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REPORT
on
COMO MINE
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Oscar H. Hershey, E.M.

BURCH, HERSHEY & WHITE

Consulting Engineers

Crocker Bldg., San Francisco, Calif.

GEOLOGICAL REPORT ON COMO PROPERTY

By Oscar H. Hershey,

Reno, Nevada, May 19, 1919.

Como Consolidated Mines Co.,
Reno, Nevada.

Gentlemen:

A letter from Mr. C. T. Stevenson, dated January 4th of this year, requested me to make an examination of your property as soon as the disappearance of snow would permit a study of the surface. In subsequent conversation he mentioned that one of the specific objects of the examination was to determine the advisability of extending a certain low tunnel. Snow conditions and my schedule did not permit me to arrive at the property until 1:30 P.M. May 12th. The work continued until noon of May 14th. I was accompanied over much of the surface by the manager, Mr. G. Gordon, and in the Como and Rapidan Mines by the superintendent, Mr. Chas. LeKamp. To these gentlemen I am indebted for information as to assays, ore shoots, and other matters obviously not based on my own observation. I was supplied with a property map on a scale of 200 ft. to the inch. It is not sufficiently detailed for surface geological mapping and contains a fanciful vein system. I also had the Runner mine map, on a scale of 40 feet to the inch. It contains no important errors, and I used it for mapping the vein systems.

From Mr. Gordon I have learned that the property consists of the two patented claims Buckeye and North Rapidan, and the lode mining locations Hillcroft No. 2, Maxwell No. 1, Hillcroft No. 1, Como, Como Eureka, Star of the West, Peer, Mohawk, Colorado, Colorado Hill, Lucky Fraction, Corona, Mohawk Fraction, Lucky Sunday, Lucky Monday, and National and two claims near the mouth of the Boyle Tunnel; also that he has under option for the Company the Mayflower claims, owned by Mr. H. W. Ely.

GENERAL GEOLOGY

The property is situated in the Pine Nut Range, between Raw Peak and Lyon Peak, at altitudes largely between 7000 and 7500 feet, in Lyon County, Nevada.

by me seems to consist of andesites, extruded during two periods. The lower andesite, down at least to the level of the Boyle tunnel, is a fairly uniform, rather fine grained-porphyrific lava that is dark greenish gray underground, and weathers brown. It is characterized by the presence of small red seams. No structure lines are discernable but I presume that it consists of a series of thick lava sheets dipping at low angles. The thickness of the series is not known, but it is evidently very great. This is the andesite that is traversed by the veins.

After the veins were formed, the surface was eroded probably to a depth of at least several hundred feet and acquired an undulating topography. Then came the extrusion of the upper andesite series. It is characterized by the presence of black hornblende prisms. It weathers greenish gray to buff. In places it has a brachioid structure, in others a compact lava. On the Lucky Sunday and adjacent claims there may be a broad dike of this andesite traversing the older andesite and interrupting the veins, but elsewhere it rests as a very thick sheet upon the uneven surface of the older andesite. So far as observed the upper andesite has no veins and caps over the veins in the older andesite. This is emphasized by the fact mentioned by Mr. Gordon that the upper andesite yields potable water while that from the lower andesite is usually strongly mineral-bearing. In the gap in the range in which the property is situated, erosion has removed the younger andesite from an irregular area and exposed the upper portion of the vein system. The latter, under cover, may be much more extensive than it appears at present.

After the lower andesite has solidified it was extensively fractured. Mineralizing solutions, presumably higher heated, arose in these fractures. The water soaked into the walls of the fractures and latered the andesite to various degrees. In the less altered phase the rock is light greenish gray and has fine-grained pyrite disseminated through it. Thence is grades to a fine grained replacement quartz, generally gray in color from the presence of fine grained pyrite. Along the main lines of fracture, veins of a somewhat coarser-grained quartz were formed. The contain vugs lined with quartz crystals, but otherwise empty. Some of the quartz is white and barren, much of it is gray in color from the presence of fine-grained sulphide. In extensive sections of the veins the sulphide is almost exclusively pyrite. Such material probably nearly everywhere contains a little gold, rarely much silver. Locally in certain veins the quartz contains in addition to the pyrite, sphalerite, chalcopyrite and tetrahedrite. These minerals are usually in larger grains than the pyrite, but they are embedded in the quartz and do not occur in cracks and vugs. For this reason I regard them as primary sulphides. The chalcopyrite certainly is primary and most of the tetrahedrite occurs in the same relation to the quartz and is often intergrown with the chalcopyrite. In a few places it seems to line cracks and may be secondary. Most of the clearly secondary sulphide that I have seen is pyrite that has been deposited in

cracks and in the vugs.

Wherever notable quantities of the tetrahedrite are present the silver content is relatively high, and that mineral is clearly the main silver-bearing mineral. It is also the chief source of the copper in sufficient quantities to yield 1% copper in ton lots.

Oxidation has a rather unusual effect on the ores. The pyrite is converted into limonite as usual and this remains in part as a yellow and reddish brown staining material. Most of the gold remains in the ore. The copper is complete leached out. Most of the silver is leached out. That is the unusual feature. In most veins in a semi-arid country much of the silver remains in the zone of oxidation, largely as silver chloride, and becomes concentrated into rich pockets. Upon the basis of Mr. LeKamp's statements of the distribution of gold and silver, I adduce the fact that over the copper-silver shoots with the possible exception of the Rapidan, there are no notable silver chloride ores. Thus near the surface gold predominates in value even in those ore-shoots in which deeper silver becomes the metal of chief value. The Rapidan appears to be the only exception to this rule.

The most important phase of my work has been the determination of the role played by the secondary enrichment process in making ore, for upon it is based a judgment as to whether certain ore-shoots may extend deep enough to justify the additional driving of the Boyle tunnel.

VEIN SYSTEM

The district contains a group of strong lodes which may be roughly divided into a set having northeastward courses and another set having northwestward courses, thus forming a veritable network. They are marked at the surface by zones in which the andesite has been softened, bleached and limonite-stained, containing lenses, streaks and veinlets of porous quartz, also limonite-stained. I will discuss the principal veins under separate headings.

Rey Del Monte Vein:- The Watson map shows a Del Monte claim which Mr. Gordon says is the oldest patented claim in the district. It is based upon a vein that has a northeast course and southeast dip of about 85 degrees. I can trace it at the surface for about 640 feet. It is usually 10 to 15 ft. wide, but most of this width is merely altered andesite. Within this there is a quartz vein usually 1 to 3 ft. thick. It has been explored at various places on the surface by means of trenches and shafts, but does not contain commercial ore, per Mr. Gordon. It has been cut by a cross cut on the 115 ft. level of the Como mine, where 60 to 12 inches of honey-combed quartz with some sulphide assays from traces to \$1.50 gold per Mt. LeKamp. A cross-cut on the 200 ft. level is caved where it reached the vein. Mr. LeKamp says the heat assay was \$4.00 per ton. Thus the Rey Del Monte vein appears unpromising and the fact that much of it does not belong to the company is not of much interest. I have mentioned it merely

to complete the system.

North Vein:- About 70 feet northwest from the Glory Hole on the Como claim, a shallow shaft shows a vein of 15 ft. in width, partly altered andesite, but largely more or less porous quartz. There are several nearly vertical gouges. Mr. Gordon says that several assays probably did not exceed \$1.50 mostly gold. Beginning 80 feet southwest the vein is exposed for 100 feet in a trench, shafts and outcrop and appears strongly. Practically under this section it is exposed in a cross-cut on the 200 ft. level where it is cut and slightly displaced by a fault that dips southeast 45 degrees. It carries low gold values in general. In a cross-cut on the 300-ft. level it is represented by a quartz-seamed zone 10 ft. wide. This section of the North Vein appears to become less promising with depth. Nearly under the first shaft it is cut in a cross-cut on the 200 ft. level and contains 12 to 24 inches of quartz with pyrite and a trace of chalcopyrite. Thus it has become much weaker with depth.

Farther southwest there is a section of the North Vein that is not exposed at the surface, but has been driven upon 130 feet on the 115 ft. level. The northeast drift follows an irregular band of quartz that is largely oxidized, but partly dark gray from sulphides. Chalcantite and azurite stains indicate the presence of copper sulphides. In a small stope where bunches of tetrahedrite may be seen, Mr. LeKamp says that 4.5 feet assays \$9.00 to \$15.00 per ton. The southwest drift follows a similar band of quartz that is in part gray from sulphides including copper, and in part oxidized. At one place 5 ft. assays \$27.00 per LeKamp. He says that the vein in these drifts was sampled by Mr. R. K. Humphreys who claimed that 55 ft. averaged \$8.00. In Mr. LeKamp's report dated Jan. 1st, 1919, it is stated that an ore-shoot is exposed 70 ft. long, 5 ft. in average width, containing values in gold, silver and copper of \$8.00 per ton. Because of the high copper content it cannot be milled with the present plant. The level is not quite deep enough to get the best result on this shoot as some of the copper and silver have probably been leached out. A cross-cut on the 200 ft. level under this section did not expose commercial ore, but the shoot may rake northeastward and lies northeast of that cross-cut.

In the next cross-cut southwest on the 115 ft. level the vein is 3 ft. wide and at one place assayed \$22.00 per Mr. LeKamp. In the next cross-cut porous quartz bunches may represent it. The north vein has been converging upon the Como vein and may reach it at about the extreme end of the 115 ft. level. At the surface the junction may be at a shaft about 75 ft. farther northeast. About 100 ft. northeast of this shaft there is another shaft on the north vein that contains 12 to 15 inches of \$10.00 or \$12.00 ore per Mr. Gordon. The value is mostly gold. This is in the right position to be on the apex of the ore-shoot in the North vein if that shoot rakes northeast. Thus the workings indicate that there may be in that vein a short one-shoot of the tetrahedrite-bearing type and they do not prove that it does not extend down to the 200 and 300 ft. levels. I am not highly impressed by the shoot because it is evidently quite short.

The Star of the West workings are on a vein that is in line with the North vein as described and I agree with Mr. Gordon that it is probably the extension northeastward of that vein. It was stoped 100 ft. long and about 25 feet to the water level, per Mr. Gordon, on a steep vein averaging about 20 inches wide. It was oxidized ore. The yield is stated at \$12,000 or \$13,000 mostly gold. Dumps indicate sulphide ore below the stope consisting of gray-stained quartz, of which some is said to have more silver than gold. There is considerable water in the rocks in this country and deeper development of this vein should await draining by the long tunnel. Obviously I cannot see enough of the Star of the West shoot to express a definite opinion regarding what it may contain with depth.

On the whole, the North vein, tho it seems to contain two small ore-shoots, does not promise to yield much tonnage.

COMO VEIN:- This vein has been the most extensively developed in the camp. It apexes near the line between the Como and Como Eureka claims and extends into the Buckeye and Star of the West claims. Ore was mined near the surface in the Glory Hole. This is completely buried under a new dump. Mr. Gordon says that the ore was about 120 feet in length, averaged about 20 feet in width and was stoped out down to the 200 ft. level, yielding about \$350,000, an average of about \$12.00 per ton. The quartz was porous and iron-stained and carried traces of copper and zinc, but no antimony or lead. There were ribs of altered andesite between bands of quartz. The 115 ft. level is caved under the old sope. For 50 ft. southwest from the cave there is several feet of quartz that carries \$4.00 to \$9.00 per LeKamp. It is partly oxidized and partly sulphide, the latter carrying too much copper for profitable cyaniding. The 200 ft. level has been opened under the stope for about 80 feet. The stope was apparently about as wide as the drift. Mr. LeKamp sampled the floor and for 30 feet, average width 4 ft., he got an average of \$11.00 not including one assay of \$143.00 per ton. By value the gold-silver ratio was 3 to 1. There was some sulphide.

On the 300-ft. level the same ore body is 140 feet long, said to average 7 feet wide, of an average content of \$14.00 same gold-silver ratio as above. It is mostly white and gray quartz, the latter stained by sulphides, including some copper-bearing sulphides. It is exceedingly difficult underground to distinguish the various sulphides because they are finer-grained in general and I did not see any of this material on the dump. Hence, I do not know to what extent it contains primary chalcopyrite and tetrahedrite. Some secondary pyrite is visible in places. The high gold ratio suggests that it is not one of the typical copper-silver shoots that I regard as primary sulphide shoots, but I am not ready to say that therefore, has been made commercial by the secondary enrichment process and will not extend deep. I simply do not know how deep it will extend, but my tendency is to think that it may extend much deeper than at present developed. To the 300-ft. level it goes down nearly vertical.

Northeast of the ore-shoot on the 300 foot level there is a wide vein matter, including much gray stained quartz. It has

a big gougy zone on the southeast wall and on the other wall a fault gouge that dips southeast 85 degrees. The quartz strongly resembles that in the ore-shoot but Mr. LeKamp says that 20 ft. only of the drift averages as much as \$7.00 per ton. The vein seems to pinch out along the big fault gouge, and thence the drift has been driven about 100 feet long the gouge in barren andesite. This section is buried at the surface under the mill and tailings pond, but beyond it appears strong again, tho lightly mineralized. Mr. Gordon says that a series of old shafts yielded no ore, tho much of the material carries \$2.00 to \$5.00 gold per ton and at one shaft assays ran to 4 or 40 ozs. silver in oxidized material. Some gray quartz has chiefly fine-grained pyrite disseminated in it. Whether sufficient tetrahedrite would appear with depth to make ore in this section of the vein I am unable to say. My inclination is to feel doubtful.

Going southwestward from the Glory Hole, the Como vein is exposed in a series of shafts. Some of the go down to the old stopes. Beyond the shaft where the Como and North veins seem to unite the two large cuts near the Buckeye shaft and combined vein is not well exposed, the indicated by altered andesite and float quartz. The two cuts mentioned are in a large vein, partly altered andesite, but chiefly quartz, that has a strong outcrop southwestward for 350 feet. Mr. Gordon says that it contains spotted gold values, some samples carrying \$4.00 to \$5.00 gold, other only \$2.00 to \$3.00, with little silver. This vein is in line with and has the course of the Rey Del Monte vein, and if the dump of the Buckeye shaft were removed, I believe they would be found to connect. My idea is that the Como, North and Rey Del Monte are converging veins that unite and form one large vein that takes the general course of the last vein. As a matter of fact the lode matter spreads out into a zone 75 to 120 feet wide that is mainly altered andesite with a strong development of Quartz near both borders and quartz seams between. It may be called the Buckeye vein. This outcrops prominently along the ridge to and beyond the southwest end of the Buckeye claim, then gradually weakens and dies out or goes under later andesite or is faulted. I did not determine which as the point is beyond your property and the problem did not seem of sufficient importance to warrant the necessary time for its solution. The gougy zone that usually forms the southeast wall of the Como vein swings around and lies near the hanging-wall of this large vein. It is exposed in several shafts, on the dump of one of which there is iron-stained porous quartz that Mr. Gordon says assays 12 ozs. silver with very little gold. In this section the gougy zone usually dips southeast 70 degrees to 75 degrees, but along the Como vein proper it dips alternately in opposite directions. It represents some post-quartz fault movement along this vein. Locally there are gouges on the other wall or passing obliquely thru the vein.

Then the cross-cut from the Como Eureka shaft reached the vein, on the 115-ft. level, there was a small shoot of ore. It was stopped under the level for 60 feet, averaged 4 feet wide and \$11.00 in value, per Mr. LeKamp. Above the level the shoot was longer and was stoped up 80 feet on a lensy streak of quartz that averaged 4 or 4.5 feet thick. The ore was mostly oxidized.

the corresponding section of the drift on the 200 ft. level follows a band of quartz that is partly gray and that yields some good assays, but will not average commercial per Mr. LeKamp. However, going southwest the drift goes obliquely across the lode to a southeast quartz streak which LeKamp says has been stoped to the cross-cut to the shaft and up to the 115 ft. level. The corresponding section of the drift on the 300-ft. level follows a strong vein, chiefly white and gray quartz but not commercial ore. Toward the southwest it has some tetrahedrite. This level may be in a pinch in the ore-shoot, a low-grade section and commercial ore may appear again with depth, but I would not base anything upon this possibility.

In the next section of the vein, going southwestward, there is not much quartz and the gougy zone is much in evidence, so that this section is often described as broken or faulted. It represents a pinch in the quartz vein. For the most part this thin section is not ore. I do not remember that there is an ore-shoot in the oxidized material on the 115-foot level. On the 200-ft. level there is a shoot 77 feet long and 3 feet wide that averages \$7.80 per ton per Mr. LeKamp. It is a vertical vein of quartz, bordered by gouges, that has been brecciated by fault movement and has gray sulphide stains. The fact that the ore is confined to the fault breccia suggests that it has been produced by secondary enrichment since the brecciation. However, in the corresponding section on the 300 ft. level LeKamp says that there the gray quartz is not too badly mixed with gouges the vein yielded good assays. Perhaps it is a primary sulphide shoot that has been broken by the fault movement, in which case it may extend much deeper. In view of its small size and the uncertainty as to its exact nature, I would not figure on it deeper than it has been developed. The LeKamp report credits it with 1000 tons of \$7.80 ore between the 200 and 115 foot levels. I had no means of verifying this, but see no reason for criticising it.

Beginning 10 feet west of No. 8 station on the 115 foot level, and extending southwestward 105 feet above there is an ore-shoot consisting of an irregular but rather strong streak of quartz that is mostly oxidized. It has been stoped above the level. Mr. LeKamp estimates that the stope contains 2700 tons of broken ore containing an average of \$8.75 per ton. The stope connects with the shaft at which I suppose the North and Como Veins unite. Mr. Gordon says that ore from the shaft yielded about \$8.00 and 1 oz. silver per ton. However, this might represent the copper-silver shoot lower, because the silver might have been largely leached out.

Beyond the last mentioned ore-shoot on the 115-foot level there is 80 feet in which the veins appear strong and consists largely of quartz gray from sulphides, but Mr. LeKamp says it averages only \$4.00 per ton. At the end of the drift there is a cave, but LeKamp says that there is a raise and short drift from which he got three samples that assayed #11 and \$14 per ton. It is a question whether this is the beginning of the so-called

Copper shoot or whether that shoot is an oxidized condition is at least in part represented by the stope with the broken ore. I incline to the latter view. The Copper shoot may occur in genetic relation to the junction between the Como and North veins.

On the 200 foot level the Copper shoot is described as 190 ft. long, averaging 16 feet wide, carrying \$8.00 per ton in gold and silver and 1.75% copper. The width is based upon a few cross-cuts and is not dependable, tho I cannot say that that amount of vein is not there. The ore piled on the dump has disseminated pyrite in fragments of altered andesite, and pyrite, spalterite, chalcopyrite and tetrahedrite embedded in quartz. There are traces of oxidized minerals, but the bugs are clean, and I see practically no evidence of secondary sulphide enrichment. I am, therefore, strongly inclined to regard this as primary sulphide ore-shoot.

What appears to be at least a portion of the same shoot on the 300 ft. level has been developed about 140 feet in length, with an apparent width of 10 to 30 feet, averaging 20 feet. Mr. LeKamp says that it averages \$6.00 with a gold-silver ratio of 1 to 4 by value. Much of the quartz has a gray stain, but tetrahedrite has not often been seen in it. This fact and the apparent decrease in value from \$9.00 to \$6.00 from the 200 to the 300 foot level might suggest that the copper and silver minerals disappear with depth, but I believe that when the shoot has been fully developed this will be found not to be the case. It is natural from the quantity of chalcopyrite and tetrahedrite to vary from level to level in a primary sulphide shoot. There may be less on the 300 than on the 200 foot level and more again at greater depth. However, just before I left the mine I found that the wet ore from the face on the 300 foot level being dumped contained considerable chalcopyrite and tetrahedrite, and we may have been judging the shoot prematurely. At any rate, I expect this copper shoot in some form to continue much deeper than the 300 ft. level.

Mr. LeKamp estimated the possibility of 60,000 tons of ore in the Copper shoot between the 200 ft. level and the surface. But it is not likely that the ore will extend nearly to the surface because in the oxidized zone, the base of which may lie little if any above the 115 ft. level the copper and most of the silver are doubtless leached out and much of the shoot has ceased to be of commercial grade. I would be more inclined to estimate ore downward than upward from the 200 ft. level.

On the 200 foot level after an interval of 60 feet in which the vein assays little, there is another ore-shoot described as 120 feet long 4.5 feet in average width and \$8.00 in average value. A stope has been begun in it because it carries so little copper that it may be treated by the cyanide process, thus it consumes 2 lbs. cyanide per ton of ore, Mr. Le Kamp says. The value is chiefly in a crushed zone adjoining the big gouge and I can see considerably secondary pyrite in it. I am afraid that the ore streak has largely been produced by secondary sulphide enrichment and cannot be depended upon to extend deep. This shoot is an

oxidized condition may be represented near the surface in the shaft on whose dump the 12 oz. silver ore occurs. In that case it rakes northeastward and may contain the 15,000 tons that Mr. Le Kamp credits to it.

The remained of the drift on the 200-foot level is in a large body of white and gray stained quartz that in pockets yields high assays, but as a whole is not commercial. The color is probably mainly due to primary pyrite embedded in quartz and a little secondary pyrite in cracks. Copper minerals are exceedingly hard to find until the last-described ore-shoot is approached. Further driving on the vein on this level does not seem warranted.

Rapidan Veins:- Extending from the vicinity of the Rapidan shaft in a southerly direction about 1200 feet to the dump of the Buckeye shaft there is a group of veins whose outcrops are characterized by a honey-combed iron-stained quartz of a more promising appearance than that of much of the quartz of the district. These lodes are more distinctly quartz veins and less zones of altered andesite than are the others. The Rapidan shaft was sunk near the footwall of one of these veins. It has an eastward inclination. On the 200 foot level there is a large body of quartz near the shaft, but it is not commercial ore. The north drift is closed by muck. In the south drift, beginning less than 20 feet from the shaft and extending about 190 feet there was an ore-shoot that averaged 8 feet wide and has been stoped up 20 to 100 feet per Mr. LeKamp. It averaged \$8.75 per ton, mostly silver. This is surprising as the ore was thoroughly oxidized. On a higher level which I did not reach on account of a bad ladder the ore extended farther south. This suggests a northward rake to the shoot. Mr. Le Kamp estimates that the stope contained 7000 tons of an average value of \$8.50 per ton.

Beyond the ore-shoot on the 200 ft. level there is plenty of quartz for 60 feet to an ell shaft, but it is not commercial ore. It has a southwestward course. On this course at the surface a strong outcrop of quartz may be traced from the old shaft for 160 feet, but it seems not to be ore. Beyond a gulch, in line with this vein and extending several thousand feet S. 60 degrees W. there is a strong vein that contains much compact white quartz and cavities from which calcite has decayed. This may be called the West Rapidan vein. The suggestion is that it contains ore only after it bends toward the north. However, there is some evidence that it is joined by a northward trending vein and that the ore in reality should be considered as being in the latter.

At the surface there is evidence of another vein about 60 feet east of the Rapidan shaft. This vein can be traced, except where buried under debris, to the Buckeye shaft dump. Where drips may be seen they are mostly eastward 50 degrees to 60 degrees. Toward the south this vein probably splits and the west branch may be traced nearly to the Buckeye shaft dump. Where last seen it dips eastward 65 degrees and contains a little tetrahedrite near the surface. At one place a band of quartz connects the two branches. Mr. Gordon

thinks the northern portion of this vein system connects with that on which the Rapidan shaft has been sunk. I failed to trace such connection on the strike, but think it probable that they connect on the dip.

On the Rapidan 350 foot level a drift has been driven northward about 180 feet in a large vein of oxidized quartz. Mr. LeKamp said it contains one ore-shoot 40 feet long and 6 feet wide that will average \$8.50 per ton value mostly in silver. The last 25 feet was in another shoot, wider than the drift, averaging \$6.00 per ton. The local management was much elated because bunches were appearing that contained fine-grained gray sulphides, specimens of which assayed very high in silver. This points to the advisability of securing a bond on the property north of the North Rapidan claims. In that direction the apex of the vein passes under the younger andesite.

In the south drift on the 350 foot level there is for 70 feet an oxidized quartz ore body 8 feet thick, averaging \$8.40 per ton, mostly silver, per Mr. Le Kamp. This presumably represents the down-ward extension, with a northward rake, of the ore-shoot stoped above the 200 ft. level. Thence the vein is narrow, crooked, oxidized, (tho the walls are not oxidized). It widens into a little shoot 40 feet long, 5.5 wide, carrying \$10.00, mostly silver, per Mr. Le Kamp. Thence to the face is a small and crooked, oxidized and iron-stained, but locally good ore. This differs so much from the vein on the 200 ft. level that I suspect that the drift is following the eastern vein that I can trace on the surface. That vein farther south has plenty of quartz. The situation here is distinctly encouraging.

The Rapidan mine has two surprising features. The first is that the zone of oxidation extends at least 350 feet on the dip of the vein whereas in most of the veins of the districts it is much shallower. The absence of a strong gouge has caused the vein to be relatively dry and this has favored deep oxidation. The second abnormal feature is that in the oxidized ore the silver ratio is usually high. Again, the dryness of the vein probably prevented as there leaching of silver as has occurred in other veins of the district. In the sulphide zone there will probably be considerable primary tetrahedrite. This may make the sulphide ore of higher grade than is the corresponding oxidized ore. Or, looked at from another standpoint, the sulphide shoots may be longer than the oxidized shoots. I regard the Rapidan veins as one of the greatest assets of the Como property. I cannot see into unexplored ground and make a wrong guess, but I have a feeling that below the zone of oxidation these veins may have relatively long shoots of primary sulphide ore that may extend to a considerable depth.

General Discussion

I must disclaim any intention of posing as an authority on the economic features of mining, especially of costs since war conditions have upset all the old standard that I formerly used,

but it will doubtless not be harmful for me to give the impressions that I have gained of the Como proposition as a mining venture.

The mill seems to make a fairly high saving on oxidized ore and on such sulphide ore as contains little copper, but it is a very elaborate affair, considering that its capacity has been only about 55 tons of Rapidan ore or 65 tons of Como ore per 24 hours. Mr. LeKamp says that it is very awkwardly arranged and he endorsed my suggestion that it might be moved to the mouth of the Boyle tunnel, better arranged and make enough saving per ton to pay for the cost of moving. However, Mr. Gordon thinks there may be enough oxidized ore to wear out the mill in its present position and that an entirely new mill of different design should be built near the mouth of the Boyle tunnel to work the copper bearing sulphide ore. This idea seems to be a good one. Some new machinery is being added to increase the capacity of the present plant.

West of the crest of the Sierra Neva range, the Como mine should be regarded as having ore of fair grade, but in Nevada, where costs are high and people are accustomed to mining high-grade ores it would probably be classed as a low-grade mine. It must be so developed and equipped as to work the ore as cheaply as possible. This points to the advisability of extending the Boyle tunnel. It is now being cleaned out and the first 600 or 700 feet are known not to be in bad condition. If the remainder of the tunnel is in fair condition and the face is within 700 ft. of the high point near the Buckeye shaft as Mr. Gordon's information indicates, it certainly seems that the company is warranted in extending it to the Rapidan and Como veins on the basis that the ore-shoots are as represented to me by Mr. LeKamp and that the Copper shoot, the Glory Hole shoot and the Rapidan shoots will go down to the tunnel level, supposed to be about 263 feet below the Como 300 ft. level.

The Company cannot afford to make an error of several dollars in figuring the average gold and silver content of the ore and has, I understand engaged the services of Mr. Alex Wise to resample the supposed ore shoots and make a new estimate of the tonnage developed. Assuming that this sampling will fairly support the estimates of values per ton given me by Mr. LeKamp, it will be in order to extend the Boyle tunnel if the old tunnel is somewhere near being in the condition suggested above. To the 700 feet assumed by Mr. Gordon I would add 300 feet to reach the ore, making 1000 feet. Nobody is able to estimate the cost of equipping and reopening the old tunnel, because its condition is not known. Mr. LeKamp thinks the extension may cost \$12.00 per foot and Mr. Gordon places the figure at \$15. with the possibility that it may vary \$5 either way from that figure. My impression, however, is that in these days of uncertain labor efficiency, the company should be prepared to support a considerable higher cost per foot. The first 1000 feet is all that could reasonably be charged against the tunnel extension as driving on the veins to develop ore-shoots

would merely be driving levels from the tunnel that otherwise would be driven from shafts.

With the ground drained by the tunnel and drifts, I anticipate no great trouble in mining the ore because of gouges on the walls in places or other causes of soft walls. The Como stopes will have to be filled by waste pretty close to the stoping face, but the Rapidan stopes may stand open for considerable lengths.

With the tunnel completed and a large tonnage of sulphide ore developed it will then be in order to build a new mill near the mouth of the Boyle tunnel. It seems clear to me that concentration by oil flotation is the process that that ore will require. For a given tonnage capacity it will require a much simpler and smaller mill than the present plant and will cost less to operate. There should be considerable saving on milling over present costs. Against this is the cost of shipment and smelting of concentrate, but I am counting on the copper recovered going a long way toward making up this additional cost and the losses thru smelting. Mr. Wise and I have made an estimate of the probably costs of working the ore by this process after the Boyle tunnel has been completed. An ore assaying \$8.00 in gold and silver and 1% copper, an operating profit of at least \$3.00 per ton seems a reasonable safe assumption.

However, when ready to consider a concentrating plant, you should engage a metallurgist to determine the details of the mill. The common way is to send a few tons of ore to an ore-testing plant, get an opinion as to the character of plant needed and then have the manager of some local mill man plan and build the plant. The best and in the end the cheapest way is to have the plant designed and constructed by a practical metallurgist.

In this connection I will take the liberty of suggesting the new member of my firm, Mr. Lloyd C. White, because he has had considerable experience in handling concentration by flotation and constructing the necessary plant.

Some idea of the possible magnitude of the operation may be gained from a compilation of the tonnage per foot depth of the various ore shoots now exposed on this Como 300 foot and Rapidan 350 ft. level. The aggregate is about 400 tons. At an average gold and silver content of \$8.00 per ton and profit of \$3.00 per ton the figures would be \$3200. and \$1200. To the depth of the Boyle tunnel they would be \$841,600. and \$315,600. But if the ore extends that deep it will extend much deeper. In 1000 feet the gross content would be \$3,200,000. and on the ore rating profit \$1,200,000. However, that is very far from exhausting the possibilities. Work in progress in the Rapidan is extending the known ore-shoots every day and I anticipate a large addition to the tonnage per foot depth that I have assumed above. It is also possible that the ore will average considerably higher than \$8.00 in gold and silver content. I regard it as entirely within the bounds of possibility that the above figures may be multiplied by three, in the final accounting. On this,

however, I am going entirely into the domain of speculation, checked by my belief that certain ore-shoots will extend deep and that the Rapidan vein will prove to have longer ore-bearing territory upon further development.

Respectfully submitted,

(signed) Oscar H. Hershey