 | 10 N | 500 | 200 | 50 N | 15 | 200 N | 30 | 0.02 L | 650 | 20 | 6.0 |
| 1C0163 | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 50 | 200 N | 70 | 0.02 L | 60 | 25 | 0.2 L |
| 1C0185 | 20 N | 5 N | 10 N | 150 | 10 N | 100 N | 30 | 10 N | 500 | 300 | 50 N | 20 | 200 N | 70 | 0.02 L | 130 | 60 | 0.2 L |
| 1C0192 | 20 N | 5 N | 10 N | 7 | 10 L | 100 N | 5 | 10 N | 500 | 30 | 50 N | 10 | 200 N | 10 | 0.02 L | 190 | 60 | 0.2 L |
| 1C0213 | 20 N | 5 N | 10 N | 5 | 10 | 100 N | 5 N | 10 N | 100 N | 70 | 50 N | 10 L | 200 N | 10 N | 0.02 L | 450 | 5 | 0.2 L |
| 1C0284 | 20 N | 5 N | 10 N | 10 | 15 | 100 N | 15 | 10 N | 700 | 70 | 50 N | 10 | 200 N | 30 | 0.02 L | 310 | 65 | 0.2 L |
| 1C0288 | 20 N | 5 N | 10 N | 10 | 10 L | 100 N | 10 | 10 N | 500 | 70 | 50 N | 10 | 200 N | 70 | 0.02 L | 460 | 170 | 0.2 L |
| 1G0086 | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 15 | 10 N | 500 | 200 | 50 N | 10 | 200 N | 20 | 0.02 L | 55 | 40 | 0.2 L |
| 1W0061 | 30 | 5 N | 10 N | 50 | 10 | 100 N | 30 | 10 N | 1000 | 200 | 50 N | 20 | 200 N | 70 | 0.90 | 2500 | 220 | 2.0 |
| 1W0211 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 15 | 10 N | 700 | 100 | 50 N | 15 | 200 N | 30 | 0.02 L | 290 | 55 | 0.2 L |
| 1W0212 | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 15 | 10 N | 500 | 70 | 50 N | 20 | 200 N | 30 | 0.02 L | 45 | 120 | 0.2 L |
| 1W0218 | 20 N | 5 N | 10 N | 30 | 10 L | 100 N | 15 | 10 N | 700 | 150 | 50 N | 10 | 200 N | 100 | 0.02 L | 160 | 85 | 0.2 L |
| 1W0247 | 20 N | 5 N | 10 N | 10 | 30 | 100 N | 10 | 10 N | 200 | 100 | 50 N | 20 | 200 N | 70 | 19.00 | 1600 | 45 | 0.2 L |
| 1W0268 | 20 N | 70 | 10 N | 15 | 10 | 100 N | 20 | 10 N | 700 | 150 | 50 N | 30 | 500 | 70 | 0.02 L | 800 | 500 | 0.2 L |
| 1W0270 | 20 L | 70 | 10 N | 30 | 10 L | 100 N | 20 | 10 N | 700 | 150 | 50 N | 20 | 200 N | 15 | 0.02 L | 60 | 55 | 0.2 L |
| DG057A | 20 N | 5 N | 10 N | 50 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 15 | 200 N | 50 | 0.02 L | 110 | 100 | 1.0 |
| DG115A | 20 N | 5 N | 10 N | 15 | 10 L | 100 N | 7 | 10 N | 300 | 100 | 50 N | 10 L | 200 N | 30 | 0.02 L | 150 | 75 | 0.8 |
| DG176 | 20 L | 5 N | 10 N | 5 | 15 | 100 N | 5 | 10 N | 500 | 30 | 50 N | 10 | 200 N | 30 | 0.02 | 4000 | 100 | 1.6 |
| DG242 | 20 L | 30 | 10 N | 70 | 10 L | 100 N | 30 | 10 N | 1000 | 300 | 50 N | 15 | 200 N | 20 | 0.02 L | 9000 | 120 | 18.0 |
| DG243 | 20 N | 15 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 1500 | 150 | 50 N | 15 | 200 N | 10 | 0.06 | 5000 | 40 | 8.0 |
| DG267 | 20 L | 50 | 10 N | 10 | 10 N | 100 N | 5 | 10 N | 150 | 100 | 50 N | 10 L | 700 | 10 | 0.60 | 14000 | 800 | 13.0 |
| DG303A | 20 N | 5 N | 10 N | 20 | 10 L | 100 N | 7 | 10 N | 300 | 100 | 50 N | 10 N | 200 N | 70 | 0.02 L | 7000 | 70 | 0.6 |
| DG371 | 20 N | 5 N | 10 N | 5 L | 30 | 100 N | 5 | 10 N | 500 | 50 | 50 N | 10 L | 200 N | 30 | 0.02 | 6000 | 150 | 6.0 |
| DG375 | 20 L | 7 | 10 N | 5 L | 10 | 100 N | 5 L | 10 N | 200 | 20 | 50 N | 10 L | 200 N | 30 | 0.02 L | 130 | 50 | 0.4 |
| DW109 | 20 L | 5 N | 10 N | 20 | 10 N | 100 N | 15 | 10 N | 200 | 200 | 50 N | 10 | 200 N | 30 | 0.02 L | 220 | 50 | 0.4 |
| ROCKS - OTHER ROCK | | | | | | | | | | | | | | | | | | |
| 1W0210 | 20 N | 15 | 10 N | 15 | 10 L | 100 N | 20 | 10 N | 200 | 300 | 50 N | 15 | 200 N | 20 | 0.02 L | 1800 | 45 | 0.2 L |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREAM SEDIMENTS - OLDER TRIASSIC ROCKS | | | | | | | | | | | | | | | | | | |
| 1W0125 | 7.0 | 1.50 | 2.0 | .7 | 1500 | .5 N | 200 N | 10 N | 10 | 300 | 1.0 L | 10 N | 20 N | 30 | 70 | 100 | 20 L | 5 N |
| 1W0139 | 3.0 | 1.00 | 1.0 | .3 | 1500 | 1.0 | 200 N | 10 N | 10 | 300 | 2.0 | 10 N | 20 N | 20 | 50 | 1000 | 20 N | 30 |
| 1W0140 | 5.0 | 1.50 | 2.0 | .3 | 1500 | .5 N | 200 N | 10 N | 10 L | 200 | 1.5 | 10 N | 20 N | 30 | 70 | 700 | 20 N | 20 |
| 1W0141 | 3.0 | 1.00 | 1.5 | .3 | 1500 | .5 N | 200 N | 10 N | 10 L | 200 | 1.5 | 10 N | 20 N | 20 | 70 | 500 | 20 N | 15 |
| 1W0142 | 3.0 | 1.00 | 1.0 | .3 | 2000 | .5 L | 200 N | 10 N | 10 L | 300 | 1.0 | 10 N | 20 N | 50 | 50 | 1000 | 20 L | 70 |
| 1W0143 | 2.0 | .50 | 0.7 | .2 | 700 | 1.0 | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 7 | 30 | 500 | 20 N | 70 |
| 1W0144 | 7.0 | 1.50 | 5.0 | .5 | 3000 | .5 L | 200 N | 10 N | 10 L | 200 | 1.5 | 10 N | 20 N | 50 | 200 | 200 | 20 N | 50 |
| 1W0145 | 7.0 | 1.00 | 1.0 | .3 | 1000 | 1.5 | 200 N | 10 N | 10 L | 300 | 1.5 | 10 N | 20 N | 15 | 50 | 1000 | 20 N | 100 |
| 1W0151 | 7.0 | 1.00 | 3.0 | .5 | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.5 | 10 N | 20 N | 15 | 70 | 100 | 20 N | 30 |
| 1W0152 | 5.0 | 1.00 | 1.0 | .3 | 1000 | .5 L | 200 N | 10 N | 15 | 300 | 1.0 | 10 N | 20 N | 20 | 70 | 300 | 20 N | 10 |
| 1W0162 | 7.0 | 3.00 | 3.0 | .5 | 1500 | .5 N | 200 N | 10 N | 10 | 200 | 1.0 L | 10 N | 20 N | 50 | 70 | 100 | 20 N | 5 N |
| 1W0204 | 7.0 | 1.50 | 1.5 | .5 | 700 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 30 | 70 | 100 | 20 N | 7 |
| 1W0233 | 15.0 | 3.00 | 7.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 70 | 200 | 150 | 20 N | 5 N |
| 0G405 | 3.0 | 1.50 | 3.0 | .5 | 300 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 20 | 50 | 70 | 20 N | 5 N |
| 0G440 | 3.0 | 1.00 | 1.5 | .3 | 700 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 7 | 20 | 100 | 20 N | 30 |
| 0G441 | 3.0 | .70 | 1.0 | .2 | 500 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 10 | 20 | 70 | 20 N | 30 |
| 0G442 | 3.0 | 1.00 | 1.5 | .3 | 300 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 10 | 30 | 70 | 20 N | 10 |
| 0G443 | 5.0 | 1.50 | 2.0 | .3 | 700 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 7 | 20 | 200 | 20 N | 70 |
| 0G444 | 3.0 | 1.00 | 2.0 | .3 | 500 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 10 | 20 | 300 | 20 N | 30 |
| 0G445 | 7.0 | 1.00 | 3.0 | .5 | 700 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 15 | 70 | 500 | 20 N | 20 |
| 0G446 | 3.0 | 1.00 | 1.5 | .3 | 700 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 30 | 20 | 150 | 20 N | 20 |
| 0G447 | 3.0 | 1.00 | 1.5 | .3 | 300 | .5 L | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 10 | 20 | 300 | 20 L | 70 |
| 0G448 | 7.0 | 1.50 | 2.0 | .3 | 700 | .5 N | 200 N | 10 N | 10 | 150 | 1.0 | 10 N | 20 N | 10 | 30 | 100 | 20 N | 10 |
| 0G449 | 2.0 | 1.00 | 1.0 | .2 | 300 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 7 | 20 | 150 | 20 L | 70 |
| 0G450 | 3.0 | 1.50 | 2.0 | .2 | 500 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 | 10 N | 20 N | 15 | 50 | 70 | 20 N | 10 |
| 0G456 | 3.0 | 7.00 | 15.0 | .2 | 500 | .5 N | 200 N | 10 N | 10 | 150 | 1.0 N | 10 N | 20 N | 15 | 70 | 20 | 20 N | 5 N |
| STREAM SEDIMENTS - MARTIN BRIDGE FORMATION | | | | | | | | | | | | | | | | | | |
| 1G0041 | 5.0 | 3.00 | 20.0 G | .3 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 15 | 70 | 50 | 20 N | 5 N |
| 0G005 | 5.0 | 2.00 | 15.0 | .7 | 300 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 20 | 70 | 10 | 20 N | 5 N |
| STREAM SEDIMENTS - HURWAL FORMATION | | | | | | | | | | | | | | | | | | |
| 0W134 | 7.0 | 2.00 | 7.0 | .5 | 700 | .5 N | 200 N | 10 N | 20 | 300 | 1.0 L | 10 N | 20 N | 30 | 100 | 70 | 20 N | 5 N |
| STREAM SEDIMENTS - WALLOWA BATHOLITH AND RELATED ROCKS | | | | | | | | | | | | | | | | | | |
| 1C0178 | 5.0 | 3.00 | 7.0 | .7 | 700 | .5 N | 200 N | 10 N | 10 | 300 | 1.0 L | 10 N | 20 N | 30 | 150 | 150 | 20 N | 5 N |
| 1C0245 | 7.0 | 3.00 | 3.0 | 1.0 | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 100 | 100 | 20 N | 5 N |
| 1G0069 | 10.0 | 7.00 | 5.0 | 1.0 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 30 | 150 | 150 | 20 N | 5 N |
| 1G0070 | 7.0 | 2.00 | 7.0 | .5 | 1000 | .5 N | 200 N | 10 N | 15 | 300 | 1.0 L | 10 N | 20 N | 20 | 100 | 200 | 20 N | 5 N |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P | CM-CX-HM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREAM SEDIMENTS - OLDER TRIASSIC ROCKS | | | | | | | | | | | | | | | | | |
| 1W0125 | 10 N | 30 | 15 | 100 N | 30 | 10 N | 300 | 200 | 50 N | 30 | 200 N | 70 | .02 L | 40 | 60 | .2 L | 1 N |
| 1W0139 | 10 N | 20 | 10 | 100 N | 15 | 10 N | 200 | 150 | 50 N | 15 | 200 | 70 | .02 L | 1800 | 300 | .2 L | 100 G |
| 1W0140 | 10 N | 30 | 15 | 100 N | 30 | 10 N | 200 | 200 | 50 N | 20 | 200 | 70 | .02 L | 650 | 160 | .2 L | 40 |
| 1W0141 | 10 N | 30 | 10 | 100 N | 20 | 10 N | 200 | 150 | 50 N | 15 | 200 | 70 | .02 L | 700 | 240 | .2 L | 60 |
| 1W0142 | 10 N | 30 | 15 | 100 N | 15 | 10 N | 200 | 150 | 50 N | 20 | 200 N | 70 | .02 L | 1500 | 100 | .2 L | 100 G |
| 1W0143 | 10 N | 5 N | 10 L | 100 N | 10 | 10 N | 100 | 70 | 50 N | 15 | 200 N | 50 | .02 L | 950 | 80 | .2 L | 100 G |
| 1W0144 | 10 N | 50 | 30 | 100 N | 30 | 10 N | 200 | 300 | 50 N | 30 | 300 | 70 | .02 L | 300 | 200 | .2 L | 100 G |
| 1W0145 | 10 N | 20 | 15 | 100 N | 15 | 10 N | 200 | 100 | 50 N | 50 | 200 N | 70 | .02 L | 1600 | 110 | 1.0 | 100 G |
| 1W0151 | 10 N | 30 | 30 | 100 N | 30 | 10 N | 200 | 150 | 50 N | 20 | 200 | 70 | .02 L | 70 | 190 | .2 L | 8 |
| 1W0152 | 10 N | 50 | 30 | 100 N | 15 | 10 N | 200 | 150 | 50 N | 15 | 200 | 70 | .02 L | 400 | 190 | .2 L | 4 |
| 1W0162 | 10 N | 50 | 15 | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 70 | .02 L | 90 | 65 | .2 L | 1 L |
| 1W0204 | 10 N | 30 | 15 | 100 N | 20 | 10 N | 200 | 200 | 50 N | 20 | 200 N | 100 | .02 L | 70 | 65 | .2 L | 1 L |
| 1W0233 | 10 N | 70 | 10 L | 100 N | 50 | 10 N | 500 | 500 | 50 N | 30 | 200 N | 100 | .02 L | 45 | 60 | .2 L | 1 L |
| DG405 | 10 N | 30 | 10 N | 100 N | 15 | 10 N | 300 | 150 | 50 N | 15 | 200 N | 50 | .02 L | 140 | 130 | .2 H | 8 |
| DG440 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 150 | 100 | 50 N | 15 | 200 N | 50 | .02 L | 180 | 110 | .2 H | 13 |
| DG441 | 10 N | 20 | 10 | 100 N | 15 | 10 N | 100 | 100 | 50 N | 15 | 200 N | 50 | .02 L | 400 | 190 | .2 H | 100 G |
| DG442 | 10 N | 20 | 10 | 100 N | 15 | 10 N | 150 | 150 | 50 N | 10 | 200 N | 50 | .02 L | 160 | 100 | .2 H | 5 |
| DG443 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 150 | 150 | 50 N | 15 | 200 L | 30 | .02 L | 300 | 140 | .2 H | 5 |
| DG444 | 10 N | 20 | 10 | 100 N | 15 | 10 N | 200 | 100 | 50 N | 10 | 200 N | 50 | .02 L | 500 | 160 | .2 H | 60 |
| DG445 | 10 N | 30 | 15 | 100 N | 20 | 10 N | 150 | 150 | 50 N | 15 | 200 L | 50 | .02 L | 700 | 480 | .2 H | 100 G |
| DG446 | 10 N | 70 | 10 | 100 N | 15 | 10 N | 150 | 70 | 50 N | 15 | 700 | 70 | .02 L | 400 | 300 | .2 H | 100 G |
| DG447 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 150 | 100 | 50 N | 15 | 200 | 70 | .02 L | 500 | 200 | .2 H | 100 G |
| DG448 | 10 N | 20 | 15 | 100 N | 20 | 10 N | 200 | 150 | 50 N | 15 | 200 N | 100 | .02 L | 120 | 100 | .2 H | 13 |
| DG449 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 150 | 100 | 50 N | 20 | 200 N | 70 | .02 L | 220 | 90 | .2 H | 13 |
| DG450 | 10 N | 50 | 10 | 100 N | 20 | 10 N | 150 | 150 | 50 N | 10 | 200 N | 50 | .02 L | 80 | 120 | .2 H | 13 |
| DG456 | 10 N | 30 | 15 | 100 N | 15 | 10 N | 700 | 150 | 50 N | 15 | 200 N | 30 | .02 L | 30 | 70 | .2 H | 13 |
| STREAM SEDIMENTS - MARTIN BRIDGE FORMATION | | | | | | | | | | | | | | | | | |
| 1G0041 | 10 N | 20 | 10 L | 100 N | 20 | 10 N | 5000 | 150 | 50 N | 15 | 200 N | 70 | .02 L | 35 | 25 | .2 L | 14 |
| DG005 | 10 N | 50 | 10 L | 100 N | 15 | 10 N | 1000 | 150 | 50 N | 10 | 200 N | 30 | .02 L | 100 | 125 | .2 H | 5 |
| STREAM SEDIMENTS - HURWAL FORMATION | | | | | | | | | | | | | | | | | |
| DW134 | 10 N | 70 | 10 | 100 N | 15 | 10 N | 300 | 200 | 50 N | 15 | 200 L | 30 | .02 L | 80 | 200 | .2 H | 13 |
| STREAM SEDIMENTS - WALLOWA BATHOLITH AND RELATED ROCKS | | | | | | | | | | | | | | | | | |
| 1C0178 | 10 N | 50 | 10 | 100 N | 30 | 10 N | 500 | 300 | 50 N | 20 | 200 N | 70 | .02 L | 85 | 40 | .2 L | 1 N |
| 1C0245 | 10 N | 100 | 10 | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 150 | .02 L | 50 | 70 | .2 L | 1 L |
| 1G0069 | 10 N | 30 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 300 | .02 L | 70 | 30 | .2 L | 1 L |
| 1G0070 | 10 N | 30 | 10 | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 150 | .02 L | 200 | 40 | .2 L | 1 L |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1W0198 | 5.0 | 1.50 | 2.0 | .5 | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 10 | 70 | 700 | 20 N | 15 |
| 0G034 | 3.0 | 2.00 | 7.0 | .3 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 15 | 70 | 70 | 20 | 5 N |
| 0G130 | 5.0 | 3.00 | 3.0 | .3 | 700 | .5 N | 200 N | 10 N | 10 N | 300 | 1.0 L | 10 N | 20 N | 20 | 30 | 70 | 20 N | 5 N |
| 0G205 | 5.0 | 1.00 | 2.0 | .7 | 700 | .5 | 200 N | 10 N | 10 | 200 | 1.0 | 10 N | 20 N | 7 | 15 | 200 | 20 L | 20 |
| 0G306 | 5.0 | 7.00 | 7.0 | .7 | 1000 | .5 N | 200 N | 10 N | 10 | 150 | 1.0 N | 10 N | 20 N | 30 | 150 | 150 | 20 N | 5 N |
| 0G384 | 3.0 | 1.50 | 3.0 | .3 | 300 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 7 | 30 | 70 | 20 L | 7 |
| 0G387 | 5.0 | 1.50 | 2.0 | .3 | 500 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 5 | 20 | 300 | 20 L | 30 |
| 0G388 | 5.0 | 1.50 | 2.0 | .3 | 300 | .5 N | 200 N | 10 N | 10 | 150 | 1.0 L | 10 N | 20 N | 7 | 20 | 300 | 20 L | 70 |
| 0W005 | 0.7 | .30 | 1.5 | .1 | 150 | .5 N | 200 N | 10 N | 50 | 50 | 1.0 N | 10 N | 20 N | 7 | 10 | 7 | 20 N | 5 N |
| 0W068 | 3.0 | 1.00 | 2.0 | .3 | 300 | .5 N | 200 N | 10 N | 15 | 150 | 1.0 L | 10 N | 20 N | 5 | 10 | 150 | 20 N | 15 |
| 0W084 | 5.0 | 1.00 | 2.0 | .3 | 500 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 7 | 20 | 70 | 20 L | 5 N |
| 0W089 | 7.0 | 3.00 | 7.0 | .7 | 1000 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 L | 10 N | 20 N | 30 | 150 | 70 | 20 N | 5 N |
| STREAM SEDIMENTS - COLUMBIA RIVER GROUP | | | | | | | | | | | | | | | | | | |
| 1C0054 | 7.0 | 1.50 | 2.0 | 1.0 G | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 150 | 100 | 20 N | 5 N |
| 1C0055 | 7.0 | 2.00 | 3.0 | 1.0 G | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 150 | 100 | 20 L | 5 N |
| 1C0056 | 5.0 | .70 | 1.0 | .7 | 700 | .5 N | 200 N | 10 N | 10 L | 300 | 1.5 | 10 N | 20 N | 15 | 50 | 30 | 20 L | 5 N |
| 1D0023 | 7.0 | 1.50 | 2.0 | 1.0 | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 30 | 70 | 150 | 20 N | 5 N |
| 1G0002 | 1.0 | .15 | 0.5 | .2 | 200 | .5 N | 200 N | 10 N | 10 L | 70 | 1.0 L | 10 N | 20 N | 5 | 30 | 15 | 20 N | 5 N |
| 1G0033 | 7.0 | 3.00 | 3.0 | 1.0 | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 70 | 150 | 100 | 20 N | 5 N |
| 1G0034 | 7.0 | 2.00 | 3.0 | .7 | 1500 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 30 | 100 | 100 | 20 N | 5 N |
| 1W0024 | 2.0 | .70 | 1.0 | .3 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 2.0 | 10 N | 20 N | 5 | 20 | 20 | 20 N | 5 N |
| 1W0181 | 10.0 | 2.00 | 5.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 70 | 150 | 150 | 20 N | 5 N |
| 1W0183 | 10.0 | 3.00 | 3.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 70 | 100 | 100 | 20 N | 5 N |
| STREAM SEDIMENTS - OTHERS SOURCES | | | | | | | | | | | | | | | | | | |
| 1C0071 | 7.0 | 3.00 | 5.0 | 1.0 G | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 | 10 N | 20 N | 50 | 100 | 150 | 20 N | 5 N |
| 1C0073 | 7.0 | 3.00 | 5.0 | 1.0 G | 700 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 100 | 100 | 20 N | 5 N |
| 1C0093 | 10.0 | 2.00 | 3.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 70 | 700 | 100 | 150 | 5 N |
| 1C0096 | 7.0 | 3.00 | 5.0 | 1.0 G | 1000 | .5 N | 200 N | 10 N | 10 L | 700 | 1.0 L | 10 N | 20 N | 50 | 70 | 100 | 20 N | 5 N |
| 1C0254 | 7.0 | 3.00 | 7.0 | 1.0 | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 70 | 200 | 150 | 20 N | 5 N |
| 1C0259 | 7.0 | 3.00 | 3.0 | .5 | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 30 | 100 | 100 | 20 N | 5 N |
| 1C0262 | 7.0 | 3.00 | 7.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 150 | 100 | 20 N | 5 N |
| 1G0027 | 7.0 | 3.00 | 7.0 | 1.0 | 1000 | .5 N | 200 N | 10 N | 10 L | 500 | 1.0 L | 10 N | 20 N | 50 | 100 | 100 | 20 N | 5 N |
| 1G0047 | 7.0 | 3.00 | 7.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 70 | 300 | 100 | 20 N | 5 N |
| 1G0059 | 7.0 | 3.00 | 7.0 | .5 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 30 | 100 | 100 | 20 N | 5 N |
| 1G0063 | 7.0 | 3.00 | 7.0 | .5 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 N | 10 N | 20 N | 20 | 100 | 100 | 20 N | 5 N |
| 1G0076 | 5.0 | 1.50 | 5.0 | .7 | 1000 | .5 N | 200 N | 10 N | 10 L | 200 | 1.0 L | 10 N | 20 N | 10 | 70 | 30 | 20 N | 5 N |
| 1W0121 | 7.0 | 3.00 | 5.0 | 1.0 | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 L | 10 N | 20 N | 50 | 100 | 100 | 20 N | 5 N |
| 1W0126 | 7.0 | 3.00 | 2.0 | .5 | 1000 | .5 N | 200 N | 10 N | 10 L | 300 | 1.0 N | 10 N | 20 N | 30 | 100 | 150 | 20 N | 5 N |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P | CM-CX-HM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1W0198 | 10 N | 30 | 20 | 100 N | 20 | 10 N | 300 | 150 | 50 N | 15 | 200 N | 100 | .02 L | 700 | 45 | .2 L | 100 G |
| OG034 | 10 N | 50 | 10 L | 100 N | 20 | 10 N | 300 | 150 | 50 N | 30 | 200 N | 300 | .03 L | 100 | 50 | .2 N | 5 |
| OG130 | 10 N | 50 | 10 L | 100 N | 15 | 10 N | 300 | 150 | 50 N | 15 | 200 N | 20 | .02 L | 120 | 80 | .2 N | 1 |
| OG205 | 10 N | 15 | 20 | 100 N | 15 | 10 N | 200 | 150 | 50 N | 15 | 200 N | 70 | .02 L | 250 | 50 | .2 N | 3 |
| OG306 | 10 N | 70 | 10 L | 100 N | 50 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 100 | .02 L | 45 | 30 | .2 N | 3 |
| | | | | | | | | | | | | | | | | | |
| OG384 | 10 N | 20 | 15 | 100 N | 15 | 10 N | 300 | 100 | 50 N | 10 | 200 L | 30 | .03 L | 100 | 120 | .2 N | 5 |
| OG387 | 10 N | 15 | 15 | 100 N | 15 | 10 N | 200 | 100 | 50 N | 30 | 200 L | 300 | .10 L | 600 | 180 | .2 N | 3 |
| OG388 | 10 N | 20 | 15 | 100 N | 15 | 10 N | 300 | 100 | 50 N | 20 | 200 L | 150 | .10 L | 500 | 250 | .2 N | 5 |
| OW005 | 10 N | 7 | 10 | 100 N | 5 L | 10 N | 150 | 50 | 50 N | 10 L | 200 N | 20 | .25 L | 0 B | 0 B | .0 B | 13 |
| ON068 | 10 N | 15 | 10 | 100 N | 15 | 10 N | 200 | 70 | 50 N | 10 | 200 N | 200 | .02 L | 200 | 80 | .2 N | 5 |
| | | | | | | | | | | | | | | | | | |
| OW084 | 10 N | 15 | 15 | 100 N | 15 | 10 N | 300 | 100 | 50 N | 15 | 200 N | 200 | .02 L | 200 | 40 | .2 N | 25 |
| OW089 | 10 N | 70 | 15 | 100 N | 30 | 10 N | 200 | 300 | 50 N | 15 | 200 L | 50 | .02 L | 150 | 60 | .2 N | 5 |
| | | | | | | STREAM SEDIMENTS - COLUMBIA RIVER GROUP | | | | | | | | | | | |
| 1C0054 | 10 N | 50 | 10 L | 100 N | 30 | 10 N | 150 | 500 | 50 N | 30 | 200 N | 150 | .02 L | 25 | 50 | .2 L | 1 N |
| 1C0055 | 10 N | 50 | 10 | 100 N | 30 | 10 N | 150 | 500 | 50 N | 30 | 200 N | 200 | .02 L | 25 | 55 | .2 L | 1 N |
| 1C0056 | 10 N | 30 | 10 L | 100 N | 20 | 10 N | 150 | 150 | 50 N | 20 | 200 N | 150 | .02 L | 10 | 200 | .2 L | 100 G |
| 1D0023 | 10 N | 70 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 150 | .02 L | 55 | 50 | .2 L | 4 |
| 1G0002 | 10 N | 20 | 10 L | 100 N | 10 | 10 N | 100 N | 70 | 50 N | 15 | 200 N | 70 | .02 L | 15 | 80 | .2 L | 12 |
| | | | | | | | | | | | | | | | | | |
| 1G0033 | 10 N | 70 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 50 | 200 N | 100 | .02 L | 45 | 50 | .2 L | 1 N |
| 1G0034 | 10 N | 30 | 10 L | 100 N | 30 | 10 N | 300 | 200 | 50 N | 30 | 200 N | 70 | .00 B | 35 | 40 | .2 L | 1 N |
| 1W0024 | 10 N | 20 | 10 L | 100 N | 10 | 10 N | 100 | 70 | 50 N | 30 | 200 N | 100 | .02 L | 15 | 65 | .2 L | 20 |
| 1W0181 | 10 N | 70 | 15 | 100 N | 30 | 10 N | 500 | 300 | 50 N | 30 | 200 N | 150 | .02 L | 45 | 55 | .2 L | 1 L |
| 1W0183 | 10 N | 30 | 15 | 100 N | 50 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 150 | .00 B | 45 | 55 | .2 L | 1 L |
| | | | | | | STREAM SEDIMENTS - OTHERS SOURCES | | | | | | | | | | | |
| 1C0071 | 10 N | 70 | 10 L | 100 N | 30 | 10 N | 150 | 300 | 50 N | 30 | 200 N | 150 | .02 L | 60 | 65 | .2 L | 1 N |
| 1C0073 | 10 N | 70 | 10 N | 100 N | 30 | 10 N | 150 | 300 | 50 N | 20 | 200 N | 100 | .02 L | 70 | 55 | .2 L | 1 N |
| 1C0093 | 10 N | 50 | 10 N | 100 N | 30 | 10 N | 150 | 500 | 50 N | 70 | 200 N | 300 | .00 B | 15 | 40 | .2 L | 1 N |
| 1C0096 | 10 N | 50 | 10 L | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 100 | .02 L | 25 | 40 | .2 L | 1 N |
| 1C0254 | 10 N | 100 | 10 L | 100 N | 50 | 10 N | 500 | 300 | 50 N | 30 | 200 N | 70 | .02 L | 50 | 45 | .2 L | 1 L |
| | | | | | | | | | | | | | | | | | |
| 1C0259 | 10 N | 30 | 10 | 100 N | 30 | 10 N | 300 | 300 | 50 N | 30 | 200 N | 150 | .02 L | 35 | 55 | .2 L | 1 L |
| 1C0262 | 10 N | 50 | 10 | 100 N | 50 | 10 N | 500 | 300 | 50 N | 50 | 200 N | 100 | .02 L | 40 | 50 | .2 L | 1 L |
| 1G0027 | 10 N | 50 | 10 | 100 N | 30 | 10 N | 500 | 300 | 50 N | 70 | 200 N | 100 | .02 L | 30 | 50 | .2 L | 1 N |
| 1G0047 | 10 N | 50 | 10 L | 100 N | 50 | 10 N | 500 | 500 | 50 N | 30 | 200 N | 100 | .02 L | 25 | 50 | .2 L | 1 L |
| 1G0059 | 10 N | 50 | 10 | 100 N | 30 | 10 N | 700 | 300 | 50 N | 20 | 200 N | 50 | .02 L | 50 | 65 | .2 L | 1 L |
| | | | | | | | | | | | | | | | | | |
| 1G0063 | 10 N | 30 | 15 | 100 N | 30 | 10 N | 700 | 300 | 50 N | 15 | 200 N | 50 | .02 L | 55 | 70 | .2 L | 1 L |
| 1G0076 | 10 N | 20 | 10 | 100 N | 30 | 10 N | 500 | 300 | 50 N | 15 | 200 N | 70 | 1.00 | 20 | 30 | .2 L | 1 L |
| 1W0121 | 10 N | 70 | 10 | 100 N | 30 | 10 N | 300 | 300 | 50 N | 20 | 200 N | 70 | .02 L | 50 | 50 | .2 L | 1 N |
| 1W0126 | 10 N | 30 | 15 | 100 N | 30 | 10 N | 300 | 200 | 50 N | 30 | 200 N | 50 | .02 L | 70 | 80 | .2 L | 1 N |

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TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-FE% | S-MG% | S-CA% | S-TI% | S-MN | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PANNED CONCENTRATES | | | | | | | | | | | | | | | | | | |
| 1C0114 | 7.0 | 3.00 | 7.0 | 1.0 G | 1500 | .5 N | 200 N | 10 N | 10 L | 150 | 1.0 N | 10 N | 20 N | 70 | 500 | 100 | 20 N | 5 N |
| 1W0244 | 20.0 G | 2.00 | 1.5 | .7 | 700 | .5 N | 200 N | 10 N | 30 | 100 | 1.0 N | 10 N | 20 N | 50 | 700 | 30 | 20 N | 5 N |

TABLE 4.—*Analytical results of anomalous samples from the Eagle Cap Wilderness and proposed additions, Baker, Union, and Wallowa Counties, Oreg.*—Continued

| SAMPLE | S-NB | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | AA-AU-P | AA-CU-P | AA-ZN-P | AA-AG-P | CM-CX-HM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PANNED CONCENTRATES | | | | | | | | | | | | | | | | | |
| 1C0114 | 10 N | 100 | 10 L | 100 N | 50 | 10 N | 200 | 300 | 50 N | 20 | 200 N | 300 | .00 B | 0 B | 0 B | .0 B | 1 N |
| 1N0244 | 10 N | 70 | 10 N | 100 N | 15 | 10 N | 100 N | 1000 | 50 N | 70 | 200 N | 1000 G | 3.00 | 10 | 20 | .2 L | 1 L |