A STUDY OF THE HANGING WALL VEIN SYSTEMS ON THE NORTH END OF THE COMSTOCK LODE, NEVADA

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In recent years there has been a great revival in old and once productive mining camps in the search for new ore reserves. With the systematic and intensive application of modern geological techniques known ore zones are being extended and new ore horizons are being found in what were once considered exhausted mining districts.

The Nevada State Bureau of Mines, under the Directorship of Mr. Jay A. Carpenter, with Mr. Carl Stoddard, as Engineer, is at present making a study of the Comstock Lode, in Nevada, in an effort to point out new possibilities for exploration in that district. As his work for a senior project in Mining Engineering at the Mackay School of Mines, University of Nevada, the writer has made a study of the East and Hardy veins and the Bonanza ore shoot in the north portion of the Comstock Lode in an effort to disclose the possibilities of undiscovered ore deposits in this area.

A study was made of the old mine records and maps on file at the Mackay School of Mines and at the office of the Consolidated Virginia Mining Company, at Virginia City, Nevada. Reference material on the Comstock Lode is abundant, and the Mackay School of Mines has a large collection of mine maps and records, including assay books and daily superintendent's reports. However, detailed geological information on the vein structure is sadly lacking, as the mining companies made practically no geological notations on their maps, and the science of structural and economic geology as we know it today was practically unborn at the time the most productive areas were worked.

However, with a careful study of the level workings, stope maps, and other records, it is possible to deduce the structural history of the ore deposits and locate areas and horizons favorable for further investigation.

The purpose of this report is to make a study of the hanging-wall orebodies in the north end of the Comstock Lode and to outline a program of investigation which may lead to the uncovering of new ore deposits in this once productive horizon.

Preliminary work includes a map of the north end of the Comstock Lode. The topography and the surface outcrop of the main Comstock fault are based on the - U.S. Geological Survey "Preliminary Map of the Comstock Lode District, Nevada," published in 1945. The underground data on the hanging-wall veins and their probable surface projections were plotted using the U.S.G.S. topography as a base.

The second enclosed map is a vertical cross-section at right angles to the strike of the East vein. It shows the relation of the East and Hardy veins to the main Comstock footwall. The third enclosure is a sketch map showing the longitudinal vertical projection of the Bonanza and East vein stopes.

The Comstock Lode, situated 22 miles southeast of Reno, Nevada, in the Virginia Range, was discovered in 1859 and by 1919 had produced $350,000,000 in gold and silver. The ore shoots, or bonanzas as they were called, extended along a fault zone striking roughly north and south for a distance of approximately four miles. These bonanzas are isolated from each other and many of them do not outcrop on the surface.

The district is roughly segregated into three zones each of which contained several bonanzas separated by more or less barren vein matter. On the south there are the Crown Point-Belcher, the Yellow Jacket, and the Gold Hill bonanzas. In the middle mines are found the Chollar-Potosi, the Norcross-Savage, and the Savage-Gould and Curry Bonanzas.

In the north end mines, with which the writer is especially concerned, there are four zones which produced notable quantities of ore. At the surface outcrop of the lode is the Ophir Bonanza, discovered in 1859 and mined to a depth of about 400 feet. The production of this bonanza exceeded $7,000,000.

The California and Consolidated Virginia, adjoining the Ophir to the south, were practically barren of high grade ore on the surface, but in 1873 an almost vertical ore shoot extending up into the hanging-wall was discovered. This became known as the Big Bonanza and produced from 1873 to 1882 a total of $105,000,000 in bullion. The surface projection of the axis of the Big Bonanza stopes is shown in the accompanying map. This ore shoot extends from its approximate intersection with the main Comstock fault on the 1750 foot level of the C & C shaft to above the 1200 foot level, a vertical distance of about 600 feet. As can be seen

from the map, it consists of two legs, one of which strikes N70°E while the other strikes about N30°E.

Stoping operations commenced on the Hardy vein in 1877, and approximately $1,500,000 was taken from the stopes in this vein between the 1900 and 2200 foot levels. The known ore shoots were confined to the relatively narrow vertical range of 300 feet and extended laterally from the line of vertical section east for about 800 feet. The ore was high in grade yeilding an average of $60 a ton.

Although the Hardy and East veins practically coincide on the 1700 foot level the latter was not discovered until 22 years later, in 1899. From 1899 to 1920 production from the East vein amounted to over $7,000,000. The productive zone extended from a point east of the Big Bonanza in Con. Virginia ground to the north line of the Union, a distance of about 3800 feet. The ore produced came from a series of isolated chutes which have a pronounced rake downward to the northeast.

It appears that the Bonanza ore chute and East and Hardy veins are tension cracks in the hanging-wall of the main Comstock fault caused by the drag produced in the hanging-wall from movement along the fault. If this is the case then little displacement is to be expected along these veins. In respect to the Bonanza ore chute and the Hardy vein this is apparently true, since the footwall of the Comstock fault is not known to be disturbed where these cracks or faults project into it. Data on the lower levels where the East vein projects into the Comstock fault is insufficient to make a definite statement, but in view of the conditions in the Bonanza ore chute and the Hardy vein, it is reasonable to assume that the East vein was formed similarly.

The most interesting feature of these hanging-wall ore zones from the standpoint of new development is the fact that from the top of the productive stopes to the surface they are practically unexplored. Referring to the vertical cross-section it can be seen that the highly productive Ryan stope on the East vein extends up to the 1700 foot level. After a search of all the available mine maps no workings could be found above this point along the projected dip of the vein. The only working above this point is the north lateral of the Sutre tunnel, and since it was driven years before the East vein was discovered apparently no sign of it was found there.

It can also been seen from the cross-section that exploration work was carried on diligently down the dip of the vein through barren sections, until ore was found again on the 2500 and 2700 foot levels. This raises the question of why exploration work was not carried up above the 1700 foot level.

It is the writer's opinion that had there been any of the usual indications of a vein above the top of the stope such as gouge or vein matter, exploration would have been carried up beyond this point. The same condition is in evidence along the entire length of the East Vein. This is not to say that in every case there are no workings above the tops of the stoped sections of the veins, but exploration work generally ceased at 200 feet or less above these points. The reason for this is not clear and as far as is known nothing has been found in the existing records to explain this lack of exploration up the dip of a productive vein. As stated previously, it is the writer's belief that if the vein structure could have been followed into upper levels it would have been explored above as it was below the stoped areas. The most reasonable way to account for the condition is the postulation of a post mineral fault, displacing the vein above the stoped areas.

Examination of the enclosed sketch map shows that a roughly straight line can be drawn from the top of the Big Bonanza downward along the tops of the East Vein stopes. If we assume that a post mineral fault intersected the East vein and Bonanza ore chute roughly along this line causing a displacement of the upper in relation to the lower portions of the veins, then this fault will readily account for the lack of exploration in the upper levels. The writer does not claim that this is the only condition that could possibly account for the facts, but he believes that taking into account all available data it is the most reasonable explanation.

Further evidence of faulting may be found in the old records pertaining to work done on the Big Bonanza. As is the case of the Ryan Stope, little exploration was done any great distance above the top levels of the Bonanza stope. Although the vein matter did not terminate directly above the stoped areas, it was apparently cut off above by what the contemporary reports called "Cap rock." This is a local terminology applied by the men who worked the Big Bonanza and is

found in contemporary reports dealing with the subject. A typical example is to be found on a map on file at the Mackay School of Mines showing the workings on the uppermost, or 1200 foot level of the Big Bonanza. A notation on this map reads, "From this point raised 111 feet in quartz and vein matter, at which point the cap rock was reached."

It is known that there are no post mineral lava flows in this area and that the rock formation does not change at the 1000 foot level, therefore it appears reasonable to assume that the "cap rock" is a fault which displaced the vein material at this point.

The purpose of this report is to make a beginning toward determining whether or not such a fault actually does exist. The first step was the plotting of the Bonanza ore chute and the East and Hardy veins on a suitable topographic base. Using values of average dip along these veins, their surface projections were plotted to show where they would outcrop on the surface if undisplaced. This is a necessary step, because the actual point where the solutions passed up to the present surface is not known. They are what is known as blind veins, and there are no siliceous outcrops to mark their presence at the surface. However, it is believed that a study of wall rock alteration in the district would enable the geologist to establish criteria for the mapping of these so-called blind veins at the surface. If the above postulated fault does exist, and its displacement is considerable, then the actual surface position of the hanging-wall veins would be displaced from the surface projections shown on the map.

It must be borne in mind that owing to variations in dip and strike the surface projections may actually vary considerably from those shown on the map, however, they will serve as a guide in searching for the actual surface positions of the veins.

Unfortunately, a great deal of the mapped area is covered by alluvium or the works of man which obscure the underlying rocks. However, from the vicinity of the Union and north-east from that point sufficient rock is exposed to carry on geological study.

A detailed geological study of this particular area has never been made, and no doubt if such work were carried out evidence of the faulting, if it does occur, could be found.

The upper extension of the Big Bonanza and the East and Hardy veins have never been prospected. It is the author's opinion that post mineral faulting may have displaced these veins, and that a systematic geological study of the area would disclose their surface outcrops. With this accomplished a program of exploration for new orebodies in the upper extensions of these highly productive ore zones can be intelligently carried out.

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