Reopening the Mexican Mine, Comstock Lode.

Written for the MINING AND SCIENTIFIC PRESS
By WHITMAN SYMMES.

Although the Mexican mine contains the deepest workings on the Comstock Lode, it has never produced enough ore to be worth mentioning. The only ore milled from the present Mexican area consisted of 308 tons, assaying $13 per ton. This was taken from a stringer on the 2700-ft. level in 1883. In 1884 the Mexican 3100-ft. winze was sunk to the 3300-ft. level, and three diamond-drill holes were driven out. The results being disappointing, all work in the lower levels at the north end was discontinued, and from that time until recently, no work has been done in the mine below the Sutro tunnel level, at a depth of 1600 ft. In 1906 a drift 215 ft. long was driven north from the Mexican-Ophir line on the 2000-ft. level, but this yielded no results, and for a couple of years there was not a miner engaged in the Mexican workings.

In July 1908 a drift was started north on the 2200-ft. level, on which the Ophir was working a body of good ore only 70 ft. from the Mexican line. When in 215 ft., this drift picked up a small vein of quartz (now known as the 'west vein'), from 2 to 5 ft. wide, and assaying from $5 to $30 per ton. The ore-shoot thus exposed, however, was only a few sets long. In the spring of 1909 I was placed in charge, with the usual instructions to find a body of pay-ore in the shortest possible time.

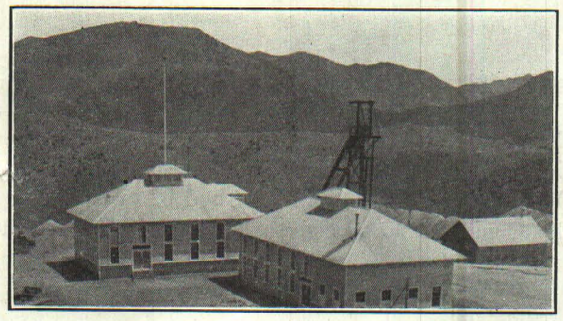


Fig. 1. Union Hoist, Virginia City.

The conditions for mining, however, were unusually bad. The company then had a one-third interest in the Union shaft, which has a modern plant, but the territory it was desirable to explore was not connected therewith. The only access was by way of the C. & C. shaft, and the Con.-Virginia and Ophir workings. Waste had to be trammed to the shaft, and timbers brought in through nearly 2000 ft. of drifts, 500 ft. of which was through the 2350-ft. Con.-Virginia 'snow-sheds', where the thermometer showed the exhilarating (?) temperature of 122 to 132°F. The mine was lacking in equipment. The rock-temperature in the Mexican drift was 107°F., and the air for ventilation, which was furnished by the Ophir management from their own insufficient supply, was 103°F., and the current was scarcely strong enough to make a candle flicker. The compressed air supply which came all the way from the shaft through a 2-in. pipe, and did yeoman's service on the way, had an unaccommodating habit of periodically dropping to 45 lb. Under the circumstances I could not muster much enthusiasm for 'following the ore'. A vision of balmy adits, fresh air, and other precursors of efficiency, presented itself as an overpowering attraction.

For many months, therefore, the Mexican did only 'dead work'. A south drift from the Union shaft workings on the 2000-ft. level was driven to a connection with the Ophir workings. A natural draft of air thus circulated along that level and up the Ophir incline, which is the up-cast for the north end mines. A blower was installed on the 2000-ft. level, and a relay blower on the 2200-ft. and these delivered air to the Mexican 2200-ft. drift through a maximum of 1200 ft. of 15-in. pipe. By this means a fair supply of air was obtained. A 2-compartment raise was then driven to the 2000-ft. level, at about the centre of the Mexican territory, and was connected with the drift from the Union shaft. The raise (or winze, as it is now called), thus became a down-cast, and the Mexican and Ophir now have an abundance of cool dry air, circulating naturally through their 2200-ft. drifts. Although the immediate objective work was upon the 2300, 2400, and 2500-ft. levels, the 2000-ft. level was chosen for access to the ore-zone, instead of some deeper level, for the reason that the former has been for a considerable time drained of all hot water and is now cool. Thus the 1850 ft. of tramming is made easier, and the air-supply reaches the ore-zone with a minimum addition of heat and moisture, which would not be the case were connection with the Union shaft made at a lower horizon, near the water level. The present temperature at the station of the Mexican 2000-ft. winze registers 87°F. The wet-bulb temperature is 73°, showing only 53% saturation. The amount of air passing through the drift in January, 1910, was 22,000 cu. ft. per minute.

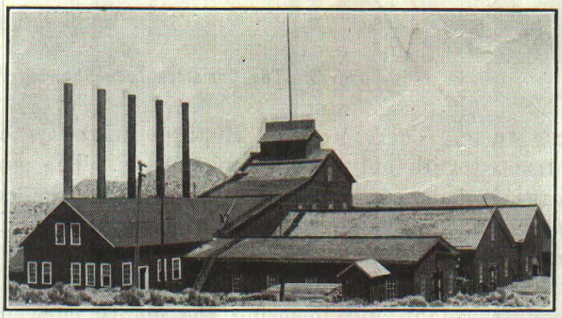


Fig. 2. Consolidated Virginia Mine.

On the 2000-ft. winze-station was placed a No. 6 Sturtevant multivane fan, direct-connected to a 20-hp. motor, with a speed of 1120 rev. per min. It is rated at 13,500 cu. ft. per minute against a 2-in. water-gauge, with a consumption of 22 brake horse-power, 11,060 cu. ft. against 4-in. pressure, taking 19.5 brake horse-power, and 8500 cu. ft. against a 5-in. water-gauge, with a consumption of 16 brake horse-power. A 20-in. trunk-line pipe runs down the winze, with 15-in. branches on the different levels.

The 2400-ft. station is thus kept down to 90°F. By a simple arrangement of gate-valves the fan is made to suck air after blasting and to deliver the smoke into a drift that connects with the Ophir up-cast. On the same station was installed a double-drum electric hoist, driven by a 30-hp. A. C. motor, with a maximum hoisting speed of 450 ft. per minute. In putting through the raise, progress was limited by inability to handle more than a certain amount of waste. Therefore the Mexican winze is constructed with only two compartments. The single cage is balanced by a counterweight in the compartment used as a pipe and ladder-way. The maximum load when hoisting a car with 1800 lb. from the 2400-ft. station is 1700 lb., and when hoisting the counterweight and lowering the empty cage it is 1630. Waugh stoping drills were used in raising, with Waugh 'sinkers' for plugging. In driving and sinking Sergeant 2½ and 3-in. machines are used. The Waugh 'sinkers' are not regularly used for sinking, as they cannot keep the holes sufficiently clear in the stiff clay that is encountered.

The results of this preliminary work at once became apparent. Previously the 'pass' system had been necessary. In the hotter and more humid headings on the Comstock, the men work a 'pass' at the face and then go out to the cooling-station to cool off; but since obtaining the Mexican air-connection with the Union shaft the 'pass' system has been abolished, and all miners in the Mexican mine now put in a full shift at the face. The labor-cost of driving immediately dropped to 46% of what it had been under the previous management for the entire mine, and to less than 40% for the drifts connected with the Mexican winze. The labor-cost in the winze drifts for the past three months has averaged $5.50 per foot, the wages of all men underground being $4 per day. Most of the rock was a fairly hard diabase, but some was soft vein-matter and required timbering. The cost of driving is considerably increased by hoisting in the winze and shaft, tramming 1850 ft. on the 2000-ft. level, and by fixed expense, which features are now receiving attention. Apart from the general pumping expense, in which the mine shares, there is no reason why work may not soon be conducted as economically as in other places which have similar rock, and where equal wages are paid.

The principal orebodies at the north end of the Comstock Lode (excepting on the outcrop) have not been found in the main 'vein', but in branch fissures which extend from the Comstock vein-matter upward into the hanging wall. This formation is shown in Fig. 4, which gives a composite cross-section, east and west, through the Con.-Virginia and Ophir. The time honored method of prospecting on the Comstock has been to drive lateral drifts and cross-cuts at random through the main 'vein' and hanging wall, and then to follow any promising stringers that were thus found. At the north end there is a belt in the hanging wall more than 800 ft. wide, sufficiently decomposed in places to have been classed by the old-time miners as vein-matter, and as this belt contains a million stringers it will be seen that the old method was a task of some magnitude. Drifts were formerly driven on all sides of

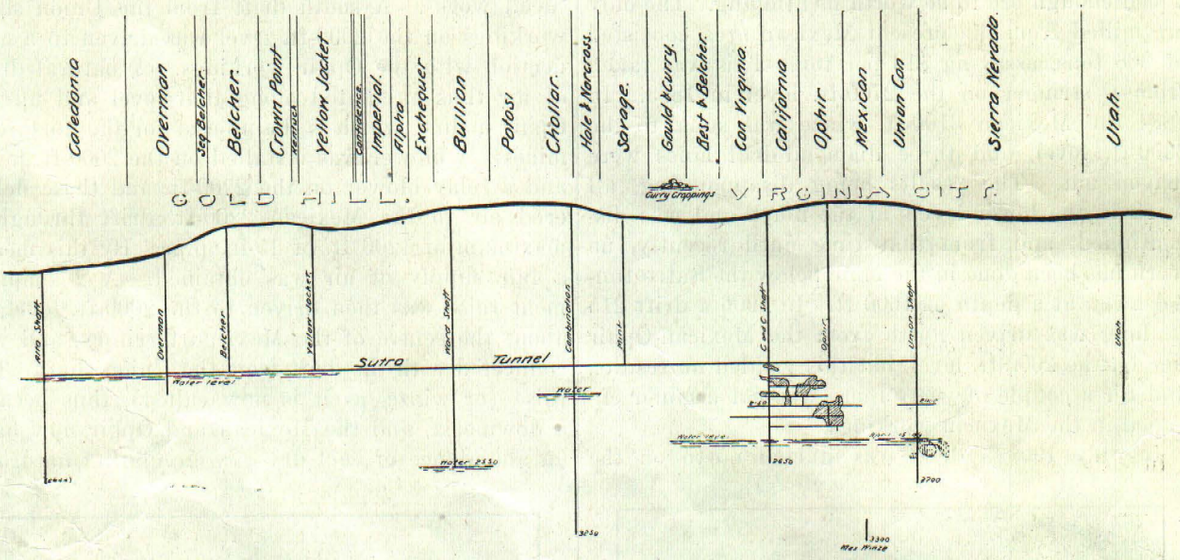


Fig. 3. The Comstock Lode Showing Water Level in 1909 and Ore Extracted Since 1890.

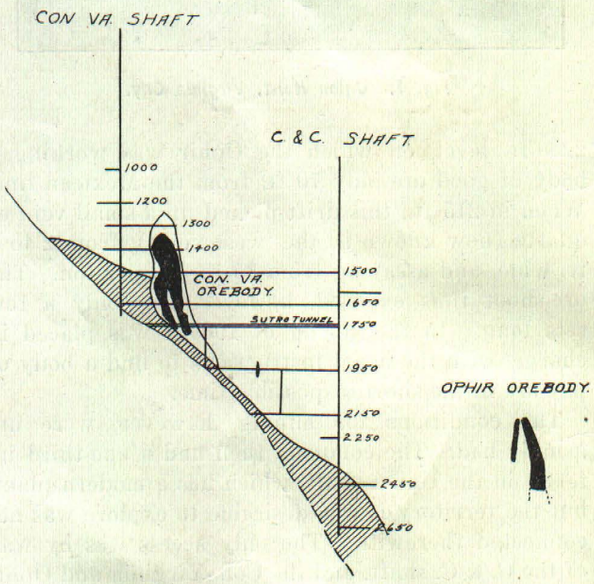


Fig. 4. Cross-Section of Lode.

the orebody lately worked in the Ophir without suspicion of its presence 250 ft. above.

Becker states:[1] "Openings of the type of that which contained the Con.-Virginia and California

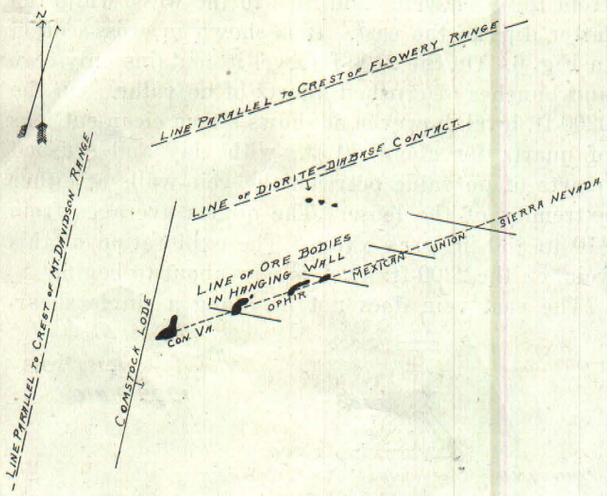


Fig. 5.

bonanzas may occur at any point on the vein, and wholly without warning from above, as was the case with that body." He believed that the orebodies occurred near points of non-conformity of the hanging and foot-walls of the lode. Church,[2] who examined the Con.-Virginia bonanza some years previous to Becker, was of the opinion that the Con.-Virginia ore was in the main Comstock vein-matter. In 1905 John A. Reid[3] made a study of certain portions of the Comstock district, giving most of his attention to the cross-faults which he found on the surface. Unfortunately he was not allowed more

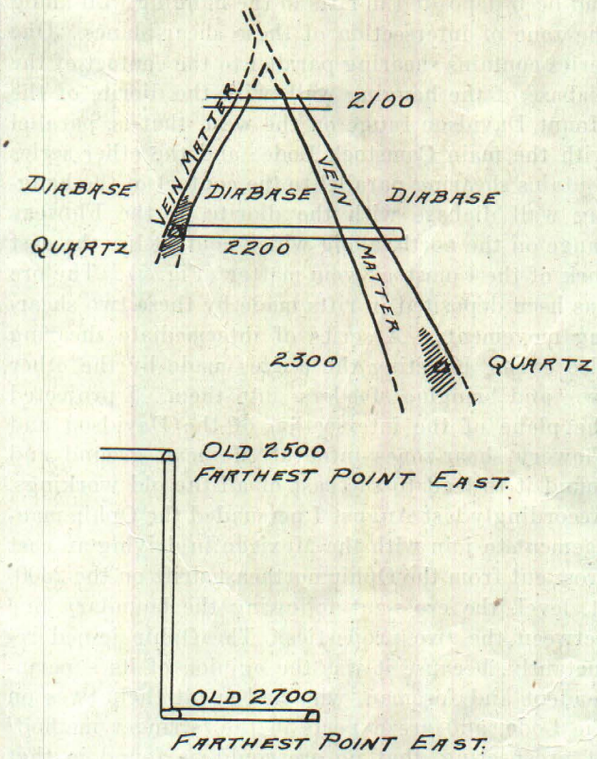


Fig. 6. East-West Cross-Section, near Mexican-Ophir Line

than a momentary inspection of the deeper mine-workings. He proposed that the ore-bearing gashes that extended from the main vein-matter into the hanging wall should be known as 'rifts'. He stated that other rifts might be found by driving exploratory drifts farther east and at greater depth, but was able to offer no more satisfactory advice.

In 1909 I began an investigation of the structural geology of the north end with a view to obtaining data for guidance in a search for ore in the Mexican

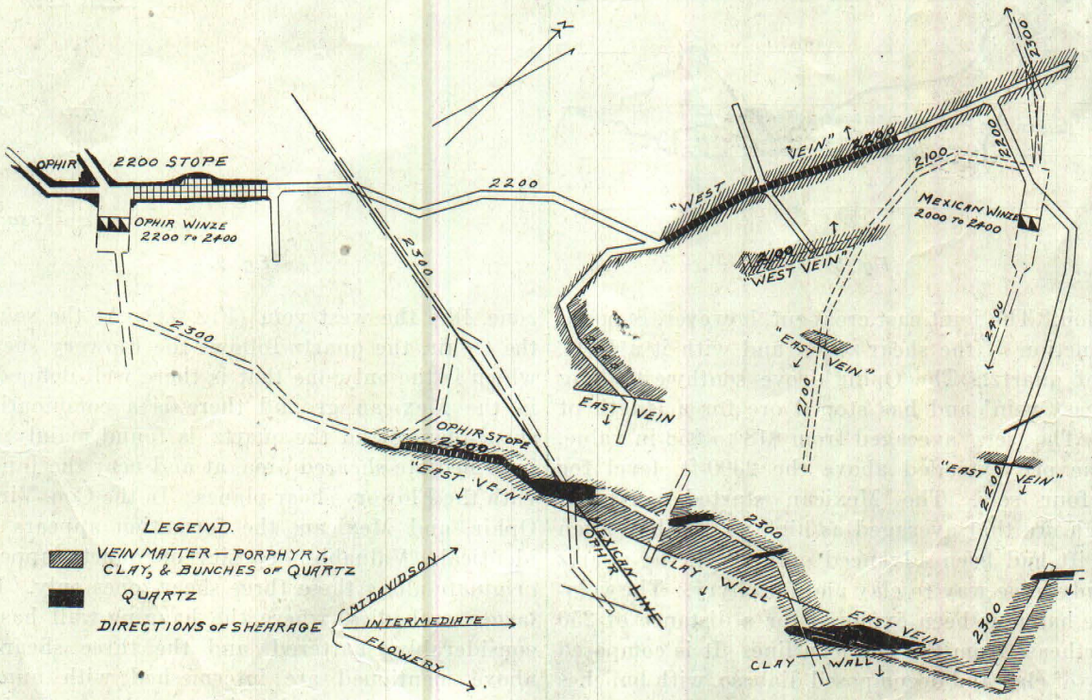


Fig. 7.

[1] 'Geology of the Comstock Lode and the Washoe District'. By Geo. F. Becker. Washington, 1882; p. 287.

[2] 'The Comstock Lode—Its Formation and History'. By John A. Church. John Wiley & Sons, New York. 1879. P. 121.

[3] 'The Structure and Genesis of the Comstock Lode'. By John A. Reid. Univ. of Cal. Publications, Vol. 4, No. 10; pp. 177-199. The University Press, Berkeley. 1905.

ground. I found that the hanging wall was sheared in two principal directions and that the orebodies had been deposited in rifts in the hanging wall along the zone of intersection of these shear-planes. One series contains shearing parallel to the contact of the diabase of the hanging wall, with the diorite of the Mount Davidson range on the west, that is, parallel with the main Comstock Lode; and the other series contains shearing parallel to the contact of the hanging wall diabase with the diorite of the Flowery range on the north, along which contact lies the east fork of the Comstock vein-matter (Fig. 5). The ore has been deposited in rifts made by these two shearing movements. A series of intermediate shearing also exists, bisecting the angles made by the other two, and bringing 'feeders' into them. I projected the plane of the intersection of the Davidson and Flowery shear-zones into the Mexican ground and found it to lead to the east of all the old workings. Accordingly last August I persuaded the Ophir management to join with the Mexican in driving an east cross-cut from the Ophir northeast drift on the 2300-ft. level, the cross-cut following the boundary line between the two properties. The Ophir joined reluctantly, because it was the opinion of its superintendent and foreman, who had spent their lives on the Lode, and are experts in the 'stringer method' of prospecting, that no ore could be found in that

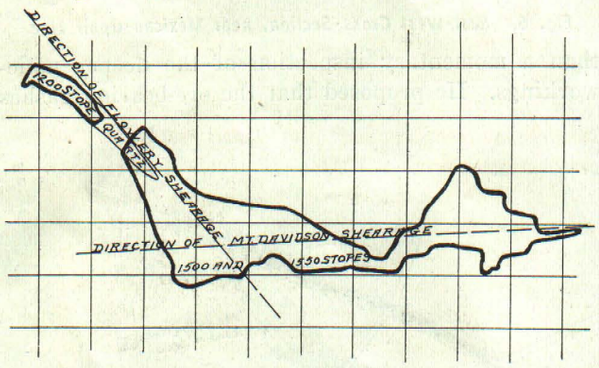


Fig. 8

direction. The joint east cross-cut, however, exposed the junction of the shear-zones, and with it a 10-ft. vein of quartz. The Ophir drove southwest along this 'east vein' and has stoped ore for a length of 60 ft. The 'sets' averaged from $18 to $58 in value, but the ore extended above the 2300-ft. level for only four sets. The Mexican started northeast through ore that averaged as high as $65, but when the drift had been advanced only 20 ft. the quartz suddenly gave way to clay and porphyry. The vein-matter has now been explored for a distance of 250 ft. northeast from the Mexican line. It is composed mostly of clay and decomposed diabase, with bunches and veinlets of crushed quartz of low assay value. A few small bunches, however, gave good assays, some as high as $120. It may be noted, in passing, that the 1100-ft. level of the Con.-Virginia, which tapped the upper tip of the 'big bonanza', went through a similar soft leached zone, and had to be closely timbered.

The ore extracted by the Ophir and Mexican from the 'east vein' is identical in mineralogical composition with the other orebodies of the north end. Exploration has also shown the structural formation to be the same. The 'west vein' in the Mexican lies in the Mount Davidson shear-zone, a little north of its junction with the Flowery range zone. It is a spur from the 'east vein' and dips to the west, while the latter dips to the east. It is shown in cross-section in Fig. 6. On the 2100-ft. level it contains only clay and bunches of crushed quartz of no value. On the 2200-ft. level, however, it shows a firm clean-cut lens of quartz for about 70 ft., with clay and crushed quartz of no value between the vein-walls at either extremity of the lense. The quartz averages from $10 to $30 in assay value. The exploration of this vein, on the 2300-ft. level, is now about to begin.

The east vein does not lie along a single shear-

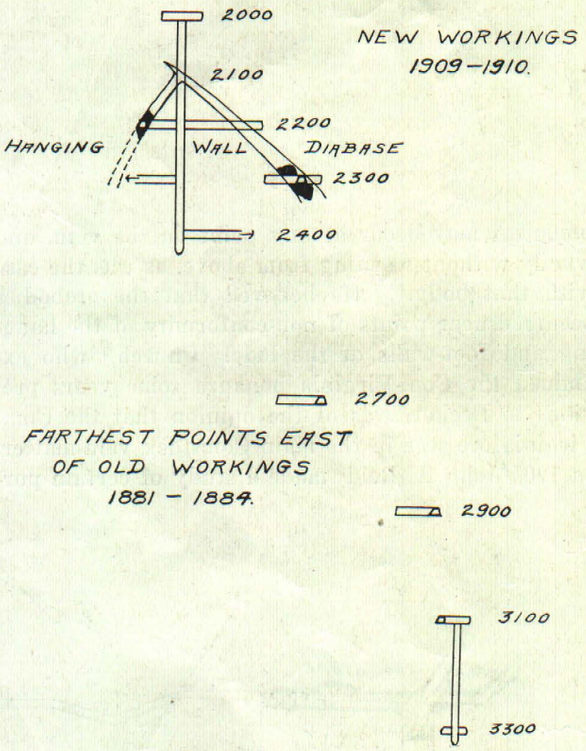


Fig. 9.

zone, like the west vein (Fig. 7). At the south, in the Ophir, the quartz follows the Flowery shearing, which is the only one that is there well defined; but in the Mexican ground there is a combination of shear-planes, and the quartz is found mainly in the intermediate sheared area, at and near the junctions with the Flowery shear-planes. In the Con.-Virginia, Ophir, and Mexican, the formation appears to be identical. Valuable deposits of quartz appear to originate along these three shear-zones only. In the larger orebodies, where the hanging wall has been considerably shattered, and the three shear-zones above mentioned are intermeshed with numerous minor shear-planes, jointings, and east and west faults, the wall-rock between the principal shear-zones has to a large extent been replaced by quartz. A vertical section through the Con.-Virginia bonanza would show a zig-zag outline, due to the shearing having different hades. In Fig. 8 the direction of the two principal shear-zones, as found in the Mexican, are superimposed upon a plan of the Con.-Virginia bonanza. It may be noted that in the latter, as in the present Ophir-Mexican orebody, on the

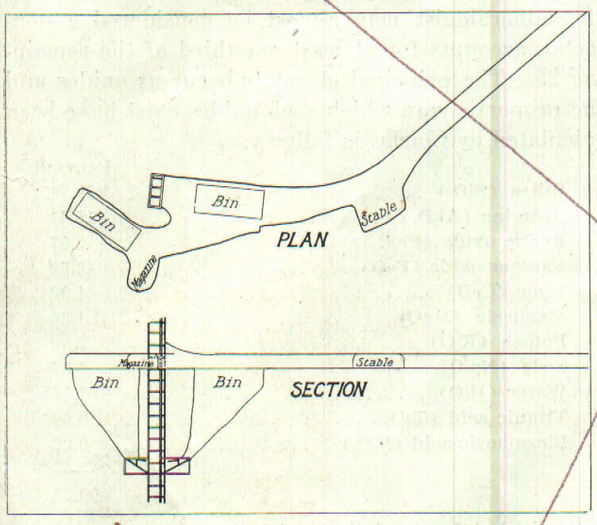
upper levels the ore appears at the south end, and in the Flowery shear-zone only.

The structural geology of the Comstock is complicated, and has never received an amount of study commensurate with its importance. The north end has already reaped some benefit from such work, and I believe that the middle and Gold Hill areas can also obtain similar benefits. The pumps at the C. & C. shaft are now lowering the water-level at the north end below the 2300-ft. level of the Mexican and Ophir, where it has stood for several years. Both of these mines have sunk their winzes to the 2400-ft. level, and are now cross-cutting toward the east vein. Whether or not they find ore there will merely determine the size of the one particular ore-body that has lately been stoped on the 2300-ft. level. The important fact has already been demonstrated that good ore can and does exist to the east of all former workings in this part of the Lode (Fig. 6); and it would also appear that exploration on the Comstock, by following stringers, is an antiquated method that must now give way to quicker, surer, and more scientific work.

EXPLOSION AT MEXICAN MINE, ALASKA.

Written for the MINING AND SCIENTIFIC PRESS
By ROBERT A. KINZIE.

At 11:30 on the night of March 2, 1910, a powder magazine on the 1100-ft. level of the Mexican mine, of the Alaska Treadwell Gold Mining Co., Douglas Island, Alaska, exploded, killing 37 men and injuring 9. The accompanying sketch shows the position of the mine-magazine. A description of the method



used in handling powder is all the information that can be given in regard to the explosion. Powder is delivered to the mine-magazines, one of which is provided on each level, once every 24 hours. Sufficient powder is delivered to supply the night and day shifts. In the case of this magazine the amount is between 20 and 30 boxes. This magazine furnished powder for the 1100-ft. level only.

The magazine in question consisted of a chamber, cut out of the rock for this purpose, and boarded up in the front. A partition divided the magazine into two rooms, and each room had a door. The door has an open grating through which the interior of the magazine can readily be seen from the outside. These doors are always kept locked, except at 'powder time', when a stope-boss is in the magazine to pass out powder to the miners, who call there for it.

The magazine is lighted by an incandescent 16 candle-power light, which is situated a short distance inside the door, no wiring crossing the stored powder. There is no heat brought into the magazine, as all powder is always thawed before being delivered to the separate mine magazines. The situation of the magazine near and beyond the shaft excludes the possibility of any men being cut off from escape in case

Magazine Marked by X X at 1100-Ft. Level.

of accident. A rescuing party was at the scene of the explosion within 35 minutes after it occurred, and no one was overcome by gas, showing that the ventilation was good, and thus serving as an argument for the advantage of placing the magazine near a shaft.

The explosion occurred just at the time the shift was waiting to go to the surface for midnight supper. Had it occurred at any other time, few, if any, would have been killed.

The men on the 990-ft. station, 110 ft. above, report two explosions; the first one put out their lights, but was of no great violence. They lighted their candles and had started for another shaft, when the second explosion of great violence occurred, knocking them over, seriously injuring one, and slightly injuring three others. The explosion consisted of a shock, followed by concussion.

The skip-chute men who were loading the skips from chutes 45 ft. below the station were uninjured, and the men on the 1200 and 1300-ft. stations were uninjured. The explosion knocked out the posts of the station-set, which, with lagging and other timbers, formed a mass of débris, closing the shaft. Among the débris were recovered 22 bodies, and five injured men.

As ore was being hoisted from the 1100-ft. level the doors were down, closing the hoisting compartment below the skip-chutes. One body was found on these doors. The man-cage compartment was open, and eight bodies were recovered from below in this compartment of the shaft.

The stable, a light board shed, was entirely demolished, and here two bodies were recovered. The stable contained two horses, one of which was killed, while the other was uninjured.

Two bodies were recovered along the drift between the station and the shaft, and the fragments of at least one body were found in a corner of the magazine. I have absolutely no clew to the cause of the explosion and cannot account for it.