BULLETIN 100

GEOLOGY AND MINERAL RESOURCES OF JOSEPHINE COUNTY, OREGON

1979

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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Oregon Department of Geology and Mineral Industries

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ERRATA SHEET

(Cartographic corrections)

Plate 1 - Geologic map of Josephine County

A. Wrong colored areas

1. Small patch of Jrgv in SW¼ sec. 15 and SE¼ sec. 16, T. 41 S., R. 9 W., on California-Oregon line in headwaters of Blue Creek is pinkish-orange and should be tan.

2. Small lenticular patch in south center sec. 15, T. 39 S., R. 8 W., at Laurel Cemetery of Trav is a brown and should be a pinkish color.
3. Small oval patch on south side thrust fault intersected by line of sec. 11 and 12, T. 39 S., R. 8 W. Lime rock is green and should be bluish gray of $T_R$as.
4. Small patch north of Deer Creek mostly in SW¼ sec. 11, T. 38 S., R. 7 W., is yellow-green ; should be blue-gray $T_R$as.

In Cross section A-A'

5. Small wedge of mg below "G" in "Geologic Cross Section" is light purple instead of pink.
6. $T_R$av near east end of cross section is light tan instead of darker pinkish color of $T_R$av.

B. Teeth are missing from areas of thrust fault near Oak Flat on the Illinois River, i.e., the round patch of um in sec. 17, T. 37 S., R. 9 W., and along west boundary of the elongate um patch lying just to the east in secs. 5,6,16,17,20 and 21, T. 37 S., R. 9 W.

Plate 3

1. Reference "Diller and Kay 1942" near the lower margin should read "1924".

2. Contour interval of map T. 33 S., R. 7 W., is partly 50 feet and partly 80 feet as two separate base maps are pieced together.

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COVER PHOTO

Hellgate Canyon on the lower Rogue River, Josephine County, Oregon. Here the river cuts through metavolcanic rocks of the Galice Formation.

GEOLOGY AND MINERAL RESOURCES OF JOSEPHINE COUNTY, OREGON

INTRODUCTION

PURPOSE

The geology and mineral resources of southwestern Oregon including Josephine County have been studied since the late 1800's, and many maps and reports of the area have been published. Most of these are no longer available. New theories and concepts of geologic processes and their relation to mineral deposits make it worthwhile at this time to review the earlier work and reevaluate the mineral potential of this area. There is a definite need to combine information from earlier reports, update the geologic maps, and review the mineral potential.

Recognizing that mineral resources and basic geology play an important part in long-range land use planning, Josephine County and the Oregon Department of Geology and Mineral Industries cooperated to produce this report, which includes up-to-date geologic maps, a mineral locality map showing the location of 470 mineral occurrences, a descriptive interpretation of the geology, and an estimate of the potential for future production of mineral resources in Josephine County.

Geologic maps prepared during this study include a map of the entire County at a scale of ½ in. to the mile, a map of the Glendale 15-minute Quadrangle east of Interstate 5 at a scale of 1 in. to the mile, and a map of that portion of Township 33 South, Range 7 West, in the County on a scale of 2 in. to the mile (Figure 1). Areas mapped at the larger scale were selected because they included County-owned land and known mineral resources.

PREVIOUS WORK

J. S. Diller was the first geologist to study southwest Oregon in detail. His earliest studies, begun before the turn of the century, were concerned both with geology and with mineral resources. In 1902, he discussed the topographic development of the Klamath Mountains; later, he and G. F. Kay described the mines and mineral resources of the Riddle Quadrangle (1908) and Grants Pass and its bordering area (1909). In 1914, Diller examined the mineral resources of southwestern Oregon and in 1921, with others, the chromite deposits. Diller and Kay's geologic map of the Riddle Quadrangle was published in 1924.

Shenon studied copper deposits of both the Waldo-Takilma area (1933a) and the Almeda Mine area (1933c). He also wrote a separate report on selected gold mines in the County (1933b). Hodge inventoried limestone (marble) deposits (1938), and Allen reviewed chromite deposits (1941). F. G. Wells and others of the U.S. Geological Survey published geologic maps and descriptions of the Grants Pass Quadrangle (1940), the Kerby Quadrangle (1949), and the Galice Quadrangle (1953). In 1947, Youngberg described the mines and prospects of the Mount Reuben mining district.

The *Oregon Metal Mines Handbook (Jackson and Josephine Counties)* was published in 1952 by the Oregon Department of Geology and Mineral Industries. Hundhausen (1956) reviewed copper deposits near Takilma, and Appling (1958) listed manganese occurrences. Ramp (1961) published a detailed report on southwestern Oregon chromite occurrences and production. Brooks (1963) included southwestern Oregon in a statewide study of mercury. Libbey (1967) compiled an important report on the Almeda Mine. Brooks and Ramp (1968) included Josephine County in their comprehensive review of gold and silver in Oregon. Hotz (1971a) described the gold districts in the Klamath Mountains and related the mineralization to the geology. Ramp (1978) listed and evaluated the nickel resources of southwest Oregon. Students who

have done field work in the area include Dick (1976), Garcia (1976), Godchaux (1969), and Vail (1977). At the time of this writing, geologic mapping is being conducted by Page and others of the U.S. Geological Survey in the Medford 1° by 2° Quadrangle.

For this present Oregon Department of Geology and Mineral Industries study, all the previous work has been reviewed. The geology is based on interpretation of published maps, studies of infrared and black-and-white aerial photographs, and field examinations in each of the 13 quadrangles included in the County. Critical areas where the authors question present-day interpretations were also reexamined. Fifty man days were spent in the field, visiting mineralized areas and checking geologic problems. Several mineral occurrences discovered during the field studies are shown on the Mineral Locality Map (Plate 2) and are included in Table 1 (folded, in envelope). The results of samples taken and assayed during the course of this investigation are tabulated in Tables 4 and 5.

The Mineral Locality Map and Table 1 are compilations of data from all available sources including the authors' field work during the past several field seasons.

ACKNOWLEDGMENTS

We wish to thank personnel of the Siskiyou National Forest and the Josephine County Forestry Department for allowing free use of aerial photographs. Siskiyou National Forest personnel also supplied large-scale planning maps used to compile field information and photogeology. J. R. Ritter of Gold Hill furnished information about the Marble Mountain quarry, Elizabeth Hiller generously loaned historic photographs for copying, and Pauline Shier of the Josephine County Historical Society aided in selection of photographs from their files. Norman J. Page of the U. S. Geological Survey furnished copies of preliminary field maps being used in compiling geology for the Medford 1° by 2° Quadrangle.

Oregon Department of Geology and Mineral Industries personnel who helped with this report include Ruth E. Pavlat, who compiled and tabulated assay data and typed the manuscript; Beverly F. Vogt and Ainslie Bricker, who edited the report; and Charles A. Schumacher, who drafted the maps. Jerry J. Gray, Economic Geologist, developed the format for Table 1.

GEOGRAPHY

LOCATION AND ACCESSIBILITY

Josephine County lies near the southwest corner of Oregon (Figure 1) and covers 1,625 sq mi of generally rugged, mountainous terrain of the Klamath Mountains geomorphic province. The County was established in 1856, shortly after the discovery of gold in 1850. Grants Pass became the County seat in 1886, the year rail transportation was completed to southwest Oregon. The Southern Pacific railroad goes north through Grants Pass to northern Oregon points; from Grants Pass it goes south through Medford and connects with the California rail networks. Interstate 5, Oregon's main north-south freeway, parallels the railroad. U.S. Highway 199 (Redwood Highway) extends from Grants Pass southwest to the Illinois River Valley and then to the Pacific Coast via northern California. Oregon Highway 46, one of the State's shortest (20 mi) highways, goes from the Redwood Highway at Cave Junction to the Oregon Caves. Oregon Highway 238 extends south and east from Grants Pass to the Applegate River Valley. A network of County, U.S. Forest Service, Bureau of Land Management, and private company roads, mainly along and branching from the lower Rogue River, lower Illinois River, and larger creek valleys, provides access to all but the most rugged, timbered, and uninhabited areas of the County.

CLIMATE AND CULTURE

Josephine County has a moderate climate, warm and dry in summer and fall, cool and wet in winter and spring. Average annual rainfall is 32 in.

Like most of western Oregon, Josephine County is growing; the County Planning Department estimates that the 1978 population was 56,000, about 5,000 more than shown in statistics published in July 1977. Some of the increase was at Grants Pass, which now has over 15,000 people. Cave Junction, with a population of about 850, is the only other population center of any size. Hugo, Kerby, Merlin, Murphy, Selma, Williams, and Wolf Creek are smaller unincorporated population centers with a few tens to a few hundred people. Population density of the County is about 32 persons per square mile.

Josephine County's economy is somewhat diversified; lumbering, tourism, light manufacturing, and agriculture all contribute significant income. The forest products industry is the most important, with 90 percent of the land forested or capable of growing trees. Only 3 percent of Josephine County lands are devoted to cattle ranching, dairying, or growing of such specialty crops as flower bulbs, hops, and mint. Tourism is increasing in importance. Several kinds of light manufacturing industries are located in the County. Mining has at times been an important industry; its history and future are discussed in the chapter on mineral resources.

TOPOGRAPHY AND DRAINAGE

Except for the relatively flat area along the Rogue River near Grants Pass and the broad valley of the upper Illinois River near Cave Junction, the terrain throughout the County is generally similar and has been interpreted as the uplifted, eroded remnants of a broad plateau, now rugged and mountainous, with considerable relief. The lowest elevation is 150 ft along the Illinois River at the Josephine-Curry County boundary; the highest point is 7,055 ft at Grayback Mountain in the south-central part of the County, near the Oregon Caves.

Josephine County contains a significant part of the Rogue, Illinois, and Applegate River drainages. The underlying geology and tectonic history is reflected by the terrain of the river valleys and canyons. Easily eroded rocks, such as decomposed diorite of the pluton surrounding Grants Pass, have produced a rather broad valley with low, rounded hills, while both upstream and downstream from this pluton, the Rogue River flows through more resistant metamorphic rocks, cutting steep-walled canyons. The southern part of the County is drained by the Illinois River and its tributaries. The broad valley through which the Illinois River flows from near the California border to Kerby reflects a complex process of tectonism, erosion, and alluviation. The Applegate River, which drains the southern and eastern parts of the County, also has a complex erosional and alluvial history.

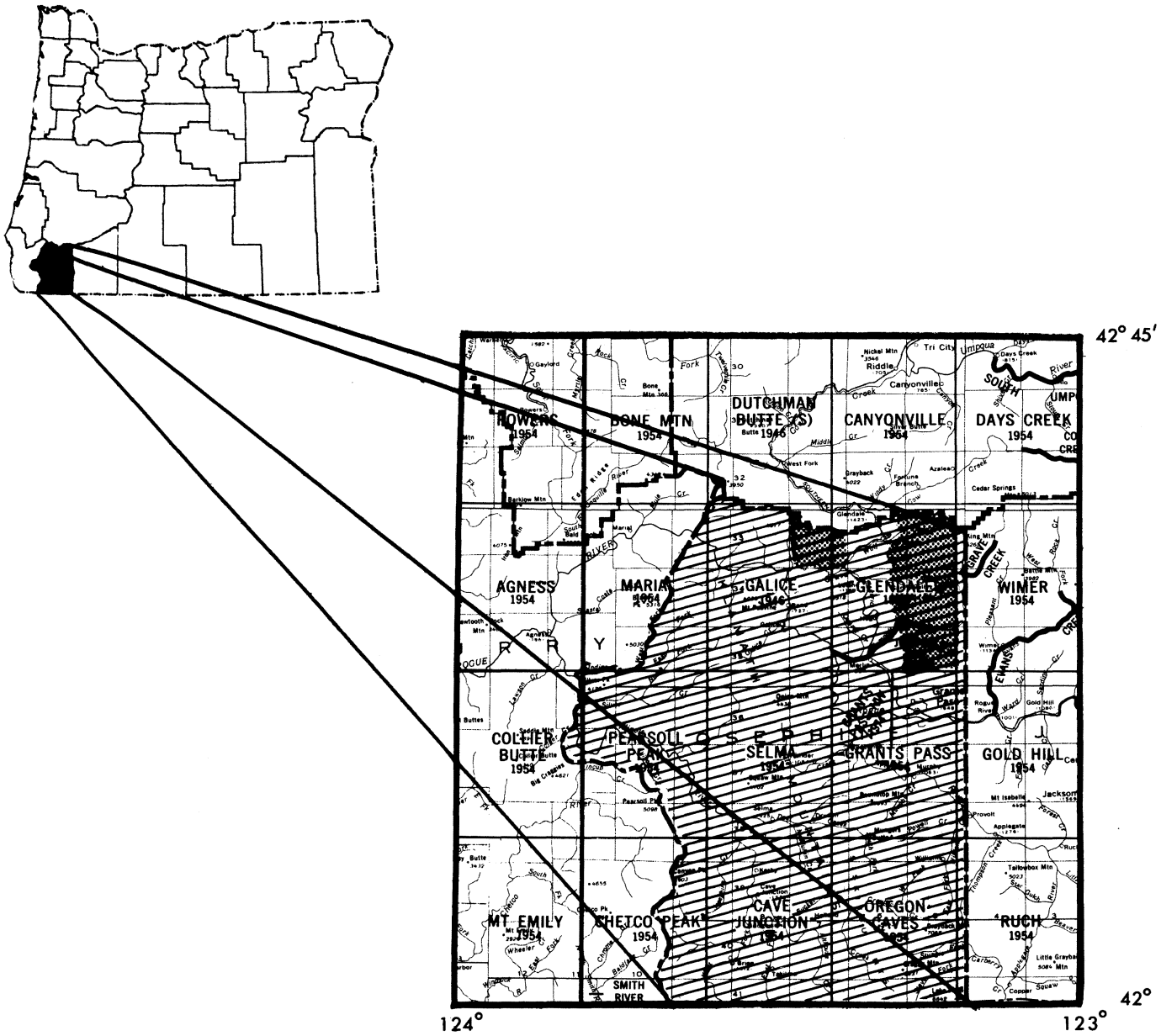


Figure 1. Index map of Josephine County showing 15-minute quadrangle map coverage. Dark areas with dots were mapped at a larger scale as part of this study (Plate 3).

GEOLOGY

REGIONAL SETTING

Josephine County lies in the northwestern part of the Klamath Mountains geomorphic province of southwestern Oregon and northern California. The structural pattern of the Klamath Mountains province as described by Irwin (1966) and Hotz (1971a) consists of four north-trending arcuate belts of rocks which are convex to the west. The oldest belt to the east and the successively younger belts to the west are each bounded by east-dipping thrust faults along which older rocks have overridden younger rocks.

The two western belts, called the Western Paleozoic and Triassic Belt and the Western Jurassic Belt, go through Josephine County. The Western Paleozoic and Triassic Belt includes the Applegate Group and associated ultramafic rocks as well as younger intrusive rocks. The Western Jurassic Belt includes the Rogue and Galice Formations and associated intrusive rocks. The western margin of this belt is also a major east-dipping thrust fault that is the eastern boundary of the Upper Jurassic Dothan Formation.

All of the layered volcanic and sedimentary rocks in the County conform to the regional trend of the Klamath Mountains province, striking north to northeast and generally dipping steeply to the east. Most of these rocks are tightly folded, with axial planes that also dip to the east.

The area which today makes up Josephine County is considered to have once been part of the continental margin along which an oceanic plate was subducted. Most of the rock formations are interpreted to have been portions of an ophiolite suite (ancient sea floor rocks) or island-arc volcanic deposits. For a general discussion of plate tectonics and related features in Oregon, see Allen and Beaulieu (1976).

STRATIGRAPHY

The rock formations of Josephine County are described from oldest to youngest. Numbers given for mines and prospects indicate locations shown on the Mineral Locality Map of Josephine County (Plate 2, folded, in envelope).

Applegate Group

Rocks of the Applegate Group mapped in Josephine County are mainly volcanic in origin and were apparently deposited in a submarine environment. Large areas of fairly well-preserved pillow lavas are exposed in the vicinity of Kerby Peak, Little Grayback, and Holcomb Peak, as well as in other parts of the eastern half of the County. Other volcanic rocks in the Applegate Group include flow breccias and tuffs. In places, these rocks are intruded by abundant diabase and gabbro dikes.

Metasedimentary rocks in the Applegate Group include argillite, slaty siltstone, chert, altered tuffaceous sedimentary rock (volcanic wacke), quartzite, conglomerate, and marble (limestone). Small areas of interbedded sedimentary rocks also occur in areas mapped as volcanic rock.

Probable age of the Applegate Group is reported by Wells and others (1949, p. 4) as Late Triassic. Hotz (1971a, p. 11) and Irwin (1966, p. 21-22) suggest that these rocks may range in age from Early Permian to Late Triassic and include the rocks as part of the Western Paleozoic and Triassic Belt of the Klamath Mountains province.

Page and others (1977) map more highly metamorphosed rock in the Wimer Quadrangle as a Paleozoic unit and separate it from the Triassic Applegate Group. Further work is needed to determine the age relationships of rocks in this group.

Mineral-resource potential: Applegate Group rocks contain a large number of gold prospects as well as a few volcanogenic sulfide occurrences (copper, zinc, gold, and silver) such as the Queen of Bronze Mine, No. 421; the Babcock Copper Prospect, No. 341a; the Gold Note Mine, Jackson County line; the Oak Mine, No. 162; and the Meathead Prospect, No. 61.

Gold mineralization occurs in quartz veins penetrating several different types of rock, including altered lava flow rock, tuff, argillite, chert, and quartzite. A concentration of gold deposits is found in Applegate Group rocks surrounding the north end of the Grayback diorite pluton.

A few, very rich, near-surface pockets of gold were reportedly found in argillite associated with

manganese oxide. The rich gold placer deposits of Althouse and Sucker Creeks were probably derived from such rich pocket deposits.

Lens-shaped masses of marble (recrystallized limestone) in the Applegate Group represent the only commercial source of limestone in the region. Rhodonite is associated with quartzites that were probably recrystallized from cherts of the Applegate Group.

Briggs Creek amphibolite

Coleman and others (1976) and Garcia (1976) name and describe a 2-mi-wide belt of amphibolite west of Galice, extending from a point about 1½ mi north of the Rogue River at Rainie Falls southward for about 24 mi to a point near the Eureka Mine at the headwaters of Soldier Creek. They describe the unit as "a tectonic slice of metamorphosed oceanic crust."

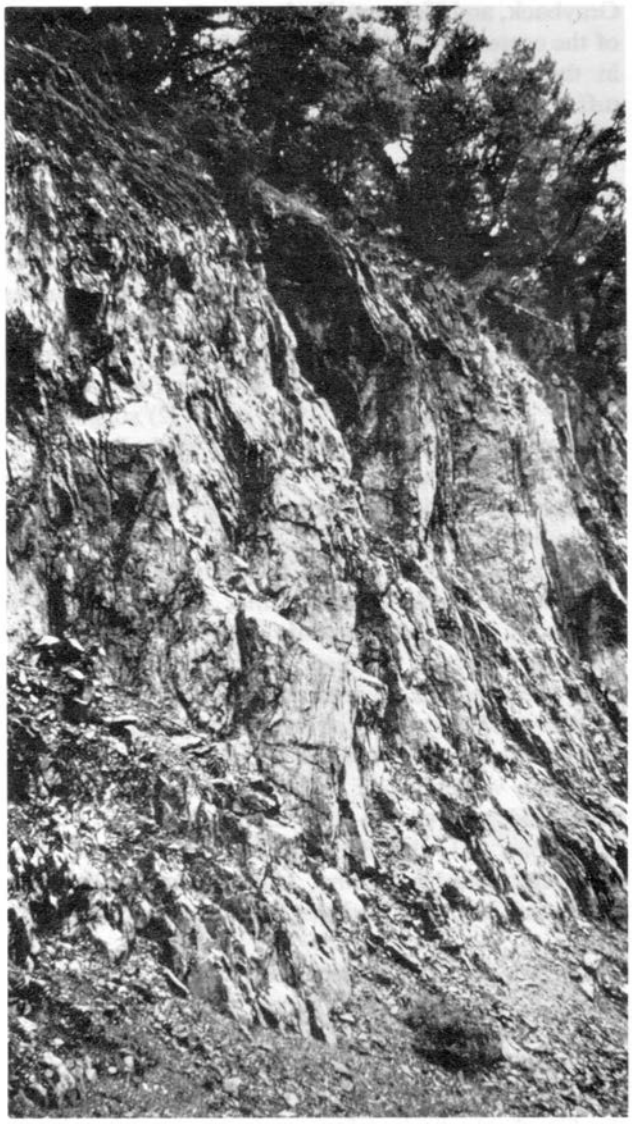


Figure 2. Typical metatuffs of the Rogue Formation, exposed in roadcut near mouth of Grave Creek.

The Briggs Creek amphibolite or amphibole gneiss includes lesser amounts of quartz-rich gneiss and quartzite. The rocks are usually distinguishable from the gneissic metagabbro of the Chrome Ridge area by their abundant quartz and more sodic plagioclase. Major minerals in the Briggs Creek amphibolite include amphibole, plagioclase, quartz, mica (muscovite and biotite), garnet, and magnetite. A few, thin layers of garnet- and magnetite-rich gneiss in Briggs Valley may have originated as layers of black sand deposited along an ancient beach. Accessory minerals such as epidote, clinozoisite, rutile, sphene, and apatite have also been reported.

Garcia (1976, p. 98) describes the Briggs Creek amphibolite as consisting of two dominant lithologies: mainly gneissic amphibolite and lesser quartz-rich gneiss. These rocks are interpreted by Garcia as having been altered from basalts and cherts.

Wells and Walker (1953) consider these rocks to be a more highly metamorphosed equivalent of the Rogue Formation; Garcia (1976, p. 98), however, reports a major high-angle fault separating the two formations. The authors of this report believe that the later interpretation of Coleman and others (1976) and Garcia (1976) is probably more acceptable.

Mineral-resource potential: Several small gold- and copper-bearing quartz veins occur in the Briggs Creek amphibolite in the Galice area. There is also a cinnabar and rhodonite occurrence, the Elkhorn Prospect, No. 181. The small high-grade gold deposits in the Briggs Creek amphibolite may have been a partial source of the placer deposits in the Galice Creek drainage.

Volcanic rocks of the Rogue and Galice Formations

The Rogue Formation, named and described in detail by Wells and Walker (1953) and by Garcia (1976), is a sequence of volcanic rocks exposed along the Rogue River from the Almeda Mine to a point downstream near Rainie Falls. The formation consists predominantly of fragmental rocks, including fine- to coarse-grained tuffs, agglomerates, and flow breccias. Less extensive lava flow rocks include light-gray to white silicic rocks and pale-green to greenish-gray andesites and basalts, some of which have pillow structures.

The clastic metavolcanic rocks, according to Wells and Walker (1953), include thin-bedded, porcelaneous material and thick-bedded, coarse lithic tuffs (Figure 2).

The Rogue Formation underlies and is approximately conformable to the Upper Jurassic Galice Formation. Age of the Rogue Formation is not known, but on the basis of its stratigraphic position, it is believed to be Middle to Late Jurassic.

Volcanic rocks of the Galice Formation in the Kerby 30-minute Quadrangle were described by Wells and others (1949, p. 4 and 5). Their report preceded their interpretation of the Rogue Formation in the Galice area (Wells and Walker, 1953). Accordingly, rocks equivalent to the Rogue Formation farther south were then described as volcanic rocks belonging to the Galice Formation. The Galice Formation volcanic rocks are interlayered and interfingered with marine sedimentary rocks; they are otherwise difficult to distinguish from rocks of the Rogue Formation. Galice volcanic rocks consist of thick, andesitic flow rocks and flow breccias and coarse agglomerates overlain by more siliceous tuffs and thin flows.

Volcanic rocks of the Rogue and Galice Formations have undergone greenschist facies metamorphism (Garcia, 1976, p. 124-125). Their textures are predominantly fragmental, and their trace element chemistry is typical of modern island-arc volcanic rocks (Garcia, 1976, p. 142).

Mineral-resource potential: Mines and prospects in the Galice area, including the Mount Reuben district, occur predominantly in the volcanic rocks of the Rogue Formation. The extensive Big Yank volcanogenic mineralized zone, which includes stratiform disseminated and massive sulfides and associated barite found at the Almeda and Goff Mines, occurs in pyroclastic rocks of the Rogue Formation. These deposits probably originated as a result of submarine volcanic eruptions. The Rogue and Galice volcanic rocks are hosts for a number of small gold-bearing quartz fissure veins and mineralized shear zones. A few examples are the Pyx, Gold Bug, Reno, and Bunker Hill Mines.

Recent mineral exploration in southwestern Oregon has focused on these altered volcanic rocks of the Rogue and Galice Formations.

Sedimentary rocks of the Galice Formation

Wells and others (1949, p. 4) described the sedimentary member of the Galice Formation as shale or slate, with a small amount of sandstone, and a few, thin, discontinuous layers of grit or conglomerate.

In a few areas, especially near the western edge of the Illinois Valley arm of the formation, along the Rogue River near the mouth of Jumpoff Joe Creek, and along Grave Creek near Leland, abundant graywacke sandstones grade upward into slaty siltstones. Slaty siltstones, usually interbedded with sandstone and thin, black shale layers, predominate in the section. A few lenses of grit and pebbly conglomerate occur in the sandy section of the formation.

Thin, black, sooty carbonaceous layers with carbonized wood and plant fragments are reported in a few places (Wells and others, 1949, p. 6), but there are no true coal beds.

The sedimentary rocks are poorly sorted, characteristically dirty, and not tightly compacted. Because of siliceous cement and abundance of clay, they have very low porosity.

The shales, siltstones, and sandstones display a distinct parting and are classified as slaty shales or slaty siltstones rather than true slates (Wells and others, 1949, p. 6). In most places, the cleavage parallels the bedding. In the crests and troughs of tight folds, however, cleavage cuts across the layers. At the crests of folds in shale, pencil structure paralleling the fold axes has also been reported by Wells and others (1949, p. 6). Drag folds, common in the sedimentary rocks, are evidence of relatively incompetent beds.

Among identifiable minerals in the shales are quartz, plagioclase, and kaolin. Secondary chlorite and tiny flakes of biotite and sericite are evidence of low-grade metamorphism (Wells and others, 1949, p. 5). Knots of cordierite occur in the slaty siltstone near its contact with the Grants Pass diorite pluton and can be found in outcrops just west of the Applegate River on U.S. Highway 199. The silvery sheen commonly seen on slightly weathered slaty siltstones of the Galice Formation is caused by the development of sericite.

Mineral-resource potential: Some gold is found in both major and minor fault zones. The gold is usually associated with quartz and clay gouge occurring in these shear zones. Galice sedimentary rocks mapped in the northern part of the County appear to have more abundant quartz lenses; in areas of deeply weathered sediments, some placer deposits such as No. 109, the Goff Placer near Leland, may have derived some gold from earlier mineralization in these sediments.

With proper processing, a fairly plastic, tan residual clay developed in areas of deeply weathered shale and siltstone is usable for common brick and tile manufacturing. Some early buildings in Grants Pass were constructed of bricks from the McFarlane Plant, No. 290, on Hayes Hill.

Intrusive rocks

The intrusive rocks are subdivided into three varieties: ultramafic, gabbroic, and granitic. Generally, intrusive relationships indicate that ultramafic

rocks were emplaced first. The gabbroic rocks are of intermediate age (145 to 155 m.y.), and the granitic rocks (diorite and related rocks) are the youngest intrusives (127 to 140 m.y.) (Hotz, 1971b, p. 17). The mineral-resource potential of each type of intrusive rock is discussed in the appropriate section.

Ultramafic rocks

Serpentinite and partly serpentinized peridotite are widely distributed through the County as narrow, highly sheared stringers and as plates localized in zones of major crustal movement. In the southwestern part of the County, the largest body, the Josephine ultramafic sheet, extends from the area of Eight Dollar Mountain southwest into Curry County and southward into northern California. It covers approximately 100 sq mi in Josephine County. This large body of partly serpentinized peridotite is believed to be the upper plate of a thrust that has been offset by later high-angle faults. Smaller bodies having similar geologic relations occur to the north and west in the Chrome Ridge area and extend to the south along the Illinois River to the County line in the vicinity of Pearsoll Peak.

Serpentinites are altered from peridotites varying in composition from dunite to pyroxenite. The most common variety is harzburgite (saxonite), composed mainly of olivine and orthopyroxene. Most of the ultramafic rocks show at least minor serpentinization. Narrow bodies and zones of more intense shearing generally display complete serpentinization.

Age of the ultramafic rocks is uncertain. Many geologists believe these rocks crystallized in the upper mantle as cumulate layers and then later were injected tectonically into the crust, sustaining partial melting and differentiation as a result of decompression during their ascent (Dick, 1977). Since these rocks have been intruded by gabbro and diorite (Hotz, 1971b, and Dick, 1976), they must predate these intrusives. There may well have been more than one episode of tectonic injection of ultramafic rocks. Serpentinites associated with the Triassic Applegate Group may have been emplaced earlier than were the ultramafic rocks associated with the Jurassic Rogue and Galice Formations.

Mineral-resource potential: Ultramafic rocks are important hosts for mineral resources including chromite, nickel, platinum, some copper, asbestos, and soapstone. Olivine can be used for making refractory brick and for the production of foundry casting sand. A few gold prospects also occur in highly sheared and altered talcose serpentinite. One such prospect in Josephine County is the Oro Grande, No. 64.

Gabbroic rocks, including metagabbro, olivine gabbro, and related dike rocks

The north-trending body of gabbroic rocks west of Chrome Ridge, in the Silver Creekdrainage, and along the Illinois River west of Oak Flat, extends south into the Chetco River drainage in Curry County. This large, complex intrusive body includes olivine gabbro and hornblende diorite and has been called the Illinois River gabbro complex (Jorgenson, 1970), the Chetco River complex (Hotz, 1971b, p. B-3), and the Illinois-Chetco gabbro-diorite complex (Brooks and Ramp, 1968) and Ramp and others (1977). Godchaux (1969) mapped gabbros within the Grayback diorite pluton east of Oregon Caves National Monument. Gabbro and metagabbro have been found at various other places in the County, and areas of abundant gabbro and diabase dikes intruding metavolcanic rocks of the Applegate Group have been mapped in the northeastern portion of the County.

Olivine gabbro in the Illinois-Chetco igneous complex is described by Wells and others (1949, p. 10-11), who distinguished coarse-grained and fine-grained varieties. The typical olivine gabbro exposed near York Butte has about 50 percent calcic plagioclase (ab 25-30), 5 to 20 percent pyroxene (hypersthene and augite), usually less than 10 percent olivine, and 5 to 10 percent magnetite. The pyroxenes are generally altered in part to green hornblende, and the olivine to serpentine. Pleonaste is reportedly a common accessory mineral associated with and replaced by magnetite (Wells and others, 1949, p. 11).

Other varieties of gabbro mapped in the County include two-pyroxene gabbro, hornblende gabbro, metagabbro, and epidiorite. Godchaux (1969) describes gabbro-pyroxenite and garnetiferous gabbro in the Grayback pluton east of Oregon Caves.

Metagabbro and epidiorite often display gneissic banding and may have cataclastic textures. Pyroxene has been altered almost completely to amphibole; common secondary minerals include epidote, chlorite, albite, and quartz.

Mineral-resource potential: These basic intrusive rocks are not considered primary source areas for mineral deposits. Some sparsely disseminated sulfides, including pyrite and chalcopyrite, have been noted in the Illinois-Chetco intrusive complex (Little Silver Prospect, No. 168). One specimen of olivine gabbro float with disseminated chalcopyrite from the Panther Gulch area assayed 0.5 percent copper (Assay No. RG-44). Locally, the gabbros contain concentrations of magnetite that, although seldom above 10 percent of the total rock, show up as magnetic anomalies detectable by airborne instruments (Balsley and others, 1960).

Diorite and related rocks

The two main diorite plutons in Josephine County are the egg-shaped Grants Pass pluton and the elongate Grayback pluton. They differ somewhat both in chemical composition and in age. The Grants Pass pluton, mainly of quartz diorite that is fairly uniform in composition, measures about 8 mi wide and 17 mi long. The Grayback pluton is about 6 mi wide and 20 mi long. It is more diverse in composition; in the southern mountainous area, it appears to be zoned with a gabbroic (mafic) and in part ultramafic core, as mapped by Godchaux (1969) (see GEOLOGY—Stratigraphy: Gabbroic rocks). Although minor differentiates of both plutons include granodiorite, granite, aplite, and pegmatite, the major rock type in both is quartz diorite.

Much of the diorite is deeply weathered and forms subdued topography and lowlands covered by alluvium, as in the Williams, Applegate, and Rogue Valleys and the outwash areas of Jumpoff Joe and Louse Creek.

Hotz (1971b) reported potassium argon ages for the Grants Pass pluton of 136 m.y. and for the Grayback pluton of 140 to 150 m.y. The Illinois-Chetco igneous complex is also dated as about 150 m.y. A number of diabase dike rocks intruding the Josephine ultramafic body were age dated by Dick (1976) and are also about 150 m.y. old.

Mineral-resource potential: Few metallic mineral deposits have been found in the diorite and related rocks, but a number of gold prospects surround the northern end of the Grayback pluton.

Minor occurrences of molybdenum and copper are found within the Grants Pass pluton near its western boundary and in a small body of quartz diorite west of Galice. Godchaux (1969) describes the Grayback pluton as an apparently zoned intrusive, which would make it a favorable area to prospect for porphyry-type disseminated sulfide mineralization.

Decomposed diorite is used as common fill material because it is easy to quarry and compact. The formation, where decomposed, is also an important aquifer.

Dothan Formation

The Dothan Formation, of Late Jurassic age, underlies about 170 sq mi of the western and northwestern part of the County. The formation is made up largely of marine graywacke sandstone and interbedded siltstone, with minor chert, conglomerate, pillow basalt, and tuff.

Diller (1907) named and described the formation for its type locality at Dothan Station, later West Fork, along Cow Creek and the Southern Pacific Railroad in southern Douglas County. The formation is quite extensive and is equivalent to the Otter Point Formation along the coast in Curry County and to at least part of the Franciscan Formation of the California Coast Range. In Josephine County, the Dothan Formation is thrust under older rocks including the Illinois-Chetco igneous complex and the Rogue Formation. This extensive thrust, sometimes referred to as the Coast Range thrust, is mapped and described by Hotz (1969), Ramp (1975), and Garcia (1976). It has been traced for about 250 mi from the vicinity of Canyonville in Douglas County to the south into northern California, where it marks the eastern boundary of the Franciscan Formation.

Mineral-resource potential: The Dothan Formation generally lacks mineral-resource potential. Locally massive, uniformly fractured, quartz- and/or calcite-veined graywacke and also pillow basalts of the formation have been quarried for road rock. Varicolored cherts are a source of common jasper pebbles found in streams that drain the formation.

Some mineralization, such as that at the Whiskey Spring Prospect, No. 10, and the Red Elephant deposit, No. 85, is attributable to the Coast Range thrust fault and occurs locally in, near, or against Dothan rocks.

Cretaceous sediments

Two small areas of fossil-bearing Cretaceous sedimentary rocks mapped in Josephine County provide an interesting clue to the geologic history of the area. The larger of these areas is in the Illinois Valley between O'Brien on U.S. Highway 199 and the site of the old mining community of Waldo. It covers an area of about 5 sq mi. The smaller area is just north of Grave Creek near the Jackson County line. A small patch surrounded by serpentinite is mapped near the head of Clark Creek in sec. 26, T. 33 S., R. 5 W.; a small part of a larger body in Jackson County extends into Josephine County to the east of Boulder Creek in secs. 25 and 36, T. 33 S., R. 5 W.

These Cretaceous rocks consist mainly of marine sandstone and conglomerate lying unconformably on the older Mesozoic rocks of the area. Diller (1914, p. 18) states that these small patches of Cretaceous rocks represent scattered erosional remnants of a continuous blanket that once covered most of the Klamath Mountains province. Winchell (1914, p. 33-34) discusses the Cretaceous rocks and takes exception to Diller's concept of a continuous blanket, suggesting instead that the deposits were formed along the shoreline of an island in the Cretaceous ocean, the "Siskiyou Island" of Condon (1902).

Shenon (1933, p. 151) describes the Cretaceous rocks northwest of Takilma in detail. The lower beds are coarse conglomerate with some interbedded sandstone and are overlain by massive sandstone beds which in places are fossiliferous.

These beds were tentatively correlated with the upper Horsetown or lower Chico Formations of California, of medial Cretaceous age. More recent interpretations (Imlay and others, 1959) consider them to be slightly older.

Rocks in the Grave Creek drainage have been mapped as correlative with the Upper Cretaceous Hornbrook Formation by Wells (1955) and Peck and others (1956); however, on the basis of more recent work in the Wimer Quadrangle, Page and others (1977) map these rocks as "Grave Creek strata" and refer to Jones (1960), who assigns these rocks on upper Grave Creek to Early Cretaceous instead of Late Cretaceous time. Now it appears that all of the Cretaceous rocks in Josephine County are of about the same Early Cretaceous age.

Mineral-resource potential: Some gold found in placers in the Illinois Valley may have been derived by weathering and erosion from Cretaceous auriferous conglomerates. Winchell (1914, p. 34) states that the Cretaceous rocks are found as bed rock in three large placer mines in the area northwest of Takilma, and in one mine, gold is derived from them.

Tertiary sedimentary rock (Umpqua Group)

Only one small area of Tertiary sedimentary rock is found at the western edge of the County along the Illinois River between Indigo and Collier Creeks.

These rocks have been downfaulted along with older underlying rocks, including gabbro and ultramafic rock, from the upper thrust plate which structurally overlies the Dothan Formation. Wells and others (1949, p. 15) report of the Tertiary sediments that "The formation is an assemblage of lenticular bodies of sandstone and conglomerate in nearly equal amounts with thin interbeds of shale. It is characterized by poor sorting, cross-bedding, and abrupt lateral and vertical variation." These rocks are thin erosional remnants; their maximum thickness just south of Indigo Creek is probably little more than 1,000 ft. Wells and others (1949, p. 15) reported only about 500 ft of section at this point and a 250-ft-thick section near the mouth of Silver Creek.

Baldwin (1974) assigns this unit of rocks to the Lookingglass Formation of middle Eocene age.

Mineral-resource potential: These rocks have no known mineral-resource potential.

Tertiary gravels

A very small patch of deeply weathered conglomerate occurs on the ridge north of York Butte. This remnant of a once more extensive deposit lies on an old erosion surface at about 4,000 ft elevation and is described by Diller (1902 and 1914) as part of the Klamath peneplane. In Curry County, a slightly larger area of similar gravels is mapped and described by Wells and others (1949) at Gold Basin, about 9 mi to the southwest. There the gravels have been prospected with little success for their placer gold content. Their age is reported to be Miocene or Pliocene (Wells and others, 1949).

Mineral-resource potential: The limited size (about 10 acres) of this formation probably precludes any mineral-resource potential. It is believed, however, that the formation was much more extensive in Pleistocene and Recent geologic time and may have been the source for some of the rich placer gold deposits of streams such as Red Dog Creek.

Landslide deposits

Landslides are a common feature in Josephine County because of the steep terrain, fractured and sheared rocks, and concentrated seasonal precipitation. Due to the small scale of the geologic map, only a few of the landslides are shown. Some of the more noticeable ones are those that have affected well-used roads: the large slide on the northwest side of Sexton Summit that disrupted Interstate 5 construction; the narrow, steep slide in sec. 9, T. 36 S., R. 7 W., that closed the Shan Creek road for two extended periods; and the slide that persistently breaks up Granite Hill road along Louse Creek at the south end of Walker Mountain. Another slide, spectacular when seen from the air, is on the south side of Silver Creek downstream from the Old Glory Mine, No. 169, where an unnamed tributary has been stripped of all loose debris and vegetation for a horizontal distance of a little more than 1 mi and a vertical distance of about 2,800 ft.

Mineral-resource potential: Part of an old landslide at the head of Wolf Creek has been mined by hydraulic methods for gold. Old landslide deposits of peridotite present a favorable environment for development of nickel-bearing laterite and saprolite (see MINERAL RESOURCES—Nickel).

Quaternary sediments (alluvium)

This map unit includes a broad range of unconsolidated fluvial deposits ranging from high-bench deposits such as Diller's (1914) auriferous gravels of the second cycle of erosion to present-day active stream

sediments (see MINERAL RESOURCES—Gold and Silver: Placer deposits). Also included are a few areas of alluvial fans or outwash deposits from small, steep, intermittent streams entering broad valleys and minor glacial moraines. Wells and others (1949) map five separate Quaternary units including the auriferous gravels of the second cycle of erosion, the Llano de Oro Formation, bench gravels, glacial moraine, and alluvium.

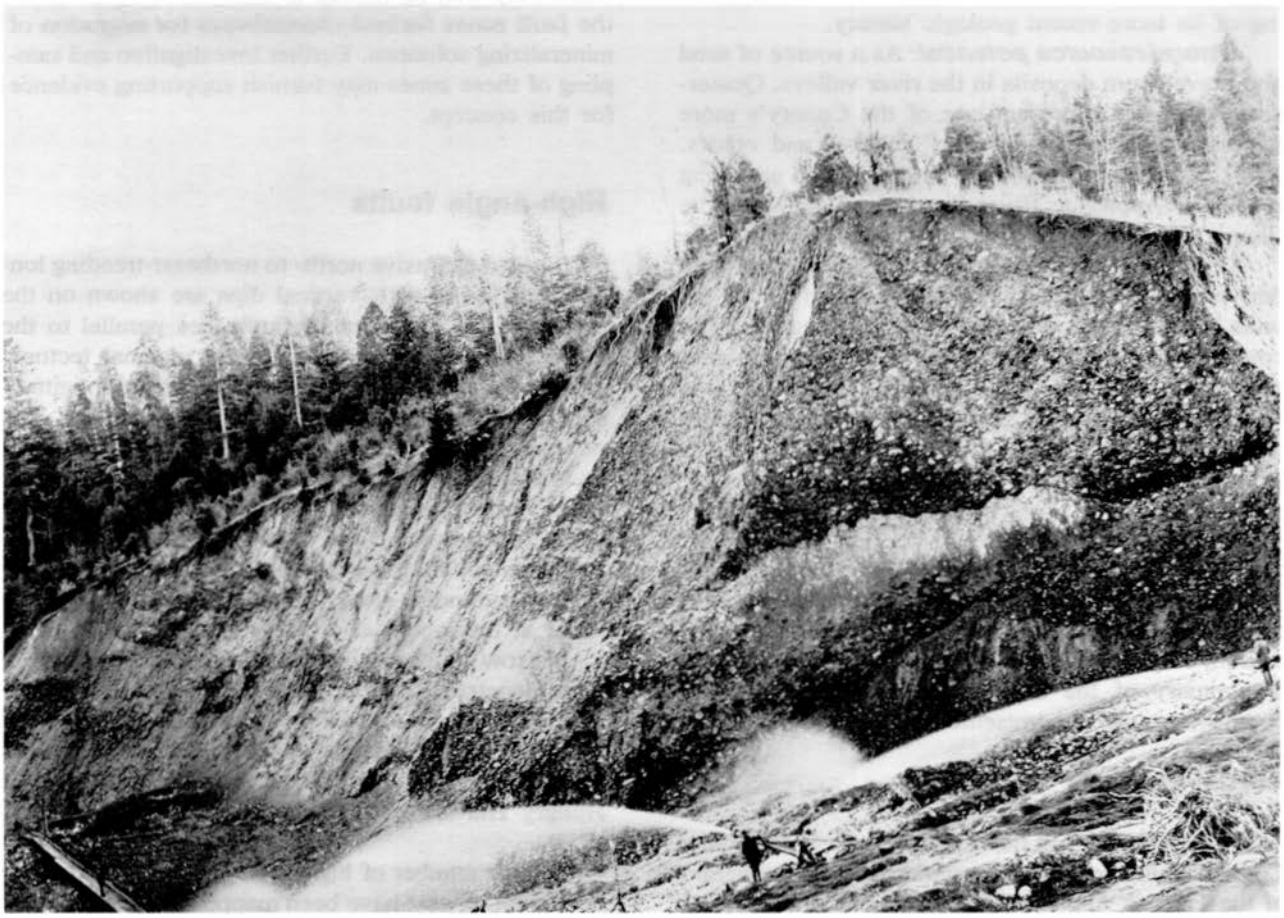
Wells and others (1949, p. 16-17) describe the auriferous gravels of the second cycle of erosion as the oldest and highest Quaternary gravels. Two small areas of these old gravels are mapped on the ridges between Onion and Swede Creeks and between Swede and Soldier Creeks. Diller (1914, p. 97-98) suggested that these gravels and the old channel gravels near Galice Creek are related and were probably deposited by a north-northeast-flowing stream that extended from about Sixmile Creek on the Illinois River to the Galice area on the Rogue River.

The old channel gravel deposits are roughly stratified, flat-lying, and in part cemented. They range from fine to fairly coarse bouldery deposits, especially next to bed rock. In the Galice area, the old channel gravel is reported to be from 100 to 140 ft thick (Diller, 1914, p. 101). Some of the near-surface pebbles are thoroughly decomposed.

Other old gravels (conglomerates that contain boulders and pebbles decomposed by weathering) are mapped on the low hills west of Takilma by Shenon (1933a) and Wells and others (1949). Shenon assigned these conglomerates to the Tertiary, but Wells and others correlated them with the auriferous gravels of the second cycle of erosion. They reach a maximum thickness of about 400 ft between Allen and Sailor Gulches near Takilma (Figure 3).

The Llano de Oro Formation was named by Shenon (1933a) for gravels at the Llano de Oro Placer Mine, later called the Esterly Placer, No. 396. It consists of poorly sorted clay and sand with small rock fragments and lenses of gravel. Wells and others (1949) mapped the formation in the fringe areas of the

Figure 3. Old channel gravels at the High Gravel (Osgood Mine), No. 416, near Waldo. Millions of cubic yards were mined here by hydraulic methods, mainly in the late 1800's.



Illinois Valley alluvium and correlated it with bench gravels lying as much as 100 ft above present streams. Loosely cemented bench gravel deposits also occur along Josephine Creek and at various places along the Illinois, Applegate, and Rogue Rivers, as in the vicinity of Limpy and Little Pickett Creeks on the west side of the Rogue River.

The two largest areas of Quaternary sedimentary deposits in the County are in the Illinois Valley and along the Rogue and Applegate Rivers and Jumpoff Joe Creek upstream from Hellgate Canyon. These unconsolidated deposits may have been formed during a temporary interruption of the main drainages as the result of displacement along a prominent north-trending fault bounding the ultramafic rocks on the west side of the Illinois Valley and extending north to the vicinity of Hellgate Canyon. To produce this alluviation, movement on the fault would have been up on the west side and down on the east side. Lakebeds associated with this ponding can be found at a few places in the valley. The most convincing site is west of Merlin in a roadcut along Abegg road at the line between secs. 19 and 24, T. 35 S., Rs. 6 and 7 W. A more detailed study of the Quaternary sediments in the County would probably lead to better understanding of its more recent geologic history.

Mineral-resource potential: As a source of sand and gravel from deposits in the river valleys, Quaternary sediments represent one of the County's more important mineral resources (Schlicker and others, 1975). The principal deposits being utilized are along the lower Applegate River flood plain and along the Illinois River in the vicinity of Cave Junction.

All of the recorded gold placer production has been derived from Quaternary sediments, and all of the units described above were important sources. The considerable potential for future placer gold production in the County is discussed later in the text (see MINERAL RESOURCES—Gold and Silver: Placer deposits).

STRUCTURE

The history and pattern of tectonic features in Josephine County are not well understood. For that reason, only a few of the apparent salient features and a summary of the authors' interpretations of this complex picture are presented in this report.

Thrust faulting

At least three main thrust faults occur in Josephine County. The oldest of these marks the western margin of the Triassic Applegate Group. Rocks of the Upper Jurassic Galice Formation and the Upper Jurassic Grants Pass quartz diorite pluton are thrust under these older rocks along this important fault, named the Lime Rock fault by Wells and others (1949, p. 18).

The second thrust fault marks the contact surrounding the Pearsoll Peak and Chrome Ridge ultramafic bodies. The fault plane has been offset by north-trending, high-angle faults that modify the boundaries of these rocks. Its age and place in the overall structure are unclear.

The third and youngest thrust fault has the greatest extent and marks the eastern boundary of the Upper Jurassic Dothan Formation. This fault can be traced southward into California, where it is called the Coast Range fault. This name is used by Garcia (1976), who mapped the fault in the Galice area. In Curry County, downdropped rocks along this fault include Cretaceous and other rocks of Tertiary age in the vicinity of Agness (Ramp and others, 1977, p. 15). In Josephine County, the Dothan Formation has been thrust under the Rogue Formation and the basic intrusive rocks of the Illinois-Chetco igneous complex.

Mineral-resource potential: Mineralization found along and in close proximity to these thrust faults may well be related to them to the extent that the fault zones formed channelways for migration of mineralizing solutions. Further investigation and sampling of these zones may furnish supporting evidence for this concept.

High-angle faults

Several extensive north- to northeast-trending longitudinal faults with vertical dips are shown on the geologic map. This set of faults lies parallel to the major axis of folding and fits the regional tectonic pattern for the Klamath Mountains. Similar longitudinal faults show up to the west in Curry County. The pattern of displacement along these faults is not clear or uniform, although most of them appear to have some vertical displacement. The persistent continuity suggests that there may have been some horizontal displacement in some of them, such as the north-northeast-trending fault which crosses the Illinois River at the mouth of Hoover Gulch.

Narrow zones of highly sheared, gougelike serpentinite penetrate some of these faults, indicating their relation to deep-seated tectonic forces. The East Hellgate, West Hellgate, Cedar Mountain, and Hansen Saddle faults, and the northeast-trending fault west of Hungry Hill are good examples (Wells and Walker, 1953).

A large number of high-angle cross faults trending northwest to west have been mapped in the County by

Wells and others (1940 and 1949) and Wells and Walker (1953). Although not all of these previously mapped faults are shown on the geologic map in this report, the structural pattern which they form is important.

The cross faults appear to be younger than the thrust faults and than most of the high-angle longitudinal faults. Most of them can be traced only a relatively short distance, and their displacements appear to have only a small vertical component.

Some relatively recent movement may have occurred along a high-angle north-northeast-trending fault or faults, such as the one marking the contact between Galice sedimentary rocks and ultramafic rocks along the west side of the alluviated Illinois River Valley and extending to the vicinity of Hellgate Canyon west of Merlin. Many interpretations are possible. One interpretation suggests the possibility that stratified Quaternary sediments such as those exposed along Abegg Road west of Merlin and described earlier could be the result of movement along a fault which ponded waters of Jumpoff Joe Creek and the Rogue and Illinois Rivers. Other possible evidence of Cenozoic fault movement is reported by Diller (1914, p. 100-101) as an offset in old channel gravels near Galice. No recent movement has been detected along any faults, and no earthquake epicenters have been recorded within the County.

Mineral-resource potential: High-angle faults are shear zones along which some mineralization has been localized. Although no large producing mines have been developed on these zones, preliminary sampling such as that at the Ida Group, No. 204; the Oro Grande, No. 64; and the King Midas Prospect (no number) situated just north of the Oro Grande all show interesting gold values in sheared, talcose serpentinites. Further investigation of fault zone mineralization appears worthwhile.

Folding

The major structural pattern found in Josephine County pre-Tertiary rocks consists of north- to northeast-trending isoclinal folds with predominantly high-angle dips to the east and fold axial planes also dipping to the east. This folding pattern also appears in the Cretaceous rocks, although the angles of dip are much shallower (usually 30° or less).

This pattern of folding in the Galice Quadrangle is described by Wells and Walker (1953):

> "The dominant structural features in the Galice Quadrangle are indicated by the north-northeastward trend and vertical to low-angle eastward dip of all the formations. This structural attitude pervades the surrounding region as well and is lost only where it is concealed under younger layered rocks or destroyed by younger intrusions. It is the result of tangential compression whereby the rocks have been closely folded and broken along high-angle reverse faults.
>
> "Thick sequences of thinly layered unconsolidated mud and silt have been so intensely plicated that the largest isoclinal folds consist of thinner and thinner sheaves down to microscopic laminae, each sheaf independently isoclinally folded within itself. Within the quadrangle, this type of folding is well exemplified in zone 1 of the Dothan Formation, in the fine tuffs of the Rogue Formation, and throughout the Galice Formation."

GEOLOGIC PROBLEMS

The geologic map of Josephine County indicates a number of geologic problems that will require considerable time and study to resolve. Perhaps the most significant problem is the contact between the Jurassic and Triassic rocks in the area north of Grants Pass. We have arbitrarily assigned to the Triassic Applegate Group all of the volcanic and sedimentary rocks east of the Grants Pass diorite pluton and east of the thrust fault contact which extends along the east edge of the pluton and then continues in a northeasterly direction from the north end of the pluton.

Sedimentary rocks on the upper reaches of Jumpoff Joe and Grave Creeks have been mapped by others as Jurassic in age. Lacking any fossils or absolute dating evidence of their age, we have mapped them as part of the Triassic Applegate Group.

Some of the sedimentary rocks mapped west of the thrust fault on the east half of the Glendale Quadrangle also appear to be equivalent to rocks mapped as Triassic Applegate metasedimentary rocks in the southern part of the County. Confirmation of this interpretation will require detailed lithologic comparisons and/or the discovery of fossils which delineate the age of the enclosing rocks. Specimens of chert have been submitted to the U.S. Geological Survey to be dissolved in acid and checked for diagnostic radiolarian fossils. These tests have not been completed at the time of this writing.

A number of high-angle faults are mapped in the County, but relatively little has been determined as to their magnitude or direction of displacement. Some are accompanied by fairly broad zones of sheared rock and/or elongate bodies of sheared serpentinite, and

talcose and pyrite-bearing gouge. Kays and Bruemmer (1964) determined from a gravity study that the major faults are deep seated and contain injections of serpentinized peridotite. They suggest that the amount of peridotite is directly related to the magnitude and extent of the faulting.

Some of the mapped faults may have very little structural importance, while others that are relatively important may have been overlooked. The thick vegetation and colluvium make detailed geologic mapping a frustrating endeavor. Filling in the gaps between good exposures of bed rock is largely a matter of geologic interpretation, and no two geologists are likely to develop identical pictures.

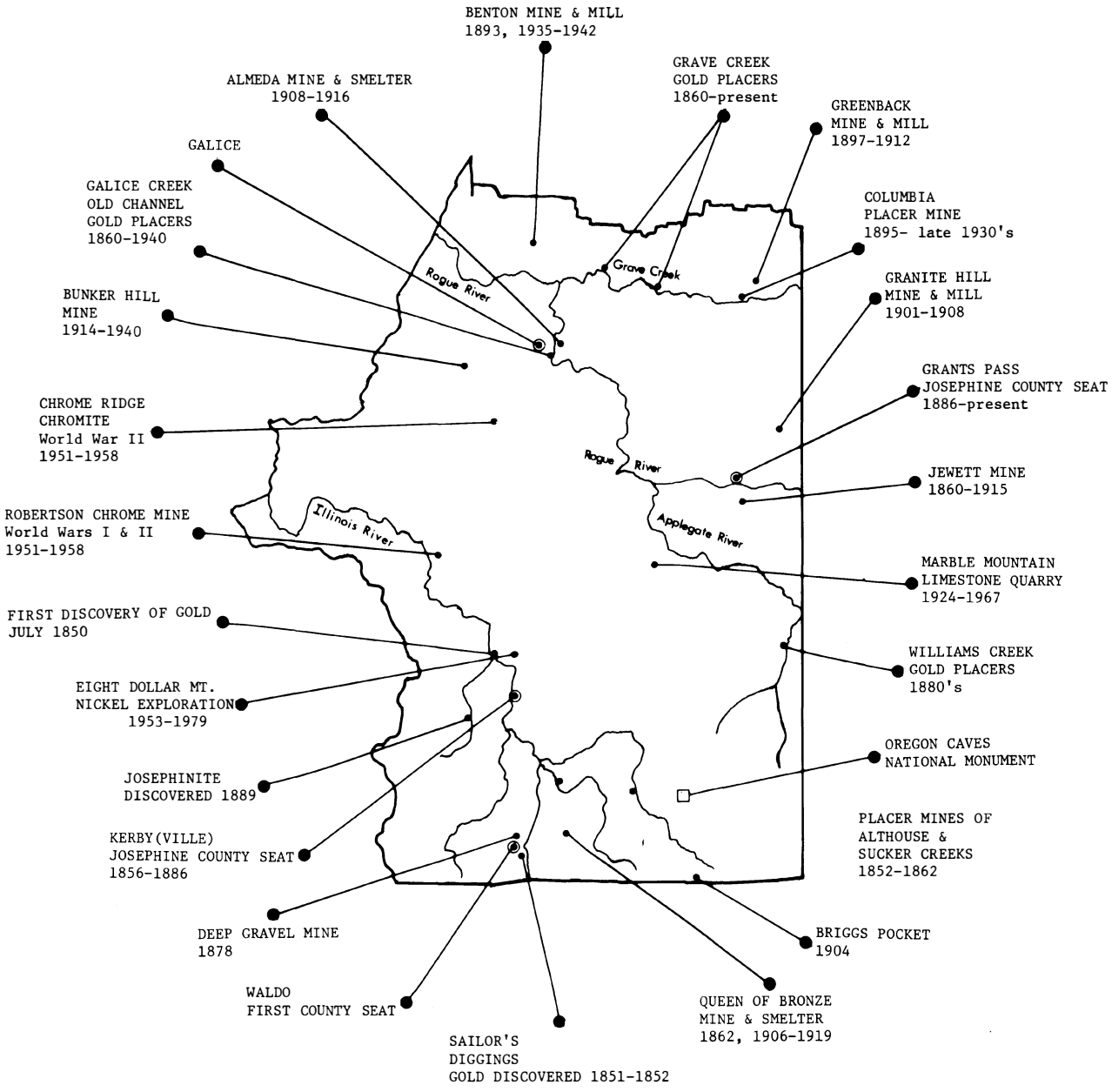


Figure 4. Some of the places and events important in Josephine County's mining history.

MINERAL RESOURCES

INTRODUCTION

The Mineral Locality Map (Plate 2) shows the location of 470 individual mines, prospects, and mineralized areas in the County as accurately as the map scale allows. The metallic mineral commodities of gold, silver, copper, chromium, and nickel have been and will continue to be the most important resources. Other metals that occur are lead, zinc, manganese, mercury, molybdenum, platinum, and tungsten. Nonmetallic minerals other than sand and gravel include asbestos, barite, limestone, semiprecious gem stones, and soapstone, with limestone the only nonmetallic commodity produced in any quantity.

Each of the 470 mines is listed in Table 1 (folded, in envelope), along with information from the listed references about its location, development, production, and mineralization. Production statistics attributed to individual mines are included in the table. Very few tunnels, shafts, or other underground workings listed in the table are still accessible; most adits are caved at the surface, and lower workings are full of water.

HISTORY

Mining began in southern Oregon in 1850 with the discovery of gold along the Illinois River near the mouth of Josephine Creek in what was later to become Josephine County. Since that time, gold, silver, copper, chromium, and limestone have been important commodities to the economy of the County. The following paragraphs provide a thumbnail sketch of some of the mining history of Josephine County. Figure 4 shows the locations and times of some of the important events.

Early-day Josephine County was almost exclusively involved with mining. Other discoveries quickly followed the finding of placer gold in 1850. Street and Street (1973) report the discovery of gold at Sailors' Diggings early in 1852. At that time, Althouse Creek was already being mined. Activity spread to Sucker and Galice Creeks in 1853 and on to many other tributaries of the Rogue, Illinois, and Applegate Rivers during the remainder of the 1850's.

The rich placer deposits within stream channels were the first to be mined and lasted only a few years; because ditches and flumes were built to bring water from miles away for hydraulic mining of the old channel, bench, and terrace gravels (Figure 3), the era of intensive placer mining was extended to the 1870's. Lodes that were the sources of gold in the placers were also sought, and as early as 1860, some surface concentrations and gold-bearing quartz veins had been found. In 1863, the Jewett Mine near Grants Pass had an 8-stamp mill.

Because underground mining was time consuming and required considerable exploration, it developed more slowly, during the 1870's and 1880's. The early 1890's saw the Mount Reuben and Galice districts become very active. Gold and silver production was coming from the Ajax, Copper Stain, J.C.L., Gold Bug, and Golden Wedge Mines. The Benton Mine had been discovered but was not to attain prominence until much later. In 1898, Greenback Mine ore was being treated in an arrastre, but soon its output increased to major production. By 1902, it was equipped with an electric-powered 40-stamp mill and a 100-ton capacity cyanide plant (Figure 5). In 1904, the Greenback produced more gold than any other mine in Oregon, except the North Pole Mine in Baker County.

About the same time, the Almeda Mine had 1,400 ft of underground workings; the Granite Hill Mine had a deep shaft and a 20-stamp mill (Figure 6); and the Daisy, discovered in 1890, was on the way to producing a quarter of a million dollars (14,000 oz) in gold and silver from rich, gold-bearing quartz veins.

Copper was discovered in the Waldo-Takilma area in 1860, but economics prevented large-scale production until 1904, when a small, matte smelter was built at Takilma. This smelter operated more or less continuously until 1910. It smelted over 20,000 tons of ore with an average copper content of 8½ percent. Of the estimated 7 million pounds of copper produced in the County, the Queen of Bronze and other mines near Takilma were responsible for nearly 6 million pounds. A small but interesting copper deposit on Fall Creek also had a small smelter as early as 1899, with some production then and some again in 1965. Considerable quantities of copper were also produced at the Almeda Mine, which as early as 1908 had a matte smelter that

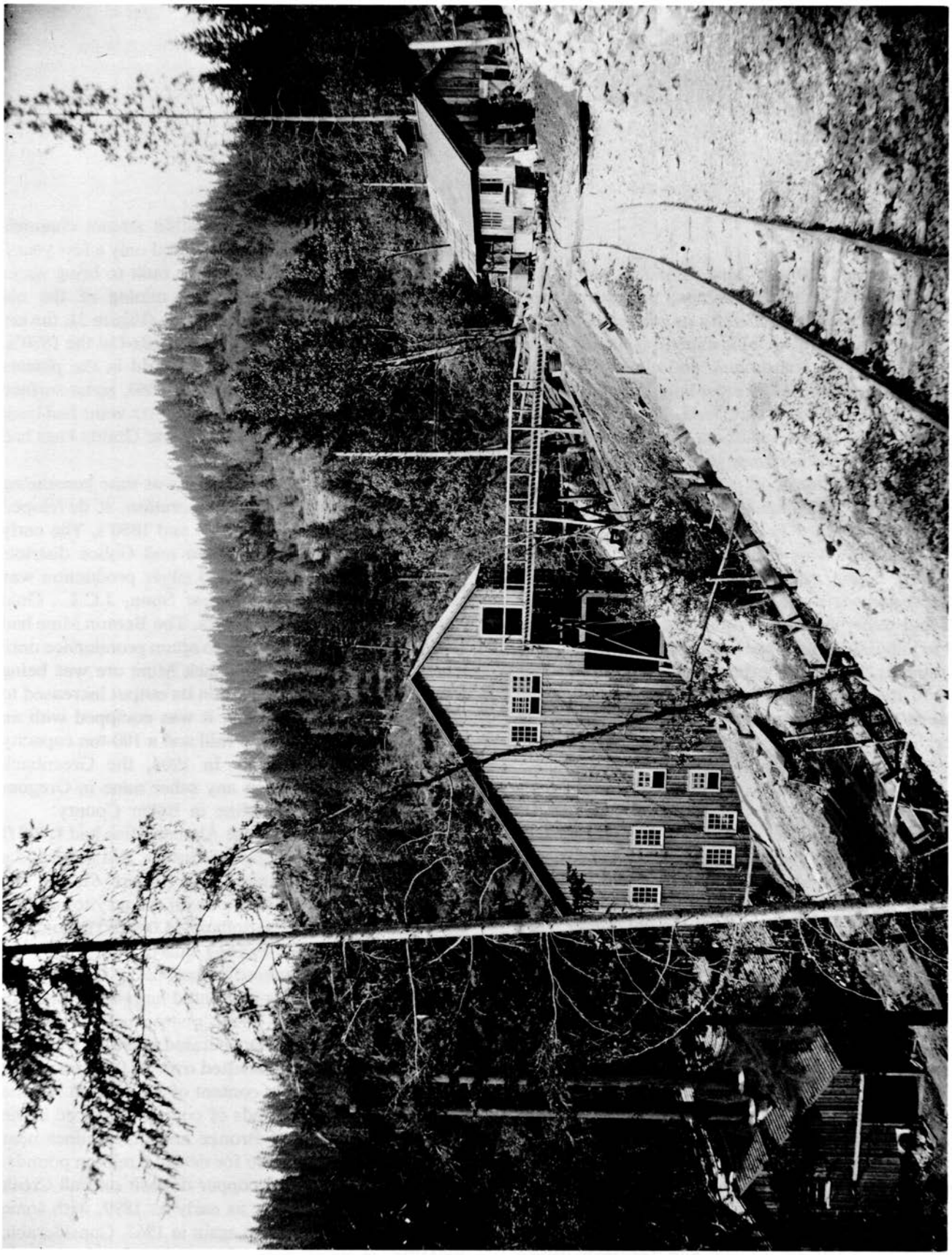


Figure 5. Greenback Mine, No. 115, and 40-stamp electric mill, 1905.

operated intermittently from 1911 to 1917 (Figure 7). The Almeda Mine ores also contained significant gold and silver values that were recovered and a gangue mineral barite that was never exploited.

Small- to moderate-size gold occurrences continued to be discovered and developed on a small scale from World War I until the early 1930's. Then the depression and its widespread unemployment, a substantial rise in the price of gold, and the development of the Benton Mine all combined to increase production to the highest levels since the early 1900's. A large dragline operation on Althouse Creek (Figure 8) and a still larger bucket-line dredge on Grave Creek (Figure 9) contributed to the increased production of gold. In 1938, about 13,000 oz were produced from a variety of placer operations and lode mines, of which the Benton Mine was the greatest. Gold and silver production remained strong until mid-1942, when World War II restrictions on labor and supplies closed down the gold mines. After World War II, the high cost of labor and mining supplies, along with a fixed price for gold, made mining uneconomic, and the important lode mines never reopened. Hydraulic placer mining provided insignificant production until about 1960. Between 1960 and 1979, the lack of incentive to explore for gold, environmental concerns and restrictions, plus the high financial risk and initial investment, discouraged any substantial gold and silver mining ventures, even though in 1969 the government began its deregulation policies for gold, and the price began to rise. From 1969 to 1979, only minor production (estimated at 100 oz per year) occurred, mainly from the operation of small portable dredges, individual sniping, and small-scale intermittently operated lode mines.

Chromium is another metal that has at times contributed significantly to Josephine County's economy. A total of 48,941 long tons of ore was sold between 1917 and 1958: first during World War I (1917-1918), during and following World War II (1941-1948), and finally between 1952 and 1958, when the U.S. Government was building a stockpile of strategic materials (Figure 10).

Nickel resources have been known to exist at Eight Dollar Mountain and other areas of the County since 1942, and several major mining companies have ex-

Figure 6. Granite Hill Mine headframe, No. 202, and 20-stamp mill.

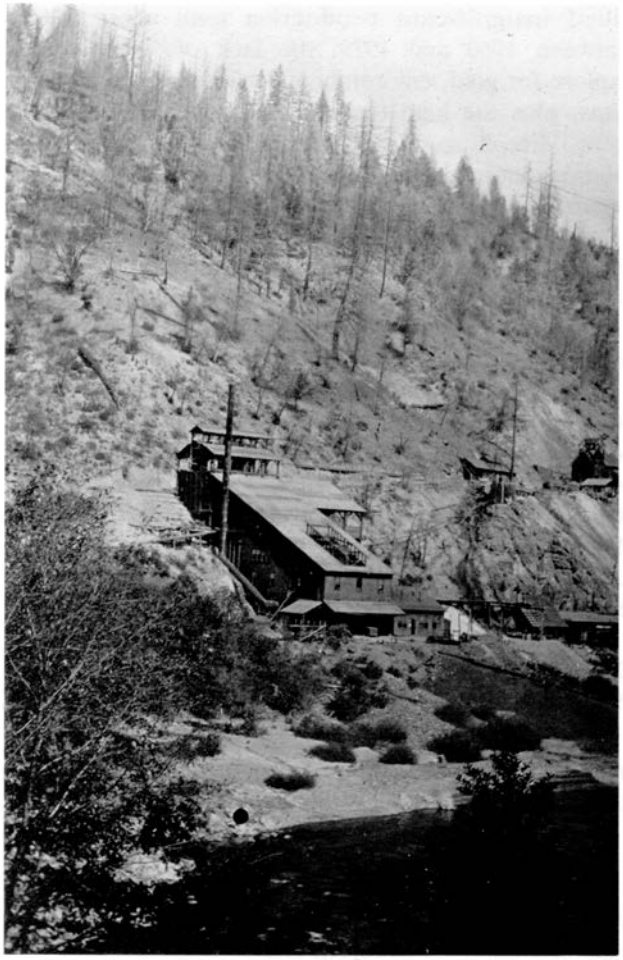


Figure 7. Almeda Mine, No. 78, and smelter, 1913.

plored and are continuing their exploration of the nickeliferous laterite deposits. In 1978, Ramp detailed nickel resources and their potential as part of an Oregon Department of Geology and Mineral Industries nickel study.

Most important of the nonmetallic mineral commodities is sand and gravel, but limestone (marble) has been mined in significant quantities from Marble Mountain near Wilderville. From the late 1920's until 1967, high-quality limestone has been produced for the paper industry and for the Ideal Cement Company plant. A small amount of marble has been quarried from the Jones Marble deposit near Williams, mainly for monuments.

Production statistics for gold, silver, copper, and chromite (Tables 2 and 3) show that the total production for Josephine County is at least $16 million, and it may be twice or even three times that amount. After the estimated $7½ million value for limestone is added, the minimum total is brought to about $25 million. Winchell (1914), Libbey (1963), and Brooks and Ramp (1968) all point out the lack of reliable reports for the early-day mining period from 1850 to about 1880. Shortly thereafter, the U.S. Geological Survey and the U.S. Bureau of Mines began their systematic annual surveys. Although the statistics are now more reliable, they are still believed to be incomplete and therefore contain serious understatements of the value of gold production. Even though the tabulations contain detailed statistics, many estimates are involved. The statistics do show interesting changing trends in mineral production due to economic or political developments of the time.

Figure 8. Sluicebox and wood-fired, steam-powered dragline at Leonard Placer Mine on lower Althouse Creek during the 1930's.

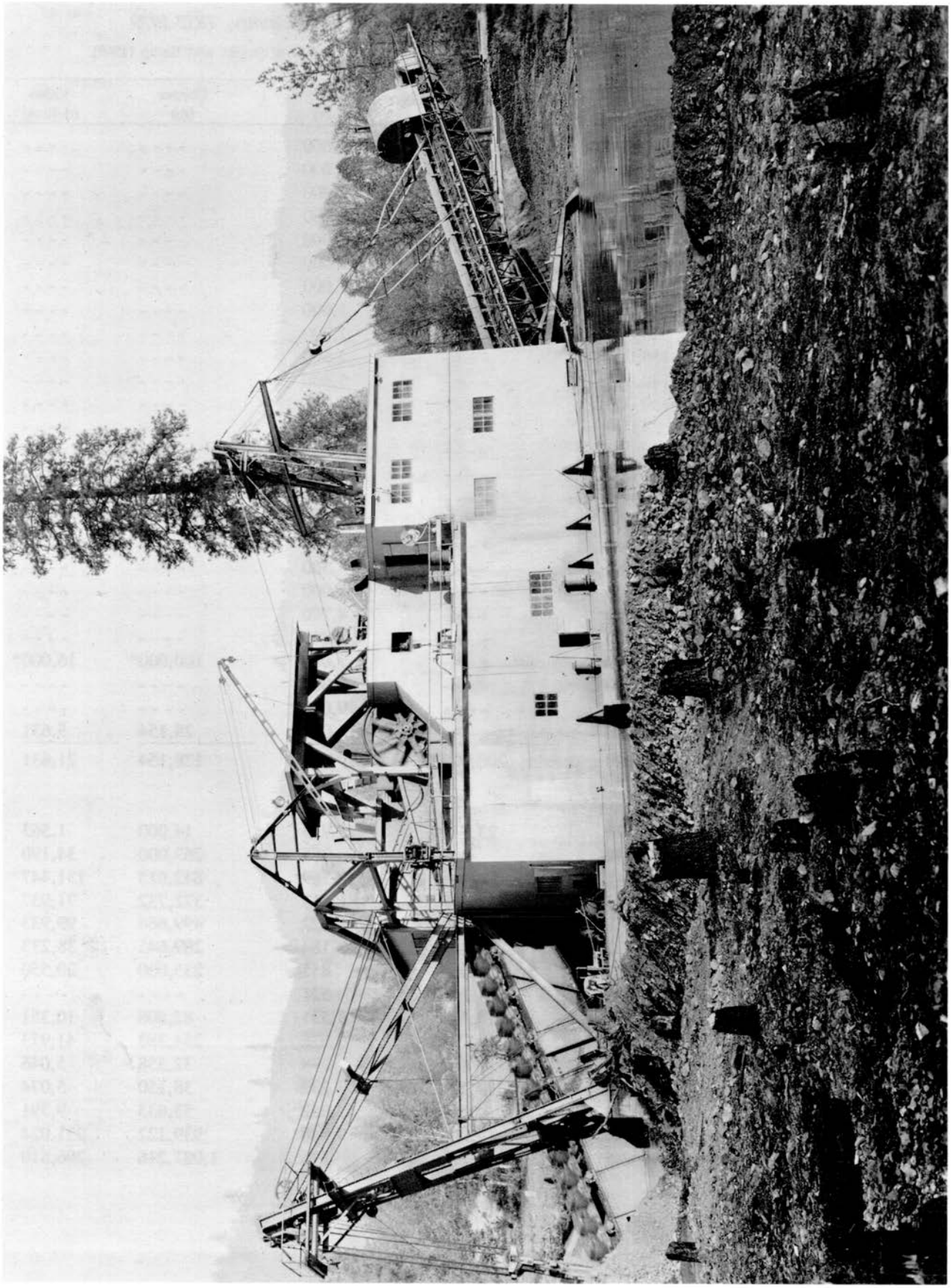


Figure 9. Bucket-line dredge of the Rogue River Gold Company, No. 112, near Leland, along Grave Creek, 1936.

Table 2. *Production of gold, silver, and copper in Josephine County, 1852-1979*

Statistics for years 1852-1902 modified from Winchell (1914); the rest modified from Brooks and Ramp (1968)

Years	Gold (oz)	Value (dollars)	Silver (oz)	Value (dollars)	Copper (lb)	Value (dollars)
1852-1863	50,000	1,000,000	- - - -	50,000	- - - -	- - - -
1864-1869	50,000	1,000,000	- - - -	50,000	- - - -	- - - -
1870-1879	40,000	800,000	- - - -	40,000	- - - -	- - - -
1880	9,750	195,000	- - - -	6,200	- - - -	- - - -
1881	9,750	195,000	- - - -	5,000	- - - -	- - - -
1882	8,750	175,000	- - - -	2,000	- - - -	- - - -
1883	5,500	110,000	- - - -	1,000	- - - -	- - - -
1884	5,500	110,000	- - - -	1,000	- - - -	- - - -
1885	3,500	70,000	- - - -	1,000	- - - -	- - - -
1886	7,500	150,000	- - - -	2,500	- - - -	- - - -
1887	7,000	140,000	- - - -	5,400	- - - -	- - - -
1888	6,500	130,000	- - - -	5,000	- - - -	- - - -
1889	1,900	38,000	- - - -	1,000	- - - -	- - - -
1890	4,250	85,000	- - - -	255	- - - -	- - - -
1891	2,350	47,000	- - - -	1,000	- - - -	- - - -
1892	3,600	72,000	- - - -	300	- - - -	- - - -
1893	5,650	113,000	- - - -	400	- - - -	- - - -
1894	6,150	123,000	- - - -	700	- - - -	- - - -
1895	14,100	282,000	- - - -	500	- - - -	- - - -
1896	10,000	200,000	- - - -	1,000	- - - -	- - - -
1897	6,100	132,000	- - - -	4,700	- - - -	- - - -
1898	7,350	147,000	- - - -	3,900	- - - -	- - - -
1899	11,800	236,000	- - - -	7,000	100,000*	16,000*
1900	12,500	250,000	- - - -	7,000	- - - -	- - - -
1901	15,000	300,000	- - - -	9,000	- - - -	- - - -
1902	17,500	350,000	- - - -	14,000	28,154	5,631
Subtotal	322,000	6,450,000	200,000*	219,855	128,154	21,631
1903	16,606	332,120	23,940	12,925	14,000	1,563
1904	15,658	323,650	664	385	263,000	34,190
1905	15,051	311,142	4,287	2,589	842,615	131,447
1906	13,460	278,243	2,855	1,913	372,732	71,937
1907	7,772	160,668	1,700	1,122	499,664	99,933
1908	7,388	132,722	6,007	3,184	289,645	38,233
1909	7,207	148,997	1,664	855	235,000	30,550
1910	7,259	150,048	965	521	- - - -	- - - -
1911	4,806	87,177	10,436	5,531	82,808	10,351
1912	3,679	76,061	10,774	6,626	254,380	41,973
1913	2,358	48,744	460	278	32,558	5,046
1914	5,390	111,428	13,078	7,232	38,150	5,074
1915	4,116	85,082	4,048	2,052	53,633	9,391
1916	4,570	94,481	14,966	9,848	939,122	231,024
1917	3,576	73,945	275	176	1,087,216	296,810

Table 2. *Production of gold, silver, and copper in Josephine County, 1852-1979* (continued)

Year	Gold (oz)	Value (dollars)	Silver (oz)	Value (dollars)	Copper (lb)	Value (dollars)
1918	3,535	73,074	581	581	795,697	196,537
1919	2,087	43,152	556	510	118,501	22,041
1920	2,110	43,608	220	239	- - - -	- - - -
1921	6,092	125,918	470	470	- - - -	- - - -
1922	1,739	35,936	488	488	435	59
1923	807	16,681	106	87	- - - -	- - - -
1924	1,094	22,629	152	102	- - - -	- - - -
1925	2,893	59,806	334	232	- - - -	- - - -
1926	2,748	56,795	253	158	12,118	1,697
1927	2,531	52,327	512	290	- - - -	- - - -
1928	1,644	33,968	465	272	148,250	21,348
1929	1,483	51,331	1,157	617	464,393	81,733
1930	2,610	53,953	471	182	149,274	19,406
1931	3,539	73,167	625	181	- - - -	- - - -
1932	4,189	86,586	602	170	- - - -	- - - -
1933	4,396	90,869	650	328	100	6
1934	5,242	183,209	1,529	988	932	75
1935	10,016	350,547	1,021	734	167	14
1936	9,672	338,520	1,220	945	- - - -	- - - -
1937	11,350	397,250	1,536	1,188	4,000	484
1938	13,042	456,470	1,774	1,147	- - - -	- - - -
1939	6,597	230,895	803	545	- - - -	- - - -
1940	11,069	387,315	1,441	1,025	26,000	2,938
1941	7,650	267,750	891	634	16,000	1,888
1942	3,380	118,240	526	374	16,000	1,936
1943	81	2,835	10	7	- - - -	- - - -
1944	198	6,930	24	17	- - - -	- - - -
1945	133	4,655	19	14	- - - -	- - - -
1946	522	18,270	74	60	- - - -	- - - -
1947	385	13,475	52	47	- - - -	- - - -
1948	325	11,375	51	46	- - - -	- - - -
1949	241	8,435	52	47	5,800	1,142
1950	676	23,360	191	173	- - - -	- - - -
1951	272	9,520	66	60	8,700	2,105
1952	167	5,845	17	15	- - - -	- - - -
1953	74	2,590	8	7	- - - -	- - - -
1954	43	1,505	-	-	- - - -	- - - -
1955	69	2,415	2	2	- - - -	- - - -
1956	114	3,990	21	19	9,200	3,910
1957	78	2,730	29	26	6,000	1,806
1958-1979* *	2,200	165,000	Included with gold		15,000	6,450
Total	567,989	12,797,434	315,118	288,119	6,929,244	1,394,728

*Estimated (Fall Creek Copper)
**Estimated

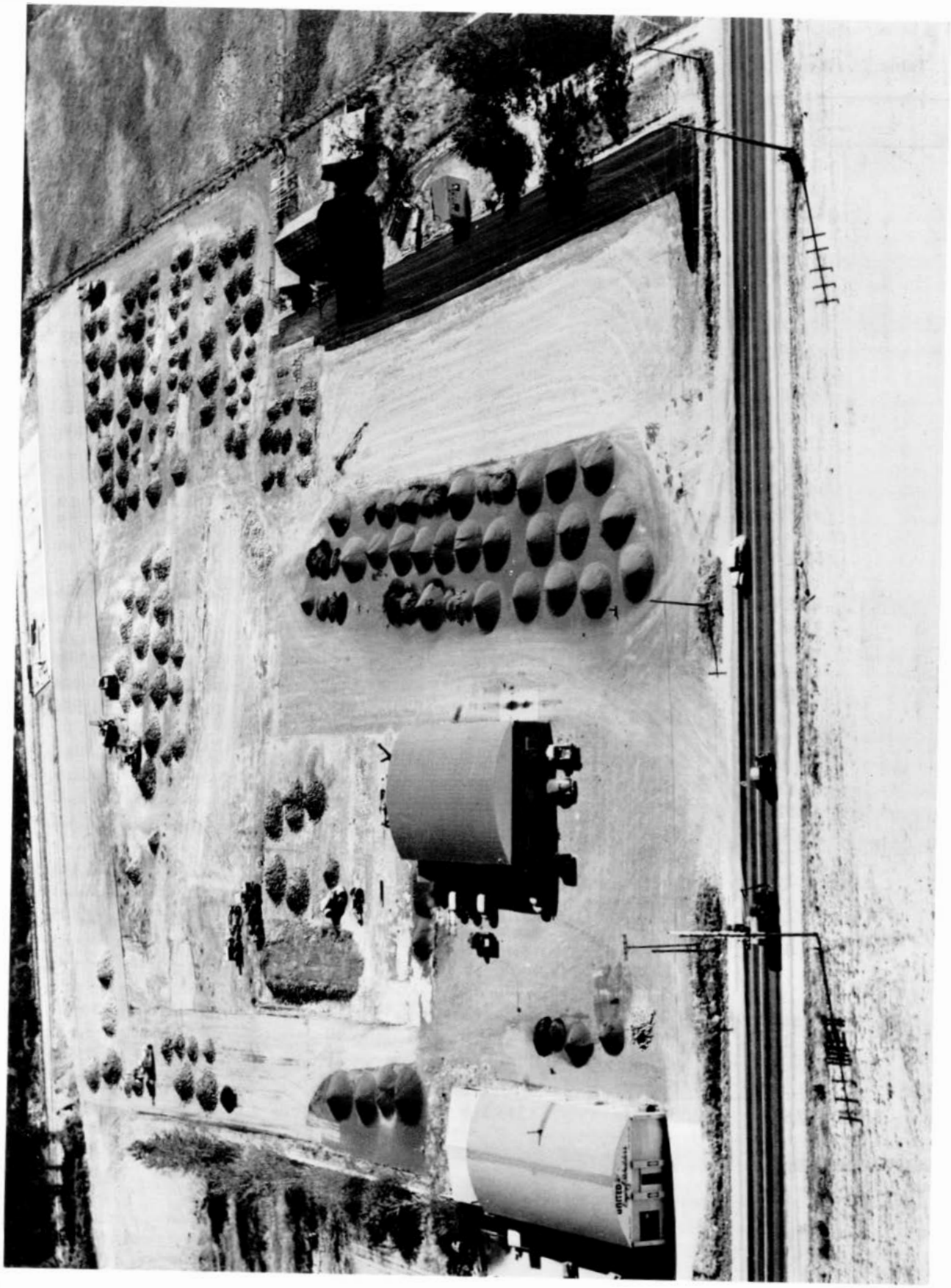


Figure 10. General Services Administration chrome ore-buying depot, Grants Pass, 1953. California and Oregon Coast Railroad ran in back of yard.

At a time when the nation's greatest problem is that of dwindling energy reserves, it would be desirable to report that Josephine County had some energy resources. However, none of the fossil fuels (coal, oil, or natural gas)havebeen produced in Josephine County, and it is unlikely that a fuel source of any significance will ever be found. No uranium occurrences are known, and no hot springs have been reported. Geothermal gradient wells near Grants Pass show a low value of heat flow at depth, indicating a low potential for geothermal energy for the area.

GOLD AND SILVER

These two common precious metals are being considered together because in nature they almost always occur together. Other than native gold, the most important gold minerals are the tellurides, composed of gold and/or silver plus tellurium. Gold also occurs in small amounts in sulfide minerals or is sometimes physically mixed with them. Pyrite, chalcopyrite, and arsenopyrite are often intimately mixed with gold in the lode mines of Josephine County. Silver produced in the County is mainly alloyed with gold; only at the Almeda Mine and related deposits of the Big Yank mineralized zone do silver values surpass gold in some of the ores.

There are many excellent discussions about gold and silver by such authors as Simons and Prinz (1973) or West (1975), who describe the physical properties, uses, geologic associations, and monetary implications of gold. For that reason, a similar discussion is not included in this report.

Lode deposits

Most of the lode gold deposits of Josephine County are in quartz-filled fissure veins with small quantities of sulfides and/or free gold. Deposits may occur as single, simple quartz veins; multiple narrow veins or stringers; mineralized shear zones devoid of quartz; or breccia zones of mixed quartz and rock fragments. White to light-gray quartz is the usual vein filling, although calcite is also common. Sulfides seldom make up over 5 percent of the vein material, and free gold may be absent or present in amounts up to several ounces per ton. The average range of gold appears to be from 0.1 to 0.4 oz per ton. Pyrite is the most frequent sulfide ore mineral; chalcopyrite, arsenopyrite, galena, or sphalerite occur less often and in smaller amounts. The presence of arsenopyrite quite often indicates higher gold values, while galena usually carries silver. Gold-silver tellurides have been reported in important quantities only at the Jewett Mine, No. 237, and at the Bunker Hill, No. 135.

Gold-bearing veins are reported to range in width from narrow "knife edge" stringers up to veins 10 ft wide; most, however, are about 1 ft wide. The veins have no regular pattern and strike in many directions. Diller (1914) found, however, that most of the persistent veins are east-west in orientation. The dips are mostly steep. Generally, the strike length of the veins is no more than a few hundred feet, and their vertical extensions are similarly limited. There are exceptions: at the Greenback Mine, No. 115, the Greenback vein, which averaged 18 in. in width, was mined for a horizontal distance of about 600 ft and to a depth downdip of more than a thousand feet.

Gold values are never uniform throughout the vein. Ore shoots of varying size and orientation usually contain the only minable ore. Factors that control the mineralization that forms ore shoots are not well understood, but the mineralization is believed to be influenced by such structures as vein intersections, abrupt changes in dip, or even changes in strike. The porosity or chemical makeup of the wall rock may also play an important role.

The relatively simple mineralogy allows lode gold to be recovered by the most basic metallurgical processes. Simple crushing, gravity concentration, amalgamation, and cyanide leaching have all been used with success. Mills for gold recovery in the County have ranged in size from small arrastres and ball mills to huge multiple-battery stamp mills. The Eureka Mine (Figure 11) operated a small 10-stamp mill, and the Greenback had a 40-stamp mill (Figure 5).

Massive sulfide deposits

Gold has also been recovered from massive sulfide (volcanogenic) deposits (see MINERAL RESOURCES—Copper). Where massive sulfides are exposed at the surface, oxidation and leaching processes remove many of the elements and leave gossan deposits where gold is concentrated. Gold values often reach several tenths of an ounce per ton, and the surface material can be processed economically. The Albright, No. 444; the Copper Queen, No. 113; and the Oak Mine, No. 162, are examples of mines where gold has been produced from this type of deposit.

Gold pockets

Pockets, small near-surface concentrations of free gold with few impurities, have been found in Josephine County. These deposits were sought after by a special kind of early miner called a "pocket hunter." The origin of these concentrations, which may contain from a few to several hundred thousand dollars worth of gold, is still not well understood. They

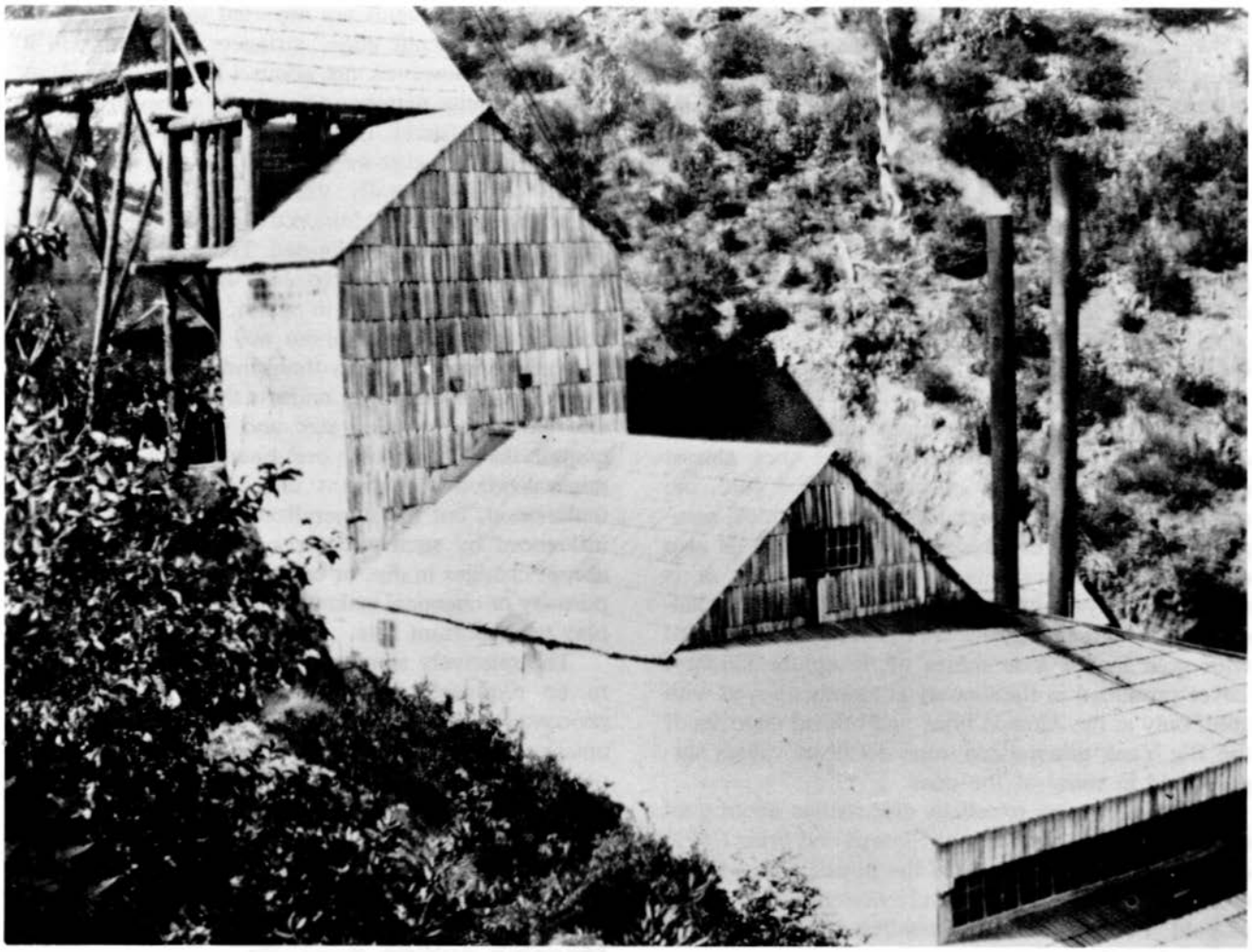


Figure 11. Eureka Mine mill, No. 244a, early 1900's. In 1901, a Huntington mill was in use, and later a 10-stamp mill was installed. (Photo courtesy Josephine County Historical Society)

are usually found near the contact of a slate, argillite, or other fine-grained carbonaceous rock. Manganese oxides and calcite are frequently present.

Brooks and Ramp (1968, p. 32) suggest that pocket deposits may result from supergene enrichment involving leaching by acid ground waters. Emmons (1933, p. 401) states, "Where gold is dissolved by acid waters containing chlorides in the presence of an oxidizing agent, such as manganese oxide, the outcrop may be impoverished and the gold carried downward so that the lower part of the oxidized zone is enriched." Many of the gold pocket deposits were coated by abundant black manganese oxides, but the importance of supergene enrichment is not known.

Some of the rich surface deposits result from the leaching away of soluble ore and gangue minerals such as pyrite and calcite, leaving nearly pure, porous, spongelike gold that may be coated with manganese and iron oxides (Figure 12).

Distribution

Most of the 470 individual mines and prospects shown on the Mineral Localities Map (Plate 2) are gold and silver occurrences. They are scattered throughout the County, but a comparison of their locations with the area geology shows some general relationships. Diller (1914), Winchell (1914), Shenon (1933b), Brooks and Ramp (1968), and Hotz (1971a) all point out the favorability of metavolcanic rocks (greenstone) for gold deposits. The general term "greenstone" has been used for fine- to medium-grained altered volcanic rocks such as those of the Triassic Applegate Group and the Jurassic Rogue Formation which, owing to the development of considerable chlorite and epidote, are characterized by a green color. The Briggs Creek amphibolite metamorphic rocks are host rocks for some lode gold deposits, and a few other deposits are reported from serpentinite or gabbro. Diller (1914)

noted that "a striking feature of many of the gold-bearing veins is that they are found in proximity to serpentine, ... usually, however, the veins are cut off sharply at the contact and the ore rarely extends into the serpentine." Intrusive dike rocks may also play a role in the location of some gold deposits; and porphyritic andesite, basalt, or diorite dikes often occur in underground workings and are associated with the gold-bearing veins.

No lode gold occurs within either the large Grants Pass or Grayback quartz diorite plutons, even though some deposits situated near their boundaries may be related to them. There are no important lode deposits in the sedimentary (shale-sandstone) parts of the Galice Formation that underlie large areas both northwest and southwest of Grants Pass or in the Josephine peridotite sheet in the southwest corner of the County.

The potential for more gold production in Josephine County is in the areas where the early-day mining was done. Beginning in the northeast part of the County (the area east of Interstate 5 and north of Grants Pass), the most important of a number of lode mines is the Greenback, No. 115, which produced about 175,000 oz in gold from a persistent 2- to 3-ft-wide quartz vein in greenstone. The Daisy (Hammersley) Mine, No. 123, about 3½ mi to the southeast, is reported to have yielded 12,500 oz in greenstone. At least a dozen other smaller mines situated in the upper drainages of Wolf and Coyote Creek, including the Martha, No. 62; Silent Friend, No. 49; Dorothea, No. 55; and Spotted Fawn, No. 50, produced from a few hundred to a few thousand ounces of gold.

The geology of this part of the County is very complex. A very contorted and broken northeast-trending zone of thrust faulting divides the Jurassic rocks on the west from the Triassic Applegate rocks to the east. Narrow belts of serpentinite and gabbro intrude this zone and contribute to the complexity. The Triassic Applegate Group greenstone-gabbro rocks to the south on the east flanks of Sexton and Walker Mountains are also hosts for quartz-vein and shear-zone deposits. The Baby, No. 160; Gopher, No. 159; and Orofino, No. 164, are examples. The Oak Mine, No. 162, an interesting massive sulfide deposit

Figure 12. Typical specimen of pocket gold. Calcite gangue mineral has been weathered out, and oxide coating has been removed by oxalic acid. Specimen is about 1½ in. long.

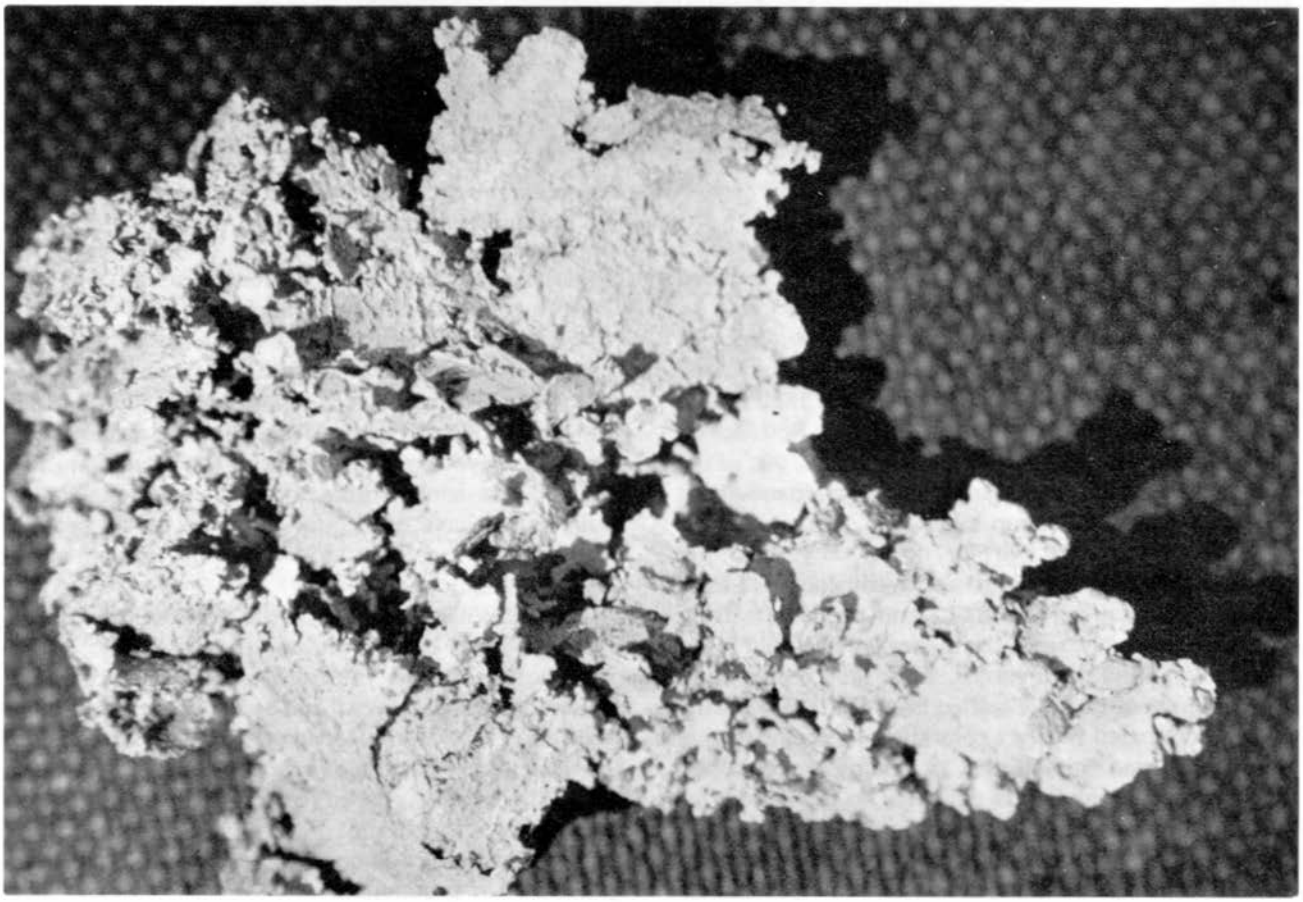


Figure 13. Briggs Pocket Mine, No. 462, in 1904. This shallow cut produced about 2,000 oz of gold before it was abandoned. (Photo by A. E. Voorhies, courtesy Josephine County Historical Society)

containing copper and zinc in metabasalt, produced some gold from oxidized ore near the surface.

Another small cluster of mines just northeast of Grants Pass, mainly at the contact between greenstone and small quartz diorite bodies, includes the Granite Hill, No. 202; Centennial Group, No. 203; Red Jacket, No. 201; and Ida, No. 204. The Granite Hill, one of the few important lodes in granitic rock, produced about 3,750 oz with a 20-stamp mill.

This northeastern part of the County, formerly known as the Greenback district, is considered to have a good potential for gold and silver production from shallow, relatively small- to moderate-size gold lodes like those found there earlier. Favorable geology and the presence of massive sulfide layers at the Oak Mine have encouraged recent exploration by metal mining companies, and this interest in finding an economic deposit of base metals is expected to continue.

The area southeast of Grants Pass along the eastern edge of the County is also underlain by mixed metavolcanic (greenstone) and sedimentary rocks of Triassic age. Scattered occurrences south of Grants Pass in greenstone include the Jewett Mine, No. 237, one of the earliest discoveries, which had considerable production from a near-surface ore shoot. At the Iron Hat, No. 294a, massive zones of pyrite and quartz in the greenstone of Pickett Mountain ridge near Murphy may also have some significance. The Mountain Lion, No. 300, is another gold lode in greenstone that is believed to have had considerable early-day production from several thousand feet of underground workings.

In the Williams area near the northwest border of the Grayback diorite pluton, the Applegate Group metavolcanic and metasedimentary rocks are mineralized, and several mines of moderate size are present. The Oregon Bonanza, No. 320; Humdinger, No. 319; Snow Bird, No. 318; and Dark Canyon, No. 348, are closely spaced quartz-vein deposits associated with andesite dikes in greenstone. These mines all contain some reserves, and the area has potential for production.

The Grayback pluton of dioritic rocks covers much of the southeast part of the County. There are only occasional occurrences in the area south of the pluton, even though the Applegate Group rocks there are of favorable composition. The Mountain View, No. 437, in greenstone, and the Arnold Mine, No. 466, in metasedimentary rock, are isolated, small, high-grade vein-type deposits that have produced a few hundred ounces each. Southwest of the Grayback pluton and the Oregon Caves to the California state line, and mainly in the drainages of Sucker and Althouse Creeks, there are many small prospects and mines. Among those that had high-grade ore shoots and some production are the Rainbow, No. 405; Frog Pond, No. 452; and the Pony Shoe Group, No. 453.

In 1904, the most famous pocket, the Briggs, No. 462, produced over 2,000 oz from a small surface pit (Figure 13). During the early 1900's, the Boswell, No. 383, had a total reported production of up to 15,000 oz from shallow workings in oxidized surface materials. The Boswell Mine is still being explored, and the area as a whole probably contains other, small, high-grade vein-gold deposits.

The Waldo-Takilma district, known mainly for its copper mines and gold placer deposits, has a complex geologic setting like that of the Greenback area. The Triassic rocks include narrow belts of greenstone, serpentinite, gabbro, and metasedimentary rocks in a zone of thrust faulting near the contact of the younger Jurassic Galice Formation to the west. The only significant lode gold production from the Waldo-Takilma area has been from the massive sulfide copper ores of the Queen of Bronze and other nearby copper mines. At the Albright, No. 444, a massive sulfide deposit in Jurassic metavolcanic rocks, surface gossan deposits were worked for their gold content in the early 1900's.

In the far southwest corner of the County, the large area underlain by peridotite and serpentinite of the Josephine peridotite sheet contains no gold lode deposits. To the north, however, a mineralized greenstone belt occurring at the head of Canyon Creek, Fiddler, Days, and Mikes Gulches, and extending northward to Hoover Gulch and the Illinois River contains the surface deposits and narrow gold-quartz veins of Pocket Knoll. The Eureka Mine, No. 244a, is reported to have had considerable output from gold-bearing ribboned veins and quartz lenses at the contact of greenstone and serpentinite (Figure 14).

The northwestern part of the County from Galice Creek to Mount Reuben contains as many as 60 gold and silver mines or prospects that have produced at least a few hundred ounces of gold. The most important mines and prospects and their approximate productions are the Benton, No. 11 (18,500 oz); Gold Bug, No. 12 (37,500 oz); J.C.L., No. 23 (5,000 oz); Bunker Hill, No. 135 (7,000 oz). The Almeda, No. 78, produced at least 1,000 oz of byproduct gold from copper ores. The mines and prospects occur in a variety of geologic environments but are mainly in a 5-mi wide, 20-mi long, northeast-trending belt composed primarily of metavolcanic rocks of the Rogue Formation but also containing a fault-bounded block of highly metamorphosed Briggs Creek amphibolite. The western part of the belt adjacent to a major thrust fault has been complexly intruded by bodies of diorite, gabbro, and serpentinite.

The mines of the Mount Reuben area, with the exception of the Benton, are in small, rich ore shoots in narrow, discontinuous quartz veins and shear zones in greenstone. The Benton, however, has more extensive and persistent ore shoots occurring in a small body of quartz diorite which intrudes greenstone and gabbro. Free gold and pyrite are the ore minerals in quartz veins and sheared altered diorite. Molybdenite and chalcopyrite are also reported. Several thousand tons of ore were blocked out before the mine and mill were closed by government order in 1942.

The mines and prospects in the Briggs Creek amphibolite are generally small, with narrow, discontinuous quartz veins along fractures. Some free gold, pyrite, and chalcopyrite are the main sulfides in the ore. The Bunker Hill, No. 135, near the west edge of the belt, is somewhat isolated and occurs near the major thrust-fault contact with the Dothan Formation. There are several, narrow, quartz-filled veins in a narrow zone of Rogue Formation greenstone surrounded by quartz diorite. Free gold and petzite, a gold-silver telluride, were recovered in enriched zones of the narrow veins. About 7,000 oz of gold have been recovered.

Two other prospects along Howard Creek, the Red Elephant, No. 85, and Blue Bell, No. 86, are near the same thrust-fault contact and contain broad zones of altered greenstone with some gold and molybdenite. This zone adjacent to the fault zone has probably not been well prospected and may likely contain mineral deposits. The high concentrations of lode mines and prospects in the Galice-Mount Reuben area and the favorable geology for both quartz-vein deposits and massive sulfides (volcanogenic deposits) give it a high potential for future discoveries and additional production from reserves such as those at the Benton Mine.

Placer deposits

Two properties of gold, its high specific gravity and its ability to resist chemical decomposition, cause it to be concentrated along with other heavy minerals in placer deposits. The principal concentrations occur

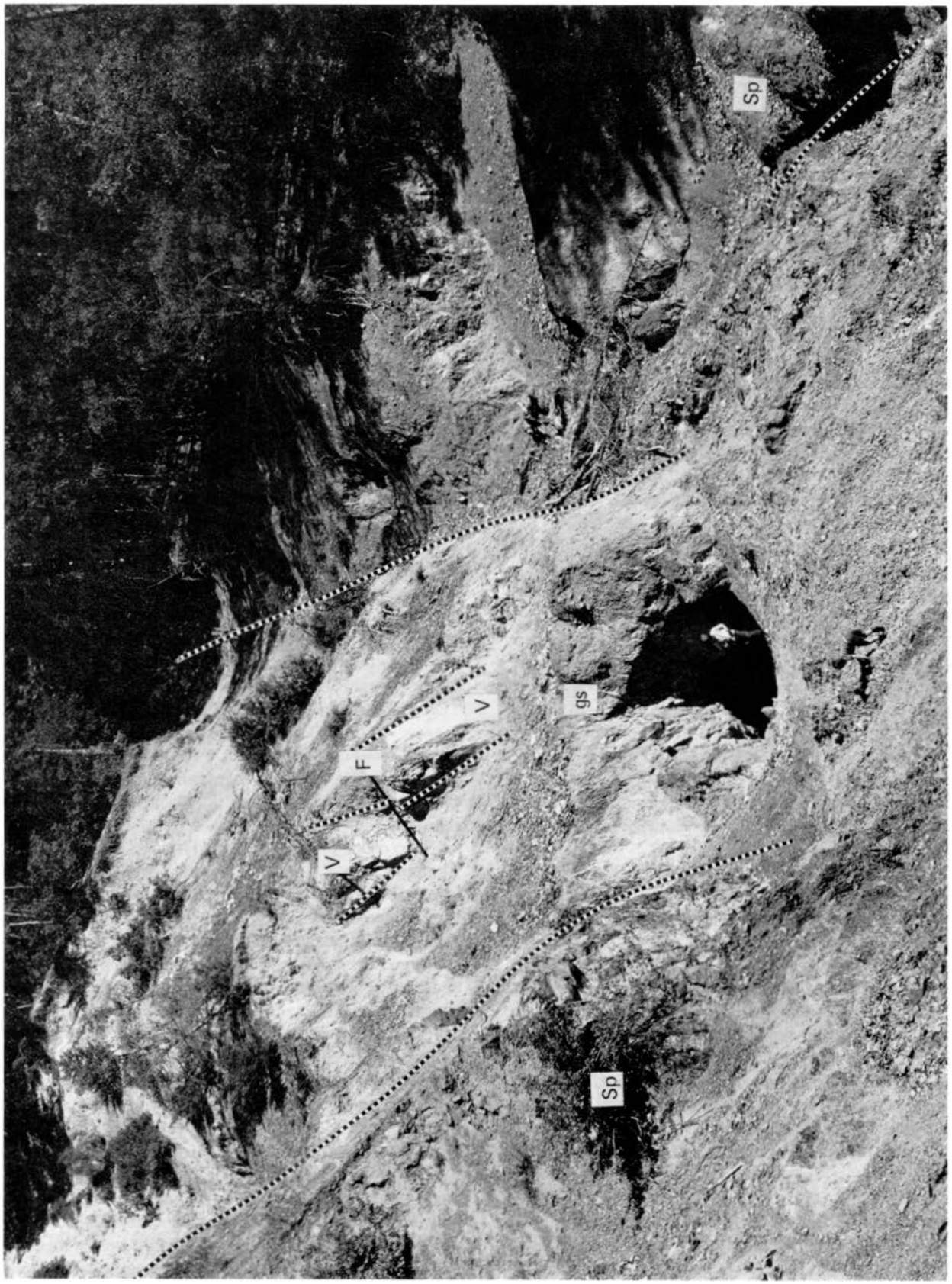


Figure 14. Eureka Mine, No. 244a, in 1972. (Sp)= serpentine; (F) = fault; (V) = vein; (gs) = greenstone. (Photo courtesy Terry Close, U.S. Bureau of Mines)

in the beds of streams and gulches downstream from lode deposits. Bed rock containing gold sometimes disintegrates more or less in place, forming residual placers on flat areas or gentle slopes. More often, however, running water carries the loosened material and much of the gold away from its place of origin. The heavier, coarser gold works its way to the bottom of the moving debris and eventually reaches bed rock. Coarser gold tends to work its way to bed rock more rapidly than the finer gold and is often found mixed with sand and gravel in crevices of the bed rock.

Paystreaks, concentrations of gold in auriferous gravel deposits, are seldom uniform or regular, so usually only part of a deposit is rich enough to work profitably. Gold may be transported long distances. As a rule, however, the greater the distance from the source, the finer, more scattered, more rounded, and more flattened the particles become. The size of the gold particles varies greatly from dust, several thousand particles of which are worth one cent, to nuggets of relatively large size. The largest nugget reported from Josephine County came from Althouse Creek and weighed 17 lb. Most nuggets, however, range from the size of a mustard seed to that of a wheat grain (Brooks and Ramp, 1968).

Placer deposits accumulated at many places in Josephine County. It is estimated that at least 75 percent of the total gold production of the County was recovered from a variety of placer deposits. Shovel, pan, and sluice box were used in early hand mining. Later, most placers were worked hydraulically by bringing large volumes of water for long distances via ditch and flume. Bucket-line dredges, draglines, and a variety of mechanical washing plants have also been used at times in the County's placer mines.

In the topography of southwestern Oregon, Diller (1914) recognized evidence of three cycles of erosion that left ancient stream channel deposits at different elevations. The oldest (first cycle) and least extensive stream gravel deposits occur at an elevation of 4,000 ft and are believed to be of late Tertiary age. The only deposit of this cycle in Josephine County is near York Butte. The gold content of this deposit is not known, but the coarse gold found on upper Red Dog Creek may have come from weathering and erosion of these first cycle gravels.

The deposits of the second cycle of erosion (of Pleistocene age) are more abundant and appear to have been left by an ancestral Illinois River that flowed northeastward from the vicinity of Sixmile Creek through Briggs Valley and joined the Rogue River near Galice. These stream-deposited gravels occur at a general elevation of 2,700 ft. Remnants of the gravels of this old channel occur on the ridges between the drainages of Briggs, Taylor, and Galice Creeks and are as much as 150 ft thick; they were the sources for major quantities of gold for the rich placers of Galice Creek; Rocky and Rich Gulches; and Swede, Onion, and Briggs Creeks. Old channel gravels also occupy high terraces along lower Grave Creek and the Rogue River. Wells and Walker (1953) divided the deposits into the old channel, about 500 ft above streams; high bench gravels, 100 to 400 ft above streams; and bench gravels, as much as 40 ft above streams. Diller's (1914) auriferous gravels of the third and continuing cycle of erosion included all of the bench, bar, and channel gravel deposits related to the present streams.

Because of the large number of individual mines and the lack of historical information about them, only a general review of the important placer deposits can be included in this report. Diller and Kay (1909), Diller (1914), Winchell (1914), Parks and Swartley (1916), Shenon (1933a), Oregon Department of Geology and Mineral Industries (1952), and Brooks and Ramp (1968) review and describe the placer mines of Josephine County in some detail.

In the northeast part of the County, including the Greenback district, most of the streams including Grave Creek and its main tributaries, Wolf and Coyote Creeks, have had important production from stream channel, bar, and bench deposits. One of the largest placer mines in the State, the Columbia, No. 116, was located on Tom East Creek, where over 2 mi of the channel below the Greenback Mine produced at least 25,000 oz of gold from about 1900 to 1941. Lower Grave Creek has had many productive placers, mainly from bench gravel deposits. One of the largest dredging operations was located near Leland from 1935 to 1939. A large bucket-line dredge (Figure 9) was used by the Rogue River Gold Company, which regularly employed 40 men, to process gravels from 2 mi of an old Grave Creek channel, the County's largest producer during the late 1930's. Dredging ceased in 1939, when upstream gravels became so thick that the bed rock could not be cleaned. Hydraulic placer mining continued on a small scale as late as 1960 on Grave, Coyote, and Louse Creeks. The small communities of Golden on Coyote Creek and Placer on Grave Creek are present-day reminders of the mining camps that once served the old mines in the Greenback district.

Near Grants Pass, a minor gold placer was worked on Bloody Run Gulch, a small tributary of the Rogue River. Farther south, along the eastern border of the County from Murphy to Williams, many of the Applegate tributaries show evidence of early mining. Miller and Rocky Creeks, Whisky and Bamboo Gulches, and other tributaries of Williams Creek were worked extensively. The placer mines of Oscar Creek, Nos. 296, 297, and 298, were known for large nuggets.

Figure 15. Logan Placer Mine, No. 396, later called the Llano de Oro or Esterly Mine, near Waldo, in the late 1800's. (Photo courtesy Josephine County Historical Society)

The Watts, No. 352, operated for many years on thick hillside accumulations below the Humdinger, Rising Star, and other lode mines of the Williams area. The Watts placer had an estimated production of over 10,000 oz.

In the southern part of the County, the placers of the Waldo-Takilma area and Althouse and Sucker Creeks are the best known and most important in the County's early history. First discovered were the rich deposits of Sailor, Allen, Fry, and Scotch Gulches, as well as the channels of Althouse and Sucker Creeks. These were intensively mined and lasted only a few years. The Althouse placers were reported to be exceptionally and uniformly rich and were famous for the large nuggets recovered. The largest reported nugget, weighing 204 oz (17 lb) and valued at $3,500, was found on the East Fork of upper Althouse Creek by Mattie Collins. Spreen (1939) reports that a single piece from near Waldo weighed over 15 lb and was valued at $3,100. An $800 nugget came from near Browntown. At July 1979 gold prices, the gold value of these nuggets would be $58,000, $51,000, and $14,000, respectively, and they would probably be worth twice that much as museum specimens.

Development of a ditch system in about 1860 and consolidation of numerous closely-spaced claims led to the development of three large placer mines: the High Gravel, No. 416 (Figure 3); the Deep Gravel, No. 393; and the Esterly (Llano de Oro), No. 396 (Figures 15 and 16). These three properties contained several thousand acres underlain by gold- and platinum-bearing gravels. All were operated seasonally from 1870 to 1940 as hydraulic mines. Their combined estimated production was about 55,000 oz. Because the ratio of platinum to gold was 1:75, a small amount of platinum was also recovered. Shenon (1933a) believed it came from the complete disintegration of serpentinite and other ultramafic boulders of the thick gravel deposits. Bed rock at the Deep Gravel and Esterly Mines was well below the elevation of the Illinois River, so huge hydraulic elevators were used to hoist the gravel and water to the sluices (Figure 16).

Spreen (1939) reports that the earliest discovery of gold was made on the Illinois River near the mouth of Josephine Creek by a party of prospectors traveling to the California gold mines in 1850. The Illinois River received its name because five members of the party had originally come from that state. The area, including Josephine and Canyon Creeks and their tributaries, mainly Days and Fiddler Gulches, was intensively mined from 1852 through the early 1900's and had important production. There were numerous moderate-size hydraulic mines on Josephine Creek, where the bed rock is entirely serpentinite, and where two prominent benches or terraces of partially cemented gravels occur. The higher and more extensive terrace

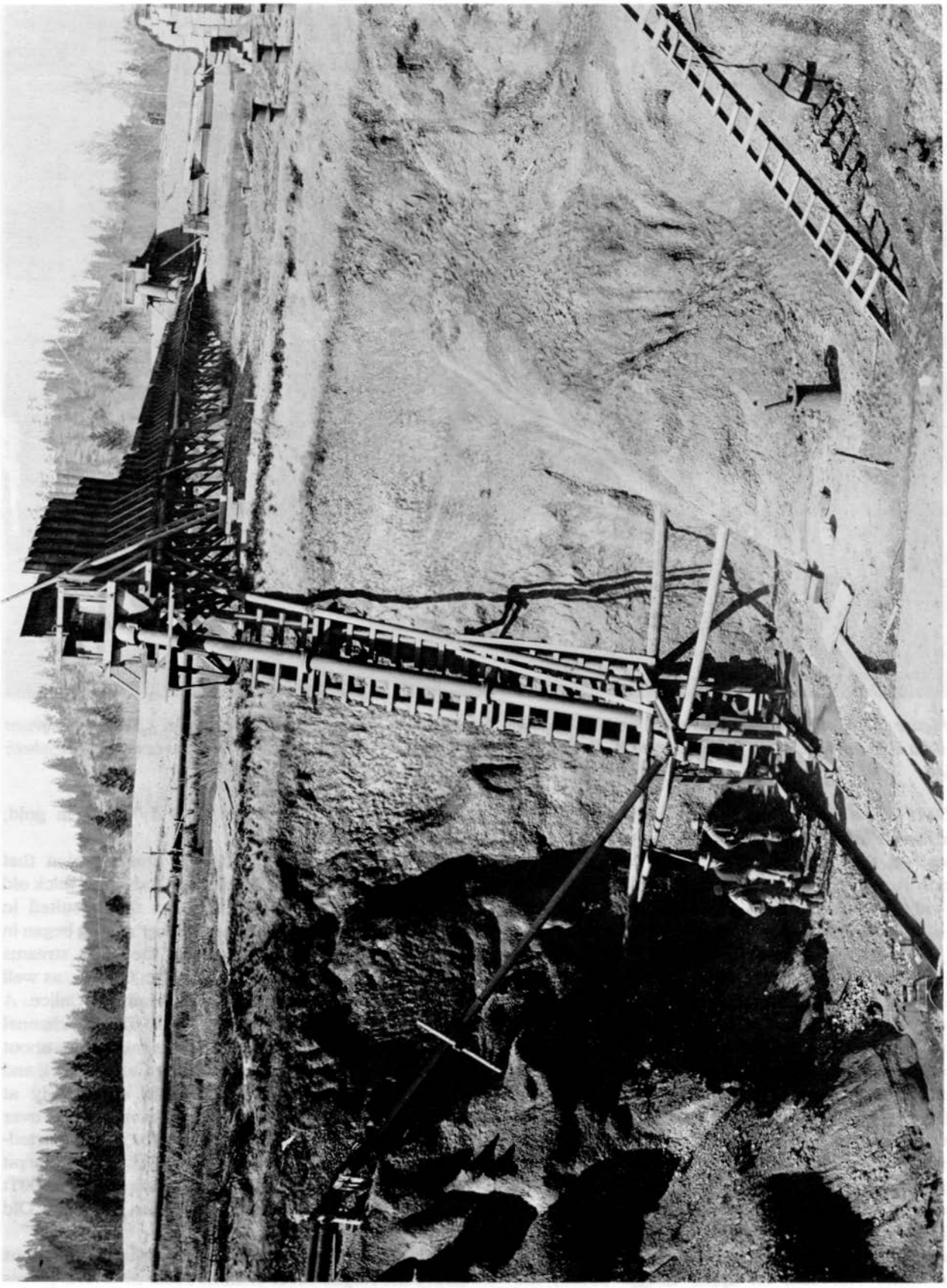


Figure 16. Hydraulic elevator, Logan (Esterly) Placer Mine, No. 396, circa 1920's.

Figure 17. California and Oregon Coast Railroad terminus at Waters Creek 1916 Rally. Copper ore from Takilma is being loaded on freight cars. Chromite was shipped from here starting in 1917. (Photo courtesy Elizabeth Hiller)

is 150 ft above the present stream channel and is well cemented. Early miners did considerable drifting (tunneling) on the bed rock. The lower, less extensive terrace is about 30 ft above the stream and has been worked out (Diller, 1914, p. 12). Platinum and the rare nickel-iron mineral josephinite were also contained in the placer gravels of Josephine Creek. The Anderson Mine, No. 310, was operated by hydraulic methods during the late 1880's and early 1900's and had a considerable production of gold and platinum from a broad gravel bench on both sides of the Illinois River below the mouth of Josephine Creek and above the mouth of Deer Creek.

Diller (1914) considered the present-day course of upper Briggs Creek to mark the approximate course of an old stream channel that had flowed northeastward to the Galice area. A number of small placers with important production probably derived their placer gold from these old channel gravels. Placers near the mouth of Soldier, Red Dog, and Onion Creeks, and the Bair Mine, No. 182, on upper Briggs Creek, are reported to have produced over 5,000 oz in gold, mainly in the late 1800's.

In the Galice-Mount Reuben area, erosion that liberated the gold from many small lodes and thick old channel gravels produced deposits that resulted in many noteworthy placer mines. Placer mining began in 1854, mainly in the channels of the main streams including Galice, Taylor, and Reuben Creeks, as well as along the Rogue River in the vicinity of Galice. A 4-mi-long band of thick (up to 150 ft) old channel gravels, one-fourth to one-half of a mile wide, about 600 ft above and roughly paralleling Galice Creek and the Rogue River, has been mined extensively at several places and is reported to have yielded over 50,000 oz. The Old Channel Mine, No. 99, is reportedly the largest placer mine in southwest Oregon. The pit is about one-third of a mile in diameter and over 100 ft deep in places. Estimated production from the Old Channel Mine is about 50,000 oz.

Terrace and bench gravels at various elevations above the Rogue River channel occur at several places

along the river, mainly above Galice. The Flanagan, No. 200, near Robertson Bridge; the Big Four, No. 153; and Stratton Creek, No. 149, were all worked extensively and had moderate production. Along the Rogue River below Galice, the Rocky Gulch, No. 100a; Dean and Dean, No. 95; Rand, No. 84; Tyee Bar, No. 3; Norton, No. 2; and Horseshoe Bar, No. 1, all had early-day production but are now within the Rogue Wild and Scenic River Corridor.

With the recently increased price of gold, some areas with thick deposits of gravel and known gold values may become economic to mine. The large areas of gravel remaining at the High Gravel, Deep Gravel, and Esterly placer mines in the Waldo-Takilma area perhaps should be evaluated.

Another area of over 100 acres along Grave Creek below the mouth of Tom East Creek near Placer has been proposed for sampling and appears to have potential for a large-scale operation.

Patches of gravel along many of the streams were missed or bypassed by the early miners. Restrictions imposed by environmental concerns and rights to water make it extremely difficult to predict any large-scale placer operations, and any such proposed operation would necessarily involve thorough reclamation procedures.

COPPER

Copper has been the second most important metal in terms of production in the County. The bulk of it was produced before 1920 from the mines of the Waldo-Takilma area. Unlike gold, which has had a history of controlled prices, copper values have varied with the economy. Only when the price has been high has it been economically feasible to exploit copper ore from the Josephine County deposits.

All of the Josephine County copper deposits appear to be massive sulfide deposits in volcanic rocks. These deposits are generally lens shaped and concordant with the beds of the surrounding rocks. The ore is composed mainly of sulfide minerals with small proportions of silicate gangue. Pyrite and pyrrhotite are the main sulfides, with varying amounts of chalcopyrite, sphalerite, and galena. Small amounts of precious metals are also commonly present. New theories of the origin of massive sulfide deposits have been developed since the late 1960's and are continuously being refined. The source of metals for these deposits may be the same magma that gave rise to the surrounding volcanic rocks. Different sulfide minerals are associated with different lava types. The assemblage of pyrite, pyrrhotite, and chalcopyrite appears to be associated with basaltic volcanic rock; chalcopyrite, sphalerite, and galena deposits are found with more silicic volcanic rock.

Both types and some intermediate varieties are present in Josephine County. All of those in the Waldo-Takilma area, which includes the largest producing mines, occur in greenstones derived from basaltic volcanic rocks. At the Queen of Bronze Mine, No. 421, small to large pods and lenses of massive pyrite, pyrrhotite, and chalcopyrite produced over 20,000 tons of ore that averaged 8½ percent copper. Most of this ore was processed at the nearby smelter; but some was shipped via horse-drawn freight wagons to the California and Oregon Coast Railroad terminal at Waters Creek, about 15 mi southwest of Grants Pass (Figure 17).

The extremely contorted and sheared nature of the greenstone at or near the Queen of Bronze Mine has obscured rock relationships, but it appears that the greenstone was once pillow lava and that the sulfides were deposited between pillows or the pillowed lava flows. The other Waldo-Takilma area mines appear to have a similar origin except for the Cowboy, No. 446, where 5,000 tons of massive sulfide ore were produced from serpentinite near its contact with greenstone. Some cobaltite and sphalerite occur with the abundant pyrrhotite and chalcopyrite. The ore mined at the Cowboy occurred in a fault zone in slickensided lens-shaped masses that were apparently tectonically emplaced.

At the Almeda Mine, No. 78, massive sulfide deposits include some galena and sphalerite. Thick layers of barite are present in some parts of the orebody, and precious metals are associated with both siliceous ore and barite. The mineralization occurs at the contact between the Rogue and Galice Formations and now appears to be a stratiform deposit in layered pyroclastic rocks ranging from andesite to dacite in composition. The mineralized zone at the Almeda Mine is as much as several hundred feet wide and can be traced both south and north for a considerable distance. This zone has been called locally the Big Yank Lode. A segment of this zone north of Grave Creek is shown on the map of T. 33 S., R. 7 W. (Plate 3).

Smaller massive sulfide deposits discovered in the early days have had some production, mainly of precious metals, from their weathered surface outcrops. The Oak Mine, No. 162, contains massive chalcopyrite and sphalerite ore and continues to be an interesting deposit. The Copper Queen, No. 113, and the Fall Creek, No. 279, are other massive sulfide deposits that have had some production and may merit further exploration. At the Albright, No. 444, two or more thick lenses of massive sulfides overlain by thick gossan deposits have produced some gold and continue to be explored for their possible copper content.

The sulfides are enclosed in fine-grained greenstone of Jurassic age.

Another cluster of small deposits of sulfides in greenstone near serpentinite contacts extends from the Ramsey Mine, No. 232, on upper Slate Creek, to Onion Mountain at the Onion Falls, No. 186. This area includes other small prospects, including the Copper Bell Mine, No. 150a, on Panther Gulch.

Massive to disseminated sulfides, mainly pyrite, also occur at the Red Elephant, No. 85, and the Blue Bell, No. 86, in siliceous greenstone of the Rogue Formation. The position of these prospects near the thrust-fault contact of the Rogue and Dothan Formation and the presence of molybdenum at the Blue Bell makes these prospects interesting.

The Brass Ledge Mine, No. 89, has produced several carloads of chalcopyrite in quartz ore from a vein-type deposit near Mount Peavine. This deposit occurs in the Briggs Creek amphibolite; its origin and associations are not clear, but it may have originally been a volcanogenic deposit that has, through metamorphism, formed a quartz-vein deposit. The Cold Springs Copper, No. 143, about 3 mi to the south, is very similar to the Brass Ledge. Further prospecting of this area of Briggs Creek amphibolite may be justified.

Other occurrences of massive sulfides of possible interest in the County are Upper Pine Creek, No. 207a, with pyrite zones and quartz veins in layered amphibolite, and the Iron Hat, No. 294a, which contains a 200-ft-wide zone of massive pyrite enclosed in Applegate Group greenstone.

CHROMIUM

History

Chromium, a strategic metal, has been produced from Josephine County mines at times of national emergencies or government stockpiling, when incentive prices were paid. Production occurred in 1917 and 1918; from 1943 through 1948, during and after World War II; and during a special government stockpiling program from 1955 to 1958 (Figure 18).

Available production statistics are either for the entire State of Oregon or for southwestern Oregon, so it is difficult to determine the exact tonnages produced by Josephine County mines.

Ramp (1961) published a detailed study of chromite occurrences of southwestern Oregon, specifying two main Josephine County areas, Chrome Ridge and the central Illinois River, as well as other scattered occurrences in the County (Table 3). The Oregon Chrome Mine, No. 249, in the central Illinois River area, was by far the largest producer, with a total output of at least 38,701 tons from 1917 to 1958. The ore averaged about 46 percent Cr_2O_3 with a Cr:Fe ratio of 2.7:1. The Deep Gorge, No. 271; Chrome King, No. 268; and Youngs Daily Dozen, No. 275, are other mines of the central Illinois River area that produced over 1,000 long tons. The Chollard, No. 402, and Esterly Mines, No. 395, near Takilma, combined for a production total of about 5,000 long tons. The rest of the production was in smaller quantities from many of the 179 mines and prospects listed by Ramp.

Origin of deposits

Chromite is considered to be magmatic in origin, which means it is a mineral which crystallizes from magma (molten rock) deep within the earth's crust. Much has been written on chromite deposits, and differing theories of their origin currently exist among reputable geologists.

Table 3. *Production of chromite in Josephine County, 1917-1958*

Location	Production (long tons)	Value (dollars)
Chrome Ridge	2,318	139,080
Central Illinois River area	38,701	2,322,060
Other (County)	7,922	475,320
Total	48,941	2,936,460

The mineral chromite, which is a complex oxide of chromium, iron, magnesium, and aluminum, is believed to crystallize early, along with olivine, at relatively high temperatures and pressures. Being heavy, it tends to settle to the bottom of the magma chamber and to form layers with cumulate textures much like those of sedimentary rocks.

A relatively new theory on the origin of chromite deposits in an ophiolite environment was advanced by Dickey and others (1971), who suggest that mantle rock under pressure contains chromium in pyroxenes and amphibole as well as in spinel. As the hot mantle rock rises into the crust, the release of pressure causes partial or incongruent melting of the chromium-bearing silicates; the primary spinel, which was originally quite rich in aluminum, becomes more chromian as it reacts with the melt. The mantle rock thus undergoes a three-way split into the unmelted residual dunite or harzburgite, newly formed chromite, and a liquid which may migrate into overlying rocks, forming dikes or other intrusive rocks of basic composition. Dickey and others (1971) suggest that this partial or incongruent melting of mantle rock probably reacts very much like a bar of hot metal in a zone-refining apparatus, and the peridotite is purged of its low

melting components. The environment in which this reaction takes place may be a midocean ridge or spreading center, where mantle rocks are believed to rise up into the oceanic crust.

Many rocks in Josephine County appear to have formed as part of an ophiolite suite (oceanic crust), while others are believed to have formed as part of an oceanic volcanic island arc.

Chromite is found exclusively in ultramafic rocks. As all of the ultramafic rocks in the County have sheared or faulted contacts with the rocks which surround them, their mode of implacement appears to have been entirely tectonic, rather than intrusive.

Distribution

Chromite deposits are scattered throughout the County in essentially all of the mapped ultramafic bodies. Most of the known occurrences are small and have had little or no reported production. The most important district in the County, described by Ramp (1961), is the central Illinois River area, where distinct zones believed to belong to a single deformed horizon have been mapped. A similar mode of occurrence is described for the Chrome Ridge area, where half a dozen of the 19 occurrences have had some production.

Both of these ultramafic areas are probably relatively shallow bodies belonging to the upper plate of a thrust, which may help explain their distribution and limitation of the occurrences. More detailed mapping which considers this concept and also the modifying effect of the associated high-angle faults bounding these ultramafic rocks may furnish clues leading to the discovery of other deposits.

Scattered occurrences in the eastern Eight Dollar Mountain arm of the Josephine ultramafic sheet may also have a logical pattern of distribution that, when deciphered, could aid in finding hidden deposits.

Mineral-resource potential

It seems logical that with an incentive price and development of a local market for domestic chromite,

Figure 18. Ore trucks loaded with chromite at the Oregon Chrome Mine, No. 249, bound for the stockpile at Grants Pass in 1954.

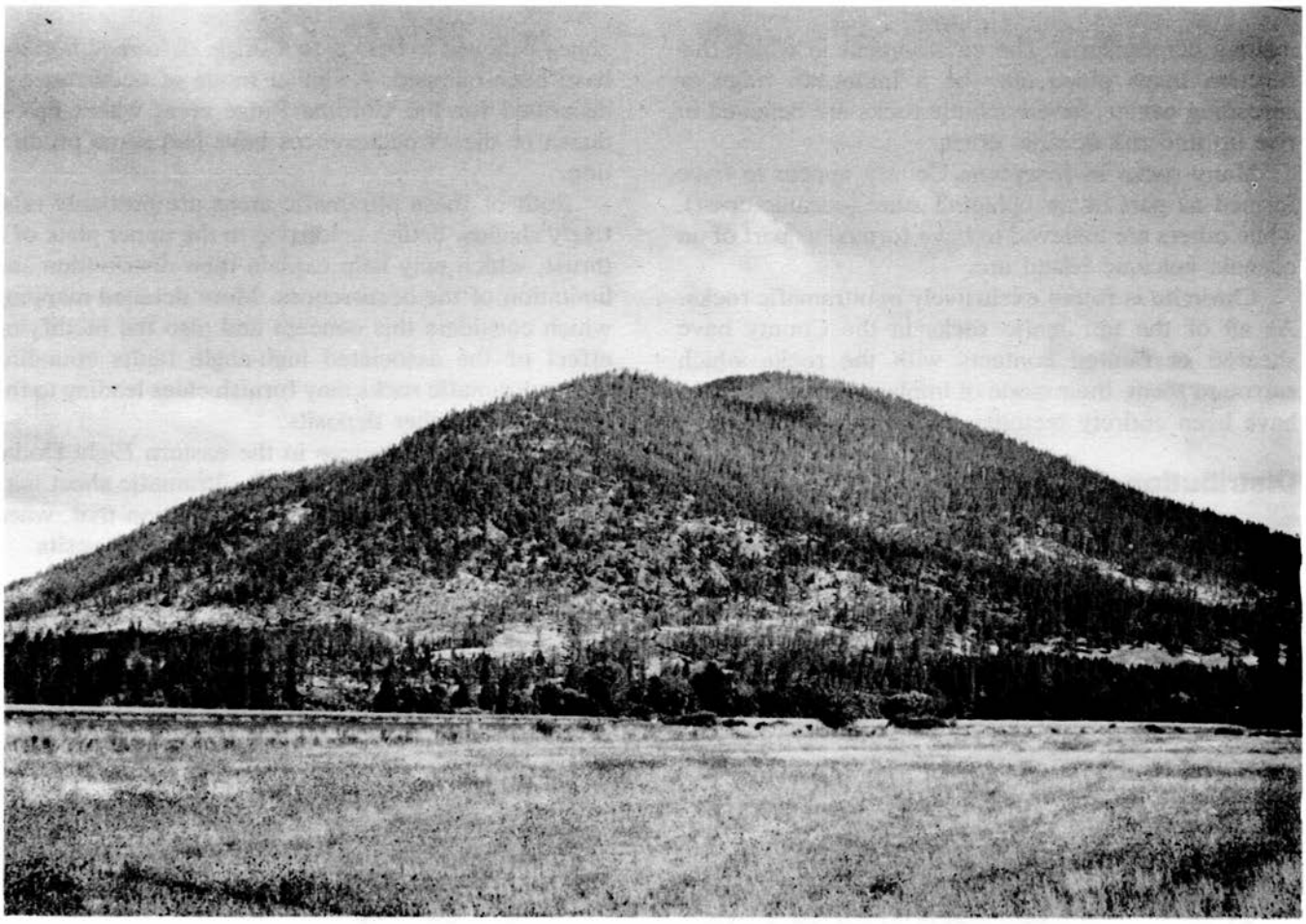


Figure 19. Eight Dollar Mountain, looking to the northwest from Sauers Flat beside U.S. Highway 199. Laterite deposits are mainly on the southeast flanks, right side, of the mountain. The entire mountain is underlain by peridotite and serpentinized peridotite.

some new production of ore similar in grade to that developed during the chromite-buying programs of the 1950's could take place.

Although no blocked-out ore remained unmined at the end of the stockpiling program in 1958, additional high-grade ore could probably be developed at Oregon's largest producer, the Oregon Chrome Mine, No. 249, and also at a few of the other occurrences described by Ramp (1961) and Thayer and Ramp (1969). Other specific areas in Josephine County that may warrant further exploration and development for chromite include the Youngs deposit, No. 275, which has a 12-ft-wide zone of about 20 percent disseminated chromite in dunite; the Shady Cove, No. 177; Buster, No. 178; and Violet, No. 179, on Chrome Ridge, which may prove to be a deformed and displaced zone of greater extent than is apparent from the pits; the Chollard Mine, No. 402, a low-grade orebody which may not be exhausted; and the ore zone at the Esterly deposit, No. 395, which produced both low-grade mill ore and high-grade lump ore and which may contain more reserves at depth and along strike.

Owing to the characteristic sinuous nature of chromite-bearing zones, which pinch and swell rapidly along strike and downdip, perhaps none of the areas of known occurrences should be assumed to have been completely exhausted.

NICKEL

A few of the more important nickel laterite deposits in southwestern Oregon are in Josephine County. They are mapped in detail and described by Ramp (1978). A brief summary of that report is given here.

History

In 1865, nickel was first discovered in southwestern Oregon at Nickel Mountain, formerly Old Piney Mountain, in southern Douglas County. The history of development there is summarized by Ramp (1972, p. 59). The Nickel Mountain Mine is still the only domestic source of primary nickel in the United States.

The first nickel exploration in Josephine County was in 1942 by Freeport Sulfur Company at Eight Dollar Mountain (Figure 19). Several other companies explored Josephine County deposits during the 1950's and are doing so currently. The details of this exploration are reported by Ramp (1978).

Origin

Nickel, a relatively insoluble, residual element, is concentrated in ultramafic rocks (peridotite) by chemical weathering processes that produce lateritic soil and weathered rock (saprolite). Unweathered ultramafic rocks, peridotite, and serpentinite contain about 0.1 to 0.3 percent Ni. Lateritic soil and saprolite derived from prolonged weathering of peridotite in Josephine County may contain from 0.5 to 2.0 percent Ni. The average assay of laterites sampled is about 0.8 percent Ni. Laterite deposits in Josephine County have developed only from relatively unserpentinized peridotites.

Distribution

Josephine County nickel laterite deposits occur in the Eight Dollar Mountain arm of the Josephine ultramafic sheet that extends from the California line up to Eight Dollar Mountain. The deposits are found on Eight Dollar Mountain, Free and Easy Ridge, Woodcock Mountain, Josephine Creek, the Rough and Ready Creek Group, and the Cedar Spring deposit along the County line northwest of Oregon Mountain.

Exploration techniques

Flat-topped ridges, benches, and old landslide deposits are favorable places for accumulation of nickel-bearing laterite and saprolite derived from peridotite. A few, potentially valuable deposits may be hidden under relatively steep, boulder-covered talus. Laterites developed on peridotite may be recognized from the air, identified on color aerial photographs, or located by walking over the ground. Preliminary sampling is generally done by hand augering with a soil auger. Bulk samples are often taken with a backhoe; deeper samples may be obtained with modern rotary drilling equipment. A portable seismograph activated by a sledge hammer is useful for rapidly determining the depth of weathering, thus avoiding some of the expense of drilling.

Mineral-resource potential

Important metals occurring with nickel in the laterite deposits are chromium (occurring mainly as chromite) and cobalt. Josephine County laterites average a little more than one percent Cr and about 0.05 percent Co.

The Rough and Ready Group, lying west of O'Brien, probably represents the largest reserves. Eight Dollar Mountain deposits (Figure 19) appear to be second in size and importance. Woodcock Mountain deposits are probably third in size.

Preliminary tonnage estimates for these deposits may be derived by using the data presented by Ramp (1978). Private company exploration of these deposits is continuing at the time of this writing, and known reserves continue to increase as the companies obtain further data.

Future production of nickel, chromium, and cobalt from these laterite deposits will depend upon such factors as the future markets for these metals, local and national political policies regarding domestic production of these strategic metals, the development of an efficient and nonpolluting metallurgical process to extract the metals, and development of satisfactory reclamation procedures for the mined areas.

At the present time (1979), a small tonnage of laterite and saprolite is being mined for shipment to a pilot plant in Tucson, Arizona, for experimental metallurgical processing.

LIMESTONE

Limestone is one of the most widely used mineral commodities and is essential to a modern industrial society. Pure limestone is composed entirely of the mineral calcite ($CaCO_3$).

Josephine County has several small- to moderate-size, lenticular-shaped bodies of white to gray high-calcium limestone or marble within the Applegate Group metasedimentary rocks (Plate 2).

By far the largest production has come from the Marble Mountain quarry, No. 291, where the Beaver Portland Cement Company, and later the Ideal Cement Company, quarried the fine-grained, medium-gray, high-purity limestone, mainly for the manufacture of portland cement, but also for paper mill rock. The present quarry is in the northernmost of six closely spaced limestone bodies that Hodge (1938) estimated to contain about 50 million tons of limestone. The quarry was operated from 1924 until 1967, when Ideal's cement plant at Gold Hill was closed. No reports of the amount produced from the Marble Mountain quarry have been published, but Hodge (1938) reported that facilities then were capable of producing 960 tons per 8-hour shift. Over the 43 years it operated, production of the cement plant was relatively steady; estimates of production from the quarry, based on available information, are from 4 to 5

million tons. The estimated dollar value is from $7½ to $10 million.

Large tonnages of high-calcium limestone that remain at the Marble Mountain deposits and lesser amounts at the Jones Marble represent a future resource for cement rock, agricultural lime, or any of the other industrial uses of high-purity limestone.

The largest and best known of the limestone masses in the County is about 25 mi east of Cave Junction and is the host for the Oregon Caves. Hodge (1938) reported this deposit as "remarkable for its extensive caves, but not quarriable, for obvious reasons." The Oregon Caves, discovered in 1874, were explored by early-day naturalists. After several private attempts to promote the caves as a tourist attraction, they were proclaimed a national monument in 1909. They are now open to visitors year around and are perhaps the most valuable tourist attraction in Josephine County.

MISCELLANEOUS METALS

Lead and zinc

Sphalerite and galena, the common ore minerals of zinc and lead, are present at many of the massive sulfide deposits described above with copper. Only at the Almeda Mine, No. 78, and the Oak Mine, No. 162, do they occur as an appreciable percentage of the sulfide minerals. U.S. Bureau of Mines statistics reported by Brooks and Ramp (1968) show the production of several thousand pounds of lead from Josephine County during 1913, 1915, 1916, and again in 1933. This production, however, cannot be verified and may be erroneously attributed to Josephine County mines.

Marine-deposited silicic volcanic rocks, mainly in the Rogue Formation, provide a favorable environment for these base metal sulfides.

Manganese

Manganese occurrences containing rhodonite and surficial manganese oxide minerals are scattered throughout the County in diverse geologic environments but are mainly associated with quartzite (metachert) layers in the Triassic Applegate Group rocks. Appling (1958) reported on several of these deposits. Some manganiferous iron layers are also present.

Mercury

Cinnabar occurrences in the County are small and limited to the Pickett and Briggs Creek areas in a variety of geologic environments. About 40 lb of quicksilver have been produced from contorted sandstones and shales at the Pickett Creek Mine, No. 197 (Brooks, 1963). Smaller occurrences are in greenstone of the Rogue and Galice Formations (Empire Mine, No. 199), with rhodonite and manganese oxides in quartzite of the Briggs Creek amphibolite (Elkhorn, No. 181), and in serpentinite and chloritized volcanic rocks near Onion Mountain (Red Ledge, No. 189). The age or origin of the mineralization is not known. None of the deposits appear to have any economic potential.

Molybdenum

The presence of molybdenum in Josephine County appears to be of academic interest only. Two occurrences in the Galice area, however, should be mentioned. At the Blue Bell, No. 86, molybdenum occurs as flakes of molybdenite with chalcopyrite in a brecciated, quartz-filled metavolcanic rock near the thrust-fault contact with the Dothan Formation. Over the years, several samples assayed by the Department have come from the small body of quartz diorite east of Soldier Camp in sec. 1, T. 35 S., R. 9 W., about 2 mi south of the Blue Bell. The samples are all described as fractured vein quartz with pyrite, chalcopyrite, and molybdenite. The samples assayed from 0.6 to 1.0 percent Mo.

Molybdenite is also reported at the Golden Pheasant, No. 139, where it occurs in vein quartz near a contact between slate and greenstone. Powellite, a calcium molybdate mineral, has been reported from an unknown location on Ewe Creek from skarn or tactite inclusions in quartz diorite. Another minor occurrence of copper and molybdenite has been reported northwest of Merlin in the NW¼ sec. 8, T. 35 S., R. 6 W., in a pegmatite vein in the diorite.

Platinum

Platinum was reported from the early placer mines, especially those of the Waldo-Takilma area, Althouse and Sucker Creeks, Josephine Creek, and the Illinois River. It reportedly occurred in the ratio of about 1 oz for every 75 oz of gold. Ramp and Brooks (1969) report that prior to 1903 there was little market for platinum; before that time, this silvery, heavy metal was discarded. Oregon's recorded production from 1903 to 1945 amounted to 2,018 oz, most of which came from the coastal black sand deposits. Some of this amount most likely came from the Llano de Oro (Esterly Mine), No. 396, where Shenon (1933a) reported that from 1917 to 1920, when it was worth $110 an oz, platinum accounted for one-tenth of the value of the clean-ups.

The platinum was most likely weathered from the

ultramafic rocks which are so widespread in the area. It is believed to be erratically and sparsely distributed as small discrete particles. A study by Page and others (1975) of bedrock occurrences of platinum in southwest Oregon shows that anomalous amounts of platinum group metals are associated with chromite (up to 945 ppb (parts per billion), more than 10 times the average content of ultramafic rocks in which they occur). The concentrations found have no economic potential at this time, but the data are limited in amount and areal distribution.

An analysis of chromite from the Salt Rock, No. 193, showed 850 ppb Pt, 14 ppb Pd, and 91 ppb Rh. The total platinum metals content of the chromites is probably somewhat higher than reported, since osmium and iridium, common in this area, were not detectable by the analytical methods used.

Miscellaneous nonmetals

Asbestos: The minerals commonly called asbestos are members of the serpentine group. The most common is chrysotile, a silky, fibrous, magnesium silicate sometimes called cross-fiber asbestos. Its resistance to burning and other insulating properties make asbestos popular for a variety of industrial uses (Wagner and Ramp, 1969). Tremolite, another asbestos mineral, is coarser, less flexible, commonly brittle, lacking in strength, and therefore less desirable for most asbestos uses. Both varieties occur in Josephine County in serpentinized ultramafic rocks.

Because the fibrous asbestos minerals make up only a small percentage of the rock mass, a large tonnage is usually required for an economically exploitable deposit. There has been no production from the known occurrences in Josephine County. Chrysotile is present in some quantity at the Foster Asbestos, No. 332, on Josephine Creek, where at least two mining companies conducted drilling programs but failed to find a large tonnage. A small occurrence of tremolite, slip-fiber amphibole asbestos, has been prospected by surface workings at the L.E.J., No. 293, on Bolt Mountain. The asbestos deposits of the County do not appear to be a potential resource.

Barite: Barite ($BaSO_4$) is a relatively heavy mineral that is vital to the petroleum industry. Finely ground, it is a major ingredient of the heavy fluid or mud used in the rotary drilling of oil and gas wells. Barite occurs as a gangue mineral in some of the volcanogenic sulfide deposits of Josephine County. Libbey (1967) reports that during the early operations of the smelter at the Almeda Mine, No. 78, the barite content of the ore was a serious problem. He reports sections of the ore zone where practically pure barite was exposed for widths of 2 to 6 ft. This barite was left in place as much as possible and could now represent a considerable resource. The location of the Almeda Mine within the Rogue Wild and Scenic River Corridor poses a problem for extracting this resource, however.

Barite crops out also at the Goff Mine, No. 14, where it occurs with base metal sulfides at a northward extension of the Big Yank Lode. South of the river at the Yankee Silver, No. 94, a similar deposit of barite and sulfides with a high silver content is being explored by geophysical techniques. If exploration should indicate enough ore for a mining operation along the Big Yank Lode, barite could represent an important by-product resource after extraction of valuable contained metals.

Soapstone: Massive impure talc (soapstone) is found as an alteration product of serpentinite and other ultramafic rocks at several places in the County. Nowhere does it occur in large enough quantities or sufficiently pure deposits to be ground and sold for powdered talc. It has been mined and marketed for carving from an outcrop and landslide deposit on Powell Creek, designated the Pugh Soapstone, No. 317a. Most of the Josephine County soapstone deposits are small and contain only small tonnages of material.

Semiprecious gemstones: Agate and jasper are transported by the Rogue River and deposited in gravel bars. These materials represent a valuable commodity for the many hobbyists and tourists who visit the recreation areas of the County. A striking red and white spherulitic jasper, nicknamed "Oregonite" by rockhounds, has been mined at the Oregonite Mine, No. 273. This attractive material takes a high polish and is prized by lapidarists.

RARE MINERALS

Of minor economic importance but certainly of academic interest are two rare minerals, josephinite and oregonite, that are found only in Josephine County. Both are metallic nickel-iron alloys that are found in the placer gravels of a short stretch of Josephine Creek and Mendenhall Creek. They are believed to be formed during the alteration of peridotite to serpentinite. Josephinite was found as silvery metallic pebbles with brownish coatings by early-day placer miners and was first described by Melville (1892). The mineral oregonite has the same appearance as josephinite; however, Ramdohr and Schmitt (1959) found it contains arsenic metal and is not magnetic, while josephinite is highly magnetic. Staples (1962) has also described these minerals in some detail. The early-day placer miners discarded the josephinite, but in recent years it has been marketed to mineral collectors by the ounce, pound, or piece.

Table 4. *Assay results of samples taken during this investigation*

Sample number	Prospect or mine name	Type sample	¼ ¼	¼	Location Sec.	T.(S.)	R.(W.)	Au (oz/ton)	Ag (oz/ton)	Cu (ppm)	Zn (ppm)	Comments
ALG- 77	Meathead	Grab	N½	NE	26	33	5	0.02	0.31	66,000	16,000	Thin layer of massive sulfides with pyrite, chalcopyrite, etc.
AMG- 10	Josephine County	Stream bed	SW	SW	15	34	6	0.02	Nil	70	85	Panned stream sediment sample
AMG- 11	Josephine County	Stream bed	SW	SW	15	34	6	0.02	Trace	50	85	Panned stream sediment sample
AMG- 21	Whiskey Creek	Grab	S½	NE	28	33	8	0.01	0.16	----	----	Iron-stained quartz with minor pyrite
AMG- 22	None	Float boulder		NW	29	35	5	Trace	Nil	----	----	Iron-stained talc tremolite schist
AMG- 23	Maynard French Iron	1,000 ft	NE	SE	26	33	5	Trace	Nil	----	----	Magnetite and limonite in metavolcanic rock
AMG- 24	No name	Roadcut	NE	NE	35	33	5	0.005	0.1	----	----	Weathered shear zone with minor quartz in slaty siltstone
AMG- 25	Bone of Contention	2-ft chip	NE	NW	25	38	5	0.01	Nil	75	48	Decomposed quartz diorite with aplite dikelets
AMG- 26	Bone of Contention	3-ft chip	NW	NE	25	38	5	0.33	Nil	110	30	Quartz fissure vein in diorite
AMG- 28	None	Grab	SE	NE	20	33	7	Trace	Nil	70	75	Weathered tuff breccia
AMG- 29	Sulfide No. 1	Dump	NE	SW	23	38	9	0.06	Nil	4,800	1,440	Thickly disseminated pyrite in altered volcanic rock, 6-ft zone
AMG- 47	Roadcut	Grab	SE	SW	15	35	5	Nil	Nil	135	94	Iron-stained clay gouge
AMG- 48	Roadcut	Random chip	NE	SW	15	35	5	Trace	0.2	50	43	Across 6-ft shear zone
AMG- 49	No name	Random chip	E½	NE	9	35	5	0.005	0.2	20	42	Sheared serpentinite-tremolite-talc rock
AMG- 50	Twelve O'Clock	Grab	S½	NE	4	35	5	Nil	Trace	120	152	Narrow seam sheared greenstone and quartz
AMG- 51	Twelve O'Clock	12-in. chip	S½	NE	4	35	5	Trace	Nil	55	3,600	Weathered, sheared, iron-stained greenstone
AMG- 52	Blue Bell	Chip	NW	NW	30	34	8	Nil	0.05	235	20	Quartz impregnated greenstone breccia with some pyrite
AMG- 53	Blue Bell	Grab	NW	NW	30	34	8	Nil	0.2	750	69	From dump, 15-ft adit, iron-stained

Table 4. *Assay results of samples taken during this investigation* (continued)

Sample number	Prospect or mine name	Type sample	Location ¼ ¼	¼	Sec.	T.(S.)	R.(W.)	Au (oz/ton)	Ag (oz/ton)	Cu (ppm)	Zn (ppm)	Comments
AMG- 54	Red Elephant	Multiple chip		SW	19	34	8	Nil	Nil	725	70	Fractured, iron-stained siliceous metavolcanic rock with quartz and pyrite
AMG- 55	Howard Creek	Grab	SE	NE	25	34	9	0.03	0.03	220	233	Quartz diorite with disseminated pyrite
AMG- 68	Black Bear	Grab		SW	26	34	8	0.52	0.18	- - - -	- - - -	From ore pile; quartz, limonite, sericite, clay mixture
AMG- 74	Rowe Property	Grab soil	SW	NE	36	40	8	Trace	Nil	250	50	Mixed soil and rock near contact of serpentinite and metavolcanic rock
AMG- 75	Rowe Property	Grab soil	N½	NE	36	40	8	- - - -	- - - -	120	100	Mixed soil and rock near contact of serpentinite and metavolcanic rock
AMG- 76	Ramsey Group	Multiple grab	S	SE	9	41	7	Trace	Nil	45	22	Gossan (metavolcanic rock) exposed in road cut
AMG- 77	Ramsey Group	Multiple grab		NE	9	41	7	0.01	Nil	50	17	Gossan (altered metavolcanic rock)
AMG- 78	Ramsey Group	Grab	SW	NE	9	41	7	Trace	0.02	50	20	Clay gouge with disseminated pyrite
AMG- 79	Ramsey Group	3-ft chip	N. edge	SE	9	41	7	0.01	Nil	50	16	Clay gouge with pyrite from roadcut
AMG- 80	Ramsey Group	18-in. chip		NE	16	41	7	0.02	0.18	8,500	745	Weathered siliceous metavolcanic rock and gossan
AMG- 84	Steward	Grab	S	SW	12	33	6	Trace	0.01	- - - -	- - - -	Vein quartz
AMG- 85	No name	20-in. chip		SE	18	33	5	0.005	Nil	- - - -	- - - -	Sheared aplite
AMG- 86	No name	14-in. chip	N½	NE	8	39	6	0.015	Nil	220	49	Porous vein quartz in pillow basalt
AMG- 87	Babcock Prospect	Grab (ore pile)	NE	NE	7	39	6	Trace	Nil	66,000	100	Banded massive sulfides in pillow basalt
AMG- 88	Babcock No. 2	Grab (dump)	NW	SE	5	39	6	0.01	0.1	370	21	Pyrite, quartz, limonite, and magnetite from dump; caved adit
AMG- 92	No name	Grab	NW	SE	30	33	5	0.005	0.02	- - - -	- - - -	Sheared iron-stained metatuff
AMG- 93	Scorpion	Grab	NW	SE	32	33	5	0.27	0.31	- - - -	- - - -	Small fissure vein with fine disseminated sulfides in metabasalt

Table 4. *Assay results of samples taken during this investigation* (continued)

Sample number	Prospect or mine name	Type sample	Location ¼ ¼	¼	Sec.	T.(S.)	R.(W.)	Au (oz/ton)	Ag (oz/ton)	Cu (ppm)	Zn (ppm)	Comments
AMG- 94	Pine Creek Pinnacle	3-ft chip	NE	SE	22	36	10	Nil	0.38	202	37	Iron-stained amphibolite with disseminated pyrite
AMG- 95	Pine Creek Pinnacle	Select grab 5 ft	NE	SE	22	36	10	Nil	0.49	78	30	Iron-stained amphibolite and vein quartz
AMG- 97	King Midas No. 2	3-ft chip	NE	SE	28	33	5	0.02	0.32	----	----	Sheared, iron-stained, talcose serpentinite
AMG- 98	King Midas No. 1	4-ft chip	NW	SW	27	33	5	0.04	Nil	----	----	Sheared, iron-stained, talcose serpentinite
AMG- 99	King Midas No. 1	3-ft chip	N	SW	27	33	5	0.05	0.48	----	----	Sheared, gray serpentinite gouge
AMG-100	King Midas No. 1	20-ft chip	NW	SW	27	35	5	0.08	----	----	----	Sheared, iron-stained, talcose serpentinite
AMG-101	King Midas No. 1 & 2	10-ft chip		S. line	27-28	33	5	0.02	Nil	----	----	Sheared, iron-stained, talcose serpentinite
AMG-102	King Midas No. 2	Grab	NE	SE	28	33	5	0.02	Nil	----	----	Sheared, iron-stained, talcose serpentinite
AMG-103	Hobson Horn	2-ft chip		SE	5	35	9	Trace	Nil	----	----	Sheared, iron-stained, siliceous metatuff on thrust contact
AMG-104	Indigo Ridge	Multiple grab	SE	SW	14	35	10	0.005	Nil	----	----	Iron-stained, siliceous greenstone
AMG-106	No name	Multiple grab	NW	NW	22	35	9	Trace	Nil	----	----	Iron-stained, altered gabbro in fault zone
AMG-114	No name	Grab		NE	15	37	9	0.005	0.1	----	----	Fractured, iron-stained vein quartz
AMG-115	No name	Multiple grab	SW	NW	6	35	5	0.005	Nil	----	----	Sheared talc-limonite rock
AMG-118	Fruitdale Creek	Grab	SW	SW	28	36	5	0.07	Trace	3,350	3,700	Pyrite with quartz-clay-limonite matrix
ANG- 1	No name	Grab	NE	SW	14	34	5	0.02	Trace	----	----	Iron-stained serpentinite gouge

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TABLE 1. MINES, PROSPECTS, AND MINERALIZED AREAS OF JOSEPHINE COUNTY, OREGON

(continued)

MINE OR PROSPECT NAME	MINERAL RESOURCE MAP NUMBER	IDENTIFICATION: ELEVATION (ft)	T.(S.)	R.(W.)	¼	¼	sec.	COMMODITY	LAND STATUS: C = County, F = Federal, P = Private, S = State, * = Withdrawn from mineral entry; Wilderness or Wild River	GEOLOGY: GEOLOGIC FORMATION	MINERALIZATION TYPE	SURFACE AND/OR UNDERGROUND WORKINGS	PRODUCTION: PAST PRODUCTION (Gold – oz; Copper – lb; Chromite – long tons; Limestone – short tons)	FUTURE POTENTIAL: A = Large; B = Moderate to small; C = None or small	REMARKS	REFERENCES
Horsetop Ber (Tennessee Ber)	1	4,450	39	33	9	23	SW	SW	F	Gold	Placer	Thin bench gravels in the Rogue Kiver; 10-ft-deep gravel; 4 bench gravels; 2 sluice boxes.	Several acres mined.	No records.	Early-day placer mine.	C		3,5,14
Horsetop Ber (Type's Ber)	2	580	9	33	32	SW	SE	F	Gold	Placer	Thin bench gravels of the Rogue Kiver; 10-ft-deep gravel; 4 bench gravels; 2 sluice boxes.	Small area mined.	Some production but not recorded.	Early-day placer.	C		3,5,14,15
Type Bar	3	605	9	33	33	SW	SE	F	Gold	Placer	Thin bench gravels of the gravel; 4 bench gravels; 2 sluice boxes.	Several acres worked.	Some production but not recorded.	Early-day placer.	C		3,5,14,15
Rogue Gravel Co.	4	3,150	9	33	12	NW	SW	F	Gold	Placer	Channel and bench gravels; 2 sluice boxes.	Several acres mined.	No production.	Early-day placer.	C		3,5,14,15
Gray Johnson Group (Mt. Reuben)	5	3,450	8	33	12	NW	NE	F	Gold, copper	Volcano-genic vein	Several shallow cuts and adits in gravel, chloritized tuff, and pyrite.	No production reported.	No production reported.		C		12,14,15
King Tutr	130															
Deposition Bratzer	131															
Jack Creek	132															
Sunstrike	133															
Old Smokey	134	Magnetic	Massive ctenolite to serpentinite.													
Buster Hill	135	Aggregation	Multiple quartz veins in granodiorite and diorite. Cinnabar in quartz.													
Sterling Water	163	Placer	Boldiary Jumpoff Joe Creek.													
Ore Fino	164	Quartz vein	Bearing quartz-vein system in greenstone.													
Sugar Pine	138	Quartz vein	5-ft-wide tenor vein; strike N. 30° E., dip 70° NW.													
Gold Star	166	Quartz vein	No information.													
Kimzlite	165	Quartz vein	Quartz veins in greenstone.													
Centennial Group (Columbia)	203	Quartz vein	Quartz veins and tenor zones in greenstone.													
Ida	204	Quartz vein	Quartz veins and tenor zones in greenstone.													
Jewett	237	Quartz vein	Quartz veins in greenstone.													
Little Silver (Lone Eagle)	168	Quartz vein	Small sinuous iron-stained quartz veins in greenstone.													
Grouse Mountain	167	Quartz vein	Quartz veins occur in greenstone and serpentinite.													
Golden Mary	238	Quartz vein	Narrow quartz veins in hard dense greenstone.													
Billy Blue	240	Mos	Small quartz lenses in greenstone.													
Mary Queen	239	Mos	Narrow quartz veins in hard dense greenstone.													
Golden Chief	205	Mos	Small quartz lenses in greenstone.													
Dry Diggins	206	Placer	Disseminated gold in decomposed diorite.													
Cobalt Group	207	Magnetic segregation	Disseminated sulfides in sheared quartz veins in greenstone.													
Lower Pine Creek	207a	Quartz vein	Pyritized zones in layered ampha-bole gneiss, sheared and fractured quartz veins.													
Golden Bear	140	Placer	Gulch Creek channel and bench gravels.													
Golden Pheasant Group	139	Quartz vein	Quartz veins and kidneys in green-stone contain magnetite between Gulch and Rogue Formations.													
Gulch	141	Placer	Gulch Creek Terrace gravels 9 ft thick with tight bed rock.													
Gal-Che (Old Dan Queen)	142	Placer	North Fork Gulch Creek gravels and present bed rock.													
Gold Springs	143	Hydrothermal	Quartz-vein system with silicified-ized pyrite and chalcopyrite and malachite in carbonatized quartzite.													
Hansen	144	Quartz vein	Narrow quartz veins with disseminated pyrite and chalcopyrite in sericitized hornblende diorite; fracture zone is quartz-carbonate-sericite.													
Lucky L and R	173	Quartz vein	Several thin parallel veins and stringers in sericitized hornblende diorite.													
Lucky L Bear	172	Quartz vein	Several thin parallel veins and stringers in sericitized hornblende diorite.													
Hoolend	171	Quartz vein	Irregular stringers of chrome in serpentinite and some amphibolite and metagabbro.													
Mertz	170	Quartz vein	Quartz veins and stringers in sericitized hornblende diorite.													
Old Glory	169	Quartz vein	Two short veins and one 18-in. quartz vein in sericitized hornblende diorite.													
Billy Blue	240	Mos	Small quartz lenses in metasedi-mentary rock; contain pyrite and chalcopyrite.													
Dry Diggins	206	Placer	Disseminated gold in decomposed diorite.													
Cobalt Group	207	Magnetic segregation	Disseminated sulfides in sheared quartz veins in greenstone.													
Upper Pine Creek	207a	Quartz vein	Pyritized zones in layered ampha-bole gneiss, sheared and fractured quartz veins.													
Golden Bear	140	Placer	Gulch Creek channel and bench gravels.													
Golden Pheasant Group	139	Quartz vein	Quartz veins and kidneys in green-stone contain magnetite between Gulch and Rogue Formations.													
Gulch	141	Placer	Gulch Creek Terrace gravels 9 ft thick with tight bed rock.													
Gal-Che (Old Dan Queen)	142	Placer	North Fork Gulch Creek gravels and present bed rock.													
Gold Springs	143	Hydrothermal	Quartz-vein system with silicified-ized pyrite and chalcopyrite and malachite in carbonatized quartzite.													
Hansen	144	Quartz vein	Narrow quartz veins with disseminated pyrite and chalcopyrite in sericitized hornblende diorite; fracture zone is quartz-carbonate-sericite.													
Lucky L and R	173	Quartz vein	Several thin parallel veins and stringers in sericitized hornblende diorite.													
Lucky L Bear	172	Quartz vein	Several thin parallel veins and stringers in sericitized hornblende diorite.													
Hoolend	171	Quartz vein	Irregular stringers of chrome in serpentinite and some amphibolite and metagabbro.													
Mertz	170	Quartz vein	Quartz veins and stringers in sericitized hornblende diorite.													
Old Glory	169	Quartz vein	Two short veins and one 18-in. quartz vein in sericitized hornblende diorite.													
Billy Blue	240	Mos	Small quartz lenses in metasedi-mentary rock; contain pyrite and chalcopyrite.													
Little Silver (Lone Eagle)	168	Quartz vein	Small sinuous iron-stained quartz veins in greenstone. Chalcopyrite present.													
Grouse Mountain	167	Quartz vein	Quartz veins occur in greenstone and serpentinite in greenstone containing chromite.													
Golden Mary	238	Quartz vein	Narrow quartz veins in hard dense greenstone.													
Billy Blue	240	Mos	Small quartz lenses in metasedi-mentary rock; contain pyrite and chalcopyrite.													
Gold Chief	205	Mos	Small quartz lenses in greenstone.													
Dry Diggins	206	Placer	Disseminated gold in decomposed diorite.													
Cobalt Group	207	Magnetic segregation	Disseminated sulfides in sheared quartz veins in greenstone and some serpentinite.													
Upper Pine Creek	207a	Quartz vein	Pyritized zones in layered ampha-bole gneiss, sheared and fractured quartz veins.													
New Deal	243	Magnetic segregation	Narrow zone of disseminated to massive chromite in serpentinite. Medium-grained narrow lens of massive chromite in serpentinite.													
Parker Creek Mining Co.	209	Placer	Gulch Creek channel and bench gravels.													
Gold Bond	210	Placer	Channel and bench gravels of Gulch Creek.													
Gold Blanket	211	Placer	Channel and bench gravels of Gulch Creek.													
Saturday Anne (Gold Jack)	212	Magnetic segregation	Lenses of disseminated, crudely banded, chromite in quartz-carbonate-sericite rock.													
Van Dyke (Red Dog)	213	Magnetic segregation	6-in-thick chromite lens in ser-pentinite.													
Gallagher Chrome	214	Magnetic segregation	3 in. layer of disseminated chromite in altered dunite.													
Hop (Hopkins)	215	Magnetic segregation	Schlieren-banded, disseminated chromite in separentinized dunite.													
Briggs Creek	216	Magnetic segregation	Massive coarse-grained chromite in altered dunite.													
Brown Scotch	217	Magnetic segregation	Narrow stringer (5–8 in.) chromite of massive chromite in dunite.													
Horse Mountain	217a	Magnetic segregation	Narrow bands of chromite in dunite.													
Sweden Creek	218	Placer	Bench and channel gravels of Sweden Creek.													
Snowy	100	Placer	Channel and bench gravels in Rogue River gravels.													
Golden Eagle)	100	Placer	Channel and bench gravels of Rogue River gravels.													
Jumpoff Joe (Cook and Howland)	125	Placer	Collluvium of old terrace gravels; irregular greenstone and rock.													
Wood	126	Magnetic segregation	Small lenses of massive to stringer-like chromite in pinky altered dunite.													
Steamboat Ridge	244	Magnetic segregation	Medium-grained narrow lens of massive chromite in serpentinite.													
Eureka	246a	Quartz vein	Ribbons, streaks, and bunches of quartz in sheared greenstone.													
Lost Chance	245	Hydrothermal	Zone of disseminated to stringer-like chromite in serpentinite. Minor fracture-filling quartz veins.													
High View	246	Magnetic segregation	Massive coarse-grained chromite in tclose serpentinite.													
Clearwater	247	Magnetic segregation	No information.													
Jet Bus – Lucky Star (Mcdonagh)	248	Magnetic segregation	Coarse-grained lenses and layers of massive chromite in dunite.													
Oregon Chrome	249	Magnetic segregation	Tabular to lens-shaped bodies of massive crystalline chromite in sheared, jointed, serpentinite													

MINE OR PROSPECT NAME	MINERAL RESOURCE MAP NUMBER	IDENTIFICATION: ELEVATION (ft)	T.(S.)	R.(W.)	¼	¼	sec.	COMMODITY	LAND STATUS: C = County, F = Federal, P = Private, S = State, * = Withdrawn from mineral entry; Wilderness or Wild River	GEOLOGY: GEOLOGIC FORMATION	MINERALIZATION TYPE	SURFACE AND/OR UNDERGROUND WORKINGS	PRODUCTION: PAST PRODUCTION (Gold – oz; Copper – lb; Chromite – long tons; Limestone – short tons)	FUTURE POTENTIAL: A = Large; B = Moderate to small; C = None or small	REMARKS	REFERENCES
Sulfide	126a	Copper, gold	Massive to disseminated chromite in serpentinite.	Magnetic segregation	Volcano-genic vein	No information.	Several acres mined.	No records.		Early-day placer mine.		3,5,14
Sexton Chromite	127	Chromium	Massive to disseminated chromite in serpentinite.	Magnetic segregation	Volcano-genic vein	No information.	Small area mined.	Some production but not recorded.		Early-day placer.		3,5,14,15
Lucky Queen	129	Quartz vein	Quartz veins in metamorphosed sedimentary rocks.	Magnetic segregation	Volcano-genic vein	No information.	Several acres mined.	No production.		Early-day placer.		3,5,14
Snook	128	Chromium	Chromite in serpentinite.	Magnetic segregation	Volcano-genic vein	No information.	Several acres worked.	Some production but not recorded.		Early-day placer.		3,5,14,15
Copper Bell	150a	Copper	Chalcopyrite, pyrite, pyrrhotite in pinky sepramentized dunite; fracture zone is quartz vein in greenstone.	Quartz vein	Hydrothermal	Several shafts and adits in quartz veins in greenstone.	Several acres mined.	No production.		Minor placer gold.		3,5,14,15,22
Little Pickett Creek	151	Quartz vein	Located in Jurassic metavolcanic rocks.	Quartz vein	Hydrothermal	No information.	At least 100 acres mined.	No production.		Minor placer gold.		3,5,14,15,22
Lindi, Ian Webber	152	Placer	Little Pickett Creek channel and bench gravels.	Placer	Placer	No information.	Several acres worked; operated until mid-1940's.	No records.		Minor placer gold.		3,5,14,15
Big Four (Borlert)	153	Placer	High terrace gravels (300 ft above Rogue River) 30 – 70 ft of terrace gravels; 15 – 20 ft of bench gravels.	Placer	Placer	No information.	Several early-day pits.	20 acres worked until 1940.		Probably less than 50 tons.		4,13,14,15,23
Horse Mountain	154	Chromium	A 50-ft-wide lens-shaped pegma-tite dyke and its quartz stockwork.	Pegmatite dikes	Alluvial deposit	No information.	Several shafts and pits.	No production.		Probably less than 50 tons.		14,23
White Wonder	155	Quartz vein	Narrow concrary crystalline quartz (pure SiO2) in perid-otite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production.		Short crosscut tunnel exposes tenor.		14,23
Eagle	156	Quartz vein	Shear zone and quartz vein with sulfides in gabbro.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production.		Short crosscut tunnel exposes tenor.		14,23
Dutch	158	Placer	Country rock is stripped at metro-politan Dutch Flat.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production.		Small production but not recorded.		14,23
Gopher	159	Quartz vein	Several quartz veins in gabbro, generally conformable to shear zone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production.		Small production but not recorded.		14,23
Baby (Long Tongue)	160	Quartz vein	Quartz vein in gabbro; 10 ft thick; 200 ft long.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Pickett Creek	197	Placer	Gulch Creek channel and bench gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Empire	199	Hydrothermal	Minor cinnabar disseminated in silicified, sheared diorite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Twelve-O'Clock	161	Quartz vein	Quartz veins and stringers in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Bustard Hill	135	Aggregation	Multiple quartz veins in granodiorite and diorite. Cinnabar in quartz.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Bohemian (Bohemian)	136	Hydrothermal	Pyrite-impregnated quartzite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Golden Queen	147	Copper	Pyrite and chalcopyrite in green-stone near bed rock.	Volcano-genic	Volcano-genic	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Fowler Group	148	Placer	Gulch Creek channel and bench gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Sweden Creek	219	Placer	Gulch Creek channel and bench gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Sterling Water	163	Placer	Boldiary Jumpoff Joe Creek.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Ore Fino	164	Quartz vein	Bearing quartz-vein system in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Sugar Pine	138	Quartz vein	5-ft-wide tenor vein; strike N. 30° E., dip 70° NW.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Gold Star	166	Quartz vein	No information.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Kimzlite	165	Quartz vein	Quartz veins in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Centennial Group (Columbia)	203	Quartz vein	Quartz veins and tenor zones in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Ida	204	Quartz vein	Quartz veins and tenor zones in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Jewett	237	Quartz vein	Quartz veins in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Little Silver (Lone Eagle)	168	Quartz vein	Small sinuous iron-stained quartz veins in greenstone. Chalcopyrite present.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Grouse Mountain	167	Quartz vein	Quartz veins occur in greenstone and serpentinite in greenstone containing chromite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Golden Mary	238	Quartz vein	Narrow quartz veins in hard dense greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Billy Blue	240	Mos	Small quartz lenses in metasedi-mentary rock; contain pyrite and chalcopyrite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Gold Chief	205	Mos	Small quartz lenses in greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Dry Diggins	206	Placer	Disseminated gold in decomposed diorite.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Cobalt Group	207	Magnetic segregation	Disseminated sulfides in sheared quartz veins in greenstone and some serpentinite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Upper Pine Creek	207a	Quartz vein	Pyritized zones in layered ampha-bole gneiss, sheared and fractured quartz veins.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
New Deal	243	Magnetic segregation	Narrow zone of disseminated to massive chromite in serpentinite. Medium-grained narrow lens of massive chromite in serpentinite.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Parker Creek Mining Co.	209	Placer	Gulch Creek channel and bench gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Gold Bond	210	Placer	Channel and bench gravels of Gulch Creek.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Gold Blanket	211	Placer	Channel and bench gravels of Gulch Creek.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Saturday Anne (Gold Jack)	212	Magnetic segregation	Lenses of disseminated, crudely banded, chromite in quartz-carbonate-sericite rock.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Van Dyke (Red Dog)	213	Magnetic segregation	6-in-thick chromite lens in ser-pentinite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Gallagher Chrome	214	Magnetic segregation	3 in. layer of disseminated chromite in altered dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Hop (Hopkins)	215	Magnetic segregation	Schlieren-banded, disseminated chromite in separentinized dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Briggs Creek	216	Magnetic segregation	Massive coarse-grained chromite in tclose serpentinite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Brown Scotch	217	Magnetic segregation	Narrow stringer (5–8 in.) chromite of massive chromite in dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Horse Mountain	217a	Magnetic segregation	Narrow bands of chromite in dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Sweden Creek	218	Placer	Bench and channel gravels of Sweden Creek.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Snowy	100	Placer	Channel and bench gravels in Rogue River gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Golden Eagle)	100	Placer	Channel and bench gravels of Rogue River gravels.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Jumpoff Joe (Cook and Howland)	125	Placer	Collluvium of old terrace gravels; irregular greenstone and rock.	Placer	Placer	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Wood	126	Magnetic segregation	Small lenses of massive to stringer-like chromite in pinky altered dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Steamboat Ridge	244	Magnetic segregation	Medium-grained narrow lens of massive chromite in serpentinite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Eureka	246a	Quartz vein	Ribbons, streaks, and bunches of quartz in sheared greenstone.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Lost Chance	245	Hydrothermal	Zone of disseminated to stringer-like chromite in serpentinite. Minor fracture-filling quartz veins.	Quartz vein	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
High View	246	Magnetic segregation	Massive coarse-grained chromite in tclose serpentinite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Clearwater	247	Magnetic segregation	No information.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Jet Bus – Lucky Star (Mcdonagh)	248	Magnetic segregation	Coarse-grained lenses and layers of massive chromite in dunite.	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23
Oregon Chrome	249	Magnetic segregation	Tabular to lens-shaped bodies of massive crystalline chromite in sheared, jointed, serpentinite	Magnetic segregation	Hydrothermal	No information.	Several shafts and pits.	No production recorded.		Small production but not recorded.		14,23

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IDENTIFICATION										GEOLOGY					FUTURE POTENTIAL	REMARKS	REFERENCES
MINERAL RESOURCE MAP NUMBER	MINE OR PROSPECT NAME	LAND STATUS F - Federal P - Private C - County S - State * Withdrawn from mineral entry; Wilderness or Wild River	COMMODITY	¼	¼	sec.	T.(S.)	R.(W.)	ELEVATION (ft)	GEOLOGIC FORMATION	MINERALIZATION TYPE	GEOLOGIC DESCRIPTION	SURFACE AND/OR UNDERGROUND WORKINGS	PRODUCTION PAST PRODUCTION Gold - oz Copper - lb Chromite - long tons Limestone - short tons	A - Large B - Moderate C - None to small		
250	Mule Shoe - Myrtle Creek	F	Chromium	SE	NW	21	37	9	1,150	um	Magmatic segregation	Thin bands of disseminated and coarse-grained chromite in altered dunite.	Small surface cuts.	No production.	C	Two small, closely spaced occurrences.	19
251	Black Rock Chromite	F	Chromium	SE	SW	9	37	8	4,400	um	Magmatic segregation	Small irregular segregation of crystals in dark-green serpentinite.	25-ft-deep shaft.	Small quantity; less than 10 tons mined prior to World War II.	C		13,14
252	Big Chief	F	Chromium	SW	NW	16	37	8	4,400	um	Magmatic segregation	Massive chromite in highly sheared serpentinite.	Shallow bulldozer excavation.	45 tons mined during 1950's.	C		19
253	Nichols	F	Chromium	NE	SW	21	37	9	1,400	um	Magmatic segregation	Banded, disseminated chromite float over blocky peridotite.	Small shallow bulldozer cut.	No production.	C		19
254	Black Otter	F	Chromium	SE	SE	20	37	9	1,100	um	Magmatic segregation	Sheared and fractured coarse-grained chromite in lens-shaped pods in blue-gray serpentinite.	Small surface cuts and shallow inclined shaft.	Small production; less than 10 tons.	C		19
255	Big Buck	F	Chromium	NW	NW	28	37	9	1,900	um	Magmatic segregation	Medium to coarse-grained lumps of float chromite from dunite bed rock.	Shallow discovery pit.	No production.	C		19
256	Leaning Pine	F	Chromium	NW	SW	22	37	9	2,700	um	Magmatic segregation	Thin lenses and stringers of chromite in highly contorted serpentinite.	Small surface excavations.	No production.	C	Assays indicate high iron content.	19
257	Shade (Black Prince)	F	Chromium	SE	SE	21	37	9	2,650	um	Magmatic segregation	Narrow layers and lenses of coarse-grained and nodular chromite in altered dunite.	Three levels of workings, totaling about 400 ft.	Total production to 1958 about 350 tons.	C		11,19
258	Crown (Hammer)	F	Chromium	NW	NE	28	37	9	3,050	um	Magmatic segregation	Small closely spaced lenses of massive chromite in bluish-gray blocky serpentinite.	50-ft-deep open cut, vertical shaft, and two short drifts.	Production from World War I thru 1958 total about 200 tons.	C		19
259	Black Diamond	F	Chromium	NE	NW	30	37	9	3,200	um	Magmatic segregation	Narrow discontinuous chromite zone in altered dunite.	Shallow surface cuts and shallow shaft.	See Butte.	C		19
260	Butte Chrome	F	Chromium	SE	NW	30	37	9	3,280	um	Magmatic segregation	Narrow discontinuous zone of massive chromite in dunite.	Bulldozer excavation.	Total production from Butte and Black Diamond 100 tons.	C	Near the Black Diamond.	19
261	High Ridge	F	Chromium	SW	NW	29	37	9	2,550	um	Magmatic segregation	3-ft-wide zone of banded, disseminated chromite in slightly altered dunite.	Small open cut.	No production.	C	High-alumina chromite.	19
262	Castle Spring (Lucky Strike)	F	Chromium	NE	SW	30	37	9	2,500	um	Magmatic segregation	Zones of disseminated and schlieren-banded chromite in dunite; also broken layer of massive chromite.	Two levels of open cuts.	65 tons of concentrate from 300 tons of ore milled in 1953.	C		19
263	Dirty Face Group	F	Chromium	NE	NW	29	37	9	2,080	um	Magmatic segregation	Float boulders of massive chromite in soil and rubble overlying serpentinized dunite.	Shallow pits and bulldozer excavations.	About 150 tons, most in 1943 and 1944.	C		19
264	Hansen	F	Chromium	SE	NW	29	37	9	2,000	um	Magmatic segregation	Narrow stringer of crushed chromite in mixed talc and serpentinite.	30-ft drift and surface excavations in landslide topography.	Total production about 180 tons.	C		19
265	Dark Star	F	Chromium	SE	SE	25	37	10	3,000	um	Magmatic segregation	Chromite boulders in landslide.	Surface excavations.	7 tons produced in 1954.	C		19
266	Early Sunrise	F	Chromium	SE	SE	35	37	10	3,950	um	Magmatic segregation	Small pods and stringers of chromite in serpentinite.	Surface excavation plus a 48-ft tunnel.	About 5 tons mined in 1955.	C		19
267	Cox - Thompson	F	Chromium	NE	SW	36	37	10	3,000	um	Magmatic segregation	No information.	No information.	None reported.	C	Location information only; may be part of Chrome King.	23
268	Chrome King	F	Chromium	NE	NE	36	37	10	3,180	um	Magmatic segregation	One or more lenticular layers of chromite up to 8 ft thick in serpentinized saxonite and dunite.	500 ft of underground workings on two levels plus surface cuts and pit.	Total production to 1958 about 1,400 tons.	C		11,13,16,19
269	Millers Dream	F	Chromium	SW	SW	32	37	9	2,080	um	Magmatic segregation	Fine-grained disseminated chromite in narrow zone in pale-green dunite.	Shallow surface pits and cuts.	No production.	C		19
270	Good Friday	F	Chromium	NW	NE	32	37	9	1,200	um	Magmatic segregation	Banded disseminated chromite in pale-green dunite.	Surface excavation only.	Small production (few tons) reportedly produced in 1940.	C		19
271	Deep Gorge	F	Chromium	NW	NE	32	37	9	1,150	um	Magmatic segregation	Olivine-rich peridotite contains layers and stringers of massive chromite.	Large surface excavations plus six short tunnels and connecting drifts and raises.	Estimated total production to 1938 is 2,000 tons.	C		19
272	Mocking Bird	F	Chromium	SE	SE	29	37	9	1,350	um	Magmatic segregation	Thin 3-ft layer and lenses of coarse crystalline chromite in blocky serpentinite.	Surface cut bench and two tunnels.	A total of 100 tons produced 1951 - 1958.	C		19
273	Oregonite	F	Semi-precious gemstones	SW	NE	33	37	9	2,420	Jrgv	Hydrothermal	Fracture fillings and lenses of spherulitic jasper in metabasalt flows.	Shallow surface cuts and a 30-ft tunnel.	1½ tons mined and marketed for as much as $5 per lb.	C	"Oregonite" is not a mineral name but trade name for this spherulitic jasper.	25
274	February	F	Chromium	NE	SE	33	37	9	1,650	um	Magmatic segregation	Massive chromite mixed with serpentinite.	Three surface cuts.	No production.	C		19
275	Young's (Daily Dozen)	F	Chromium	NW	NW	6	38	9	2,950	um	Magmatic segregation	Zones of disseminated chromite up to 12 ft wide in partly serpentinized dunite.	Several large open cuts.	Total production is about 800 tons of disseminated ore.	B-C	Saddle Chrome prospect joins the Daily Dozen and has similar ore zones.	19
276	Old Casey	F	Chromium	NE	NE	6	38	9	2,480	um	Magmatic segregation	Banded disseminated chromite in serpentinized dunite.	Two small surface pits and short inclined tunnel.	No production known.	C		19
277	Calumet (Mohawk)	F	Gold, copper	NE	SW	5	38	9	1,650	Jrgv	Volcanogenic(?)	Quartz veins and veinlets in fragmental tuffaceous greenstone, chalcopyrite, and galena.	Several old caved tunnels lead to nearly 2,000 ft of workings.	Gold production not reported; 180 tons of chromite produced.	C	Diller (1914) suggested this may be a large low-grade deposit; on the west side, chromite occurs at Mohawk in serpentinite.	3,5,14, 19,22
278	White Water	F	Chromium	SE	SE	5	38	9	1,600	um	Magmatic segregation	Thin lens of coarse-grained chromite in sheared green-gray serpentinite.	One short tunnel.	5 tons produced in 1950's.	C		19
279	Fall Creek (United)	F	Copper	NE	NW	4	38	9	1,150	Jrgv, um	Volcanogenic	Massive sulfides, pyrrhotite and chalcopyrite, in lenses in greenstone and serpentinite.	Several surface excavations; two tunnels (now caved) with about 1,000 ft of development work.	400 tons shipped in 1899; 25 tons shipped in 1956.	C	Now mostly within the corridor of the Illinois Wild and Scenic River.	3,5,13, 14,25
280	Lucky Hunch	F	Chromium	SE	SE	33	38	9	1,250	um	Magmatic segregation	Cluster of disconnected chromite lenses in highly sheared talcose serpentinite.	Large open cut.	150 tons produced in 1956.	C	One large pod of chromite 6 ft by 8 ft by 10 ft weighed 46 tons.	19
281	Store Gulch	F	Chromium	NE	NW	3	38	9	1,500	um	Magmatic segregation	Small chunks of chromite mixed in serpentinite.	Shallow bulldozer cut.	6 tons of float in 1950's.	C		19
282	Sixmile Copper	F	Copper	NE	SW	35	37	9	1,250	Jrgv	Volcanogenic	Massive sulfides, chalcopyrite and pyrite in metavolcanic and serpentinite contact zone.	Shallow discovery cut.	No production.	C	Minor gold, silver, and cobalt present in sulfides.	25
283	Sixmile Creek	F	Gold	NW	NW	2	38	9	1,520	Qs, um	Placer	20 ft of terrace gravel 500 ft above the Illinois River; serpentinite bed rock.	Small acreage mined.	Production not reported.	C		3,14,23
284	Stecher	F	Gold	SW	NE	2	38	9	1,100	Qs, Jrgv	Placer	Channel and bench gravels of Illinois River; serpentinite, greenstone bed rock.	Small area mined.	Production not reported.	C		14,23
285	Cedar Creek	F	Chromium	NE	NW	5	38	8	2,550	um	Magmatic segregation	Fine-grained massive chromite in serpentinite.	No information.	No production.	C		19
286	Bluff	F	Nickel, cobalt, copper	SE	NE	32	37	8	2,725	um	Metamorphic	Lens of massive magnetite with minor pyrrhotite and chalcopyrite in serpentinite.	Shallow open cut.	No production.	C	Selected rock assays 2% Ni, 2% Co.	25
287	Horseshoe	F	Chromium	NW	SW	33	37	8	2,080	um	Magmatic segregation	Sample only of massive chromite in serpentinite.	No information.	No production.	C	Part of Squaw Creek Group.	19
288	Rhea Chromite	F	Chromium	NW	NW	4	38	8	1,950	um	Magmatic segregation	Same as Horse Shoe.	No information.	None.	C	Part of Squaw Creek Group.	19
289	Squaw Creek (Lone Pine)	F	Chromium	NE	SW	4	38	8	1,600	um	Magmatic segregation	Dislocated broken pieces and lenses of massive chromite in sheared serpentinite.	Four levels of bulldozer cuts.	Production records not available but probably less than 50 tons.	C		13,19
290	McFarlane Brick Plant	F	Clay	SW	SE	24	37	8	1,650	Jgs	In situ weathering	Residual common clay on Jurassic shale, slate of Galice Formation.	Shallow pit about 1 acre.	No detailed records; brick and tile produced 1940-1947.	C	Products were common brick and tile of only medium quality for local use.	14,25
291	Marble Mountain	P	Limestone	SW	SW	19	37	6	2,300	TRas	Sedimentary	Tabular deposit of high-quality limestone interbedded in metasedimentary sequence of Applegate Group rock.	Large benched quarry with several levels.	Estimate 3 to 5 million tons produced from 1938 to 1960.	A	Large supply of high-quality limestone remains.	4,9,10, 14,25
292	Muck Limestone	P	Limestone	SW	NW	30	37	6	2,450	TRas	Sedimentary	Similar to Marble Mountain deposit; gray high-purity limestone.	Small quarry opening 25 ft high, 30 ft wide.	Some production of high-quality rock in 1940's.	A	Smaller lens of limestone in same zone as that at Marble Mountain quarry; large tonnage available.	4,9,14,25
293	LEJ Asbestos	F	Asbestos	SE	SW	9	37	6	1,225	um	Metamorphic	Two narrow seams (up to 4 ft wide) of tremolite asbestos in weathered serpentinized peridotite.	Open cut 70 ft wide, 120 ft long, 35 ft deep.	3 tons shipped in 1952.	C		25
294	Michigan	P	Gold	W½	SW	16	37	5	1,300	TRav	Volcanogenic	Pyritized quartz veins in greenstone.	Surface cuts; vertical shaft with two levels of workings, now caved.	No records.	C		3,4,5,10, 14,16
294a	Iron Hat	F	Gold	NW	SE	17	37	5	1,600	TRav	Volcanogenic	Gossan zone 500 ft wide, 1,000 ft long; also massive pyrite 200 ft wide in Triassic metavolcanic rock.	Surface cuts; one 150-ft tunnel plus some diamond drilling holes.	No production.	B-C	Large tonnage of pyrite; traces of copper and gold.	25
295	Glenda Lou	F	Gold	NE	NW	11	37	5	3,200	TRav	Quartz vein	Narrow high-grade stringers in weathered metavolcanic rock.	Several small surface cuts and one short adit (caved).	No production.	C		14
296	Bishop and Sturdevant (Oscar)	F	Gold	NE	SW	22	37	5	1,250	Qs, TRav	Placer	Channel and bench gravels (12 ft thick) of Oscar Creek; metavolcanic bed rock.	Not reported but considerable acreage worked.	Production records (totals) not available; early-day (before 1914) production of 2,200 oz.	C		3,14
297	Jewell and Moore Group	P	Gold	NW	NE	22	37	5	1,330	Qs, TRav	Placer	Channel and bench gravels of Oscar Creek.	Not reported.	Production to 1916 reported to be 2,500 oz.	C		5,10,14
298	Andes and Howard	F	Gold	SW	SW	15	37	5	1,750	TRas	Quartz vein	Northeast-trending shear zone in Applegate metasedimentary and metamorphic rock.	About 500 ft of workings on several levels (all caved).	No records.	C		5,14
299	Porcupine	F	Gold	SW	NW	23	37	5	2,600	TRav	Quartz vein	Quartz containing free gold in metavolcanic rock of Applegate Group.	No information.	No records of production.	C		14
300	Mountain Lion	F	Gold	SW	NW	25	37	5	1,350	TRav	Quartz vein	Quartz vein up to 3 ft wide in greenstone contains sulfides.	8,000 ft of crosscuts, drifts, and other workings, mostly caved.	Production not recorded but believed to be appreciable.	C		3,4,5,10, 14,16
301	Exchequer	P	Gold	NW	SE	35	37	5	1,250	TRav	Quartz vein	Pyrite and free gold in quartz and sheared greenstone 4 ft wide in Applegate metamorphic rock.	1,200 ft of workings on four levels, two shafts.	No records of production; estimates show about 2,500 oz.	C		4,5,14,22
302	Becca and Morning (Casey)	F	Gold, copper	NW	SE	7	38	9	3,350	Jrgv, um	Volcanogenic	On serpentinite/greenstone contact; altered zone with some gossan.	Three tunnels, now caved, and several surface trenches and pits.	Small production not recorded.	C	Assays show up to 8% Cu.	3,5,14,22
303	Big Four	F	Chromium	SW	SE	7	38	9	2,800	um	Magmatic segregation	Small lenses and discontinuous layers of massive chromite in serpentinite.	Open cut and short tunnel, now caved.	15 long tons in 1952.	C		19
304	Copper Boy	F	Copper	SE	NE	8	38	9	1,700	Jrgv, um	Volcanogenic	Small lens-shaped pods of copper sulfides and magnetite in serpentinite-greenstone.	Unknown.	No production.	C	Similar to mineralization at Fall Creek.	23,25
305	Williams and Adylott (Hoover Gulch Group)	F	Gold	SE	NE	10	38	9	2,000	Jrgv	Quartz vein	Thin to thick quartz veins with shear zones in greenstone, at contact with serpentinite.	Two short adits plus shallow surface excavations.	No records available.	C	Most of small production probably came from placer in gulch.	3,5,14,25
306	White Pine	F	Gold	NE	NW	14	38	9	3,900	Jrgv	Quartz vein	Quartz veins in greenstone with gold-bearing pyrite.	No information.	Not reported.	C		14
307	Gold Blanket	F	Gold	SE	NW	14	38	9	4,000	Jrgv	Quartz vein	Quartz veins in greenstone with gold-bearing pyrite.	No information.	Not reported.	C		14
308	Gold Ridge	F	Gold	NW	SW	14	38	9	3,850	Jrgv	Quartz vein	Quartz veins with free gold and pyrite in greenstone.	Surface excavations, shallow shafts and short adits, now caved.	250 oz from pocket prior to 1939.	C		3,14
309	Phillip (Vanguard)	F	Gold	NW	NW	23	38	9	3,200	Jrgv	Quartz vein	Sulfides in quartz in greenstone.	80-ft tunnel, now caved.	No records.	C	On Days Gulch near Pocket Knoll.	3,14
309a	Sulfide #1	F	Gold, copper	NE	SW	23	38	9	2,540	Jrgv	Massive sulfide	6-ft-wide zone of pyrite in altered metavolcanic rock.	One short adit N. 20° E.	No production.	C		25
310	Anderson (Holiday)	F	Gold	NW	NE	18	38	8	1,150	Qs, um	Placer	Channel and bench gravels of Illinois River; fine to coarse gold; rough serpentinite bed rock.	Large acreage mined; about 50 acres.	No records but production believed to be large; late 1800's and early 1900's.	B-C	On both sides of Illinois River below mouth of Josephine Creek.	3,13,14
310a	Griffin	F	Chromium	—	NW	18	38	8	1,450	um	Magmatic segregation	Banded chromite up to 4 ft wide in serpentinite.	Surface trenches, shallow shafts.	Estimated total 50 tons produced.	C	May have some reserves of concentrating ore.	19
311	Toots	F	Chromium	NE	NE	19	38	8	1,950	um	Magmatic segregation	Float boulders of massive chromite in serpentinite.	Surface pits.	4 tons produced.	C		19
312	Eight Dollar	F	Nickel	— — —	— — —	16, 21, 28	38	8	2,000	um	Residual concentration	Lateritic soil and saprolite up to 100 ft over an area of at least 200 acres.	Exploration trenches and backhoe pits plus drill holes.	No production.	A	With new extractive technology, this deposit represents large resource of nickel, cobalt, and chromium metals.	24,25
313	Stevens - Miller	F	Chromium	NE	SW	7	38	5	4,450	um	Magmatic segregation	Narrow lens-shaped bodies of massive chromite in serpentinite.	Two shafts and open cut 40 ft wide, 70 ft long and 12 ft deep.	40 tons produced in 1954.	C		19
314	Pennington Butte	F	Chromium	NW	NW	8	38	5	4,600	um	Magmatic segregation	Lenses of disseminated and massive chromite in serpentinite.	Long shallow surface trench.	30 tons produced 1942 - 1954.	C		10,19
315	King	P	Gold	NW	SW	17	38	5	2,000	TRav	Quartz vein	Narrow, discontinuous quartz veins in metavolcanic and metasedimentary rocks of Applegate Group.	100-ft tunnel and 100-ft shaft, now caved.	No records.	C		14
316	Sunny May Day	F	Gold	SE	NE	20	38	5	2,950	TRav	Quartz vein	No detailed information; quartz vein in greenstone.	No information.	No information.	C	May be part of the Red Rose Group.	23
317	Blue Mule	F	Gold	SE	NW	20	38	5	3,300	TRav	Quartz vein	Pyrite in narrow stringers of quartz in greenstone.	Open cut 30 ft long.	No records.	C		14
317a	Pugh Soapstone	F	Soapstone	SE	SW	17	38	5	2,750	um	Metamorphic	Selvages of talc on greenish-gray serpentinite.	Open cut.	Estimated 50 tons late 1960's.	C	Black soapstone sold for carving.	25
318	Snow Bird (Tip Top) (American Beauty)	F	Gold	NW	NE	20	38	5	3,200	TRav	Quartz vein	Northwest-trending quartz vein in metavolcanics and diorite; ore minerals are free gold, pyrite, galena.	Three adits and other cuts and shafts one above another; total about 600 ft.	No records; some ore mined and milled.	C		22,25
319	Humdinger	F	Gold	NE	NW	21	38	5	2,300	TRav	Quartz vein	Composite fissure vein up to 9 ft wide in greenstone and argillite.	1,200 ft of workings in several adits, and shafts.	Records incomplete; main production in early 1900's; 100 oz from lump ore in 1949.	B-C	Still worked in early 1970's.	3,4,5,10, 14,16,22,25
320	Oregon Bonanza	P	Gold	SE	SE	16	38	5	2,100	TRas	Quartz vein	Mineralized shear zones and quartz vein in intensely altered and silicified metasediments of Applegate Formation.	Tunnels, shafts, and lateral workings total about 1,300 ft.	Early records not available; smelter returns 1936 - 1939 show production of about 650 oz.	C	Ore minerals are free gold, pyrite, and galena.	3,5,14, 22,25
321	Rising Star (Oregon Beauty)	F	Gold	NE	NE	21	38	5	2,200	TRav	Quartz vein	Vein quartz up to 4 ft wide in metavolcanic rocks.	One adit 1,500 ft long.	No records.	C	Between Humdinger and Oregon Bonanza.	4,5,14
322	Horsehead (Washington Brick and Lime)	P	Limestone	SE	SW	15	38	5	1,700	TRas	Sedimentary	Part of narrow limestone lens within the Applegate Formation.	Quarry 200 ft long, 35 ft wide, 45 ft high.	Limestone has been produced at several periods, mainly in the 1930's, 1940's, and 1950's; no totals.	C		9,14,25
323	Summit Group	F	Gold	NE	SW	19	38	9	4,150	Jrgv	Volcanogenic	Pyrite and chalcopyrite in quartz veins and sheared zones in greenstone.	Several shallow open cuts and two short tunnels.	No production.	C		14,25
324	Neil	F	Gold	S½	SW	34	38	9	2,350	Jrgv	Volcanogenic	Shear zone near contact of greenstone and serpentinite.	One tunnel 400 ft long.	High-grade pocket reported to have been found.	C		3,5,14
325	Mood	F	Gold	NW	SE	34	38	9	1,800	Jrgv	Quartz vein	Irregular quartz veins in shear zone in greenstone.	Over 2,000 ft of workings; several tunnels and levels.	A few hundred ounces reported prior to 1927.	C		3,5,14
326	Blue Lode	F	Gold	NW	NW	35	38	9	2,800	Jrgv	Quartz vein(?)	No information.	No information.	No information.	C	Location information only.	13
327	McGrath Lode	F	Gold	SW	SW	26	38	9	2,850	Jrgv	Quartz vein(?)	No information.	No information.	No information.	C	Location information only.	13
328	Chatty	F	Gold	SE	NE	26	38	9	3,150	Jrgv	Quartz vein	Iron-stained quartz vein in decomposed greenstone at serpentinite contact.	Surface pits plus 110-ft-long tunnel.	Rich surface pocket yielded about 400 oz in early days.	C		3,5,14
329	Black King	F	Chromium	NW	SE	24	38	9	2,350	um	Magmatic segregation	Thin lenses of massive chromite in serpentinite.	Shallow surface cuts.	Small tonnage produced in 1950's.	C		19
330	Madison Gulch	F	Chromium	SE	NW	2	39	9	1,800	um	Magmatic segregation	Massive chromite; also some mixed magnetite in serpentinite.	Surface excavation.	No production.	C		19
331	Gray Rock	F	Chromium	SW	SE	35	38	9	1,700	um	Magmatic segregation	Irregular chunks of massive chromite in serpentinite.	No information on workings.	No production.	C		19
332	Foster Asbestos	F	Asbestos	N½	SW	36	38	9	1,350	um	Metamorphic	Chrysotile veinlets up to ½ in. wide in serpentinite.	150-ft adit plus several drill holes.	No production.	B-C	This property has been drilled by at least two mining companies.	13,25
333	Bear	F	Gold	NE	SW	36	38	9	1,350	Qs, um	Placer	Josephine Creek high bench gravels and conglomerates up to 100 ft thick.	1,100 ft of bedrock drifts; large yardage mined.	Not reported but probably 10,000 to 20,000 oz.	C		14,25
334	Gold King	F	Gold	SW	NE	36	38	9	1,250	Qs, um	Placer	Channel and bench gravels of Days Gulch and Josephine Creek; serpentinite bed rock.	No information on acreage mined.	No records available.	C		25
335	Norton (Suetter)	F	Gold	NE	NE	36	38	9	1,300	Qs, um	Placer	Channel and bench gravels of Josephine Creek.	Several acres worked with dragline and gravel-washing plant.	No records; has operated from early 1900's to the present.	C		13,25
336	Golden Princess	F	Gold	S½	SW	30	38	8	1,250	Qs, um	Placer	Bench gravels adjacent to Josephine Creek; serpentinite bed rock.	Several acres mined.	Not recorded; estimated 500 - 5,000 oz.	B-C	Seven mining claims, estimated 70 acres of placer ground.	13,14,25
337	Independence (Goshen)	F	Gold	NE	NE	30	38	8	1,250	Qs, um	Placer	High bench gravel and conglomerate in separate benches above Josephine Creek; serpentinite bed rock.	Several hundred feet of bedrock drifting; also large area mined hydraulically.	No records kept, but estimated 500 - 5,000 oz.	C	Water right dates to 1873.	13,14,25
338	Old Ray	F	Gold	NW	NW	29	38	8	1,200	Qs, um	Placer	Channel and bench gravels of Illinois River below mouth of Josephine Creek; serpentinite bed rock.	No information; some bed rock drifting.	No records of production.	C	This is probably near the site of the first discovery of gold in southwest Oregon in July 1850.	1,3,10
339	Nickel - Chrome Group (Eight Dollar #1)	F	Chromium	S½	NE	29	38	8	1,750	um	Magmatic segregation	Branching veins and veinlets of massive chromite in dunite.	Open cut 100 ft long, 60 ft wide, and 20 ft deep.	1½ long tons of hand sorted ore produced in 1952.	C		19
340	Free and Easy	F	Nickel	S½	—	32	38	8	2,200	um	Residual concentration	Red soil and weathered rock (saprolite) remnant of a large, old landslide.	Small discovery and exploration cuts.	No production.	B	Moderate to large potential reserves of nickel-bearing laterite present.	24,25
341	Deer Creek	F	Chromium	SW	SW	24	38	7	1,925	um	Magmatic segregation	No information.	No information.	None.	C	Location information only.	19
341a	Babcock	F	Copper	SW	SW	5	38	7	4,180	TRav	Volcanogenic	Massive pyrite layers and lenses in greenstone; metapillow basalt.	One short caved adit; dump about 200 cu yd.	None.	C		25
342	Paradise #1	F	Chromium	SE	NW	4	39	6	3,600	um	Magmatic segregation	Narrow stringers of massive and disseminated chromite in serpentinite.	Shallow bulldozer excavation.	No production.	C	Ore has low chromite content and low Cr:Fe ratio.	19
343	Paradise #2	F	Chromium	SW	SE	33	38	6	2,850	um	Magmatic segregation	Narrow sinuous zone of disseminated chromite in serpentinite.	Open-cut area with short tunnel.	Small quantity produced but not recorded.	C		10,16,19
344	Munger Creek (Silver Tip)	F	Chromium	SW	NW	25	38	6	3,700	um	Magmatic segregation	Thin lenses of massive and some disseminated chromite in sheared and broken serpentinite.	Narrow open cuts and one short tunnel.	Total production some during World War I is estimated to be 50 to 100 tons.	C	Ore is low grade and probably refractory.	11,19
345	Arrowhead	F	Gold	NE	SE	24	38	6	2,800	TRav	Quartz vein	Pyrite in narrow quartz vein in greenstone.	One short adit.	No recorded production.	C		5,14
346	Elder Manganese	F	Manganese	NW	NW	6	39	5	2,080	TRas	Metamorphic	Rhodonite and black manganese oxide in metasedimentary rocks.	Narrow open cut.	Small quantities of deep-pink rhodonite produced for lapidary use.	C		14
347	Jones Limestone	F	Limestone	SE	NE	31	38	5	2,500	TRas	Sedimentary, metamorphic	Elongate lens of white marble 300 ft wide, 2,000 ft long, interbedded with metasedimentary rock and serpentinite.	Three quarry levels.	Some early-day production for monument stone and a few thousand tons from 1950 to date.	B	Estimates of quantity present range from 5 - 10 million tons of marble.	4,9,10, 14,25
348	Red Rose (Dark Canyon)	P	Gold	E½, W½	SE, SW	19, 20	38, 38	5, 5	3,400	TRav	Quartz vein	Narrow northwest-trending fissure veins in complex metasedimentary, metavolcanic terrain; serpentinite present.	Several adits plus surface cuts; total over 700 ft.	Some production in early days from high-grade, hand-sorted ore; total not recorded.	C		14,25
349	Turvey Limestone	F	Limestone	SE	NW	29	38	5	3,200	TRas	Sedimentary	Narrow lens of limestone (marble) 25 - 40 ft wide, 400 ft long, interbedded metasedimentary rock.	None; outcrops only.	No production.	C		10
350	Brown Owl	F	Gold	SW	SW	20	38	5	2,600	TRav	Quartz vein	No information.	No information.	No information.	C	Location information only.	16
351	Bear	F	Gold	NW	NW	28	38	5	2,100	TRav	Quartz vein	No information.	No information.	No information.	C	Location information only.	16
352	Horsehead (Watts)	P	Gold	NE	SE	21	38	5	1,600	Qs, TRav	Placer	Creek gravels and colluvium 15 - 20 ft thick over a large area; greenstone bed rock.	At least 25 acres worked 1861 - 1940.	No accurate records but estimates are from 12,000 to 15,000 oz.	C	Fine and coarse gold with nuggets up to 12 oz.	3,5,10, 14,25
353	McPherson	F	Gold	NE	SE	7	39	9	2,800	Jrgv	Volcanogenic	Sulfides including tellurides reported from contact zone between slates and greenstone.	200-ft tunnel.	No production recorded.	C		3,5,13,14
354	Winters	F	Gold	SE	NW	8	39	9	2,000	Jrgv	Volcanogenic	Massive pyrite in greenstone; shear zone near their contact with metasedimentary rock.	Number of short prospect tunnels.	No production recorded.	C		3,5,14
355	Bowden	F	Gold	SW	NW	9	39	9	1,900	Jrgv	Volcanogenic	Pyrite and chalcopyrite in greenstone shear zone and quartz veins.	No information.	No production recorded.	C	Several tons of ore reportedly shipped in early days.	3,5,13
356	Big Bill	F	Chromium	SW	SW	11	39	9	2,400	um	Magmatic segregation	No information.	No information.	None.	C	Location information only.	19
357	Alta (Oro Fino)	F	Gold	NW	SE	2	39	9	1,600	um	Hydrothermal	Mineralized dacite porphyry (?) dike in serpentinite.	No information on workings.	Some early-day production, totals not recorded.	C		3,5,13,14
358	Low Boy	F	Chromium	NE	NE	2	39	9	2,200	um	Magmatic segregation	Banded disseminated and massive chromite layers in blocky saxonite.	Two open cuts about 30 ft wide, 50 ft long, 15 ft deep.	No production.	C		19
359	Tennessee	F	Chromium	NE	NE	11	39	9	1,850	um	Magmatic segregation	Coarse-grained massive chromite layer in blocky, partly serpentinized peridotite.	Small bulldozer excavation.	21 long tons of high-grade chromite shipped late 1950's.	C		19
360	Silver Nugget	F	Gold	SW	SW	12	39	9	1,600	Qs, um	Placer	Cemented bench gravels of Josephine Creek; serpentinite bed rock.	Three small surface pits; small area mined.	No production recorded.	C	Probably produced some josephinite.	13,14
361	Josephine #4	F	Chromium	NW	NE	13	39	9	2,000	um	Magmatic segregation	Narrow steeply dipping seams of chromite in serpentinite.	50-ft tunnel plus surface excavation.	A few tons shipped in 1950's.	C		19
362	Roseburg and Fidelity	F	Gold	SW	NW	7	39	9	2,200	Jrgv	Quartz vein	Vuggy quartz veins, free gold in greenstone surrounded by serpentinite.	Three tunnels, at least 500 ft, all now caved.	Rich placer deposits reported but production not recorded.	C		3,5,13,14
363	Tennessee Pass	F	Chromium	SE	NE	12	39	9	2,165	um	Magmatic segregation	Medium to coarse-grained massive chromite lenses in contorted serpentinite.	Short tunnel, now caved, plus surface excavation.	Total of 310 tons produced.	C	Most production during World War I.	19
364	Lucky Strike	F	Chromium	NE	SE	18	39	8	1,700	um	Magmatic segregation	1-ft-wide, sinuous discontinuous zone of chromite in highly sheared, serpentinized saxonite.	300-ft-long, 50-ft-wide, 20-ft-deep cut with short tunnel.	20 tons produced.	C		19
365	Chapman Creek	P	Chromium	SW	SE	14	39	8	2,260	um	Magmatic segregation	Banded, disseminated chromite in altered dunite.	Bulldozer excavations.	Production estimated to be small (less than 5 tons).	C		19
366	Holton Creek	F	Limestone	NE	NE	14	39	8	2,800	TRas	Sedimentary	Narrow lens of fine-grained, high-purity limestone.	No information on workings.	None reported.	B-C		14,25
367	Associated	F	Chromium	NE	NE	13	39	8	2,250	um	Magmatic segregation	2-ft-thick lenses of disseminated chromite in serpentinized dunite.	Irregular-shaped 20-ft-deep open cut.	Estimated production 5 - 10 tons.	C		19
368	Sulfide	P	Copper	SW	SE	21	39	7	1,700	TRav	Volcanogenic	Reported as occurrence of sulfides.	No information.	No production.	C		13
369	Old Smoky	F	Chromium	SE	SW	14	39	9	3,150	um	Magmatic segregation	Thin layers of massive chromite.	No information.	No recorded production.	C		19
370	Mighty Joe	F	Chromium	NW	SW	13	39	9	2,100	um	Magmatic segregation	Thin discontinuous chromite schlieren in serpentinite.	Four aligned open cuts.	7 tons mined and shipped in 1952.	C		19
371	Josephine Creek	F	Nickel	—	—	23, 24	39	9	2,000 to 2,400	um	Residual concentration	Several small- to moderate-size deposits of laterite soil and weathered peridotite.	Small exploration pits.	No production.	A-B (?)	Additional exploration needed to determine tonnage available.	20,25
372	Black Streak	F	Chromium	NW	NW	24	39	9	2,160	um	Magmatic segregation	Thin platy lenses of chromite in serpentinized dunite.	Small surface cut.	3-ton shipment in 1952.	C		19
373	Cutler	F	Gold, josephinite	NE	NW	24	39	9	1,800	Qs, um	Placer	Channel and bench gravels of Josephine Creek.	Small area mined.	No records; josephinite as well as gold produced in small quantities.	C	There are concentrations of josephinite at this location.	25

(continued)

TABLE 1. MINES, PROSPECTS, AND MINERALIZED AREAS OF JOSEPHINE COUNTY, OREGON

IDENTIFICATION										GEOLOGY					FUTURE POTENTIAL	REMARKS	REFERENCES
MINERAL RESOURCE MAP NUMBER	MINE OR PROSPECT NAME	LAND STATUS F - Federal P - Private C - County S - State * Withdrawn from mineral entry; Wilderness or Wild River	COMMODITY	¼	¼	sec.	T.(S.)	R.(W.)	ELEVATION (ft)	GEOLOGIC FORMATION	MINERALIZATION TYPE	GEOLOGIC DESCRIPTION	SURFACE AND/OR UNDERGROUND WORKINGS	PRODUCTION PAST PRODUCTION Gold - oz Copper - lb Chromite - long tons Limestone - short tons	A - Large B - Moderate C - None to small		
374	Woodcock Mountain Nickel	F, S, C, P	Nickel	—	—	25, 26, 30, 31	39, 39	9, 8	2,800 to 3,300	um	Residual concentration	Red soil and weathered rock (saprolite) underlie an area of 175 acres, 30 ft deep; bed rock partly serpentinized harzburgite.	Bulldozer trenching, drill-hole sites, and other surface pits.	No nickel production; exploration only.	A-B	Estimates of tonnage vary from 3 - 7 million tons of 1% Ni.	13,20,25
375	Nettie	F	Chromium	S½	NE	25	39	9	3,300	um	Magmatic segregation	Small stringers and lenses of chromite in partly serpentinized peridotite.	Small discovery cuts.	No production.	C	Low-grade; high-alumina chromite.	19
376	Dottie May	F	Chromium	NE	NW	30	38	8	2,400	um	Magmatic segregation	Narrow stringers of massive chromite in partially serpentinized dunite.	Shallow open cut and short tunnel.	No production.	C	Chromite is high-alumina, refractory.	19
377	Last Chance	F	Chromium	SE	SW	19	39	8	2,450	um	Magmatic segregation	Lenses and stringers of chromite in serpentinite.	Open cut 50 ft wide, 100 ft long, 25 ft deep.	None reported but small amount probably produced.	C		19
377a	Mansfield	P	Copper	SE	SW	27	39	7	1,700	um	Hydrothermal	East-west shear zone in serpentinite; secondary copper minerals.	Several bulldozer cuts.	No production.	C	Boulder-type copper deposits; chalcocite and native copper with magnetite in serpentinite.	25
378	Condore	P	Chromium	NW	SW	34	39	7	2,050	TRas	Quartz vein	Vein quartz in shear zone in metasedimentary rocks.	Glory hole shaft, 20 ft deep, plus other short caved shafts.	None recorded.	C		25
379	Cannon and Connacher	P	Gold	SW	SE	34	39	7	2,100	TRav	Quartz vein	Quartz vein 1½ - 4½ ft wide in metavolcanic, metasedimentary rocks.	250-ft tunnel with short inclined shaft.	None recorded.	C		14
380	Portland Group	F	Gold	NW	NE	3	40	7	2,550	TRas	Quartz vein	Quartz vein up to 3 ft wide in Triassic metasedimentary rocks.	All workings now caved, include 350-ft adit, 115-ft-deep shaft with other underground workings; total about 600 ft.	Some ore mined and milled in early 1900's; no totals recorded.	C		5,14
381	C C Chrome	F	Chromium	SE	NE	3	40	7	2,600	um	Magmatic segregation	No information.	No information.	No records.	C	Location information only.	23
382	Cohn Ledge	F	Gold	SW	SE	35	39	7	3,150	TRav	Quartz vein	Vein quartz in greenstone and metasedimentary rock.	Early-day shaft 300 ft deep is reported.	Ore is reported to have been mined and milled by Chinese workers in late 1800's.	C	Reported to be oldest lode mine in southern Oregon.	14
383	Boswell	P	Gold	SE	SW	36	39	7	2,650	TRav, um	Volcanogenic	Iron and manganese gossan in sheared zone several feet wide in meta-andesite at serpentinite contact.	Early-day pits and tunnels of several hundred feet; late 1970's, open pit.	Reports on production range from 3,000 - 15,000 oz from rich pocket-type accumulations.	C	Last worked during 1970's.	14,25
384	Akers (California Bar)	F	Gold	SW	NE	1	40	7	1,950	Qs, TRav	Placer	Channel and bench gravels of Sucker Creek.	No information of quantity or area mined.	No totals recorded but probably had sizeable production.	B-C	U.S. Bureau of Mines estimates 1 million cu yd of gravel remains.	14,16,25
385	Oregon Bar	F	Gold	SE	SE	36	39	7	1,900	Qs, TRav	Placer	Channel and bench gravels of Sucker Creek.	No information of quantity or area mined.	Same as above.	B-C	U.S. Bureau of Mines estimates over 1 million cu yd remain.	25
386	Gem Quartz (Little Jim)	P	Gold	SE	NE	36	39	7	2,300	TRav	Quartz vein	Rusty quartz veins with pyrite, chalcopyrite in greenstone.	Several adits; over 800 ft of workings.	No records but probably a few hundred ounces produced in early 1900's.	C		4,5,14,16
387	Ow Yuen	F	Manganese	NW	NW	5	40	6	2,400	TRas	Sedimentary, metamorphic	Small northeast-trending pods and lenses of pink rhodonite and oxides with quartzite.	Several shallow surface cuts.	Small quantity of lumps and chunks of lapidary material produced.	C		14
388	Dead Horse	F	Chromium	NW	SW	34	39	6	4,700	um	Magmatic segregation	Location information only.	Location information only.	No production.	C	Location information only.	19
389	Grayback	F	Gold	SE	NW	35	39	6	3,500	TRav	Quartz vein	Triassic metavolcanic rocks.	No information.	No production.	C	Location information only.	23
390	Rough and Ready Bench	F	Nickel	—	E½	1	40	10	2,800	um	Residual concentration	Total of 115 acres of red soil and weathered peridotite. Up to 35 ft deep, average Ni content estimated 0.7%.	Exploration trenches only.	Exploration only.	B	Part of Rough and Ready Group laterites.	24
391	Alberg	F	Gold	SE	NW	5	40	9	3,600	um	Hydrothermal	Gossan zone up to 4 ft wide in serpentinite near contact with gabbro.	Shallow discovery cut and inclined shaft of unknown depth.	No information.	C		13,25
392	Rough and Ready Group	F	Nickel	—	—	8-11, 14-18, 21,22, 27,28	40	9	Various elevations	um	Residual concentration	Several hundred acres underlain by red soil and weathered peridotite; average nickel content 0.8%.	Exploration excavations.	Exploration only to date.	A-B	Probably has largest and most important laterite deposits of the Rough and Ready area.	24
392a	Rough and Ready Outwash	F, P	Nickel	—	—	13,14, 18,19,	40	9, 10	Various eleva-	Qs	Transported and residual	1,100 acres underlain by red soil and weathered peridotite boulders.	Exploration trenches and pits.	Exploration only to date.	A-B	Large alluvial fan of Rough and Ready Creek.	24
393	Deep Gravel	P, F	Gold, platinum	—	—	16, 17, 20, 21	40	8	1,450	Qs, Ks	Placer	Llano de Oro Pleistocene terrace gravels up to 90 ft thick; Cretaceous sandstone bed rock.	Several large deep pits covering at least 65 acres.	Estimated production to 1942 is reported as about 25,000 oz.	B	Gravel reserves of 20 million cu yd reported to be present now.	3,4,5,8, 13,14,25
394	Llano de Oro	P	Chromium	NW	SW	22	40	8	1,600	um	Magmatic segregation	Irregular stringers and lenses of chromite in serpentinite.	Large placer mining pit exposes serpentinite in which chromite occurs.	No recorded production.	C	In pit #2 of Llano de Oro placer mine.	8, 19
395	Esterly	P	Chromium	—	S½, N½	22, 27	40	8	1,500	um	Magmatic segregation	Irregular bodies of chromite in serpentinite.	Several open pits and trenches.	Total production of about 1,500 tons.	C	1,100 tons produced World War I.	8,11,13,19
396	Esterly (Llano de Oro)	P	Gold, platinum	NW	NE	27	40	8	1,500	Qs, um	Placer	Pleistocene gravels of the Llano de Oro Formation average about 18 ft thick; serpentinite, sandstone bed rock.	Several large pits; more than 30 acres mined.	Total production from late 1800's to 1935 estimated to be about 25,000 oz.	B-C	One of the most productive gold-platinum placers in Oregon; large areas underlain by Llano de Oro Formation remain.	3,5,8,9, 13,14,22
397	Ali	F	Chromium	SE	SE	24	40	8	1,900	um	Magmatic segregation	Location information only.	Location information only.	No information.	C	Location from U.S. Bureau of Mines MILS.	23
398	Spence	F	Gold	SW	NW	19	40	7	2,600	TRav	Volcanogenic	Pyrite in greenstone.	Caved tunnels of 500 and 50 ft.	No recorded production.	C		25
399	Ducommun (Elephant)	P	Copper	NE	SE	18	40	7	2,000	TRav	Volcanogenic	Pyrite and chalcopyrite in greenstone.	One 440-ft adit.	No records of production.	C		4,5,14,25
400	Atlas Gold (Leonard)	P	Gold	—	—	4, 7, 8, 18	40	7	1,500	Qs, TRav	Placer	Channel gravels of Althouse Creek; greenstone and serpentinite bed rock.	No information on quantity mined.	Production not recorded.	C	2½ mi along Althouse Creek; last mined in 1941.	13,25
401	Horseshoe	F	Gold	NW	NE	17	40	7	1,800	TRav	Quartz vein	Greenstone-serpentinite contact.	Workings caved; dump indicates several hundred feet of workings.	No records.	C		5,14
401a	Kerby Queen (Sowell)	F	Copper	Near center		17	40	7	1,750	TRav	Volcanogenic	Chalcopyrite and copper oxides; shear zone in greenstone.	Two tunnels, about 1,000 ft of workings.	25,600 lb produced in 1900.	C	Had a 10-ton matte furnace about 1900.	14
402	Challard (Golconda)	F	Chromium	SE	SW	17	40	7	2,175	um	Magmatic segregation	Medium-grained disseminated to massive chromite as lenses and narrow seams in sheared to blocky serpentinized dunite.	700 ft of underground workings plus extensive surface excavations.	Total production World War I - 1954 about 3,500 tons of mill ore; 100 tons of lump ore.	C		11,13,19
403	Althouse	F	Chromium	NE	NE	22	40	7	2,100	um	Magmatic segregation	Lenses of massive chromite in serpentinite.	No information on workings.	19 tons of lump ore shipped in 1952.	C		19
404	Tip Top	F	Gold	NE	NE	11	40	7	2,720	TRav	Quartz vein	Sulfides in 3-ft-thick quartz vein in greenstone.	Crosscut tunnel 275 ft long.	No production recorded.	C		14,16
405	Rainbow (Siskron)	F	Gold	NW	NW	12	40	7	2,400	TRav	Quartz vein	Rusty quartz vein up to 5 ft thick with sulfides and free gold in greenstone.	Crosscut adit with winzes to several levels.	Production in 1917 - 1937 2,300 oz; minor production since 1937.	C		14,16,25
406	Yeager	P	Gold	NW	SE	12	40	7	2,050	Qs, TRav	Placer	Channel gravels of Sucker Creek; greenstone bed rock.	No information about area mined.	No records.	C	Location information only; U.S. Bureau of Mines MILS.	16,23
407	Edmonds	F	Gold	SE	SE	12	40	7	2,100	Qs, TRav	Placer	Channel and bench gravels of Sucker Creek with rough greenstone bed rock.	No information of area mined.	Production not recorded.	C	Location information only from U.S. Bureau of Mines MILS.	16,23
408	Four Star	F	Gold	NE	NE	13	40	7	2,150	Qs, TRav	Placer	Channel gravels of Sucker Creek.	No information.	No records.	C		14
409	Charlie Canyon	F	Chromium	SE	NW	30	40	9	3,050	um	Magmatic segregation	Lenses of massive refractory chromite in serpentinite.	No information.	No production.	C		19
410	Molly Group	F	Chromium	SE	NE	29	40	9	3,500	um	Magmatic segregation	Location information only.	Location information only.	No production.	C	Location information only.	19
411	Dick and Dick	F	Chromium	NW	NE	28	40	9	3,000	um	Magmatic segregation	Small chromite lenses in partly serpentinized peridotite.	Four narrow open cuts.	Small tonnage mined during World War I.	C		14
412	Reynolds Copper	F	Gold, copper	SW	NW	27	40	9	2,800	um	Volcanogenic(?)	Pyrrhotite and copper carbonates in serpentinite shear zone.	850 ft of tunnels; three adits now caved.	Production not recorded.	C		3,5,14
413	Cat Bird	F	Chromium	NE	SE	28	40	9	2,800	um	Magmatic segregation	No information.	No information.	None.	C	Refractory-grade ore reported; location information only.	19
414	Fry Gulch	P	Gold	SE	SW	28	40	8	1,550	Qs, Ks, um	Placer	Colluvium and gulch gravel derived from terrace gravels; average thickness 6 ft; sandstone and serpentinite bed rock.	No information on area mined.	No records of extensive mining and production of late 1800's and early 1900's.	C	Gold is reported to be flaky and angular; some has coatings of iron oxides.	3,8,13, 14,22
415	Waldo	P	Gold	SW	NE	28	40	8	1,565	Qs, um	Placer	Colluvium and gulch gravel derived from older terraces; serpentinite bed rock.	No information on area or quantity mined.	No production records of extensive early-day production.	C	Includes townsite of Waldo.	8,14
416	High Gravel (Osgood)	P	Gold	NE	NE	33	40	8	1,900	Qs, TRav	Placer	Weathered terrace gravels and colluvium in Allen Gulch; greenstone bed rock.	Large area; several deep pits mined in early days.	Estimated production of 6,500 oz to 1917.	C		3,4,8,13, 14,22
417	Logan's Sailors Gulch	P	Gold	SE	SW	27	40	8	1,825	Qs, TRav	Placer	Thick decomposed Pleistocene terrace gravels and colluvium in Sailor Gulch; greenstone bed rock.	Few acres mined from this part of the old Sailor Diggings.	Produced over 3,000 oz before 1900; no records since then.	C	Gravels up to 85 ft deep; still large yardage present.	3,8,14,22
418	Daisy Mining Co.	P	Gold	NE	NE	34	40	8	1,575	TRav	Volcanogenic	Pyrite, chalcopyrite with secondary copper minerals in iron-stained shears in greenstone.	Two adits, lengths unknown.	No recorded production.	C		5,14
419	Lilly	F	Copper	SW	SE	35	40	8	2,150	TRav	Volcanogenic	Irregular lenses and pods of massive sulfides (chalcopyrite, pyrrhotite, and sphalerite) in sheared greenstone.	Surface cuts and tunnel of several hundred feet with numerous crosscuts.	300 tons of copper ore (16 to 28%) produced in early 1900's.	C	Estimated that 120,000 lb of copper were produced from 300 tons early 1900's.	8,14,17
420	Waldo	P	Copper	NW	SW	36	40	8	2,300	TRav	Volcanogenic	Broken, faulted tabular layer of massive sulfides including pyrite, chalcopyrite, pyrrhotite, and cubanite in greenstone.	Several tunnels; total underground workings 2,000 ft plus surface cuts and pits.	No records but reports indicate it was the second largest producer in the Waldo District.	B-C	Development began in 1896; most production from 1903 - 1910.	3,4,5,8, 14,17,25
421	Queen of Bronze	P	Copper	NE	NW	36	40	8	2,400	TRav	Volcanogenic	Disconnected tabular bodies and lenses of massive sulfides, pyrite, pyrrhotite, chalcopyrite, sphalerite in greenstone.	7,000 ft of drifts and crosscuts on several levels; numerous large stopes.	Total production estimated to be 35,000 tons of ore from which about 6 million lbs of copper and 6,000 oz gold were produced.	C	Production mainly from 1903 - 1910, 1916 - 1919, 1928 - 1930; complex geology; greenstone appears to be derived from pillow lavas; exploration continues from time to time.	3,4,5,8, 14,17,25
422	Valen (Ali Baba)	F	Chromium	SE	NW	31	40	7	2,400	um	Magmatic segregation	Irregular, sinuous bands of disseminated chromite in serpentinized peridotite.	Several bulldozer cuts.	Total production of 550 tons of mill-grade chromite ore.	C		19
423	Elder Creek	F	Chromium	S½	SW	30	40	7	2,400	um	Magmatic segregation	Samples of massive chromite submitted for assay; no further information.	Not known.	No production recorded.	C		19
424	Happy Camp	F	Chromium	SE	NW	30	40	7	2,525	um	Magmatic segregation	Narrow seam of crushed chromite in highly sheared serpentinite.	Shallow cut and 15-ft adit.	Minor production of milling-grade ore, about 10 tons.	C		19
425	Sunset	F	Gold	SW	SW	22	40	7	2,000	Qs	Placer	Location information only.	No information.	No information.	C	Called Althouse - Rum Gulch in ref. 13.	13,23
426	May Queen (Apple)	F	Gold	SE	SE	28	40	7	2,250	Qs, TRas, um	Placer	Channel, bench, and gulch gravels of Althouse Creek; argillite, serpentinite bed rock.	About 5 acres worked on Althouse Creek and adjoining gulch.	Worked by hand for 80 years but no record of production.	C	Placer gold reported to be coarse.	14
427	Althouse - Rum Gulch	F	Gold	NE	SW	26	40	7	3,250	Qs, TRav, um	Placer	Old channel gravels with serpentinite, greenstone bed rock.	No information on area mined.	No records of production.	C	Ground reported to average $0.40 cu yd.	14
428	Luethye	F	Gold	NE	NE	26	40	7	3,680	TRav	Quartz vein	Location information only.	No information.	No records.	C	Location information only.	16,23
429	Middleman	F	Gold	SW	NW	24	40	7	3,680	TRav	Quartz vein	Quartz veins in slate and shale.	Three adits 150 ft, 100 ft, and 75 ft long.	No production recorded.	C		14
430	Four Leaf Clover	F	Gold	NW	NW	19	40	6	2,250	Qs, TRav	Placer	Partially cemented old channel gravels; 300 ft wide, greenstone bed rock.	150-ft drift on bed rock.	Production not recorded.	C		14
431	Bolan (State Claim)	F	Gold	SE	SE	19	40	6	2,600	TRav	Volcanogenic	Pyrite and free gold in shear zone in greenstone.	One 250-ft tunnel; one 80-ft inclined shaft.	Production, if any, not recorded.	C		14
432	Brooklyn (Gold Pick)	F	Gold	NE	SW	30	40	6	3,450	TRav	Quartz vein	Quartz vein 1 ft wide with pyrite in greenstone.	300-ft main adit and several short stopes.	Production probably small; not recorded.	C		4,5,14
433	Bolan (Black Diamond)	F	Chromium	NW	SW	31	40	6	3,600	um	Magmatic segregation	Thin lenses of fairly massive chromite in highly sheared serpentinite.	Surface excavations.	Few tons of marginal ore shipped in 1950's.	C		19
434	Bonanza	F	Chromium	SW	SW	31	40	6	3,850	um	Magmatic segregation	Location information only.	Location only.	Only location information.	C		23
435	Kester	F	Gold	NE	NE	29	40	6	2,650	Qs	Placer	Channel gravels of Sucker Creek.	No information.	Production information not available.	C	Location shown on Oregon Caves 15' Quadrangle map.	16
436	Grizzly	F	Gold	W.edge	SW	33	40	6	3,100	Qs	Placer	Location information only.	No information on workings.	Production information not available.	C	Location shown on Oregon Caves 15' Quadrangle map.	16
437	Mountain View (Mitchell)	F	Gold	SE	NE	23	40	5	4,800	TRav	Quartz vein	Iron-stained vein quartz; contains free gold in greenstone.	Adit and shaft with a total of about 250 ft of workings.	Few hundred ounces mostly from 1937 to 1942.	C		14,25
438	Cedar Springs	F	Nickel	—	—	35	40	10	4,000	um	Residual concentration	Red soil and weathered rock overlying partly serpentinized harzburgite and dunite.	Small exploration pits.	Exploration is only activity to date.	B	Estimated tonnage 2,700,000 tons of 0.6% Ni.	24
439	Black Bear	F	Chromium	SW	NE	7	41	9	2,550	um	Magmatic segregation	Narrow zone of banded disseminated chromite in dunite.	Several large bulldozer cuts.	No production.	C		19
440	Blue Bucket #5 (Last Drink #1)	F	Chromium	SW	SW	8	41	9	2,400	um	Magmatic segregation	Narrow zone of nodular chromite in blocky serpentinized saxonite.	Small hand dug surface excavation.	No production.	C		19
441	God's Little Acre	F	Chromium	NW	SE	32	40	9	3,200	um	Magmatic segregation	No information.	No information.	No production.	C		19
442	Chrome King (Fattig)	F	Chromium	SW	NE	5	41	9	2,800	um	Magmatic segregation	Massive refractory chromite; thickness and enclosing rock not known.	No information.	No production.	C		19
443	Chrome Dome	F	Chromium	SW	NW	9	41	9	2,450	um	Magmatic segregation	Narrow zone of disseminated chromite in dunite.	Small trench.	No production.	C		19
444	Albright (Turner)	P	Copper, gold	SE	NE	16	41	9	2,800	Jrgv	Volcanogenic	Two or more thick lenses of massive sulfides overlain by gossan enclosed in fine-grained greenstone.	Numerous short tunnels, surface pits and drill sites.	Small production of gold from gossan ore in early days.	B	Pyrite and chalcopyrite are chief sulfide minerals; exploration continues from time to time at this promising copper prospect.	8,13,14, 22,25
445	Owens (Black Nugget)	P	Chromium	SE	NW	11	41	8	2,650	um	Magmatic segregation	Lenses of massive chromite in sheared serpentinite.	Large, irregular bulldozer cut.	200 tons produced World War I - 1958.	C		8,11,13,19
446	Cowboy	P	Copper	NE	NE	11	41	8	2,550	TRav, um	Volcanogenic	Series of lenses of massive sulfides in serpentinite at greenstone contact.	2,000 ft of tunnels and various surface pits.	1,500,000 lb of copper estimated from 5,000 tons of ore early 1900's.	B-C	Pyrrhotite, chalcopyrite, and sphalerite are main sulfide minerals; cobaltite and cubanite are present.	8,13,14
447	Lyttle	P	Copper	SE	SW	1	41	8	2,700	TRav	Volcanogenic	Disconnected layers and lenses of massive sulfides including chalcopyrite in greenstone.	800 - 1,000 ft of early-day workings; none open now.	300,000 lbs of copper from 1,500 tons of ore; this may be included with production from Queen of Bronze.	C	Ore treated at Takilma smelter.	1,2,3,8,14
448	Black Boy	F	Manganese	SE	SW	7	41	7	4,480	TRas	Sedimentary	Manganese oxides, hematite, and magnetite in a layer of chert.	Inaccessible 25-ft shaft and small test pits.	No production.	C	Low-grade material in a narrow lens of brecciated chert.	18
449	Lucky Strike	F	Gold, silver, copper	SE	SW	5	41	7	4,000	TRas	Quartz vein	Pyrite, chalcopyrite, and galena in a 5-ft-wide, flat-lying quartz vein in metasedimentary rock.	Shallow surface excavations.	Minor placer production.	C		25
450	Johnson	F	Gold	SE	NW	9	41	7	3,500	Qs, TRav	Placer	Channel gravels containing large boulders; W. Fork Althouse Creek; greenstone bed rock.	5 acres reported mined.	No records of production.	C		14,25
451	Ramsey	F	Gold	SW	NW	9	41	7	3,800	TRav	Volcanogenic	Gossan zones in fine-grained metavolcanic rock.	Trenches and other surface excavations.	No records of production.	C	Assays show only trace amounts of gold, silver.	16,25
452	Frog Pond	F	Gold	SW	NE	15	41	7	4,400	TRav	Quartz vein	Free gold and sulfides in quartz veins and calcite stringers in greenstone.	Early-day shafts, short tunnels and connecting workings total less than 300 ft.	No records.	C		13,14,16,25
453	Pony Shoe Group	F	Gold	SW	NW	14	41	7	5,000	TRav	Quartz vein	Pyrite, galena, chalcopyrite in quartz and calcite pods and stringers in fractured greenstone.	500 ft in several adits and inclined raises, none open now.	No records.	C		13,14,16,25
454	Happy Day Group (Blanket Ledge)	F	Gold	NE	NW	13	41	7	5,200	TRav	Quartz vein	Narrow flat-lying quartz vein containing sulfides in metavolcanic rock.	Several cuts and three tunnels totaling about 500 ft.	Small production reported in the 1930's.	C		14
455	Althouse	F	Gold	SW	NW	12	41	7	4,450	Qs, TRas	Placer	Channel gravels of upper Althouse Creek.	No information.	No records.	C		13,14
456	Lucky Strike	F	Gold	NW	SW	1	41	7	5,000	TRav, um	Volcanogenic	12-ft-wide contact zone of greenstone-serpentinite; free gold in talcose gouge.	Small area stripped using self-shooter.	Up to 1937, 50 oz of production from pockets reported.	C		14
457	Camp Bird	F	Gold	NE	NE	7	41	6	5,300	TRav	Quartz vein	Narrow quartz vein in greenstone.	Short adit and shaft no longer accessible.	No records.	C		4,5,14
458	Lucky Penny	F	Gold	NW	NW	16	41	6	5,700	TRav	Volcanogenic(?)	Location in metagabbro; no information on mineralization.	No information.	No records.	C		23,25
459	Tomlinson, Gates, and Thompson	F	Copper	SE	SE	5	41	6	4,850	TRav	Quartz vein	4-ft-wide zone of quartz with chalcopyrite, bornite, chalcocite and secondary copper minerals.	Upper shaft and other workings of unknown length.	No records.	C		4,14
460	Tannen	F	Gold	SE	NW	4	41	6	3,280	Qs, TRav	Placer	Channel and bench gravels of Sucker Creek; greenstone bed rock.	No records of acres or yardage mined.	No recorded production.	C		14
461	Lost (Swan Mountain Group)	F	Gold	NE	NE	2	41	6	5,600	TRav	Volcanogenic	Sulfide zones in greenstone; free gold and secondary copper minerals.	400 ft of open pit works.	Production records not available.	C		14
462	Briggs Pocket	F	Gold	—	NE	14	41	6	5,000	TRav	Quartz vein	Surface concentration of free slab gold in narrow quartz vein in metavolcanic rock.	Shallow surface cuts only.	Minimum of 2,000 oz in 1904 from small quantity of quartz ore.	C		22
463	Wild Deer	F	Manganese	SE	NW	8	41	5	2,000	TRas	Sedimentary	Manganese and iron oxides in quartzite (chert) associated with metavolcanic rock.	Several shallow prospect pits and trenches.	No production.	C	Several truckloads smelter-tested in 1940's and found to be acceptable additive in manufacturing of foundry pig iron.	18
464	High Gap	F	Chromium	NW	NW	16	41	5	6,000	um	Magmatic segregation	High-iron chromite in serpentinite.	No information.	No production.	C		25
465	Sunset	F	Chromium	SE	NE	16	41	5	5,150	um	Magmatic segregation	Massive float chromite on serpentinite.	No information.	No production known.	C		19
466	Arnold	F	Gold	NE	NE	16	41	5	5,680	TRas	Quartz vein	2-ft-wide quartz vein with free gold and sulfides in metasedimentary rocks.	Two tunnels and long trench explore vein.	At least 600 oz produced up to 1940.	C	Average tenor of ore reported to be $20 per ton (Gold at $35).	14,25
467	Hinkle Lake	F	Manganese	NE	NW	10	41	5	5,500	TRas	Sedimentary	Mixed manganese and iron oxides in lenses and layers in quartzite.	Small trench.	No production.	C		18
468	Low Gap	F	Manganese	SW	SE	34	40	5	4,500	TRas	Sedimentary	Mixed manganese oxides and rhodonite as narrow bands in quartzite.	Shallow surface cuts.	No production.	C		18
469	Larkspur	F	Manganese	NE	SW	2	41	5	5,000	TRas	Sedimentary	Mixed manganese and iron oxides as bands and lenses in quartzite.	No workings.	No production.	C		18
470	Cynthia	F	Chromium	SE	NE	15	41	5	4,600	um	Magmatic segregation	Lenses of massive chromite in serpentinite.	Open cut 200 ft long, 25 ft wide, 15 ft deep.	135 tons produced in 1957 plus a small amount during World War I.	C		19

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DONALD A. HULL, STATE GEOLOGIST

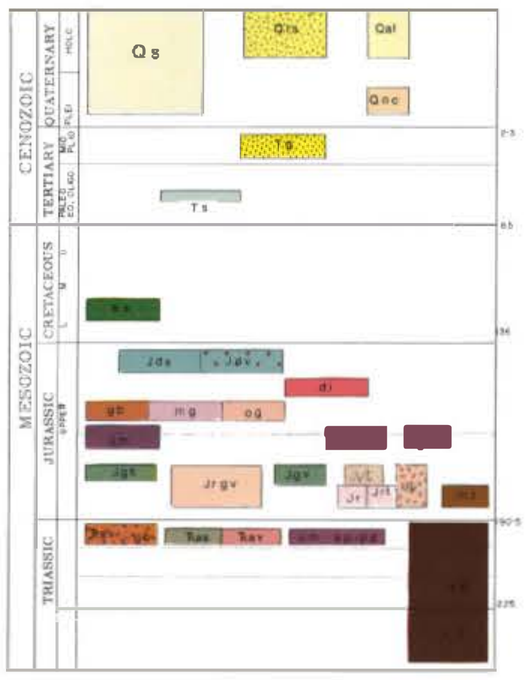
PLATE 1

GEOLOGIC MAP of Josephine County, Oregon 1979

NORTH

Compiled by Len Ramp 1979
Cartography by C. A. Schlicker 1979

GEOLOGIC TIME ROCK CHART



(Bibliographic and geographical statements are deemed also explanations required on the investigation.)

EXPLANATION

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCK UNITS

Qs — **Quaternary sediment:** *Stream-deposited sand, silt, and gravel; bench gravel deposits; glacial moraines; outwash and fan deposits (not always shown where thin). Source of sand and gravel where conveniently located. Some areas still contain important deposits of placer gold and minor platinum.*

Qls — **Landslide deposit:** *Mass-wasted rock and soil debris with wide range of size and composition. Only a few of the larger and more recent landslide areas have been mapped. Ancient landslides in ultramafic rocks may contribute to reserves of nickel-bearing laterite. Colluvium (eluvium) composed of loose rock and soil derived from underlying bed rock.*

Tg — **Tertiary gravel:** *Old stream gravels above 4,000 ft elevation near York Butte. No known mineral potential, but these deposits probably contributed some placer gold where carried by erosion in to streams such as Red Dog Creek.*

Ts — **Umpqua Group:** *Marine sedimentary rocks including conglomerate, mudstone, and siltstone exposed near west edge of County along Illinois River. No known mineral potential.*

Ks — **Marine sedimentary rock:** *Marine, beach, and nearshore deposits of conglomerate, sandstone, and siltstone. Includes Lower Cretaceous "Grave Creek Strata" of Page and others (1977) and Jones (1960), formerly Hornbrook Formation of Peck and others (1956) in Grave Creek drainage, and Lower Cretaceous rocks (Horsetown Formation) of Wells and others (1949) in southern Illinois Valley (Imlay and others, 1956). Former bed rock for gold placer mines in Illinois Valley. Conglomerate layers may have contributed some gold.*

Jds / Jdv — **Dothan Formation:** *Marine sandstone, siltstone, chert, and conglomerate (Jds). Pillow basalt and tuffs (Jdv). No known metallic minerals, locally used as source of road building material.*

Jgs — **Metasedimentary rock:** *Slaty siltstone, sandstone, and shale. Galice Formation of Diller and Kay (1924), Wells and others (1940, 1949), and Wells and Walker (1953). Gold mineralization in quartz veins and shear zones occurs locally. This unit is bed rock for numerous gold placer mines. Where deeply weathered, rocks form clay suitable for common brick and tile.*

Jrgv — **Metavolcanic rock:** *Rogue and Galice Formations, including siliceous to basic tuffs, andesitic to basaltic flow rock, pillow lavas, breccias, and agglomerates; also contains minor interbedded tuffaceous sedimentary rocks including chert, graywacke, and mudstone. Diabasic dike swarms occur locally. Most favorable unit for locating massive sulfide deposits and gold-bearing quartz veins. Many productive mines occur in metavolcanic rocks with gabbro-serpentinite associations.*

Ras / Rav — **Applegate Group:** *Metasedimentary rocks include slaty siltstone, argillite, quartzite, phyllite, schist, chert, conglomerate, and lenses of limestone (largely marble) (Ras). Metavolcanic rocks include pillow lavas, tuffs, breccias, agglomerates, and locally, numerous gabbro and diabase dikes (Rav). Metallic minerals are found mainly with metavolcanic rocks and include volcanogenic base metal sulfide deposits near Takilma and numerous gold-bearing quartz veins. Lenses of high-purity limestone (marble) and beds of rhodonite are associated with metasedimentary rocks.*

Briggs Creek amphibolite: *Gneissic amphibolite rich in quartz, green amphibole, and plagioclase; locally includes quartzite and garnet-rich layers; may be equivalent to the Applegate Group or May Creek Schist of Diller and Kay (1924). Contains gold bearing quartz veins, narrow zones of base metal sulfides, and minor lenses of rhodonite and manganese oxide.*

INTRUSIVE ROCK UNITS

di — **Quartz diorite and related rocks:** *Includes hornblende diorite, granodiorite, and a few dacite and diabase dikes. Where decomposed is source of common fill. Pegmatite veins contain high-purity quartz and feldspar. Minor gold, copper, and molybdenite mineralization occurs near contacts with older rocks.*

Jdv / Rav — **Dike rock:** *Areas of abundant gabbro and diabase dike swarms in older volcanic rocks (gb + Rav). Gold-bearing quartz veins are concentrated in these rocks primarily in Greenback area.*

gb / mg / og — **Gabbro (gb), metagabbro (mg), and olivine gabbro (og):** *Includes massive and layered gabbroic rocks with cumulate textures. Pyroxenes of metagabbros are generally altered to amphiboles, and rocks resemble gneissic amphibolites. Olivine gabbro locally contains minor disseminated copper sulfides; gabbros locally have concentrations of up to 10 percent magnetite.*

um — **Ultramafic rock:** *Largely serpentinite with some residual peridotite including harzburgite, dunite, and pyroxenite. Narrow serpentinite bodies are highly sheared and occupy zones of major faulting. Contains deposits of platinum and disseminated chromite, nickel in laterites, and minor copper and gold. Platinum of placer deposits also originates in these ultramafic rocks.*

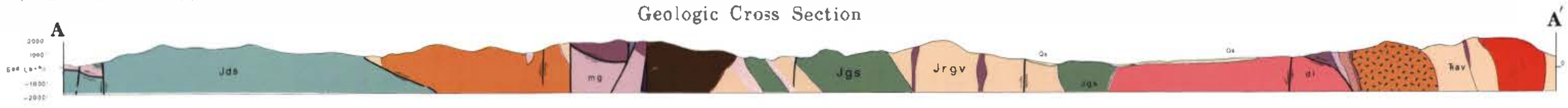
Modified after Diller and Kay (1924); Godchaux (1959); Page and others (1978); Shenon (1933a); Vail (1977); Wells and others (1940); Wells and others (1949); Wells and Peck (1961); and Wells and Walker (1953).

GEOLOGIC SYMBOLS

High-angle fault: *Some faults may have been channelways for ascending metal-bearing solutions that resulted in deposits of gold, silver, copper, and other minerals; however, some faults are post-mineralization and displace ore-bearing veins.*

Thrust fault: *Some important gold mineralization may be associated with thrust fault marking east edge of Dothan Formation (Jds, Jdv) e.g. Bentor Mine and Red Elephant and Blue Bell prospects. Direct association, however, is obscure (saw-teeth in upper plate).*

Geologic Cross Section



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Mineral Locality Map of Josephine County, Oregon 1979

NORTH

Legend

- Nickel Laterite Areas
- Limestone and Marble Lenses
- Metallic mineral mine or prospect: includes gold, copper, molybdenum, zinc, mercury
- Metallic mineral mine or prospect: includes nickel, chromium, manganese, iron
- Nonmetallic mineral mine, quarry, or prospect: includes limestone, silica, soapstone, asbestos, clay, semiprecious gemstones
- Numbers in circles, squares and triangles refer to table

Boundaries and sites are approximate • Limited by scale of map

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Base Map from USGS 15' series (Topographic)

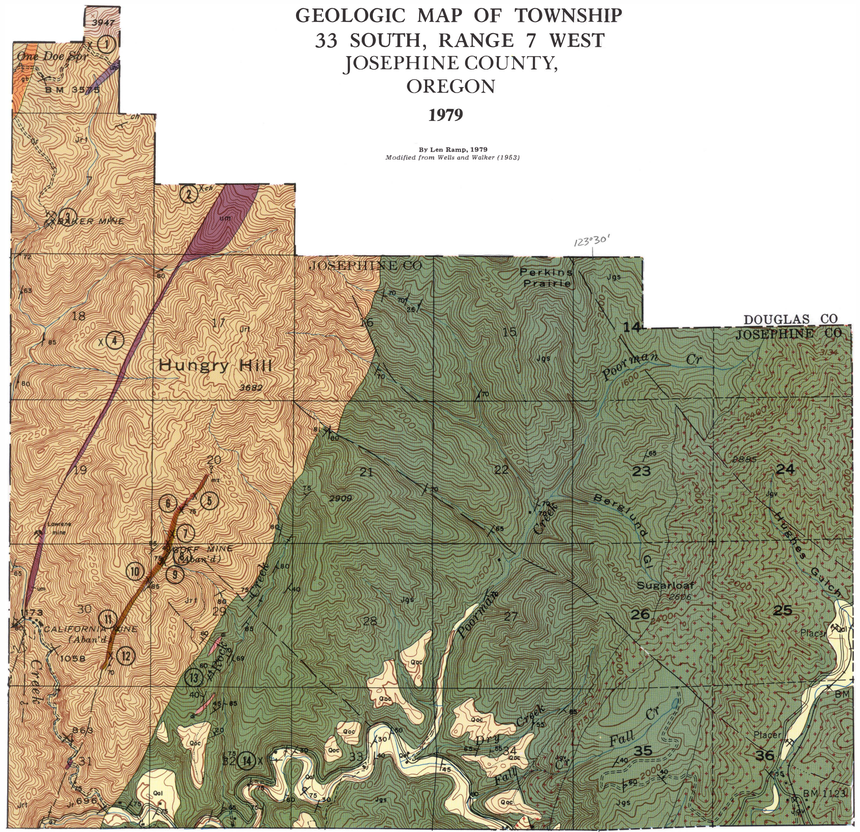
Mineral Locality Map of Josephine County

PLATE 2

GEOLOGIC MAP OF TOWNSHIP 33 SOUTH, RANGE 7 WEST JOSEPHINE COUNTY, OREGON

1979

By Len Ramp, 1979
Modified from Wells and Walker (1952)



SCALE

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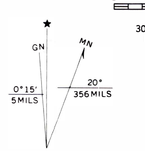
CONTOUR INTERVAL 80 FEET



UTM GRID AND 1954 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

GEOLOGIC MAP OF TOWNSHIP 33 SOUTH, RANGE 7 WEST IN JOSEPHINE COUNTY

EXPLANATION

SEDIMENTARY AND LAYERED VOLCANIC ROCKS

Alluvium: *Gravel, sand, silt, and colluvium along creeks and low-level bench gravels along Grave and Wolf Creeks. Unit is generally gold bearing. Included in* **Qs** *on* **Geologic Map of Josephine County (Plate 1)**

Old Channel gravel: *Poorly sorted, locally decomposed gravel intermixed with layers of gray clay and buff to red sandy soil from 200 to 600 ft above present stream level. Unit is usually gold bearing. Included in* **Qs** *on* **Geologic Map of Josephine County**

Galice Formation metasedimentary rock: *Dark-gray to black, thin-layered slaty siltstones with less abundant graywacke sandstones and minor layers of grit. Small lenticular quartz veins are common in some areas of slaty siltstone*

Galice Formation metavolcanic rock: *Andesitic lava flow rock, agglomerates, tuff breccias, and interbedded tuffaceous sedimentary rocks. Included in* **Jrgv** *on* **Geologic Map of Josephine County (Plate 1)**

Rogue Formation: *Layered siliceous to basic metavolcanic rocks; largely tuffs and tuff breccias with mainly andesitic lava flow rock and some agglomerates with minor interbedded tuffaceous sedimentary rock and chert. Undifferentiated Rogue Formation* **(Jr)**. *Area of mostly tuff* **(Jrt)**. *Small area of chert* **(ch)**. *Included in* **Jrgv** *on* **Geologic Map of Josephine County (Plate 1)**

INTRUSIVE AND MINERALIZED ROCKS

Quartz diorite: *Small, deeply weathered dikes, probably quartz diorite composition. Intrudes Galice Formation sedimentary rock*

Gabbro: *Stringers and lenses of dikelike gabbro and diabase intrusive rock in Rogue Formation occurring at One Doe Spring and mainly west of the map area*

Serpentinite: *Altered peridotite; highly sheared where intruded along fault zones as west of Hungry Hill. Equivalent to* **um** *on* **Geologic Map of Josephine County (Plate 1)**

Mineralized zone: *Altered, pyrite-impregnated, tuffaceous rocks with lenses of barite and massive pyrite at the Goff Mine, occurring parallel to layers and foliation in the Rogue Formation* **(Jrt)**

Table 5. Sample assay results T. 33 S., R. 7 W.

Map number	Sample number	Sample type	Mine or prospect	Location ¼	¼	Sec.	Au oz/ton	Ag oz/ton	Cu ppm	Zn ppm	Description
1	AMG–37	Grab	None	NW	SE	6	Trace	Nil	165	42	Vein quartz.
2	AMG–38	Grab	None	NE	SW	8	Trace	0.3	120	26	Vein quartz in chert.
3	AMG–36	12-in. chip	Baker Mine		SW	7	0.01	0.1	190	20	Vein quartz in chloritic greenstone.
4	AMG–35	Grab	None	SW	SE	18	0.01	Nil	105	20	Altered siliceous volcanic rock (float).
5	AMG–39	Multiple grab	Goff zone	N	SW	20	0.005	0.2	495	44	Gossan. Leached outcrop siliceous metavolcanic rock with abundant limonite.
6	AMG–40	Multiple grab	Goff zone		SW	20	Trace	Nil	575	118	Gossan. Leached outcrop siliceous metavolcanic rock with abundant limonite.
7	AMG–41	Grab	Goff zone	SW	SW	20	0.005	Nil	2,200	109	Limonite gossan.
8	AMG–15	Grab	Goff Mine	NW	NW	29	0.13	4.99	-----	-----	Massive barite with minor disseminated sulfides from ore pile.
9	AMG–34	45-ft chip	Goff Mine	NW	NW	29	0.01	Nil	855	4,000	Chipped across mineralized zone in adit.
10	AMG–42	Multiple grab	Goff zone	E	NE	30	0.01	Nil	510	78	Leached outcrop siliceous metavolcanic rocks with abundant limonite gossan.
11	AMG–43	Multiple grab	Goff zone	N	SE	30	Trace	Trace	400	202	Leached outcrop siliceous metavolcanic rocks with abundant limonite gossan.
12	AMG–44	16-ft chip	Goff zone		SE	30	0.01	Nil	110	72	Siliceous tuff with streaks of pyrite from wall of 16-ft adit.
13	AMG–14	Grab	None	SE	SW	29	0.24	0.12	-----	-----	Leached outcrop iron and manganese oxide-stained shear zone.
14	AMG–33	Grab	None	E½		32	0.02	Nil	110	26	Vein quartz in slaty siltstone.

Geologic Symbols

- Contact.
- Fault dashed where approximate; dotted where concealed. Arrow shows direction of dip. Bar and Ball on downthrown side.
- Thrust fault dashed where approximate; dotted where concealed. Teeth on upper plate.
- Strike and dip of layered rocks.
- Strike and dip of foliation
- Strike of vertical layers
- Strike of vertical foliation
- Strike and dip of overturned layers
- Sample site.
- Areas of thin partial colluvium cover.

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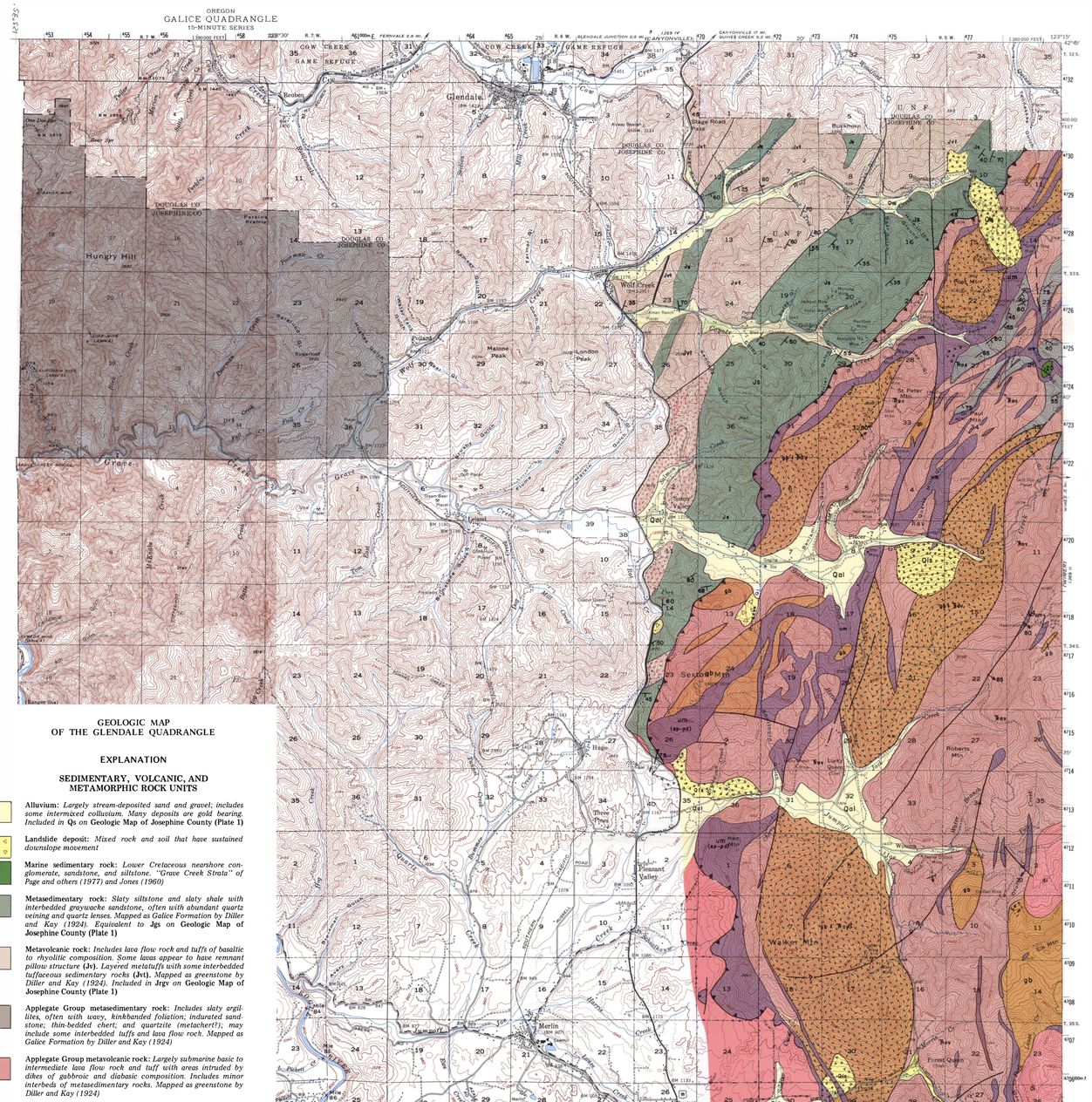
GEOLOGIC MAP OF THE GLENDALE QUADRANGLE (in part) JOSEPHINE COUNTY, OREGON

1979



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GEOLOGIC MAP OF THE GLENDALE QUADRANGLE

EXPLANATION

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCK UNITS

Qal — **Alluvium:** *Largely stream-deposited sand and gravel; includes some intermixed colluvium. Many deposits are gold bearing. Included in* **Qs** *on* **Geologic Map of Josephine County (Plate 1)**

Qls — **Landslide deposit:** *Mixed rock and soil that have sustained downslope movement*

Ks — **Marine sedimentary rock:** *Lower Cretaceous nearshore conglomerate, sandstone, and siltstone. "Grave Creek Strata" of Page and others (1977) and Jones (1960)*

Js — **Metasedimentary rock:** *Slaty siltstone and slaty shale with interbedded graywacke sandstone, often with abundant quartz veining and quartz lenses. Mapped as Galice Formation by Diller and Kay (1924). Equivalent to* **Jgs** *on* **Geologic Map of Josephine County (Plate 1)**

Jvt — **Metavolcanic rock:** *Includes lava flow rock and tuffs of basaltic to rhyolitic composition. Some lavas appear to have remnant pillow structure* **(Jv)**. *Layered metatuffs with some interbedded tuffaceous sedimentary rocks* **(Jvt)**. *Mapped as greenstone by Diller and Kay (1924). Included in* **Jrgv** *on* **Geologic Map of Josephine County (Plate 1)**

Trgs — **Applegate Group metasedimentary rock:** *Includes slaty argillites, often with wavy, kinkbanded foliation; indurated sandstone; thin-bedded chert; and quartzite (metachert?); may include some interbedded tuffs and lava flow rock. Mapped as Galice Formation by Diller and Kay (1924)*

Trgv — **Applegate Group metavolcanic rock:** *Largely submarine basic to intermediate lava flow rock and tuff with areas intruded by dikes of gabbroic and diabasic composition. Includes minor interbeds of metasedimentary rocks. Mapped as greenstone by Diller and Kay (1924)*

INTRUSIVE ROCK UNITS

di — **Quartz diorite and related rock:** *Largely quartz-biotite-hornblende diorite with a few small areas of granodiorite and minor pegmatite and aplite dikes*

gb — **Gabbroic rock:** *Includes cumulate gabbro, metagabbro (hornblende gabbro and amphibolite), and areas with abundant gabbroic and diabasic dikes in basaltic rocks*

gb-Trgv — **Dike rock:** *Areas of abundant gabbro and diabase dike swarms intruding metabasalt of the Applegate Group*

um sp-pd — **Ultramafic rock:** *Largely serpentinite* **(sp)** *with some partly serpentinized peridotite in larger bodies* **(sp-pd)**. *Equivalent to* **um** *on* **Geologic Map of Josephine County**

COMPILED BY Len Ramp 1979
Cartography by C. A. Schumacher 1979

Modified after Diller and Kay (1942); and Page and others (1978).

PLATE 3

Map prepared by
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES