

MINES OF THE RIDDLES QUADRANGLE, OREGON.^a

By J. S. DILLER and G. F. KAY.

GOLD-QUARTZ MINES OF THE RIDDLES QUADRANGLE.

By G. F. KAY.

INTRODUCTION.

The Riddles quadrangle is situated in southwestern Oregon. It is a 30-minute area and embraces parts of Douglas, Jackson, and Josephine counties. It lies immediately south of the Roseburg quadrangle, which has been described in folio 49 of the Survey.

The geology and economic resources of this area were studied, for folio publication, by Mr. J. S. Diller and myself, during the summers of 1906 and 1907. In connection with this work, the placer deposits and gold-quartz mines were examined. It is the intention in this paper to describe only the latter, the former having been studied by Mr. Diller, who describes them on pages 147-151.

My thanks are due to many persons connected with the mines for information and other kindnesses, particularly to Capt. J. S. Buck, of the Greenback; Mr. S. G. Adams, manager and secretary-treasurer of the Baby mine; Mr. John Scribner, of the Silent Friend mine; and Mr. J. H. Beeman, of Gold Hill, owner of the Lucky Bart group. I am also much indebted to Mr. Diller for many valuable suggestions.

GEOGRAPHY AND HISTORY.

The Riddles quadrangle is of moderate relief, its elevation ranging from about 600 feet to 5,274 feet above sea level. In the northern part is South Umpqua River with its large tributary, Cow Creek. The chief streams of the southern part are Grave Creek, Jumpoff Joe Creek, and Evans Creek, all tributaries of Rogue River, which crosses the quadrangle only in the southwest corner.

The Southern Pacific Railroad passes through the northwestern part of the quadrangle, reenters it about the middle of the western

^a The first paper of the group on the Riddles quadrangle (Nickel deposits of Nickel Mountain, Oregon, by G. F. Kay) was published in Bull. U. S. Geol. Survey No. 315, 1907, pp. 120-127.

side, and runs southward, keeping within the quadrangle to its southern boundary, which lies between Merlin and Grants Pass. There are wagon roads along almost all the main streams, and trails run over many of the more mountainous parts. Hence the region is, in general, fairly accessible.

Much of the higher ground is covered with forest, but in many of the valleys there are small ranches. The climate is such that quartz mining can be carried on, without much inconvenience, during all seasons of the year.

The history of gold mining in southwestern Oregon dates back for more than fifty years, the first discovery having been made about the middle of the last century. From that time to the present, this portion of the State has yielded a considerable percentage of the total gold production of Oregon. The two counties from which most of the gold has come are Josephine and Jackson, both of which lie partly within the Riddles quadrangle.

In the early days practically all of the output came from the placers. Between 1880 and 1890 there was a small but gradually increasing yield from the gold-quartz mines. During the succeeding ten years the production of the placers continued to decrease and that of the gold-quartz mines to increase. In 1905^a the value of the product of the placers of Josephine and Jackson counties was \$165,793, whereas the value of the output of the quartz mines (including that of three quartz mines of Lane County and less than \$2,000 worth of gold from copper ores) was \$236,193. Of the latter amount the Greenback mine, which is in the Riddles quadrangle, contributed a large part. Since the fall of 1906, however, this mine, which was for several years the chief gold-producing mine and one of the best-equipped mines in Oregon, has been closed. Moreover, several prospects, which a few years ago were considered very promising, have proved disappointing and work on them has been suspended.

GEOLOGY.

The rocks of the Riddles quadrangle comprise both sedimentary and igneous rocks of various ages. The former belong mainly to the Mesozoic and the Tertiary, but in the southeastern part of the area are highly metamorphosed sedimentary rocks, in which, as yet, no fossils have been found, but which, owing to resemblances to fossiliferous rocks occurring farther southwest in California, are thought to be of Paleozoic age. The igneous rocks are in large part intrusive, but considerable areas show undoubted volcanic characters.

The sedimentary rocks which are thought to be Paleozoic consist chiefly of mica slates, mica schists, and micaceous quartzites. To the same system belong scattered lentils of crystalline limestone

^a Mineral Resources U. S. for 1905, U. S. Geol. Survey, 1906, pp. 288-292.

found a short distance beyond the southern limits of the quadrangle. These rocks are widely separated from the Jurassic of the quadrangle by igneous rocks.

The Mesozoic rocks belong to the Jurassic and Cretaceous systems. The Jurassic sediments consist mainly of slates and sandstones with interbedded shales; conglomerates and cherts are subordinate. These rocks, particularly the sandstones, usually show quartz veining and pronounced induration. The Cretaceous beds consist chiefly of conglomerates, sandstones, and shales, and have been divided, on the basis of fossil evidence, into the Knoxville, Horsetown, and Chico formations. The Chico is now represented by but a few small remnants of the original widespread formation. The chief remnant within the area of the quadrangle is on Grave Creek about 6 miles above the small village of Placer. It is not underlain by the Horsetown or the Knoxville but by older slates and by igneous rocks. There is evidence of a slight unconformity between the Knoxville and the Horsetown. The Knoxville rocks are locally veined and indurated, but generally to a much less degree than those of the Jurassic.

The Tertiary rocks are of Eocene age. They consist of yellowish sandstones, shales, and conglomerates, the stratification being well preserved.

The evidence indicates a great unconformity between the Jurassic and the Cretaceous; a somewhat less important unconformity separates the Cretaceous from the Eocene.

The igneous rocks are of various kinds, including greenstones, peridotites, serpentines, granodiorites, dacite porphyries, and augite andesites.

The greenstones are widespread and are generally altered to such an extent as to be unsatisfactory for study. Under this name are included several kinds of rocks so related in the field that it is practically impossible to map them separately. What may be considered the normal type resembles, when fresh, a gabbro, consisting essentially of pyroxene and a lime-soda variety of feldspar. Some phases of the greenstone are dioritic, some diabasic, and some fine grained and compact, resembling basalt. Moreover, some of the rocks included as greenstone are of the nature of volcanic breccias; others show decidedly vesicular characters. All these types are, no doubt, closely related genetically, but they may vary considerably in age. All are of a more or less green color and almost everywhere they show marked evidence of extensive crushing and veining. Associated with the greenstones in the west-central part of the quadrangle are a few lens-shaped areas of rhyolite.

The peridotites consist chiefly of olivine and enstatite, the former usually predominating, but locally the pyroxene is so abundant that the rock is a pyroxenite.

The serpentines have resulted chiefly from the decomposition of the peridotites and the pyroxenites, but some areas of the serpentine are probably the result of the decomposition of basic phases of the greenstones. Much of the serpentine shows shear zones and slickensided surfaces.

The granodiorites are of granular texture and include rocks which vary considerably in composition. The more acidic approach the granites and the more basic include quartz diorites. These rocks are composed chiefly of feldspar, quartz, and hornblende or mica, or, as is more commonly the case, both hornblende and mica. The color varies, depending on the amount of dark-colored minerals present, but the prevailing color is dark gray. The feldspar is chiefly plagioclase which belongs to the acid end of the soda-lime series. It is usually present in greater amount than the quartz. The mica is generally biotite, but muscovite is also found, and in places both are present. Apatite, magnetite, and locally garnet are accessory minerals.

The dacite porphyries are thought to be closely related genetically to the granodiorites. They have a rather sparse distribution, occurring as small knoblike areas and as dikes. They are usually light colored and have as their chief constituents quartz and soda-lime feldspar, both of which minerals in much of the rock form distinct phenocrysts.

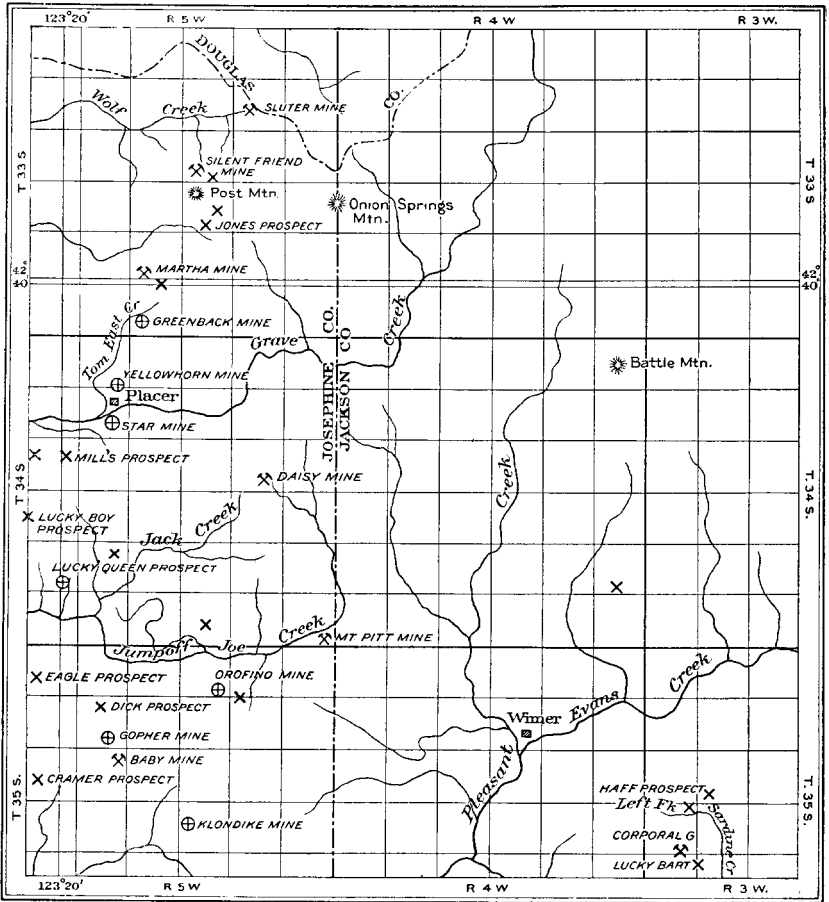
The augite andesites occur only in small dikes and have been found cutting greenstones, granodiorites, and the Horsetown formation of the Cretaceous. The dikes of this rock were found only in the eastern half of the quadrangle.

The relative ages of the igneous rocks have been fairly well worked out. The greenstones are the oldest, then come the peridotites, next the granodiorites and dacite porphyries, and finally the augite andesites. Except some of the greenstone, which is probably Paleozoic, none of the igneous rocks described are thought to be older than the Jurassic, some are younger than the Lower Cretaceous, and all, except the augite andesites, are older than the Eocene. The augite andesites are probably related to the volcanics of the Cascades, and if so related they are of Tertiary age.

THE ORE DEPOSITS.

The chief gold-quartz mines and prospects of the Riddles quadrangle are in Josephine and Jackson counties, mainly in the former, as indicated on the accompanying map (fig. 8). The gold quartz is found in small veins, veinlets, and stringers in several kinds of rock. Within Josephine County all the paying veins have been in greenstone; a few prospects but no mines have been located in serpentine.

A striking feature in connection with many of the gold-bearing veins found in the greenstones is their proximity to serpentine, but usually the veins are cut off sharply at the contact of the greenstone with the serpentine. This may indicate either that the rock from which the serpentine was derived was younger than the vein or that displacements have occurred at the contact of the greenstone and its decompo-



Gold mines (in operation)
 Gold mines (not in operation)
 Gold prospects

FIG. 8.—Map showing gold-quartz mines and prospects of Riddles quadrangle, Oregon.

sition product, the serpentine. In Jackson County the paying veins have been found in metamorphosed sediments, and usually they are within short distances of dikes or irregular areas of greenstone.

Quartz veinlets are also found in the granodiorites, but as yet no mine has been developed in these rocks within the area of the Riddles quadrangle. However, a few hundred yards south of the southern

boundary, in the granodiorite, is the Granite Hill mine, which has been for several years an important producer of gold.

The evidence suggests that all the gold-bearing veins in the several kinds of rock are younger than the early Cretaceous and older than the Eocene. However, some of the veins in the metamorphosed sediments may be pre-Cretaceous.

The vein filling is chiefly quartz, calcite, and pyrite; here and there arsenopyrite, pyrrhotite, sphalerite, chalcopyrite, and galena are also present. The action of the mineral-bearing solutions on the country rock adjacent to the veins was such as to produce a strongly chloritized and, in places, talcose rock much of which contains carbonates or pyrite.

The gold-producing veins range in width from mere seams to veins more than 4 feet wide, but the average width of all the veins examined was less than 1 foot. In the best mine that has been found in the region, the Greenback, the average width of the vein was about 18 inches. In many places there are sheared and brecciated zones, in which occur several veinlets and stringers usually running parallel to one another, but locally irregular and running in various directions. In general, individual veins and veinlets are not continuous except for short distances, and in many localities, to further interfere with the continuity of veins, there has been a considerable amount of faulting along planes at various angles to one another. The walls of some of the veins are fairly well defined for short distances, but many of them show no distinct boundary between the vein material and the country rock.

Although gold-bearing veins and veinlets are found running in various directions, those which have been most productive trend in general east and west. For example, at the Greenback mine the vein has a direction nearly east and west; at the Martha mine, between northwest and west; at the Baby mine, northwest to nearly west; at the Corporal G mine, S. 85° W.; and the veins of the Lucky Bart group run almost west. The dips of the veins range from nearly horizontal to vertical, but usually they are at fairly high angles.

The values are found chiefly in the quartz of the veins and veinlets, but in the brecciated zones some gold is obtained in the fragments of chloritized rock which carries pyrite. The values are mostly in free gold, but the sulphides also carry gold, the amount varying considerably in different veins and in different parts of the same vein.

Some of the quartz veins which carry values are later in age than others which carry no values. This is well shown at the Baby mine, where the gold-bearing vein cuts a much wider barren vein. The barren vein appears not to have changed the strike, dip, or values of the Baby vein. In the neighborhood of the Corporal G are veins

which are themselves barren, but where the younger gold-quartz veins intersect them the values are said to be enriched.

DESCRIPTIONS OF THE PRINCIPAL MINES.

Although there has been much prospecting for gold-quartz veins during the last fifteen years within the area of the Riddles quadrangle, comparatively few important discoveries have been made and some of the mines are no longer producing. Some of the most important mines are described below.

GREENBACK MINE.

The Greenback mine is situated on Tom East Creek, a branch of Grave Creek. It is worthy of note here that on the same stream, below the Greenback, is the Columbia placer mine, which is one of the most productive of southwestern Oregon.

The Greenback was discovered in 1897 by two prospectors, who lived in the vicinity of Placer on Grave Creek. They worked the deposit for about a year, treating the ore with an arrastre at Placer. They then sold the property for \$30,000 to the Victor Junior Gold Mining Company, the chief owners of the stock being W. H. Brevort, of New York, and Messrs. Moffatt and Smith, of Denver. In 1902 more than 90 per cent of the stock was purchased by Mr. Brevort, and the corporation was named the Greenback Gold Mining and Milling Company. No transfer has since been made.

From the time when the property came into the possession of the Victor Junior Gold Mining Company until 1906 the development of the mine was rapid, more equipment being added each year. At first a 5-stamp mill was installed, later 5 stamps were added, and when, in 1902, Mr. Brevort became the chief owner, there were 15 stamps, besides a crusher, an air compressor, and three Wilfley tables for concentrating. Mr. Brevort's company soon began the construction of a new mill, about a quarter of a mile farther down the stream. At first 20 stamps were used in this mill. This number was increased until, in 1905, 40 stamps were being used. The new plant has three large Risdon crushers and 12 concentrating tables. There is also a cyanide plant consisting of four large tanks, with a capacity of 100 tons a day. For a while the mill was equipped with both steam and water power, but in 1905 a complete electric system was installed. The power was brought, by way of Grants Pass, from the Ray dam on Rogue River, a distance of about 30 miles. However, in the following year (August, 1906) all work at the mine was suspended and as yet it has not been resumed.

The workings of the mine are extensive, consisting chiefly of cross-cut tunnels to the vein and drifts and shafts on the vein. Much of the ore has been stoped along the whole length of the vein to a

depth of about 1,000 feet from the surface. The lowest of the workings are on the twelfth level. Below the ninth level the mine is filled with water.

The country rock is greenstone, which is considerably metamorphosed, but where most free from alteration it is of the nature of a gabbro. To the east and southeast of the mine there is a considerable area of serpentine, and a short distance to the north lies the southwestern limit of a band of siliceous slates which extends for some miles to the northeast.

The Greenback vein has a direction almost east and west, and dips, in general, about 60° N. It averages about 18 inches in width, but ranges from less than 6 inches to more than 4 feet. Where it is widest there is a crushed zone of quartz stringers and country rock, forming in places a beautiful breccia; the country rock of the breccia is strongly chloritized and contains sulphides which carry values. In many places the foot and hanging walls of the vein are fairly definite, but where considerable brecciation has occurred there is no distinct boundary between the vein material and the chloritized country rock. The vein is cut off sharply to the east against serpentine and to the west by a fault. The vein between the serpentine and the fault plane has an average length of more than 500 feet and within this distance there are only minor displacements. The vein has not been picked up to the west beyond the fault plane, nor has it been found in the serpentine to the east. This latter fact tends to prove that the rock from which this serpentine was derived was younger than the vein, rather than, as is indicated in some places in the quadrangle, that the present relations are due to displacements between the greenstone and its decomposition product, the serpentine.

The vein filling consists of quartz, calcite, and pyrite, which vary in amount in different parts of the vein. The average content of the ore mined from the first and second levels was between \$8 and \$9 to the ton; a few assays on these levels ran above \$40 to the ton. Captain Buck states that over 75 per cent of the values of the ore was free-milling. The concentrates ran about \$75 to the ton and after cyaniding the ores contained less than \$1 to the ton. Within the mine there is but little evidence, except near the surface, of oxidation of the ores.

A short distance to the south of the Greenback vein and running almost parallel to it is the Irish Girl vein. On this very little work has been done.

MARTHA MINE.

The Martha mine is in the SW. $\frac{1}{4}$ sec. 28, T. 33 S., R. 5 W., about $1\frac{1}{4}$ miles north of the Greenback. It was purchased by the Greenback Company in 1904 and somewhat extensively developed. The electric power of the Greenback was extended to this property, and

in 1906 an aerial tramway was constructed to connect the two mines and for a few months the ore of the Martha was conveyed by the tramway to the Greenback plant and treated there. The tramway is said to have cost \$20,000. The company also installed a 75-horse-power air compressor. When the Greenback was closed the company also stopped all work at the Martha.

The mine was prospected by four tunnels whose length aggregates nearly 3,000 feet. At the time the property was examined (June, 1907) it was leased by J. M. Clarke, of Golden, Oreg., who had brought in five stamps and was treating the ore which had been mined by the Greenback Company but which had not been shipped to the mill.

The country rock is greenstone. The ores resemble those of the Greenback, but do not carry as high values in gold. They are found in narrow veinlets and stringers in zones of shearing and brecciation, which have a general trend between northwest and west and which range in width from a few inches to more than 4 feet.

BABY MINE.

The Baby mine is in the northwest corner of sec. 16, T. 35 S., R. 5 W., and is owned by the Capital City Gold Mining Company. The property was located in 1897 and since that time has been extensively developed by the present and the former owners. It is now leased by R. S. Moore, of Grants Pass. During the summer of 1907 three stamps were in operation. Mr. Adams, the manager of the company, says that the mine has yielded gold to the value of more than \$20,000.

There is on the property a 5-stamp mill, two boilers, a concentrating table, and a small crusher. The development consists of more than 1,500 feet of tunnels, shafts, drifts, upraises, and crosscuts.

The vein occurs in greenstone and averages about 4 feet in width, but in places a fissured zone more than 10 feet wide has within it many parallel stringers of quartz which carries gold. The vein ranges in direction from northwest to nearly west and dips to the northeast, usually at high angles, although it is in some places almost vertical and in others almost flat.

A striking feature of the mine is the prevalence of faults. These are not only numerous, but they vary considerably in direction and in amount of displacement. One of the most prominent of the fault planes runs S. 80° W.

The vein material consists of a somewhat sugary-looking quartz, some calcite, and some pyrite. The values are carried chiefly by the quartz; in many parts of the vein free gold may be seen with the unaided eye. The sulphide varies in amount in different parts of the vein, and when concentrated yields about \$75 worth of gold to the ton.

SILENT FRIEND MINE.

The Silent Friend property is in the southern part of sec. 15, T. 33 S., R. 5 W., on the north slope of Post Mountain. It is owned by the original locators, John Scribner and George Henderson, both of Speaker, Oreg. They discovered the vein in 1900, worked it until 1902, then leased it for eighteen months to Joseph Dyseit. From the expiration of this lease until August, 1906, no development was carried on, but from that date to the present the owners have been working the mine on a small scale. Mr. Scribner states that from the oxidized material on the surface overlying a network of small stringers he has taken gold to the value of more than \$7,000.

The chief development has been by two tunnels. The lower of these is 320 feet in length and crosscuts several small stringers. The upper is 75 feet in length, with an upraise to the surface.

The country rock is greenstone, which is strongly chloritized adjacent to the veins. The chloritization is, no doubt, due to the action of the mineral-bearing solutions. The ores are found in veinlets and stringers which run in various directions, but the majority of them have a general trend between southwest and west.

The filling consists of quartz, calcite, pyrite, arsenopyrite, and, locally, chalcopyrite. Some specimens of ore, which were found to consist largely of calcite, chlorite, and arsenopyrite, showed considerable free gold visible to the unaided eye. These specimens, which were taken from the bottom of one of the drifts, appeared to represent in the mine the ore of an 18-inch brecciated zone, which could be followed for several feet.

DAISY MINE.

The Daisy mine, which is on the divide at the head of Jack Creek, is on one of six claims constituting the Oregon Mohawk gold mines, owned by G. R. Smith, of Grants Pass. It was discovered in 1890 and for a time was worked under the name of the Hammersly mine. Then the stock was acquired by Morton Lindley, of San Francisco, who later disposed of it to the present owner.

Preparations were being made during the summer of 1907 to pump the water from the mine, which had been idle for some time, and mining operations were to be resumed. Mr. Smith stated that the mine had produced gold to the value of more than \$200,000.

The workings consist of an inclined shaft 175 feet in depth, from which, at a distance of 115 feet below the surface, there is a drift along the vein for 350 feet to the west and 50 feet to the east. All the ore above has been stoped. From the bottom of the shaft there is a drift running eastward on the vein for 140 feet and westward for 243 feet.

The veinlets of gold-bearing quartz carrying pyrite run about east and west and are in a chloritized greenstone. The ore-bearing zone has a width of about 3 feet.

MOUNT PITT MINE.

The following notes were obtained from J. S. Diller, who examined the Mount Pitt property.

The mine is situated in the southeast corner of sec. 36, T. 34 S., R. 5 W. It was located by H. G. Rice, of Grants Pass, the present superintendent. The property is owned by A. C. Hooper, of Portland.

The present workings consist of an entrance tunnel of 225 feet to cut the vein, a drift of 100 feet along the vein, and an upraise of 200 feet from the drift to the surface. A mill has recently been erected containing a crusher, an automatic feeder, 5 stamps, and a concentrating table.

The ore is found in small, irregular veins in sheared greenstone, the sheared zone being usually about 3 feet wide. The quartz veins are rarely well marked, the greatest width of quartz seen being 4 inches and this is not persistent for more than a yard or so. The quartz veinlets are in general parallel to the plane of shearing, but some of them are small cross gash veins nearly horizontal.

OROFINO MINE.

The Orofino property, which is located in sec. 3, T. 35 S., R. 5 W., has been closed for several months and the workings are beginning to cave. The present owners are Messrs. Monahan and Mason, of Seattle. The last work was done by B. F. Chase, of Portland, who had a lease.

C. D. Crane, of Grants Pass, stated that there had been nearly 2,000 feet of work done on this property. Fourteen carloads of ore have been shipped to smelters at Tacoma, Wash., and Ashland, Oreg. The mine had at one time considerable equipment, including a 2-stamp mill, cyanide tanks, rock crushers, boilers, and hoists, but much of this material has been sold and shipped away.

The ore occurs in veinlets and stringers in a much fractured, brecciated, and chloritized greenstone. Many of the fragments of country rock of the breccia contain considerable pyrite. The vein filling consists chiefly of quartz and calcite, and, as shown by the relations of the two, the calcite was deposited later than the quartz. Sulphides are also present in some parts of the vein in considerable amounts, but in other parts they are almost entirely absent. A large amount of ore is now lying on the dump and many sacks of ore are ready for shipment.

OTHER MINES IN THE GREENSTONE AREAS.

All the mines thus far described are associated with greenstones and the descriptions indicate that the characters of the ores of the mines and their modes of occurrence are very similar. Many other mines and prospects associated with the greenstones might be described, but they would show few new features. Some of these are now being developed; some have been extensively prospected but have never produced; others have, in the past, produced small amounts but are no longer being worked. Among such mines and prospects may be mentioned the Lucky Queen, Mill's prospect, Star mine, Olympic prospect, Spotted Fawn prospect, Blalock & Howe mine, Eagle prospect, Cramer prospect, Gopher mine, and Dick prospect, most of which are indicated on the map (fig. 8). To the north of the area shown on the map are the Gold Bluff and Levens Ledge mines, both near Canyonville.

CORPORAL G MINE.

Of the mines which are not associated with the greenstones but with metamorphosed sediments the chief are the Corporal G mine and the Lucky Bart group, which lie west of the Left Fork of Sardine Creek.

The Corporal G mine is located in the southern part of sec. 19, T. 35 S., R. 3 W. It was discovered in 1904 by J. R. McKay, who, after taking out considerable rich ore, sold it to Mrs. Nina M. Smith, of Gold Hill, the present owner. The property is now leased by J. E. Kirk.

The workings consist of three tunnels, one above another on the vein. The longest tunnel is 92 feet in length, the shortest 63 feet. The ore occurs in a small vein with fairly definite walls of micaceous quartzite and mica slate. The average width of the vein is about 7 inches; it runs S. 85° W. and dips steeply to the north. The filling consists chiefly of quartz and calcite, but pyrite, pyrrhotite, chalcopyrite, bornite, sphalerite, and galena are also present. A few of the hand specimens show free gold.

Close to the Corporal G is the Volunteer claim on which a stringer running parallel to the Corporal G was followed by a drift for 135 feet, when it pinched out. This stringer intersects a barren cross vein running about N. 30° E.; at the intersection the values in the stringer are said to have been enriched.

LUCKY BART GROUP.

The Lucky Bart group consists of eleven claims in the NW. $\frac{1}{4}$ sec. 29 and the SE. $\frac{1}{4}$ sec. 30, T. 35 S., R. 3 W. The chief claim, the Buckskin or Lucky Bart, was discovered by Joseph Cox, who sold it in 1892

for \$15,000. This amount he had to share with his partner, Bart Signoretti, who had had no part in the discovery, hence the name Lucky Bart. The company which bought the property worked it for four years when one of the shareholders, J. H. Beeman, of Gold Hill, purchased the rights of his associates and became the owner. About the same time Mr. Beeman purchased adjoining claims until he had title to all the property included in the Lucky Bart group. At present mining operations are being carried on at only one of the claims, the Yours Truly. The workings on the other claims, but mainly on the Lucky Bart, are in such condition that it is unsafe to enter them. The only workings examined were those of the Yours Truly. Information with regard to the other workings of the group was obtained from J. H. Beeman and J. E. Kirk.

Ore has been mined from five veins which run in a general direction a little south of west. These veins have an average width of less than 2 feet; the country rock is metamorphosed sediment, mainly mica slates and micaceous quartzites. The general strike of these rocks in this vicinity is somewhat east of north; the dip is to the southeast and is usually at fairly high angles. The total amount of ore that has been milled exceeds 14,000 tons, which gave values ranging from \$4.80 to \$100 a ton of free-milling ore. The ore from the Lucky Bart claim carried an average of 3 per cent of sulphides, which ran from 4 to 8 ounces of gold to the ton and a like amount in silver. Nine tons of ore from the deepest workings of this claim were shipped to the Tacoma smelter and gave returns of \$130 to the ton. Practically all the ores from the group have been treated at a mill on Sardine Creek; the sulphides were shipped to the smelters at Tacoma, Wash., and Selby, Cal.

At the Yours Truly, where work is now being done by J. E. Kirk, who has a lease on the property, the workings consist of an entrance tunnel of 75 feet to the vein, 100 feet of drifting on the vein, and a shaft of 30 feet. The country rock is mica slate. The vein has an average width of about 1 foot and runs S. 85° W. At the end of the drift there are two veinlets of 8 inches and 4 inches in width and also a small seam. Within the workings there is evidence of considerable faulting; the directions of the fault planes observed were somewhat east of north. Mr. Kirk states that the veins carry more values adjacent to the fault planes than elsewhere. The ores of the Yours Truly are highly oxidized and carry an average value of more than \$30 to the ton.

CONCLUSIONS.

Of the many veins and veinlets within the Riddles quadrangle on which work has been done, comparatively few have developed into profitable mines. The chief reason is to be found in the structural

features of the rocks in which the ores occur. The Paleozoic and early Mesozoic sediments, with their associated igneous rocks, were, previous to the mineralization of the region, subjected to earth movements of such a nature that no definite, continuous fissures were formed, but rather, in general, innumerable minute and irregular fractures running in various directions. Later, when the mineral-bearing solutions, which may have been connected with one or more of the igneous intrusions, passed through these rocks and deposition therefrom took place, the gold was not concentrated in definite lodes but was widely distributed through the rocks in small veins, veinlets, and stringers, few of which are continuous except for short distances. Furthermore, in those places where fairly distinct and rich veins were formed, subsequent faulting has frequently been so prevalent that it is difficult and costly to follow the values. Notwithstanding these unfavorable conditions, however, the gold-quartz veins have produced and will probably continue to produce considerable amounts of gold. But the hope of finding vein deposits which will develop into large and profitable mines is not encouraging.

The veins and veinlets have been subjected to erosion for many thousands of years, during which time an immense amount of material has been freed of its gold. Much of this gold has been deposited in the neighboring streams, from which it has been and is being mined as placer gold.

PLACER MINES OF THE RIDDLES QUADRANGLE.

By J. S. DILLER.

INTRODUCTION.

Placer mining is one of the most important industries of the Riddles quadrangle. There are 54 placer mines; 10 are in the northern half of the quadrangle in Douglas County; the remainder are in the southern half—18 in Jackson County and 26 in Josephine County. The total output of placer gold in the quadrangle up to date has been approximately \$725,000. In 1906, according to the returns of Mr. Yale, of the Geological Survey, the output was \$69,395, a considerable increase over that of the previous year.

The placer mines are all in gravel closely associated with the present streams. By far the greater portion of the mines are in the present stream beds or low terraces. Only a few are in gravel of the higher terraces, which rise from 100 to 400 feet above the stream.

No definite trace of ancient high-level gravels such as occur in the gold belt of the Sierra Nevada of California has yet been found in the Riddles quadrangle.

The gravels vary much in the form of the pebbles. On the higher terraces and the steeper grades of the larger streams they are generally well rounded, though some may be subangular, but in the gentler grades and especially also on the smaller lateral branches the gravel is subangular to angular. The contrast may be seen in comparing the well-rounded gravel of the Steam Beer mine on Grave Creek near Leland with the subangular gravel of the Columbia on Tom East Creek, near Placer.

The grades of the present streams range from 10 to 333 feet per mile, as made out approximately from the contour map. The major part of the placer mines are on grades not over 100 feet per mile. A smaller number are on grades between 100 and 200 feet per mile, and a few have grades greater than 200 feet per mile.

The highest terrace records are few, but if they may be depended on they seem to indicate that the grade of the streams when the gravels of the highest terrace were formed was probably lower than that of the present streams; moreover, the gravel of the highest terraces is on the whole not so coarse as that of the lower terraces and the present stream.

RIDDLES DISTRICT.

The placers of the northern part of the quadrangle are widely scattered, generally small, and for the most part unimportant. They lie on Rattlesnake, Middle, Catching, Mitchell, Jordan, Canyon and Shively creeks. The Ash mine, which covers about $3\frac{1}{2}$ acres near Mitchell Creek, is peculiar in that the material washed is chiefly slope waste of slates and sandstones. On Shively Creek extensive preparations were in progress in 1906 for mining at the forks, but later returns have not been received.

COW CREEK DISTRICT.

Starvout Creek is a tributary of Cow Creek that drains the northern slope of Green Mountain. Three of the mines on this creek, the Harrah, Booth, and Curtis Brothers, have lately been in operation, but the Mizer and O'Shea only keep up assessment work. A large tract has been covered by these placers near the present stream level, and they are reported to have been fabulously rich in the early days. The bed rock is slate except in the Curtis Brothers mine, which is near the contact of the slates, greenstone, and serpentine.

Just beyond the western limit of the Riddles quadrangle, in Cow Creek canyon, are the Victory and Gold Flat placers, or terraces, about 150 feet above the stream. A dozen miles farther down are the Cain and the Cracker Jack, on terraces over 500 feet above the creek. All these are important placers formed under conditions in strong contrast with the gentle grade of Cow Creek above Glendale.

WOLF CREEK DISTRICT.

The Wolf Creek district includes not only the three placers more or less active on the main stream above the railroad station but also the four on Coyote Creek, which joins Wolf Creek at the post-office.

In Payne's mine, near Foley Gulch, a rusty rotten gravel is well exposed. The greenstone pebbles are completely rotten; those of slate are not so thoroughly decomposed. This gravel has the aspect of great age, but this illusion is dispelled by the freshness of the dark-gray gravel upon which it rests. The mine stretches up from the creek level to the terrace nearly 100 feet above. Coyote Creek has but little fall and the Ruble elevator has been used to advantage.

Near the mouth of Bear Gulch the bed of Coyote Creek has been mined for nearly half a mile. Its richness is due to the fact that Bear Gulch drains the slope from the Martha mine and the west end of the Greenback.

GRAVE CREEK DISTRICT.

Grave Creek is not only the most important placer stream in the Riddles quadrangle, but considering its size it is one of the most important in the State. Almost a score of placers, old and new, occur along the part of its course lying in this quadrangle, and half of them are still active during the good water season.

In the vicinity of Leland the lower Lewis and the Goff mines have not been worked lately. The water of their main ditch is now used in the Columbia. A small test of one-fourth acre in 20 feet of gravel was made last winter on the Klum property. The Steam Beer, owned by H. K. Miller, has continued in full operation for a number of years and there is more ground ahead. The ditch is about 9 miles in length and supplies a head of 200 feet. The gravel terrace is 50 feet above Grave Creek, which affords excellent dumping ground. The mine exposes 25 feet of gravel, generally coarse below, and made up largely of pebbles of greenstone with scarcely any quartz. The bed rock is slate.

On Brimstone Creek the gravel mined some years ago includes much quartz that appears to come from residual material on a terrace 300 feet above the creek.

The Columbia mine, near Placer post-office, is owned by L. A. Lewis, of Portland. It is the largest placer mine of the region and is supplied with water by two ditches from Grave Creek, one giving a head of 100 feet and the other of 600 feet. The mine occupies the valley of Tom East Creek, which drains the vicinity of the celebrated Greenback mine and is advancing in that direction. The gravel ranges from 4 to 30 feet in depth and is coarsest below, with boulders a few of which reach 3 feet in diameter. The fragments are in general subangular and almost wholly greenstone. A few are rotten,

but most are solid. The gold is fine, and nuggets are rare. With three 5-inch giants nearly 6 acres are mined over annually. The grade is low and to keep the sluice clear the tailings are washed aside from the end of the sluice by a powerful side stream which piles up the gravel in a prominent heap.

Near the headwaters of Grave Creek there are a number of active placers. Most of them are on the present stream bed, which has been washed for miles, but a few are on terraces up to 150 feet above the level of the creek.

JUMPOFF JOE DISTRICT.

The lower portion of Jumpoff Joe Creek traverses an area of granodiorite and has no placers, but above the forks placers occur among the greenstone hills on both Jack Creek and the main branch. The principal mine is the Swastika, under the management of A. B. Call. It occupies a low terrace in the forks at the mouth of Jack Creek. The Swastika property is said to include a large part of Jack Creek, and prospects have been made nearly 2 miles above its mouth toward the Daisy quartz mine. The Swastika has been operated by the present company for about a year. Two 18-inch pipes were used, one with a head of 150 feet and the other about 75 feet. The sluice dump was disposed of by a strong side stream.

The gravel is from 15 to 30 feet deep and is composed of greenstone pebbles. It is coarsest below, with boulders up to 2 feet in diameter. In many places the whole mass is rotten, so that many of the boulders go to pieces under the stream from the giant. The bed rock of the Swastika mine and throughout the slopes of Jack Creek is greenstone.

On the main fork of Jumpoff Joe Creek there are a number of small placers near its head and a larger one 5 miles below, where Cook & Howland have stripped the shallow bed of the stream, exposing the slates for half a mile to a width of 100 to 200 feet. The slope being gentle, an elevator was used.

EVANS CREEK DISTRICT.

Pleasant Creek, a branch of Evans Creek, heads against Grave Creek and has several active placers. For over 3 miles the bed of Pleasant Creek was almost completely mined out years ago, and later efforts have been directed to the benches rising up to 100 feet. The largest amount of work has been done at Harris Gulch, where an area of rotten gravel about 8 acres in extent has lately been removed. A smaller cut has been made in a well-marked terrace at Jamison Gulch, and farther up, between the forks, Thompson Brothers have washed off the residual material of a serpentine point 200 feet above the streams.

All the placers on Pleasant Creek except the one last mentioned are on granodiorite but near the contact with both slate and greenstone, which may be the source of the gold.

SOURCE OF THE PLACER GOLD.

The source of the placer gold is in the auriferous quartz veins, which are most abundant in the greenstones, though they occur in the slates also. The larger veins at many places are worked in quartz mines, but all the veins, both large and small, have contributed gold to the placer gravels. The greater number of placers are on slate bed rock. This does not necessarily indicate that the slates have been the chief source of the gold in the placers, but that in the process of stream erosion the slates are more readily terraced so as to preserve the gravels for mining.

PRODUCTION OF THE PLACER MINES.

Where data have been available for estimates the yield of the placers per cubic yard of gravel has ranged from 10 to 25 cents. Much of the gravel must have averaged 50 cents and in exceptional cases run as high as \$1.50. To state it in another form, a number of the mines appear to have yielded from \$4,000 to \$6,000 per acre.

As already stated, the total production of the placers in the Riddles quadrangle has been approximately \$725,000, of which considerably more than half has come from Grave Creek. A still larger proportion of the present annual output is from Grave Creek, for it has not only the greatest number of mines but includes the two largest producers. The approximate production by districts is as follows:

Total production of placer gold in Riddles quadrangle to 1907, by districts.

Riddles and Cow Creek districts.....	\$100,000
Wolf Creek district.....	75,000
Grave Creek district.....	400,000
Jumpoff Joe district.....	50,000
Evans Creek district.....	100,000

These estimates are more likely to be below than above the truth, for little is really known of the yield of the early placers.

NOTES ON COPPER PROSPECTS OF THE RIDDLES QUADRANGLE.

By G. F. KAY.

Copper minerals have been found at several places within the Riddles quadrangle, but as yet no paying mine of copper has been developed. During the summer of 1907 work was being done on two prospects which are of sufficient interest to merit a brief description.

The Joseph Ball mine is situated in the NW. $\frac{1}{4}$ sec. 36, T. 32 S., R. 4 W., which is on the southwest slope of Cedar Springs Mountain. The elevation at the mine is about 4,250 feet. Some ore has been carried by pack train to Glendale, on the Southern Pacific Railroad, a distance of more than 20 miles. The country rock is serpentine, which has been greatly fractured and sheared, and locally, where it has been decomposed, magnesite with some strontianite is present. The ores consist of native copper, copper glance, cuprite, and the copper carbonates. They are in a faulted zone in the serpentine, which shows numerous slickensided surfaces on which are vertical striae. Within the workings the faulted zone varies in direction and the plane of shearing is very irregular. On this plane have been found flat pieces of native copper as large as the hand; the copper glance and cuprite have also been found on this plane as nodular masses and as scattered fragments. The workings consist of an upper tunnel of 150 feet along the fault zone and a lower tunnel of 145 feet from which there is an upraise of 60 feet to the upper tunnel. At the time the mine was examined the company was preparing to sink, from the lower tunnel, a shaft on the fault plane.

The Oak mine, in the SW. $\frac{1}{4}$ sec. 4, T. 35 S., R. 5 W., was located in 1905. It is owned by the Oak Consolidated Mining and Milling Company. Copper was found on this property while a gold-quartz vein was being developed. A tunnel was being run to crosscut some quartz stringers in a fractured zone, when copper pyrites was found. The mineral occurs as small irregular masses in a fractured and chloritized greenstone. During the summer of 1907 the company was installing an air compressor, hoists, and machine drills and plans were being made to prospect the property thoroughly.

Some prospects of copper occur in greenstone near Glendale and A. D. Leroy, of Merlin, has done some work on a quartz vein carrying copper in the N. $\frac{1}{2}$ sec. 8, T. 35 S., R. 6 W.