

BEN HARRISON (Gold)

Greenhorn District

Greenhorn Area

Owners: The present owner is the Ben Harrison Mines Company of Lima, Ohio, W. T. Agerter and J. R. Carns, trustees. J. J. Heilner of the law firm of Heilner, Smith, Grant and Fuchs, Baker, Oregon, is their representative.

Development: 2 tunnels and shaft, about 4000 feet of work; attain 600 feet below outcrop.

"The Ben Harrison mine is located near the headwaters of Clear Creek close to the northwest corner of sec. 36, T.9 S., R.34 E. It is 23 miles by wagon road from Whitney and 28 miles by wagon road from Sumpter. These are stations on the Sumpter Valley, a narrow gauge railroad.

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"The elevation of the working tunnel is about 6500 feet. The country rock is a medium grained slightly porphyritic "tonalitic" granodiorite. The granodiorite is cut by what are probably granodiorite porphyry dikes. About a mile northeast of the mine on the same branch ridge of the intrusion which extends out toward the Red Boy mine is an exposure of badly altered rock. The roughly parallel attitude of the hornblende crystals and the glassy nature of its feldspar suggest that this rock may have been a flow of dacite, the effusive equivalent of granodiorite. In any case it is genetically connected with the granodiorite intrusion and may have been caused either by a volcanic eruption or else a foundering of the roof of the Greenhorn intrusion, which had stopped its way so close to the then existing surface that a portion of the roof of ancient rocks broke loose and was submerged, permitting the molten rock to flow out.

"Aplite dikes abound in the granodiorite and vary in size from an inch or less up to a foot or more in width and some of them, probably the last ones formed, have such a decreased amount of feldspar that they approach quartz veins in composition, but are not mineralized.

"About one-half mile south of the Ben Harrison mine and crossing the saddle of this north and south branch of the main ridge is a body of older rocks which at the apex of the ridge is nearly one-half mile wide. This older rock is greenstone and greenstone schist. Its contact with the granodiorite on the north and south sides was not fully observed, but underground in the Ben Harrison mine inclusions of greenstone were noted in the granodiorite, proving that these greenstones are the older rocks.

"This greenstone is a very fine grained, badly kaolinized and seriticized rock containing considerable secondary quartz and chlorite. It was probably originally a basalt. The schists are fine grained, consisting chiefly of biotite and apparently secondary quartz with a few garnets. This rock is probably also of igneous origin. This greenstone schist is surrounded on all sides by granodiorite, indicating that it was a downward projecting portion of the roof of older rocks, the main body of which has since been eroded. A great many good sized veins are found exposed in this greenstone, which have been prospected from time to time, the oldest of which is the 'Potosi'.

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"The Ben Harrison vein strikes N.30° E. and dips 67° E. and is lenticular in shape both along its strike and dip. Its minimum width of gouge and altered rock is about 18 inches and its maximum 21½ feet.

"The length so far stopped above the 200-foot level is about 400 feet; above the 350 and 500-foot levels the stopes are about 300 feet long. On the 600-foot level the vein has been drifted upon for 350 feet, which at the south face is 12 feet wide and the north face 6 feet wide and averaging 68 inches for the 350 opened up. This is the same average width for the length of the drift as is the 500 stope on that level. The average stoping width for the entire mine so far opened up is 77 inches, and the lowest level, the 600 has good faces of ore both north and south and will likely exceed all other levels in tonnage-feet. Its average value is between 19 and 20 percent higher than the average value of the ore in the rest of the mine, which averages a little above \$10 a ton for the 87,000 tons blocked out on at least three sides above the 500-foot level.

"The vein, a brecciated replacement, between the gouge on both walls is made up of fragments of granodiorite up to a foot or so in diameter, surrounded by vein quartz up to six inches wide. The fragments themselves are much silic-

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ified and cut by minute reticulate veins. The ferro-magnesian silicate minerals are entirely decomposed and the feldspars largely kaolinized. Calcite, probably derived from the country rock, is present. The same alteration occurs in the wall rocks to a lesser degree, but this alteration of the wall rock is greatest next to the widest part of the vein.

"The outcrop of the vein is inconspicuous and is at a narrow portion of the lens, where it is only about two feet wide. At the surface it shows a typical sheared character and mineralization. Quartz, limonite, and kermesite, the red oxide of antimony, were observed there.

"Several branch and parallel veins, some of which are of considerable economic importance, from which high-grade shipping ore is often taken, have been developed during 1915 and 1916. These veins, particularly the one located the 'split vein', but in reality a continuation of the main vein, are showing up good bodies of milling ore and bid fair to multiply the tonnage available for each level.

"The ore minerals are pyrite, stibnite, a little chalcopyrite, and sphalerite. The silver sulphides are pyrargyrite and stephanite, with gold of about equal value to the silver in the ore. The gold values in the various parts of the shoot so far opened up remain reasonably constant, but the silver values are quite variable. The good silver ore is in horizontal layers, a streak of lean and a streak of fat, as it were. The silver values vary also greatly between the foot wall and hanging wall. There are many thin lenses of considerable wall area more often on the foot wall, though frequently on the hanging wall and occasionally between walls or else in branch veins into the hanging wall. Sometimes these sulphide sheets are almost pure stibnite with only a moderate silver content, while in other places they consist of quartz and disseminated stephanite, the black brittle sulphide of silver and antimony, in which there is present a small amount of pyrargyrite.

"There is also a wide variation in the silver content along the strike of the ore shoot. For instance, upon the lowest level, which is only partially developed, the average gold content north of the shaft compared with that south differs only 14 percent, while the silver content has fourteen times as much in one as in the other." 1/

"Vein strikes NE, dips SE. The width of the vein explored in the Ben Harrison mine largely ranges from 2 to 8 feet, of which one-quarter to one-half consists of several strands of quartz in the midst of sericitized quartz diorite. The vein, therefore, is much like the Monumental vein, near Granite. This section of the quartz vein material shows that an early barren quartz was crushed and arsenopyrite, pyrite, sphalerite, tetrahedrite, and stibnite were deposited in the breccia. Later a barren white quartz cemented the crushed material and sulphides." 2/

"The Ben Harrison mine, after being idle for a number of years, was recently reopened by the Campbell-Oregon Mining Co., George M. Henderson, manager.

"An ore shoot 300 to 400 feet long was mined by earlier operators to a depth of about 450 feet below the outcrop, or about 300 feet below the adit level. Some ore had been developed, but not mined, 100 feet lower on the 600-foot level. The Campbell-Oregon company is deepening the shaft and driving

levels at 100-foot intervals. When visited, preparations were being made to mine ore left by earlier operators above the adit level in addition to ore from lower levels.

"The ore shoot is a strong quartz vein between quartz diorite walls. The walls are clean-cut; the gouge seams along the vein walls are comparatively thin. A portion of the vein contains numerous inclusions of sericitized quartz diorite. The vein is from 2 to 10 feet wide. According to Swartley, a maximum width of  $21\frac{1}{2}$  feet was recorded. The average width is probably 4 to 5 feet.

"The vein strikes  $N.3^{\circ} E.$  and dips  $80^{\circ} E.$  in the upper workings but flattens to  $55^{\circ}$  in the lower levels. Sulphide mineralization comprises pyrite, arsenopyrite, chalcopyrite, and some stibnite and tetrahedrite. It was stated that gold is found chiefly with the arsenopyrite. The ratio of gold to silver appears to vary widely from place to place. Swartley (14) stated that gold and silver occur in equal value; Hewett (31) gives the ratio of silver to gold at 50 to 1; when the mine was visited in 1936, the ratio of silver to gold was said to be averaging about 5 to 1.

"Swartley (14) stated that the average value of ore in the upper workings was a little over \$10 a ton, but that the ore developed on the 600-foot level was 19 to 20 percent higher in grade.

"The mine is completely equipped. A 700-cubic foot, 125 h.p. Sullivan WJ3 compressor supplies compressed air for mining. A 500-cubic foot compressor is in reserve. The shaft is provided with a 50 horsepower single-drum hoist of 500 pounds capacity. Other equipment includes a small sawmill, a 100-ton flotation mill, bunkhouses, and the necessary shops and miscellaneous equipment.

"A 5 x 10 foot, 2-compartment shaft is being sunk at the rate of about 3 feet per day of three shifts. Two miners per shift are employed in the bottom. The shaft and adjacent workings were making about 30 gallons of water a minute. Over-all costs are approximately \$40 a foot.

"The upper part of the shaft is vertical; as the vein flattened, the shaft was inclined to conform to the dip.

"A flat-back, open-stope mining method with stull support is used. Development raises are spaced about 200 feet apart. Where possible, flat holes are drilled with mounted jackhammer. Otherwise, self-rotated stopers are used. Detachable bits are used throughout . . . . .

"Mine ore is dumped on a 2-inch grizzly; the oversize goes to a 3D Gates gyratory crusher set for  $1\frac{1}{2}$  inch discharge. Grizzly undersize and crusher product go to a 150-ton ore bin.

"Crushed ore is fed by two Denver feeders to a 6 x 6 foot and a 6 x  $4\frac{1}{2}$  foot ball mill in closed circuit with a Dorr duplex classifier. Three pounds of forged-steel balls are consumed per ton of ore ground.

"Classifier, overflow, at 150 mesh, goes to a 10 x 40 foot thickener, from which the pulp is discharged at about 40 percent solids by two diaphragm pumps. The pulp flows to the first of a series of 5 Kraut flotation cells. A finished concentrate is taken from the first cell. A tailing is taken from

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