Interpretation of Effect of Faults on Veins

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There are two kinds of faults, pre-mineral and post-mineral, in their relation to veins. The pre-mineral fault has a bearing on the genesis of the mineral in the vein and may be mineralized itself. It then takes on the nature of a vein itself and may be affected by a post-mineral fault cutting it. A pre-mineral fault becomes a post-mineral fault when it cuts a pre-mineralized vein. This is not a very common occurrence, and this paper on the effects of the faults on the veins has to do only with post-mineral faults.

The large pre-mineral faults of the Belt series area of the Northwest are the evidence of the major earth movement followed by the secondary faulting and fracturing which produced the structures for the ore deposits and also the channels up which ascended the mineral-bearing solutions for mineralization.

The Leonia, Snowshoe, Hope and Osburn Faults are major faults and pre-mineral. Of these only the Snowshoe Fault has been mineralized. In this case the source of mineralization was in a channel along a post-fault dyke and found its way along secondary faults and fissures to the Snowshoe Fault. Where there were none the fault was not mineralized. Even where the mineralizing solutions followed sills and bedding planes the fault was barren. It had no effect upon the veins except acting as the terminus of them. The plan of the fault herewith shows the condition.

It is the post-mineral faults which are of interest to the miner because of their effects on veins and the problem of finding the extensions of the veins beyond the faults and many thousands of dollars and years of effort have been spent in doing it in the hope of finding the same rich mineralization in the faulted sectors. Practically in all cases they have been a disappointment and it is for this reason the interpretation of the effects is important. Each of the cases shown in this paper are actual and can be named if need be.

There have been rules laid down for finding the extension of veins beyond post-mineral faults which are all very good as long as the conditions for which they have been worked out exist. That is not always the case. The simpler way is the study of the contact of the fault and vein. Here the direction of the throw can be determined by the effect upon the vein and the country rock on both sides of the fault. There is a dragging effect in the vein and the country rock as well and frequently minor step faults in the vein just before it reaches the fault. The matter of secondary enrichment on one side of the fault and conditions which prevent it on the other is an important effect upon the vein.

In a Coeur d'Alene mine a vertical displacement for a normal fault acted as a barrier to the downward movement of the meteoric water causing an enrichment of the vein above the fault. The faulted sector was a partly leached primary vein, the values in which were too low to be of commercial value. No improvement in depth can be expected until the water level of the country is reached, at which point there will be a zone of secondary enrichment succeeded by the primary ore below it. As the vein above the enrichment is comparatively short, no such large tonnages of very high grade ore can be expected as that which was the result of leaching the thousands of feet of vein before it was eroded off.

In the case of the reverse fault the

same condition exists. A primary vein of a low grade had been subject to secondary enrichment resulting in a very high grade ore above the fault while below it was in its original condition except a slight loss from leaching, but it was not worth development.

The effect of horizontal displacement by a vertical fault of a dipping vein was to produce two step faults in the same direction as the movement on the other side of the fault. Drag ore was formed leading to the faulted sector. Naturally with the dipping of the vein there would be an enrichment near and along its intersection with the fault on the right side, and none on the displaced sector. This is shown on the vertical projections of the planes of the fault and the vein.

When the ore occurs in shoots there would only be drag ore where the shoot was cut by the fault and there would be enrichment along the fault with depth and of the drag ore the same. The faulted sector would be primary ore without any enrichment. In the particular occurrence I have shown the results were very disappointing but no more than could be expected.

The effect of flat faults on veins is anything but beneficial for the faulted sector. In the case of the steep vein when it reached the fault, it was cut off abruptly and broomed out. The upper part of the vein had good walls and the gangue mineral could be easily separated in milling. Below the fault it was a frozen vein without walls that could be broken to and while it has values high enough to be a milling grade of ore it is expensive to mine, requires fine grinding and is so hard that grinding and milling costs are high.

In the case of the flat vein cut by a flat fault: This is a bedded vein in slates. The vein, while narrow, was pure galena and easily mined in spite of being only 12 inches wide until it was cut off by a fault. Beyond the fault that 12 inches of galena had been broken and numerous small beddings and seams through a width of five feet. It could not be worked at a profit.

In all of these cases cited mining was started on the good side of the fault. If it would be started on the other poorer side it would be enrichment in the faulted sector. But whichever way the fault is approached the same rules apply. Each fault must be studied by itself and much useless work can be avoided if this is done. Having determined the conditions of the vein and the direction of the throw, the effect of the fault upon the vein should be determined with a large degree of certainty.