

## Another Butte in Southern Idaho?

### Volcano Mining District in the heart of a productive agricultural area has received little attention from state and U.S. geologists

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*Can the Butte copper district be duplicated?* The answer to the above question by an experienced Montana geologist familiar with the history of Montana's famous copper camp would be a decisive "no," and he would be right unquestionably, for as a matter of experience in metal mining development, there are no exact duplicates in nature as nature abhors a straight line.

Broad experience teaches that there is an individuality to every mining district and in fact to almost every separate ore body in a district. It has been pointed out, however, by such authorities as Dr. Spurr and other noted geologists, that there is a genetic or blood relationship or type characteristic among mining districts and ore deposits, especially in the Cordilleran area of the west, which should have some value in an economic forecast based on surface outcrop and shallow development conditions if such conditions are of sufficient strength, and evidence closely comparable to magmatic activity.

#### **Butte's unique position**

The Butte district probably carries the highest concentration of copper values of any district in the world in a similarly constricted area. Its production of copper and other metals during the past 50 years is said to have exceeded 2 billion dollars and is unique in this respect as well as in many others, especially in the primary character of its predominant ore: chalcocite.

For many years, Butte was the only important productive copper ore district in the world whose enclosing formation was eruptive granite. This formation is now the source of more than half the copper production of the United States.

The outstanding characteristic of the Butte granite or quartz monzonite is its local association with a zone or belt of later igneous differentiates, originally of basic andesite formations, but more conspicuously with siliceous dike rocks in association with the ore bodies.

In forecasting the development of another mineral district star of the Butte magnitude, the writer recognizes that he is dealing with very shallow phases of raw material, but believes that this material is of such blood relationship to the surface expressions of the Butte ore deposits as to justify this comparison.

#### **Surface was unattractive**

The Butte district in Montana is situated within the southwest edge of the main lobes of the Boulder granite batholith - a magma chamber of 2,200 square miles in exposed surface area. The surface evidence of the great ore bodies at Butte was decidedly unattractive.

The general formation of highly altered and disintegrated eruptive granite or quartz monzonite was traversed by lean quartz pyrite veins carrying low silver values and a little copper carbonate stain.

These together with the manganese-gossan veins of the old silver mines are associated with strong dikes of aplite, rhyolite and quartz porphyry and in only one instance, I believe, did commercial copper exhibit a surface outcrop crest.

To plant a new industrial unit of the capacity of Montana's great copper camp practically in the lap of the productive agricultural area of Southern Idaho is a consummation devoutly to be wished, and a forecast not devoid of material substance.

The Idaho district under consideration in this forecast is known as the Volcano Mining District. It is situated in Camas and Elmore Counties in south central Idaho within fifteen miles of the Union Pacific Railway at Glenn's Ferry on the south and within five miles of the branch terminal of the same line at Hill City on the north.

In spite of its attractive comparison with Butte conditions, the Volcano district has so far escaped the attention of the U.S. Geological Survey and Idaho Bureau of Mines and Geology, except in its outlying edges.

One of the old reports on the geology and water resources of the Snake River Valley by Russell covers the rhyolite feature of Mount Bennett at the west end of the district, and a recent paper by the State Bureau on ground water for irrigation on Camas Prairie by Piper is confined to the artesian water possibilities of the valley, with little reference to the general geology of its borders other than their magmatic and volcanic character.

Geologically this district is located at the extreme southern edge of the magma chamber known as the Idaho granite batholith, which has ten times the volume of the Boulder Batholith in Montana, with an exposed surface area conservatively estimated at 22,000 square miles.

The granite formation of this district shows the same characteristically weathered and disintegrated surface as does the Butte district, with occasional patches of wind carved, weathered bouldery and monolithic pillars of harder formation.

### **Parallels flat valley**

This interesting mineral district lies parallel to the broad flat-floored intermountain valley of Camas Prairie, a notable dry farming wheat section of Southern Idaho, 10 miles broad and 30 miles long. Viewed from one of the grain fields in the valley, the mineral belt looks like a low weathered granite ridge rising to an elevation of a thousand feet above the valley floor, within a distance of a mile and a half. Its straight east-west contour and fairly uniform northern slope suggests a false scarp of regional proportions.

The northern slope of the ridge is scored by numerous short shallow erosion channels, usually carrying springs and patches of brushwood such as willows and quaking aspen. Several of these shallow gullies are without doubt roughly north and south lines of cross faulting as they conspicuously displace the vein.

The elevation of the valley floor opposite the central part of the mineral belt is 5,200 feet and along the crest of the ridge 6,200 feet above sea level.

### **Area's geology described**

Following the crest of this ridge which is in reality the southern edge of a remnant plateau area, varying from a mile to two miles broad, the disintegrated granite formation over approximately a mile in width and for a N. 70° E. strike length of five or six miles, is conspicuously traversed by a close set series of nearly vertical aplite dikes of equal proportion in size to the Butte formations of this character, then by a series of more or less cellular quartz pyrite veins.

One of these, the Revenue, while it may not make Daly's original snake-the Anaconda-look like an angle worm in comparison, is to say the least a very worthy duplicate of that noted mineral outcrop, and consists in this instance of an opaque white quartz vein, in places intensely brecciated to a boxwork silica expression that is from forty to eighty feet wide in almost continuous low outcrops above the plateau surface for a distance of two miles, with short intermissions of siliceous banded shear zone structure and intensely sheared and sericitized granite walls.

This great vein is succeeded in the central cross-section under discussion by a highly altered and intensely mineralized quartz porphyry or feldsite porphyry dike or stock that is 180 feet wide, its exact petrographic determination being difficult on account of the highly mineralized condition of the surface outcrop, which carries bands of light spongy gossan several feet wide with considerable copper carbonate staining and giving light values in silver up to three or four ounces.

### **Chalcopyrite near surface**

This is succeeded by three narrower quartz filled fissures. One of them, with a continuous outcrop of 1,000 feet, is five to 10 feet wide and in some shallow surface pit development has afforded specimen values in small kidneys of clean chalcopyrite ore of \$80 per ton in copper, gold, and silver.

This series, a few hundred feet farther south, is succeeded by a parallel dike of igneous rock that is probably a basaltic andesite, and again by other parallel dikes up to fifty feet thick of rhyolite or quartz porphyry. The whole series is cut at an oblique angle by occasional cream colored narrow dikes of fine grained aplite two to three feet wide.

A little farther west on this interesting belt, the rhyolite appears as a surface flow or capping to the copper-bearing quartz veins and dikes over a short stretch of their course. These formations, together with remnant patches of basalt, indicate former extensive coverage of the formation that has been removed by erosion.

As rhyolite dikes are so conspicuously associated with the Butte ore bodies, whatever their function may have been in connection with the primary supply of the ore solutions, it is interesting to record the occurrence of this type of igneous rock in the district under discussion, which occurs in such volume as to make the rhyolite butte for which the famous Montana copper camp was named, together with its continuous dikes and flows, look like a small knot on a big log by comparison.

### **Possible influence of dikes**

The Butte geologists give little credence to the influence of the Butte rhyolites, one way or another, on the ore deposition of that district. A more liberal view of this particular item of Butte geology is worth considering, as these great siliceous dikes were doubtless stokers and conditions to the ore bearing granite wall rocks of the district, and probably are responsible in a measure at least for the conditioning and faulting of the granite formation.

They also evidence a silex condition of differentiation and liquid flux and phase of deep-seated magmatic activity, that seems to be favored by the authorities to be one of the essential factors of final segregation of metallic mineral values prior to their ascent as gases or other solutions into the fissure courses in which they are deposited as ore bodies.

*In this respect the Volcano district ore zone has a superior advantage over the Butte district.*

The rhyolites of the Volcano district are most conspicuously exhibited at the west end of the belt in the round-topped summit of Mt. Bennett, which has an elevation of 6,700 feet and is made up entirely of immense rhyolite dikes. Mt. Bennett probably constitutes one of the principal centers of eruption and extrusion of this class of siliceous magmatic slags which forms a belt of these acid lavas eight miles wide and thirty miles long by probably 10,000 feet in vertical cross section. These rocks, by reason of their hard resistant character, comprise the more prominent outcrop formation along the plateau area of the mineral belt, whose general surface is covered with a deep mantle of coarse sandy soil supporting rich growth of wild grasses and sagebrush and is largely fenced and covered by enlarged dry-farm homesteads on which the mineral rights are reserved to the government.

#### **Watching Butte since 1884**

The writer first visited the Butte district in Montana in the spring of 1884 when its surface conditions were not so badly scarred as at present. He has since had repeated opportunity to note these conditions of the Montana camp, both at the surface and underground, and is highly impressed with the similarities of this Idaho district, not only of the mother magma formation but also of the conspicuous comparative character of its later intrusive vein and dike conditions.

#### **The Blackstone group**

There is very little development in the Volcano district on which to base a forecast of similar phenomenal ore development at depth to that which resulted at Butte from similar shallow surface tests and outcrop conditions.

One of the few shallow prospect developments of this Idaho district is an old discovery near the west end of the mineral zone, known as the Blackstone Mine, which was located forty years ago by two noted jurists of Idaho – the late Joseph J. Rich of Paris, Idaho, and Hon. James H. Hawley of Boise.

The Blackstone Group, consisting of five claims patented many years ago and idle since the patent was issued, carries a sheared quartz fissure richly stained with manganese oxide and copper carbonate. It was developed by a short crosscut tunnel at a face depth of 100 feet where the oxidized condition still prevailed but disclosed some fair sized kidneys of chalcopryite ore which together with the richer carbonate materials is said to have afforded three small carload shipments of hand-picked ore that gave smelter returns of 15 percent copper and \$20 per ton in gold and silver. These old workings are long since caved and the evidence of values is the surface outcrop cuts where a vein of green and black stained shelly quartz five feet wide gives average values of 2.5 percent copper and \$5 gold and silver per ton.

#### **Shaft at the Opportunity**

About a mile west of this development, the Opportunity Mine has a vertical shaft 150 feet deep on a siliceous copper carbonate and manganese stained shear zone 10 to 20 feet wide, which exhibits the same deep oxidation as was common in the early history of the Butte mines. This dry shaft revealed no sulphide mineral but gave a gradual increase in the associated silver values in the gangue of the vein. A band of soft, sooty manganese on the hanging wall at the shaft bottom, six inches wide, gave an assay of 5 percent copper, 12 ounces silver and 60 cents gold per ton.

Extending east on the zone from this point for a distance of three miles, the numerous outcrops carry shallow prospect pits, in no place exceeding thirty feet in depth.

The thirty-foot prospect shaft of the Revenue Group of claims is now badly caved but its dump ore from a five foot quartz vein exhibits selected specimens of hard quartz containing pyrite, chalcopryite and occasionally coarse crystals of both galena and sphalerite. The lead-zinc association is found at several other shallower prospect pits on this and other quartz veins of the zone.

### **Tunnel cut rich silver**

At the extreme east end of the mineral belt where it strikes the flat floor of the Camas Prairie valley, a series of closely parallel quartz veins and mineralized porphyry dikes outcrop conspicuously above the surface. On one of the smallest of these veins, some very rich silver ore was found and a shallow tunnel was extended in 200 feet a number of years ago. This tunnel is now caved and inaccessible, but is reputed to have marketed small shipments of from five to thirty tons of crude ore carrying 200 to 500 ounces of silver per ton, with several dollars gold.

There is a good sized dump of cobbings at the portal of this old tunnel that gives assay sample values of 60 ounces of silver from a brown stained granular quartz with corroded segregations of soft chalcopyrite, and the walls of a caved discovery shaft ten feet deep on the same vein exhibit stringers of quartz and brown hematite.

One of these stringers several inches wide gives an assay sample result of 110 ounces silver and \$10 gold per ton, and in harder quartz bands some scattered crystals of chalcopyrite and a blue sulphide material, probably argentite.

### **Development now underway**

The most promising and important development on this interesting belt is now underway and is likely to shortly reveal its economic possibilities within a few months. This development is on the Revenue Group of claims, covering the central section of the mineral zone for a distance of a mile and a half over its most conspicuous quartz and copper stained porphyry outcrops. It consists of a crosscut tunnel starting at an elevation of about 600 feet above the valley bottom, in one of the more favorable erosion channel depressions.

The tunnel is now 1300 feet long, will shortly penetrate the big Revenue quartz vein at the face depth of 400 feet, and will be continued across the system for an additional 800 feet.

The accompanying cross section of the formation penetrated by this tunnel is of keenest interest, and while the maximum depth to be obtained under the mineralized outcrop is comparatively shallow, it is to be expected that an unaltered sulphide condition of the veins, as indicated by their gossany outcrops, may be anticipated, in a degree at least, by reason of the fact that the tunnel has been very wet since it was started.

The first 400 feet of the course of the tunnel from the portal is through rotten, decomposed, blue granite of fairly coarse texture, and a thin section of this rock gives the following: "Orthoclase and quartz inclose euhedral plagioclase crystals. Biotite, hornblende, magnetite and a little augite are accessories. The feldspars are somewhat cloudy."

### **Tunnel cuts dike series**

This granite is succeeded along the course of the tunnel with an equal volume of aplite dike formation alternating with bands of altered granite, as shown in the section. One of these aplite dikes is 150 feet broad and intensely brecciated, so much so as to involve heavy timbering and spiling for that distance.

At the 750-foot station, an aplite dike was intersected about 150 feet wide, carrying a hanging wall band five feet wide that had been intensely fractured and its fine network of fracture or shrinkage planes completely saturated with molybdenite, giving the rock a general blue cast. This dike is succeeded by another zone of granite, and again another fifty foot aplite dike, extremely siliceous and fine grained, resembling quartzite to the unaided eye, was passed through and again altered granite was encountered.

In a petrographic determination of this fresh phase of the aplite, according to thin section studies, the rock was found to consist essentially of quartz, orthoclase and a little albite, with beautiful spherulites around the corroded quartz phenocrysts and zone of micropegmatitic structure.

### **Big vein 100 feet ahead**

It is expected that the big north vein of the series, 40 to 80 feet wide, will be encountered within 100 feet of the present face of the tunnel if its dip of a few degrees from the vertical exhibited in its surface outcrop is maintained at this depth.

The contacts of these aplite dikes with the granite vary from an irregular intermeshing of the two formations to distinct talc gouge partings.

The tunnel has been wet overhead since the first big brecciated aplite dike was cut, and occasional big rushes of water were encountered after passing through the talcy contact gouges. The back of the tunnel dries as the face advances, which, however, continues wet, and the tunnel drain is now carrying approximately thirty gallons a minute of water flow.

These conditions evidence the probable upper surface of the ground water circulation but should mean some unaltered sulphide conditions when the big quartz vein and its parallel highly mineralized porphyry dike are encountered.

### **May be largely pyrite**

It is to be expected that these sulphides will be largely pyrite, but should have commercial association of chalcopyrite mineral and probably some zinc and lead, judging from the shallow pit development in the surface outcrop of these ore bearing fissures.

If the development at this level should reveal associated chalcocite mineral, the identification of the zone as a geologic blood relation of the Butte district in Montana will be substantially completed and will justify the economic forecasts of its probable great economic importance for more extensive and deeper development.

The Revenue Group of claims is owned by the Consolidated Mines Syndicate, a development enterprise supported entirely by widespread public stock subscription. Frank E. Johnesse, First National Bank Building, Boise, Idaho is manager.

The company owns three other properties in other Idaho districts, on all of which extensive preliminary development work has been performed, and some large ore resources proven on each property. Mr. Johnesse has the reputation of getting more results in underground work for the money obtained from his stockholders than is common from such speculative development investments.

### **Eight men now working**

The present Revenue tunnel was started last January. It is 5x7 in the clear inside the timber portion. It is equipped with a portable two-drill compressor, and the camp consists of a blacksmith shop, cook shanty, dining room and a frame bunk house for the accommodation of ten men. A crew of eight men is now employed.

The tunnel carries an 8-inch galvanized ventilation pipe with an elbow and a vertical standpipe thirty feet high at the portal. A small jet of compressed air is injected into the standpipe at the elbow and gives excellent ventilation at the face, exhausting powder gasses in about fifteen minutes after a round. This simple contrivance has been fully effective so far and may be of interest to other enterprises of this nature.

The overall cost of the tunnel to date has averaged \$13 per foot. The cost was increased by the 150 feet of ground encountered, some of which had to be breast boarded and top spiled with short lengths of track iron.

The cost is a credit to the operator and emphasizes the altered character of the formation encountered, which is a favorable augury of the general geological conditions of the ore-bearing zone and is comparable to the conditions encountered at shallow depths in Butte. The character of the ore occurrence to be shortly proven by this interesting piece of development is awaited with keenest interest and anticipation.