

CHAPTER V.

DETAILED DESCRIPTIONS OF MINING DISTRICTS (CONTINUED.)

SUSANVILLE DISTRICT.

GEOLOGY.

The Susanville district is situated on the Middle Fork of John Day River, 30 miles west of Sumpter in air line, though by wagon road the distance is about 55 miles. From Austin the road follows the Middle Fork down to Susanville, which has an elevation of 3,500 feet. Heavily forested ridges rise on both sides of the little gravel flat on which the town is located. About 7 miles northeast from the river the Greenhorn Ridge rises to over 7,000 feet, so that the slopes down to the river are not very steep. On the southwestern side of the river the configuration is more irregular and the ridges attain a height of only about 5,000 feet.

The geological features are as follows: The Middle Fork has cut down through the basalt flow which in Miocene times filled the valley, and the road from Austin to near Susanville is entirely in this lava rock. At Susanville the old rocks of the Greenhorn Ridge reach down to the river and across it, but only, it is believed, for a short distance. These old rocks also continue down the Middle Fork until below the mouth of Big Creek, or 6 miles below Susanville, where, according to information, the lavas again begin.

A fissile, dark-gray clay slate is the principal formation exposed above and below Susanville. At the Badger mine a strike of N. 70° E. and a southerly dip of 65° was noted; one-half mile below the mine, in Elk Creek, the strike is N. 80° E., and 1 mile below Susanville it is S. 85° E. with steep southerly dip. Thus, in general, the strike of the series is east-west and similar to that of Sumpter. Smaller dikes of aplitic rocks cut the slate between the town and the Badger mine. In Elk Creek, 2 miles above the river, at the Otter mine the slate is adjoined by serpentine, which continues up Elk Creek, mixed with much greenstone (diabase or gabbro) up to near the head of the creek, when a high ridge of granitic rock appears. This is probably the continuation of the central area of quartz-diorite mentioned in the description of the Greenhorn Mountains. Dikes of basalt are said to break through this granitic rock and on the flat summit is a small table of basaltic lava. West of the head of Elk and Deep creeks the high ridge gradually sinks.

QUARTZ VEINS.

The placers of Elk Creek have been worked since 1864 and are described below. Prospecting for quartz began as early as 1869, when Mr. Cabell's pan-amalgamation mill was built on Elk Creek $2\frac{1}{2}$ miles above its mouth. Ore from a vein called the Monumental was worked there, yielding, according to Mr. Haskell, \$15,000. Several other prospects were then in active operation, but for many subsequent years little or nothing was done, until recently, when renewed prospecting has given good results. While there are some narrow quartz veins with products of free gold, the bulk of the ore consists of heavy sulphurets, which contain little or no free gold. The values are chiefly in gold, though the rich shipping ore also contains much silver. The total production from the quartz veins probably does not exceed \$100,000. This is to some extent due to the inaccessibility of the district, making shipping expenses extremely high. Apparently there are several claims of considerable merit.

The Badger mine is at present the most important producer. Its vein was known as early as 1869 and was worked under the name of the McQuade ledge. In 1870-1874 some free gold was extracted from the decomposed croppings. This ore yielded \$26 per ton in arrastre, the gold being 691 fine. Later on a 10-stamp mill with concentrators was built on Elk Creek below the mine, but the ore was soon found unsuited to such treatment. At present the rich ore is sorted and shipped to smelter. It is clear that the values must exceed \$30 per ton to make the transactions profitable. The developments consist of an incline shaft 250 feet deep, with drifts and tunnels aggregating 1,500 feet. Apparently there is an excellent chance for a deep tunnel from Elk Creek.

The Badger is located 400 feet above Elk Creek, $2\frac{1}{2}$ miles northeast from Susanville, at an elevation of about 4,300 feet. The country rock is slate. The vein strikes a little north of east and dips 60° to 70° S. Though this is about the same direction as that of the slate, it is easily seen that the deposit is a fissure vein, for the slate is cut near and in the vein by a great number of parallel quartz seams (Pl. LXVII) perpendicularly to the schistosity. The first-class ore consists of a massive irregular mixture of sulphurets; pyrite, arsenopyrite, and zinc blende make the bulk, together with a little galena, chalcopyrite, and tetrahedrite.¹ The shipping ore always contains galena. On the dump are several hundred tons of second-class ore, among which is noted masses up to 2 feet in diameter of pyrite and arsenopyrite. Other parts of the second-class ore consist of veinlets of quartz in argillite, with a little pyrite, arsenopyrite, and zinc blende. The adjoining argillite, aside from a little pyrite contained in it, appears

¹A sample of shipping ore containing tetrahedrite was found to contain 1.04 ounces gold and 909.08 ounces silver per ton.

entirely fresh. The surface ore contained some free gold down to a depth of 25 or 50 feet.

The Stockton, prospected by a 200-foot shaft, adjoins the Badger and is supposed to cover its extension.

On Elk Creek, below the Badger mine, is the Bull of the Woods group, with the Otter as one of the principal claims. The Otter vein, carrying heavily sulphureted ore, is located in serpentine near the slate contact and is developed by a 600-foot-long tunnel, above which much ore is said to have been stoped. The ore contains dolomite or magnesite, together with pyrite, arsenopyrite, and a little galena. It contains both gold and silver.

The Gem vein, 2 miles above the Badger, on Elk Creek, was worked to some extent in early days. The quartz contained free gold at the rate of \$6 per ton, and the heavy sulphides assayed \$35 in silver and gold, according to Mr. Haskell. The vein is noted for a considerable percentage of copper. At Elk City, 6 miles above Susanville, some prospecting for quartz has been carried on. Between Susanville and the Badger mine the slate contains several narrow quartz veins in which pockets are sometimes found. Among these is the Skyscraper, located three-fourths of a mile from town on the ridge west of Elk Creek.

Prospects have been found on Deep Creek and on Onion Creek, as well as on Camp Creek. The Princess vein is located near the head of Deep Creek at the contact of slate and granite. It is said to contain white quartz carrying free gold with rich sulphurets.

PLACER MINES.

The well-known placer mines of Susanville were discovered in 1864 and have been worked every season since then. Elk Creek has been the greatest producer, but Deep Creek, 1 mile below Susanville, as well as Onion Creek and Big Creek, still farther down the river, have also yielded considerably. All of these producing creeks join the Middle Fork from the north side and descend from Greenhorn Mountains. The Middle Fork itself has been worked below Elk Creek and is reported to have produced \$50,000 in fine flour gold. The production during the first four years after the discovery amounted to at least \$80,000 (Raymond's report for 1870). For subsequent years the scattered data are obtained in the Mint report as follows:

Production of placer mines of Susanville district, 1882-1892.

1882.....	\$15,000
1883.....	25,000
1884.....	16,000
1889.....	8,700
1890.....	11,200
1891.....	7,000
1892.....	14,000

The total production is probably in the vicinity of \$600,000. During 1900 all the creeks were worked, at least for a short season. Chinese miners were at work on Elk Creek, 1 mile above the town, with hydraulic apparatus and derricks. Drifting operations were in progress on Big Creek, 8 miles from the river. Of the creeks emptying into the river from the south, Bear Creek, 1 mile below Susanville, is being worked, and some gravel is being washed at the head of Camp Creek.

The placers of Susanville contain coarse gold of a fineness of 865; a nugget worth \$480 was found on Elk Creek, another worth \$625 on Deep Creek, while Buck Gulch, below Deep Creek, holds the record with an \$800 nugget. Cinnabar in rounded masses up to 3 or 4 inches in diameter, intergrown with normal vein quartz, is of common occurrence on Elk Creek, but has not yet been found in place. No platinum occurs in the placers. Elk Creek has been worked continuously for about 2½ miles above its mouth. Eight miles above the mouth, at Elk City, some placer work has also been done. The pay seemed to be derived from the west side of the creek, the east fork being barren, and sometimes the gold may be traced up the hill to the quartz veins from which it was derived. These appear generally to have been narrow and of a pockety nature. The gravel is coarse and contains many boulders of greenstone, which must be handled with derricks. Usually the bottom of the creek is level and 100 feet wide. It contains two or three channels or gutters, the rims of which were raised 1 to 3 feet above the bottom. These gutters practically contain all of the gold. The bottom of the creek is filled 10 to 20 feet deep with gravels. It has been stated above that some placer work has been done on the Middle Fork. This stream flows in a gravel-filled channel in places as much as several hundred yards wide, suitable for dredging, the depth to bed rock ordinarily being only 8 to 10 feet.

Prospecting operations for this purpose were carried on in 1898 between the mouth of Granite Boulder Creek, which is somewhat auriferous, and a point below Susanville. Many shafts were sunk, and it is believed that in favorable places along certain channels the gravels averaged 20 cents per cubic yard.

QUARTZBURG DISTRICT.

GENERAL FEATURES.

Between the Middle and South forks of John Day River rises a complex of older rocks, culminating in the round-topped Dixie Butte, which attains an elevation of 7,700 feet. It is probably on all sides surrounded by Miocene lava flows. From the bare summit of Dixie Butte, one of the landmarks of the country near which the old California trail runs, heavily timbered ridges extend in all directions. The thick forests on the north side of Dixie Butte are said to be favorite haunts of elk and bear.

The geological structure of this area is complicated, but in general the rocks consist of diorite, diabase, and other greenstones, together with serpentine, inclosing smaller areas of clay slates, the exact age of which is not known; they are, however, older than the accompanying intrusive rocks. The stage road to Prairie crosses the most easterly part of the area; imperfect exposures show diabase, porphyry, serpentine, and siliceous clay slates. But immediately at the summit, toward Prairie, basalts and andesites begin and continue down to John Day Valley. A beautiful view of the latter is obtained from this place. Between the scattered yellow pines of the park-like forest the bare volcanic slopes of the valley with its broad pastures and irrigated fields present an attractive picture, and across it toward the south rise the jagged, snow-flecked lava peaks of the Strawberry Range. On the easterly road, leading down to the valley from the summits by way of the sawmill and Spanish Gulch, first clay slates and then 2 miles of serpentine are crossed before the lava again begins.

Going up from Prairie to Quartzburg district, the road follows Dixie Creek, with its extensive and not yet exhausted placer deposits. Two miles upstream the valley widens and the covering basalt and andesite give place to an old sedimentary rock, a massive argillite. Two miles farther up, at the road junction, a narrow canyon begins, at the entrance to which is a little serpentine. The canyon, however, is cut in a normal, hard, medium-grained diorite, consisting of green hornblende and feldspar. One and a half miles still farther up, the valley opens, the diorite grows darker, and at the forks of the creek it is replaced by a diabase-porphyry. This is a very tough, dark-gray rock with dark-green crystals of augite in a groundmass of medium grain. Between Comer post-office and Present Need mine there is a great complication of igneous rocks, most of them dark-green diabase of varying grain, and also some diorite-porphyrines or lamprophyric dike rocks. Similar rocks, mostly uralite-diabases, are seen on the east forks of the creek, where the copper prospects are located.

Just above the Present Need mine coarse diabase appears, in places containing small seams of dark-gray dense rock which consists of quartz and tourmaline; but these veinlets carry no ores. In the cross-cut of the Present Need a 200-foot-wide belt of peculiar grayish-green, fine-grained, sometimes flinty rock appears, which seems to be diabase-tuff and allied rocks greatly altered by contact metamorphism. These are described more in detail on page 588.

The auriferous character of this area is shown by the fact that in practically all of the streams heading toward Dixie Butte placers have been worked. Important placers are found in Dixie Creek, but auriferous gravels have also been worked on Camp, Ruby, and Happy Camp creeks, draining toward the north, and Rich and Spanish creeks, toward the east.

The principal quartz veins have thus far been found on the west fork of Dixie Creek, though it is by no means improbable that discoveries will be made in other parts of the area. The veins are narrow and rich and contain heavy sulphurets in quartz gangue. The oxidized surface ore contains much free gold, but at slight depth the ores become much more base. The strike is generally north-northeast or northeast, while the dip, with few exceptions, is steep to the east.

On the east fork of Dixie Creek copper deposits of a very different type occur.

The quartz veins were discovered soon after the placers and have been worked intermittently at least since 1880. In 1900 the Present Need, owned by Mr. W. E. Gifford, who kindly furnished much information, was the only vein upon which active work was being done. The production of these quartz mines is not accurately known, but is not believed to have exceeded \$100,000. Much gold was derived from the oxidized croppings, but few have been worked in depth.

GOLD-QUARTZ VEINS.

The first prospects are encountered a short distance below Comer post-office. The more important claims are located half a mile above this place.

The Present Need was located about ten years ago and has since been worked on a small scale, the ore being calcined in a kiln and then reduced in an arrastre. The developments consist of a crosscut tunnel 100 feet above the creek level and 200 to 300 feet of drifts. The country rock is a diabase, but the crosscut has exposed a narrow, greatly contact-metamorphosed series of diabase-tuff and allied rocks appearing in strata with a general east-west direction. The vein strikes N. 20° E. and dips 70° ESE. Like the other veins in the district, it is not traceable for a long distance. The width is 2 to 3 feet, indicated by fissures in the hard diabasic rocks. The ore occupies from 4 inches to 2 feet of this width and consists of solid quartz with heavy sulphurets in irregular intergrowth. There are pyrite, hard and yellow, softer yellowish-gray marcasite, and a little chalcopyrite, zinc blende, and galena. This ore is very rich and the pyrite often contains free gold. It assays from 6 to 25 ounces silver and 4 to 5 ounces in gold per ton, a total value of about \$100. With the imperfect extraction used, only about two-thirds of this amount was saved.

The ore occurs in two shoots on the vein, both dipping 65° S. on the vein; the shoots are 70 feet long, and are separated by a barren zone of 70 feet.

A few hundred feet north of this mine is the old Keystone, now idle. The Mint reports show that it was worked in 1882, during which year the small veins of Quartzburg produced about \$12,000, and that at that

time seven levels were run. In 1883 it is reported that 500 tons of ore at \$40 per ton were worked at a cost of \$8.50 per ton. In 1889 the mine is credited with a production of \$5,800. The vein strikes northeasterly and dips southeasterly. It is 4 feet wide between walls, the pay forming a narrow streak on the hanging, on the foot, or on both. The gangue contains much calcite, but otherwise the ore is similar to that of the Present Need.

A short distance above, the Colorado, a parallel vein, is located, and still higher up are many other claims. The Yankee Boy, on the ridge between the two forks of the creek, southwest of Copperopolis, strikes northeast and dips southeast, and is developed by 1,000 feet of tunnels. The croppings showed very heavy gold specimens, but in depth the ore became more base.

COPPER VEINS.

The active development of these claims, situated in the narrow canyon of the east fork of Dixie Creek, is of recent date, though at least one, the Standard, has been known for many years.

The Copperopolis claims are located on the west side of the canyon, 2 miles above the forks of the creek, and the croppings have an elevation of 5,250 feet. The developments consist of several cuts and shorter tunnels. An 800-foot tunnel from creek level, tapping the vein 300 feet below the croppings, was begun at the time the prospects were visited, in October, 1900. The country rock consists of a medium-grained uralite-diabase in which the vein strikes about N. 60° E., the dip being uncertain. It is traceable across a small gulch for a distance of at least 1,000 feet. The deposit forms a heavy body of tourmaline, quartz, and chalcopyrite, with a little malachite and azurite near the surface, the total width being about 75 feet, including an intercalated horse. About 40 feet of the width is copper bearing. The exact percentage of copper, sampled across the width, can not be stated; it may average 3 or 4 per cent. The ore is largely a replacement of diabase by quartz, tourmaline, and chalcopyrite, but in this rock are contained richer seams with comb-quartz and chalcopyrite. The ore is said to contain gold and silver. There is undoubtedly a large body of low-grade copper ore; though the lateral as well as the vertical extent is still unknown, the showing warrants further exploration. The concentration of the ore will be a little difficult, for the specific gravity of tourmaline (3.2) is not greatly different from that of chalcopyrite (4.2).

Somewhat less than 1 mile above the forks is the Standard copper mine, located on the east side of the creek, 300 feet above it, and at an elevation of 4,900 feet. The vein crops in a dark-greenish, altered diabase-porphry; its strike is northeast, the dip 30° SE. The developments consist of a 100-foot-deep incline; a 300-foot-long tunnel,

100 feet below the croppings, has not yet struck this flat vein, but found a stringer of ore with about the same strike and standing vertical. The ore is here from a few inches to 1 foot wide. Both the veins are probably largely due to processes of replacement. From the shaft a few tons of chalcopryite, also containing gold and silver, have been shipped. From the tunnel 10 tons of ore were shipped in 1900, which, according to the officers of the company, contained \$34 per ton in copper, gold, and silver. There is good opportunity for a crosscut to the veins 200 feet below the present tunnel.

The ore consists of chalcopryite, with a little pyrrhotite and smaltite. The latter mineral is a light steel-gray arsenide of cobalt and is of rare occurrence in the United States. It occurs chiefly in the vertical vein intergrown with chalcopryite. The only gangue mineral is calcite, and this occurs sparingly.

PLACER MINES.

The Dixie Creek placer mines were discovered about 1862, and were reported rich, though no data as to production are at hand. Raymond's report for 1870 contains the statement that at that time there were 100 white men and 200 Chinamen employed, and that the fine, scaly gold was 860 fine. In 1873 the creek is reported as turned over to Chinese labor. In 1882 two small hydraulic plants were in operation, producing \$30,000 (Mint report). At the present time very little placer mining is done.

The placers consist of the gravels accumulated in the present creek to a depth of 10 or 15 feet. The workings extend upstream from Prairie for 5 miles, or to the entrance of the diorite canyon, where the grade becomes very steep. The width of the gravel-covered river bottom is from 300 to 800 feet, the whole of which has been worked.

Six miles east of Prairie are the old Spanish Diggings, which have yielded a moderate amount of gold. The upper end of John Day Valley contains no placers. On the east side of Dixie Butte are the old placers of Happy Camp, still worked on a small scale by Chinese. Northwest of the same mountains are the Ruby Creek placers, still worked by whites and Chinese. Small placers are also reported from the head of Camp Creek.

CANYON DISTRICT.

GENERAL FEATURES.

The celebrated placer mines of Canyon are situated in the upper drainage basin of the South Fork of John Day River. The valley here widens to a broad depression, about 18 miles from east to west, and from 4 to 8 miles from north to south. In contrast to the narrow and heavily timbered valleys of the North and Middle forks,



A. JOHN DAY VALLEY.



B. CANYON.

this is a bare expanse of gravelly pasture land with strips of alluvial soils along the river from a quarter mile to 1 mile wide. The elevation at John Day is 3,000 feet; at Prairie, 3,500. The climate is fairly mild and dry, the water supply ample; in consequence the valley was settled soon after the discovery of the placers, and has for thirty-five years supported a prosperous community of cattlemen and farmers. North of the river the hills rise gradually and culminate in a timbered ridge forming the divide between the Middle and South forks of John Day River. The eastern end of the valley is surrounded by dark forested mountains rising to about 6,500 to 7,000 feet. At the very head of the valley there is, however, an unexpectedly low pass (elevation about 4,500 feet), through which a wagon road leads over to the Malheur River Basin. South of the valley the picturesque Strawberry Range rises abruptly, with serrated peaks, culminating in Strawberry Butte, with an elevation of about 8,600 feet. Toward Canyon the sharp ridges are a little lower, but still attain 8,000 feet. The range presents a steep but not very regular slope, with numerous salients and deeply incised canyons. Hot springs are found on Reynolds Creek in the uppermost part of the valley.

GEOLOGY.

The older pre-Miocene diabases, slates, and serpentines from the north side of the valley have been described under the heading "Quartzburg district" (p. 709). The eastern end of Strawberry Range, including the butte of the same name, is built up of Tertiary lavas. But at the foot of this mountain the underlying rocks appear, and their contact gradually rises westward, until in a short distance they form the summit of the mountains, culminating in a group of peaks and ridges which a few miles south of Canyon attain 8,000 feet above the sea. South of Prairie, below Strawberry Butte, serpentine appears in great development. It reaches 900 feet above the foothills, and also continues westward across Indian Creek. At Gillespie's sawmill it contains small bunches of chromite. The range was not ascended any farther than the claim known as the Oregon Wonder, at an elevation of 6,300 feet; but the color and configuration of the high ridges back of Canyon indicate that they are composed of a granitic rock. Prospectors state that diorites and porphyries are the prevailing rocks, and in the gulches, coming down from the peaks, are abundant cobbles of a very coarse diorite with hornblende crystals up to 2 inches in length.

Above Canyon serpentine crops below the gravels almost within the limits of the settlement. Immediately above and on the west side fissile clay slate begins, with east-west strike and steep southerly dip. This continues for a few hundred feet, with a smaller mass of serpentine intercalated with slates. The relations between the two rocks are

not clear, though the serpentine, an altered igneous rock, is probably intrusive in the slates. Above this follows another belt of serpentine about 1,000 feet wide and adjoined on the south, without well-exposed contact, by diabase and diabase-porphry. At this point the canyon becomes deep and narrow; on the east rises the pronounced salient, Canyon Peak, which is also made up of diabasic rocks.

In general there is a marked similarity in geological structure between the Greenhorn Mountains, Dixie Butte, and the Strawberry Range. All of them are built up of diorites, diabases, and serpentines, inclosing smaller masses of sedimentary rocks, usually clay slate.

Extensive areas of basaltic and andesitic rocks surround John Day Valley. Most of them, it is believed, are of early Neocene age. The road from Austin to Prairie, after crossing the divide, descends over long ridges of pyroxene-andesite, both massive and brecciated. Lower down the gradually flattening ridges are made up of massive basalts, and these continue for 3 miles, down to the level of the valley. The same fine-grained, often vesicular basalts form the low hills bounding the alluvium on the north for several miles east of Prairie. Augite-andesite directly overlies the argillite on Dixie Creek a couple of miles above the junction with the main river, and it is, indeed, probable that the andesites are the older of the two rocks. All the way down to the town of John Day basalt bluffs follow the north side of the river, gradually increasing in height; near John Day they are about 500 feet high. In places white tuffs alternate with the basalt. The surface ascends gradually from the bluff to a moderately high divide, the slope probably indicating the surface of the lava flows. At a few places near John Day the black, glassy olivine-basalt appears on the south side of the river, but the exposures are usually small and covered by gravels.

Along Canyon Creek above John Day the basalt is overlain by a considerable thickness of light-colored rhyolitic tuff, extensively used as a building stone at Canyon.¹ Above this tuff again rest more recent gravels.

The uppermost part of the valley was not visited, but it is believed to be entirely covered by basalt and andesite, these extensive areas forming a continuation of the area surrounding Austin and extending over the headwaters of Burnt River. Without much doubt this area of lavas continues and forms the summit of the Strawberry Range to a point a short distance west of Strawberry Butte. The form and color of the jagged ridges indicate clearly enough their volcanic origin. Strawberry Butte is formed by a great number of superimposed dark lava flows, and was no doubt once the locus of a most intense eruptive

¹This rhyolite is evidently the same that Dr. J. C. Merriam describes under the heading Rattlesnake formation, which he considers of Pliocene age (Univ. Cal., Bull. Dept. Geology, Vol. II, No. 9.)

activity. The rock forming its slope is a basalt cut by a rhyolite dike of immense size.

The broad extent of the valley from Prairie across to the foot of Strawberry Butte is a gently sloping surface covered with coarse basaltic gravel. Broad gulches cut in this slope reveal thick strata of these coarse gravels interstratified with some sandy material. At some point near the river coaly material has been found, no doubt embedded in these strata. West of Prairie the basalt north of the river is for some distance covered by these gravels.

Along the road down to John Day, volcanic bluffs, as stated, follow the north side of the river. The south side of the alluvium is bordered by lower bluffs, from 100 to 300 feet high, less abrupt and with smoother outlines. They consist of coarse gravel with occasional softer strata, and in several places are seen to rest on basalt (fig. 85). All these gravels form a part of the old, late Neocene flood plain which shortly after the close of the eruptions covered the John Day Valley to a height several hundred feet above the present river level. The position of this flood plain indicates that the river then took a course from 2 to 3 miles south of its present channel. The exposures at Canyon (see below under "Placer mines"), indicate that the bottom of these old river deposits lies considerably below the present bed of the river.

The most recent deposits are the alluvial sands and gravels along the present river course. These are over 1 mile wide at the junction of John Day River and Strawberry Creek. Two miles below Prairie are narrows, where a little canyon has been cut through a bed of basalt. Below this the alluvial deposits are from 1,000 to 2,000 feet wide.

GOLD-QUARTZ VEINS.

Canyon Peak, the bold salient from the main range which rises back of Canyon, consists of coarse gabbro or gabbro-diabase containing irregular masses of a dark-green, finer-grained diabase or diabase-porphry. This hill is celebrated for its rich pocket veins, and most of the placer gold in the vicinity is probably derived from its veinlets. The production from these veins is very difficult to estimate. At any rate it has not been very considerable, and few of the prospects rise to the rank of a mine. On the summit of Canyon Peak, $1\frac{1}{2}$ miles above the Great Northern, is the Idaho vein. There is said to be a strong vein of quartz, in the vicinity of which many small pockets have been found. Some distance below is the Mountain View. Here, also, is a well-defined strong vein, 3 feet wide, crossed by a network of stringers carrying products of coarse gold.

The Great Northern mine is located 2 miles southeast of Canyon, on a steep slope 1,540 feet above the town, at an elevation of 4,700 feet. A very fine view of John Day Valley is obtained from this point. This

deposit was discovered in 1898 by Ike Guker. Placers have been worked in the gulch a couple of hundred feet below it. In 1898 \$30,000 was extracted from one of the seams in a surface cut, and prospecting operations have since that time been carried on by a company having its headquarters in Salt Lake City. The developments aggregate 2,000 feet of drifts and crosscuts.

The country rock consists of gabbro and irregular bodies of diabase-porphry. The latter, being often soft and traversed by calcite seams, is locally called lime, though it is without doubt an igneous rock.

A surface pit, about 50 feet by 50 and perhaps 20 feet deep, shows decomposed rock cut by seams usually dipping 30° to 40° east or west. The bonanza mentioned above was extracted from one of these seams. From a tunnel level 50 feet below extensive drifting has been done in an attempt to follow these seams. A vein of quartz 1 to 2 feet thick has been uncovered, striking north to south, and dipping 25° W. This is practically barren and is accompanied by an impregnation of pyrite and seams of calcite. Some of the seams in the tunnel above the vein carried wire gold, with a tendency to crystallization, inclosed in calcite.

About 300 feet east of this point another strong quartz vein, 2 feet thick, has been found. This strikes east-west, and dips 35° S. It carries massive white vein quartz, in places stained green by chromium.

At Prairie Diggings, 3 miles east of Canyon, placers containing rough quartz gold have long been worked. In the same vicinity is reported a large vein of base character and, to judge from specimens, inclosed in slate. In Raymond's report for 1870 it is stated that the body of quartz mixed with country rock is 400 feet wide, strikes northeast to southwest, and dips 60° SE. In 1872 a mill had been erected and \$10,000 extracted, but soon after this the enterprise was abandoned, the quartz being, it is stated, of too low grade.

Aside from the occurrences described, the Strawberry Range apparently contains few mineral deposits. Near the head of Canyon Creek, 7 or 8 miles southeast of Canyon, claims have been located. The Chambers group is said to show a strong quartz vein 5 to 30 feet wide, containing a little chalcopyrite and limonite. The strike is said to be N. 60° E. In the Will Cleaver group, in the same vicinity, similar ore is found, claimed to average \$8 in gold and 4 per cent in copper.

Almost due south of Prairie, high up on the side of Strawberry Butte, a great number of claims have been located, the principal one known as the Oregon Wonder. A trail leads up to this place from Gillespie's sawmill (elevation 4,200 feet) near the mouth of Indian Creek Canyon. The trail for the first few hundred feet leads over serpentine. Above this rock lie heavy flows of basalt, which at the claims (elevation 6,300 feet) is cut by a big rhyolite dike at least 300 feet wide, the outcrops

of which form a bold and precipitous cliff. This dike continues for a long distance eastward and a continuous chain of claims is located on it. The rock is a yellowish-gray to brownish lithoidal rhyolite, showing very pronounced flow structure. It consists of sanidine crystals embedded in a microfelsitic groundmass. Little spots and seams of limonite abound in it, and it also carries traces of silver, and occasionally traces of gold.

PLACER MINES.

The placers of Canyon are justly celebrated as the most important and productive deposits of the kind in Oregon. They were discovered in 1862, and in less than a year many thousand miners were at work on the gravel bars of the creek and in the gulches of the surrounding hills. During the first few years the production was very great, but exact figures will probably never be known. Estimates are made varying from \$3,000,000 to \$5,000,000 a year. In 1865 the product was estimated at \$22,000 a week (Raymond's report, 1870), or about \$1,000,000 a year. In 1870 it had already fallen to \$300,000 a year. In the following year the production was still further reduced, but remained for a long time about \$100,000. The Mint reports for 1883 and 1884 estimate \$87,000 and \$80,000; for 1890 \$72,000, and for 1891 \$100,000. While the figures are incomplete and untrustworthy, it is scarcely probable that the total production much exceeds \$15,000,000. In 1882 there were 16 hydraulic plants (many of them small) in operation, and two-thirds of the products were derived from Chinese companies.

At the present time both white and Chinese miners are operating, mostly on a small scale. Mines near Marysville and the Humboldt hydraulic mine were worked. The amount annually extracted from the placers during the last few years probably varies between \$30,000 and \$50,000.

The water supply is abundant, being secured from Canyon Creek and gulches east of it. The principal ditches are reported as follows:

Ditches in Canyon Creek district.

Name.	Miles.	Capacity (in miner's inches).
Miners	20	700
Hillis	11	800
Thompson	4	600
Humboldt	8	1,200
Lone Star	4	500
Forlorn Hope	4	500

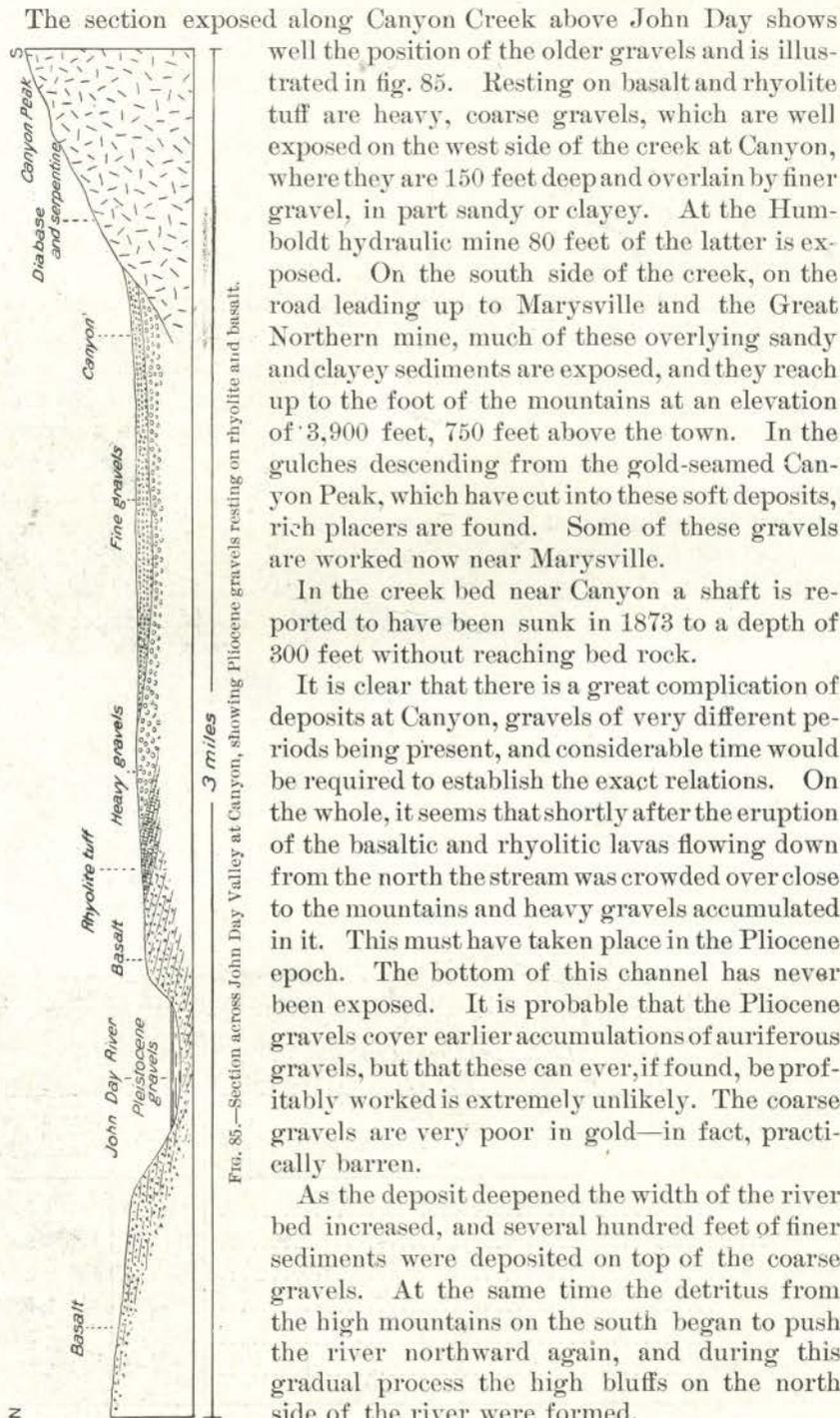
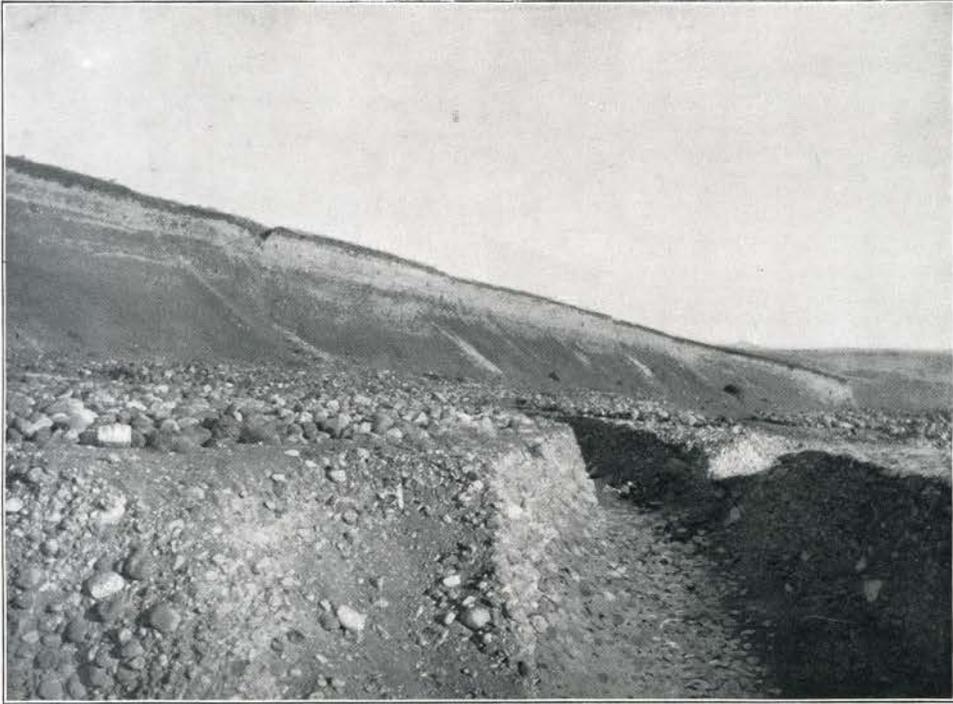


FIG. 85.—Section across John Day Valley at Canyon, showing Pliocene gravels resting on rhyolite and basalt.



A. HUMBOLDT PLACER MINE.



B. NELSON PLACER MINE.

The finer gravels are workable only at certain places. The most important locality is the Humboldt mine, 150 feet above Canyon and on the western side of Canyon Creek. Hydraulic operations have been carried on here for many years. A strip of ground half a mile long and several hundred feet wide has been washed, leaving a bank 80 feet in height (Pl. LXXIV, A). The bed rock is formed by coarse, cemented gravel; the pay is said to be concentrated in the first 4 feet overlying the bed rock. The exposed bed rock is nearly level, but is said to slope gently westward. This gravel mine has been worked for over thirty years, the output being reported as from \$10,000 to \$20,000 per season. These gravels, no doubt, represent the bed of Canyon Creek at a time when the main stream had already been pushed northward to nearly its present position. The rich gravels of Marysville, situated on the hill $1\frac{1}{2}$ miles east of Canyon, and the gravels of the present gulches above Marysville are comparatively recent deposits; they are derived from the rich pocket vein of Canyon Peak, and some of the deposits have been worked almost up to the veins. Most of the gold has, however, been caught on the clays and gravels of the older river sediments, below the outcrops of the older rocks.

With the final establishment of the present drainage, Canyon Creek has been deepened to its present level. Its bed is from 200 to 600 feet wide, covered with gravels to a depth of 15 to 18 feet. These have, of course, been worked over, some parts more than once, but a certain amount of gold is still found concentrated on the bed rock. The workings extend for 5 miles up from John Day River. In 1900 prospecting shafts were sunk in these gravels with a view to dredging operations, and the results are said to have been satisfactory. The placer gold from Canyon is often 900 fine, and sometimes, as at the mouth of Canyon Gulch, 990, or \$19.82 per ounce. The gold from the quartz veins averages 830 fine.

Above John Day there is apparently not much gold in the main river, but below this place for several miles the bars have been, and are still, worked by derricks and wheelbarrows. The depth to bed rock is usually only about 18 feet. Extensive prospecting for dredging ground was recently undertaken 4 miles below John Day by the Pomeroy Company, of Portland. The results have been so satisfactory that a dredger will soon be erected here. The gravels are reported to average over 30 cents per cubic yard, most of the gold, of course, being found on the bed rock. Bed rock of serpentine and slate shows at intervals, according to Mr. J. H. Pomeroy, in the river below John Day, and the gold is often so coarse that it must be of local origin instead of having been washed down from Canyon Creek.

At Spanish Gulch, about 70 miles west of Canyon, on Crooked River, auriferous gravels were deposited on serpentine, and have been worked for many years. A production of \$1,400 is given for

1882 in the Mint reports. In 1898 \$16,000 was taken out in a couple of months, the gold being very coarse. This locality, which was not visited, is, as far as known, the most westerly point of the gold belt of eastern Oregon.

Another district not visited is that of Fox, Hamilton, and Long creeks, about 20 miles due west of Susanville. Small but persistent amounts of from \$1,000 to \$7,000 of placer gold are yearly reported from this vicinity.