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The Pioneer-Indiana Group,  
Bullfrog District, Nevada.

By

Forbes Rickard, Mining Engineer.



The Pioneer-Indiana Group is situated about the little town of Pioneer, seven miles north of Rhyolite, in the Bullfrog District, Nevada.

The property is attracting a good deal of attention just at this time, through the rehabilitation of the Pioneer Mine, which had been practically depleted of high-grade shipping ore by the leasing company which preceded the present management under the Tobin Brothers. The latter have recently erected a mill for the treatment of the bulk ore of the mine and are bringing the property back to the productive, and profitably productive, stage. Altogether the Pioneer bonanza may be credited with upward of \$500,000. gross production.

The Indiana has gone through expensive litigation with the Pioneer interests, but that is over with and boundary lines have been adjudicated with finality. The effect of this litigation has been to deprive the Indiana of what is known as Indiana No.2 Main Shaft. Workings now open out from what is known as the Engineer Shaft, 405 ft. deep, 8-1/2 x 4 ft. in the clear, with hoisting compartment and manway securely timbered. Main levels and crosscuts are run out at 200 ft. and 265 ft. respectively, and through these it has been the aim and effort of the Indiana operators to pick up the main Pioneer oreshoot in its southwesterly extension; and failing in that, to at least prove the existence of separated parts of the main orebody. Thus far developments cannot be said to have been successful, but as I shall go on to show there is encouragement in what can be seen in the mine, particularly at and about the 265-ft. Level.

Surface equipment consists in,



One 40 H.P. Electric Hoist,  
About 500 ft. of Cable,  
Two Ore Buckets, and Ore Cars,  
One Blacksmith Shop and Equipment,  
One Blower and Motor for same.

The geology of the territory which includes the Pioneer orebody is much complicated by faulting and through the convergence of a variety of rhyolitic flows and tuffs, and possibly the inclusion of dissected parts of sedimentary chloritic schists and quartzites. In broad terms, the Pioneer orebody lies in a zone of sheeting and brecciation, in its widest places resulting in mineralization to a width of fifty to sixty feet, and having very much the form of a chimney; in fact, the plan of the orebody in successive levels looks like a series of overlapping concentric rings. Separately from this there is a zone of sheeting and fracturing in the mass of hard rhyolite which is developed by the workings before they approach the point of the main Pioneer orebody. In this zone there are a number of fractures and veinlets which are locally termed "water courses",- these affording occasional assays ranging from a few cents to a few dollars. They are in my opinion unimportant.

The deciphering of structural features is very necessary in this camp of Pioneer, in finding your way to an orebody and in following it up.

Chemical action of vein solutions is everywhere confined to the fractures and the fissures. It does not extend into the country rock, and there is no extensive alteration of the country rock as is commonly observed in other districts. Similarly, the boundary between the vein proper and body of



adjacent rhyolite in the Indiana ground is not likely to be distinct.

Veins and faults in this district are very closely associated and both occupy fissures formed at the time that the region received its structural dissection. In the Bullfrog District proper it is claimed that about 10% of the faults are associated with veins of either known or prospective value. The tremendous block faulting of the Bullfrog District is illustrated in U. S. Geological Survey Bulletin No. 407, which has been of great aid to me in assembling my information. While, in the district to which this Bulletin refers, many fault displacements are less than 100 ft., there are instances (like the Montgomery-Shoshone fault) where the displacement is over 2000 ft. vertically. Nearly everywhere in the district in general there is a horizontal displacement, or heave, accompanying the vertical displacement, but these faults are simplified in that the horizontal movement is always found to operate in one direction.

Pyrite everywhere is altered to limonite, but none of these veins were originally rich in sulphides; it is nowhere more than a slight impregnation. Quartz in greater part is formed by the silicification of fragments of rhyolite and finely-granulated interstitial material. Coarsely-crystalline quartz is not characteristic of any of these veins of Pioneer and often it is hard to distinguish between the valuable breccia ore of the orebody and the iron-seamed breccia that may be found in a part of the mine away from the orebody. The rhyolitic flows, when shattered, give rise to the rhyolite breccias, and when these have been enriched by deposition of gold in the seams and interstices of the rock it constitutes



ore; where no enrichment has taken place it is country rock and waste.

In all the veins which I saw in the district, manganese was present in association with calcite, and where calcite had been removed there was left a black residual product, or earthy residue. In the Yellowjacket Mine of this district there is a working which is called the "Coal Hole" on account of the black earthy dust which sifts from the vein when it is worked. Men working there come out of the mine as black as if they were working in coal.

Most of the production made by Pioneer owners and by lessees has been sorted by hand and shipped out of the district. Some of it has gone to Salt Lake City and to San Francisco smelters. The richest shipment ever made went to Salt Lake City and brought \$10,000. net for the carload. In latter times little or no rich shipping ore has been found, until, recently, about the 225-ft. Level, there has been developed a streak of very rich ore, as high-grade in fact as anything that has come from the mine in its history. The beginnings of this were shown to me when I was at this mine, but it is too early yet to gauge the importance of the new discovery.

In the accompanying plan map I appropriate the survey of Mr. W. B. Milliken, Mining Engineer, making such changes and alterations as occur to me to make. I have designated the rock changes so as to relate the one rock to the other and to permit of comparison relative to the rock formation in the Pioneer Mine.

My conclusion is that only at the extremity of the long crosscut is there any real analogy between the formation



in the two mines, and that it will be necessary to pick up the orebody very close to the common endline of the two properties before following it back into the Indiana ground. And by reason of the angle of the Conservative Claim, which juts into the Indiana Claim about the southwest extremity of the main stope, it is going to be difficult to keep within the Indiana boundary in prosecuting the work about the 265-ft. Level. Reference to the map will make this clear.

The characteristics of the Pioneer oreshoots are:

1.- That they are limited on the footwall, or easterly, side by a 50 ft. thickness (more or less) of brick-red attrition clay; that is to say, a clay that has been formed under intense crushing strains connected with fault movements.

2.- As the orebody is followed down it shifts, or breaks away, into the upper or hanging wall and becomes successively richer and smaller in dimension.

3.- That in the lower parts of the oreshoot the ore makes well out into what is known as the Green Rhyolite, which everywhere flanks the orebody on the upper side. Whether this is a true rhyolite remains to be determined. It is recognized that the green color in some of these rocks is due to abundant chlorite, and probably derived from a pre-existing large deposit of green chloritic shales of the original formation.

The ore itself, as previously noted, is a brecciated rhyolite seamed with hydrous oxides of iron and manganese. The values are entirely in gold,- silver being so small as to be negligible.

In the lowest level of the Pioneer Mine there has been much work done northward into Tobin Mountain which apparently has been unproductive. It is safe to say that it has been



unprofitable, since no workable orebodies have been developed through the many tunnels fingering into the hill. In my opinion some of these tunnels underlap the long crosscut of the Indiana.

Further, since these same attrition clays, the greenish schistose rock, the rhyolite breccia, and the so-called green rhyolite, can all of them be identified in the formation which I endeavor to show mapped in plan, it is reasonable to conclude that they should somewhere in the Indiana ground be similarly productive. The explanation for the circumstance that nothing more has been developed than is the case, is found in the condition of interruption of the Pioneer orebody in a flat vein system which does not permit of your figuring the extension of this ore to parts of the mine vertically, or approximately so, below the old stope of the Pioneer. The part of the mine where the interference of these flat veins is noticeable is marked by much kaolin, which occurs in irregular earthy patches, and a similar thing is noticeable in one of the rock strata near the breast of the long crosscut. This to me plainly indicates that your work on the 265-ft. Level, which is the only work that approaches near to the old stope, has been done on a horizon which is too low relative to the levels which develop the orebody of the bonanza stope in the Pioneer; so that while this work touches ore in one or two places about this part of the Indiana ground, it does not develop the oreshoot.

My recommendations are, first, that you put up a series of raises, intelligently spaced to prospect the vein of the west side of the green tuffaceous rhyolite (25 ft. thick), and that this be done in extension of the work which, about the



present raise, once broke into promising ore values. Next, that a raise be put up following the attrition clay seam next to the green rhyolite that shows in the end of the main crosscut. In my judgment this latter work will lead into ore which is closely connected with the oreshoot of the bonanza stope.

In order to carry out this plan of work it will be necessary to enter into a friendly agreement, legally drawn, with the Pioneer Mine, which will permit of connecting your workings with their workings at some point most convenient to both parties. This mainly for purposes of ventilation, which is badly needed in both mines,- in the Indiana more than in the Pioneer. If such an arrangement were carried out it would be easy to connect up with the air line from the compressors of the Pioneer Mine and to get a supply of air for the use of machine drills on stoping ground.

Similarly, later on in the ultimate project, an arrangement could be entered into with the Pioneer owners providing for the development of their spring, and thereby the enlargement of their water works, so as to supply any mill which you might be warranted in constructing on your ground for the beneficiation of your ores.

In conclusion, I firmly believe that ore can be developed in this property which will be sufficiently profitable to reimburse your owners for all capital outlay made up to this time and to yield a commensurately good profit over and above all future outlay.

Respectfully submitted,

(Signed) Forbes Rickard

Mining Engineer.

Dated at Denver, Colorado,

February 16, 1914.