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Loma Prieta  
Copper Basin  
Copper & Molybdenum

immediately below the oxidized ground and it may be expected that Phelps, Dodge & Co., will further explore the sulphides in the future.

THE LOMA PRIETA MINES COMPANY property formerly owned by Joseph Scherer, the P-A Company and others. 27 claims unpatented. Revisited Sept. 7, 1916. (I made a detailed examination of the prospect in 1914.)

A shaft, now 150 feet deep, has been sunk on the small Rob Roy fraction adjoining the Commercial Mining Company's <sup>or Mary Bell</sup> Copper Bell claim. <sup>Mary Bell?</sup> The ore is chalcopyrite with a considerable percentage of molybdenite, in quartz. The association of copper with the molybdenite makes the latter unattractive commercially, although it is possible to make a separation, at some expense, by electrostatic and other methods. The country rocks are quartz-monzonite and granite, fissured in all directions and cut by intrusive alaskite (pink and white aplite) and by diabase dikes. The surrounding hills, including Bradshaw Butte, are generally rhyolite stocks and intrusions. The trend of mineralization appears to be a little west of north, and there is some evidence of shear zones in a general NW-SE direction. Lines of fracture, extending to the Commercial Company's ground, run N 20 E, and N 60 W. A fault, after mineralization, runs N 20 W, along which an aqueous concentration of values is evident. The ore deposit generally is the result of replacement along fractures in the quartz monzonite.

It is apparently the present intention of the operators to develop the higher grade concentrations of mineral rather than a larger body of more or less disseminated low grade chalcopyrite ore, which might be too low grade to be commercial under the local conditions. While the chalcopyrite is primary and of probable deep seated pneumatolytic origin,

the higher grade ore bodies now being prospected are of pegmatitic habit, and I think it will always be very hazardous to make any estimates beyond such ore actually developed.

A little drifting has been done south-east and north-west at 150 feet. The south-east breast is in good looking ore, but the north-west drift has encountered a wedge shaped lean zone, supposed to be the continuation of a lean zone found dipping west in the shaft. In any event, a continuation of the north-west drift would soon reach the Commercial Mining Company's boundary line.

I am informed that the price paid by the Loma Prieta Company for the property was \$40,000; \$23,000 to Joseph Scherer and \$17,000 to Judge Parks.

*L. F. Holland*

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Walter Harvey Weed's Report of Nov. 15, 1916, said tonnage of ore blocked out, including low grade ore, did not exceed a few thousand tons, but that there was reasonable hope of developing a large body of cocentrating chalcopyrite ore averaging 1 to 1-1/2 to 2-1/2% copper, but grade could only be determined by exploration. He states that samples showed an average value of 2.36% for 40 feet along the east drift, but of only 1.93% for the entire 90 feet of drift. The values in the North (or NW) crosscut average 1.27% Cu. for the entire drift, with 36 to 48 cents per ton in silver. A sample from the bottom of the shaft sunk on the richest part of the deposit assayed 3.8% copper and 24¢ silver per ton. The S. W. face assayed 0.8% Cu. with 30¢ silver and the breast of the W. drift showed 1.7% Cu. with 42¢ silver. He recommended exploration laterally rather than in depth, as there is little probability of the ore becoming higher grade with depth.

May 24, 1917. Mr. Howard S. Nichols, who has just visited the Loma Prieta on behalf of the Santa Fe Railroad, states that the shaft is now down 417' and that it is intended to drift at 390'. He gathered that the operators of Copper Basin prospects, more particularly the Copper Hill property, are now attaching more importance to the molybdenum content, which is said to average  $1\frac{1}{2}\%$ , rather than the copper which is said to average 2%. The Arizona Sampling & Reduction Co., of Wickenburg, have been seeking molybdenum ores on behalf of Garford of Cleveland, who is the principal owner of the Wickenburg sampler.

Note by S. M. S.  
Oct 37

This property has been examined on several occasions during the past few years as a possible source of molybdenum. The occurrence of the metal seems to be probably & assays are very erratic. It has failed each time to come up to the standard required by the examining engineers but may yet be operated in a small way as local people seem to have much confidence in its possibilities.

# Loma Prieta

From Letter of Harbauer, Sept. 30th, 1935

Your letter of Sept. 26th was received and I thank you for the notes on the Loma Prieta Mine which you enclosed.

I spent two days at the Loma Prieta last week, one day in rigging up a cable and winch and one day down in the mine.

There are two levels run from the shaft, one at 143' depth and the other at 393'. About 300' of drifting was done on the upper and around 1000' on the lower level.

There is an extensive mineralized area showing in the drifts but it is of a buncy irregular nature and the average value of the deposit can only be determined by a large number of samples. The lower level shows more molybdenum than the upper one, but I do not think that it will average  $\frac{1}{2}\%$ .

Smoot and Harrison decided not to have the mine samples after seeing the lower level so my job was cut short. They hope to get others to sample at their own expense and expect someone out in a few days.

Sampled by ~~Libbs~~ Fred Libbs in 43  
with Int loan. Results were disappointing  
but it still has promise if price of MoS<sub>2</sub>  
should be high

## LOMA PRIETA MINE

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## LOMA PRIETA MINES COMPANY

Report by W. Tovote, E.M.

The Loma Prieta Mines Company is a stock company, organized under the Laws of the State of Arizona. The authorized capitalization is 1,500,000 shares, of which about 1,000,000 are issued, the balance remaining in the Treasury.

Judge T. G. Norris, of Prescott is President.

Mr. A. B. Peach, of Prescott, is Superintendent.

PROPERTY: The Company owns 27 unpatented and one patented mining claims in the Copper Basin District, Yavapai County, Arizona. The property is about 12 miles south of Prescott. It is adjoined and partly surrounded by holdings of the Commercial Mining Company, a subsidiary of the Phelps-Dodge Corporation.

The nearest Railroad point is Skull Valley, about 8 or 9 miles to the south, a station on the Santa Fe, Prescott and Phoenix R. R. The road connecting the mine with the Railroad is of easy grade, but rather cut up by the heavy ore teams hauling ore from the Commercial Mine. It is part of the State Highway, connecting Wickenburg and Prescott.

The property has an approximate elevation of 3300 feet, and is situated at and near Copper Basin Wash, the principal drainage of this section. The topography is not sharp and consists of low rolling hills, dissected by usually broad erosion valleys and drainage channels, and forms the lowest foothills of the high mountains to the north, between Copper Basin and Prescott.

The surface is in most places deeply covered by soil and gravel and supports an abundant vegetation, principally oak brush, manzanita and acacias. Formerly it was probably a forest of pine, juniper and oak trees, but most of the larger trees have been cut down.

Water is very shallow and stands normally less than 20' below the surface. The water is strongly mineralized and not well

adapted for domestic purposes, but is used in the boilers and would be good and sufficient for milling purposes.

**HISTORY:** The Copper Basin country is an old mining district. Gold, Silver, Lead, Zinc and Quicksilver are known to occur, but the principal metal found in the district is copper and usually associated with molybdenite. The most important mine of the district is the Copper Basin Mine of the Commercial Mining Company. Large areas of rather high grade copper conglomerate at the surface led to its discovery. It has produced a very large tonnage of ore and could ship 150 tons per day of nearly 4% copper ore, if the smelters would allow such a tonnage.

The Copper Basin Mine is working exclusively oxidized ore and no serious attempt has been made to develop the sulphide horizon, which is to be expected below - this in spite of the fact that the oxide ore does not show a great deal of secondary enrichment and that a fairly high grade sulphide ore is to be expected below in the main ore shoots. The largest ore body developed here and partly stoped, measured 200' x 100', without indicating its limits.

Other properties in this immediate vicinity have been tested to some extent and quite a few have been very good promise, but the water was generally too much of a handicap for the small prospector and most of the work has been confined to shallow surface diggings.

In 1916, the Loma Prieta Mines Co. was formed and acquired its present holdings. Development in depth was resorted to and kept up in spite of severe handicaps. While the technical administration was not very good in the beginning, it has been excellent for the last year and a great amount of work has been accomplished, demonstrating the occurrence of very large sulphide bodies in depth. The new company has done pioneer work and indicated possibilities, which its older and richer neighbor failed to grasp.

**THE MINE:** The Loma Prieta Mine is opened by a two compartment shaft with levels at 140' and 390', besides short drift at 35'

and 80'. Some sulphide ore was found in the drift on the 33' level, but it was still partly oxidized and of small extent. In the shaft, the ore was encountered at about 60' and has continued to the bottom of 414'. The grade is generally low, but streaks and bunches of high grade ore are found frequently, which helps to raise the average tenor.

On the 150' level a total of 263' drifting and cross-cutting has been done, of which 225' are in ore, averaging 1.50% cu. with additional values in gold, silver and molybdenum.

On the 400' level a total of 730' of drifting and cross-cutting, 465' of which are in ore averaging 1.25% cu. with additional values in gold, silver and molybdenum.

The shaft has been sampled from 150' below the collar down to the bottom of 414' and averages over this distance 1.30% Cu. As mentioned before, the ore goes up in the shaft to about 60' below the surface and near the shaft, even higher, but no assay record has been kept of this part of the workings and cannot be secured now, because the shaft is timbered and lagged, but it is safe to assume that the grade will at least hold up to the other average.

While the 150' level indicates an area of only between 8000 and 9000 sq ft., which might be considered milling grade of ore, the ore shoot here is not developed to its limit. On the 400' level, however, the oreshoot, which has been prospected up to now, is fairly well limited and surrounded by material, which, under any circumstances, would be too low grade to consider ore. Still there are better streaks through this low grade area, which might possibly increase and strengthen in other horizons and lead up to other ore bodies.

The indicated workable area on the 400' level, measures approximately 25000 sq ft and would represent 2000 tons of ore for every foot vertically.

We can therefore, assume that the Loma Prieta has at present a probable tonnage of not less than 500,000 and not over 750,000 tons of ore, assaying between 1.25% and 1.50% cu. The values in gold, silver and molybdenum, as indicated by compound, assays of the 105' and 400' levels are:

Au. Ag. Mo.

*Assays says not enough Mo to make determination*

It is very probable that the amount of ore could be materially increased by drifting in easterly and westerly direction. It must be well understood, though, that this ore is not ore in sight, but only probable ore and considerable lateral and vertical work would be necessary before this ore is definitely proven and blocked out, as engineering standards require exposure on all four sides before considered ore actually in sight. However, the showing is extremely encouraging for the amount of work done and proof is furnished that large low grade masses of copper ore exist.

This is besides, only one of a number of ore shoots that are indicated by the surface geology, obscured as this is by gravel cover and vegetation.

**GEOLOGY:** The principal formation in Copper Basin is a granitic rock, of probably Mesozoic age. It ranges in composition from granite porphyry to Monzonite. Quartz is not all times present and the orthoclase seems in excess of the plagioclase feldspar. Dark ferro-magnesian minerals, principally biotite and amphibole, are usually plentiful.

In this granitic massive are found lenses of semischistose acid and basic rocks, probably inclusions of older formation younger than the main granite porphyry massive are dikes of a dark monzonite-porphry. This rock does not only occur in dike form, but more frequently in irregular masses and bunches and seems very closely connected with the main intrusion. The youngest rock in the district and probably the most important, in relation to the ore deposits is an acid, fine grained intrusive of rhyolitic habitus.

This rhyolite is found in three main massive and in numerous dikes. A series of white quartz dikes and areas of silicification, traversing the basin are in all probability part of the same volcanic actions and constitute the last activity of the subsiding period of volcanism.

The rhyolite is normally of a dull whitish color and shows only quartz and feldspar to the unaided eye. It is practically identical in the massive and the dikes. The greatest area of rhyolite is found just outside of the basin proper and forms the rugged porphyry mountain alongside of the Skull Valley road on Frank Cass's ground.

In the basin are the rhyolite mass of Bradshaw Mill, which is on the Loma Prieta ground and another one, farther southwest on the West side of Copper Basin Wash.

It is very probable that these mountains are only high points of the rhyolite intrusion, exposed by later erosion and in depth the whole basin is pervaded by masses and dikes of this rock.

Rhyolite dikes are found in three main systems: N. 60 to 90 W., E. 20 to 30 W., and N. 15 to 35 E. The same directions are repeated in the complicated system of fracturing and fissuring, which traverses the basin and served as deposition channels for the metallic sulphides, a fact which suggests the close relation between the rhyolite intrusion and the sulphide mineralization.

While the N. 20 W. fissures normally dip steeply to the West and the N. 70 W. to the South, the N. 20 E. fractures show no uniformity, but show dips in both directions. Generally though the west dipping fractures of this system are very flat, while the east dipping ones are steep. Their arrangement suggests strong lateral pressure, which in sedimentary rocks would have been relieved by folding.

All the different veins, fissures and fractures seem to

intersect each other with no apparent displacement and seem to be therefore, contemporaneous and due to the same sources. While individual fissures can sometimes be traced for long distances and considerable ore has been produced from such fissure veins, these are not the most important sources for ore in the Copper Basin District. Far more important are the wide fracture zones of small and disappearing fissures which traverse the monzonite in all directions and show as areas of crumbling granite with brown limonite seams on the surface. Zones like this are indicated several hundred feet wide and persist over long distances, even if the individual fractures are weak and of small extent. They would probably be designated as LODES or Shear Zones.

The most important parts of these lodes are, where two different systems intersect each other. The fracturing here increases frequently to strong brecciation in the country rock - A brecciation, which has been cemented by later mineralization. Both the main monzonite and the later monzonite dikes are affected by this brecciation and fracturing.

All evidence points to the conclusion that the rhyolite intrusion was very forcible and abrupt; that it shattered and shifted the older rocks and that the last stages of this volcanic activity introduced mineral solutions, both metallic and non-metallic, which recemented some of the fracturing and invaded the monzonite along fissures and brecciazones and caused the present ore deposits.

While, as mentioned before, intersections of two lode systems tend to increase the area and intensity of the mineralization, individual lodes might contain workable ore for some distance away from intersection points, but will gradually impoverish. I do not believe though, that any part of these lodes can be found, that does not show a trace of copper. The intersection zones and especially those where the fracturing was strong enough to produce brecciation, will, at all times show a certain quantity of high

grade I do not expect, unless a strong fissure vein follows or crosses the lodes. Up to now, only a few such strong veins have been proven in Copper Basin and all of them on Commercial ground. The strongest and most persistent of which is the Garberino vein, which should pass into the Loma Prieta ground on the Anna claim, but has not been proven till now. These veins strike N 15 to 20 W. Next in importance are veins of N 70 W strike; of these a rather good one is indicated on the patented Copper Glance claim of the Loma Prieta holdings.

Others of the same system pass probably in vicinity of the Loma Prieta shaft, but cannot be traced well on account of the covered surface.

I have tried to embody the principal features of the surface geology on the map accompanying this report. It covers only a part of the total area and besides, is necessarily very incomplete, because, as mentioned before, the heavy covering of gravel and vegetation renders an exact representation impossible. From the data available, it is evident that the Anna, the Mary, on which the shaft is located, the Rob Roy and the Shenandoah claims are some of the best potential ground, which the company owns and that work on these claims will have very good chances of success. A very good piece of ground is also the Copper Glance fraction, the isolated patented claim, situated beyond the Commercial Mine, but the ground is handicapped by being detached and of small extent.

From purely geological reasons, I would think that the area adjoining the rhyolite mass of Bradshaw Hill would ultimately prove very good prospecting ground also, but I was unable to trace anything definite on the surface, because talus and debris covering are deeper here than anywhere else.

From the evidence available in the few exposures along creeks, roads and prospect workings, it is indicated that an area about 2000' wide is traversed by lodes and dikes N. 15 to 35 W. strike, which are crossed by a series of N 60 to 80 W veins and fracture zones. Mineralization and brecciation are strongest at and near the intersection zones, which would form the logical points to prospect. It

is reasonable to

is reasonable to assume that all these intersection points will show ultimately ore bodies similar to that exposed in the shaft, but there is no reason why further work should not prove a larger extent and area of higher grade ore as well in the present, as in future ore shoots.

THE ORE: The ore proven until now is a deposition of metallic and non-metallic minerals in the shattered and brecciated monzonite. There are several periods of mineralization, which overlap and grade into each other.

The first is silification and deposition of vein quartz, rarely quartz and orthoclase, indicating the pegmatitic character of this first mineralization. In connection with it is found sometimes, molybdenite especially bound to a semi-chalcedonic variety of the quartz. Pyrite deposition begins a little later in conjunction with the quartz. Still later and after silification has come practically to a standstill, chalcopryrite was introduced with later molybdenite. The last deposition is that of the carbonate minerals of the dolomite ankerite group, often in conjunction with chalcopryrite. Very rarely, a last abortive silica-deposition is indicated. The effect of this mineralization is as well a hardening of the invaded rock, due to the introduction of silica, as a softening, due to the simultaneous decomposition of the rock minerals, especially the feldspars, possible ore shoots are therefore indicated on the surface by prominent quartz reefs on the one hand and by depressions, due to less resistance to erosion on the other. Ultimately, I believe, the latter will prove the more important.

Pyrite is the most widely distributed of the minerals. It has penetrated the monzonite, together with quartz for long distances, and even has gone far beyond the quartz along slips and joint planes. At all times it carries a certain amount of copper, probably an admixture of chalcopryrite.

The main values in the ore are in the form of a very pure chalcopryrite, which is found in grains, seams and rather massive bunches.

The molybdenite is very thoroughly intergrown with the ore and is found also fairly massive.

Sometimes the molybdenite extends beyond the copper area and a rather high grade and clean product of this valuable mineral could be sorted out, which I consider an important economical factor. All the ore, which might contain 1.0% Mo. and better, could be treated by differential flotation for the Mo. contents. The prices offered for molybdenite concentrates of 50% Mo. \$2, if fairly free from iron, copper, arsenic and phosphorus, is now \$1.15 and better per pound of metal, on long time contracts.

The ore generally improved very much in grade in brecciated areas and along stronger veins. The brecciated areas are rather irregularly distributed, but a system of this occurrence could probably be worked out ultimately. They seem to be intimately connected with fracturing in N 20 to 30 E direction. Dolomite and molybdenite, as well as high grade chalcopyrite are nearly always found in them.

Strong veins have not yet been disclosed by the work done, except one vein zone, shown both on the 150' level and the 400' level, near the shaft. Here some very good ore is found. This vein strikes N 60 W, but it is not very strong and has not been followed to any extent. It certainly seems advisable to follow this vein out farther, as it might improve as well and produce some ore of shipping grade, as lead to new ore shoots. I expect that ultimately, other and stronger veins will be found besides.

There is a tendency in the mine for high grade ore to appear in very flat veins and bunches and if this tendency can be established further, lateral work, as done principally up to now, would tend to lower the average of the ore and vertical work would give a better and more nearly correct idea. Work along the high grade streaks, on either level, would be very advisable, both for information and possible financial returns.

TYPE AND ECONOMIC CHARACTER OF THE ORE:

The ore is a straight sulphide ore, sparsely distributed in the granitic country rock. It should lend itself exceptionally well to concentration by flotation and should allow a very high ratio of concentration.

I believe that ore with 1.25% cu., if found in sufficient quantities, would be workable. To work this grade of ore, a tonnage of at least 5,000,000 tons would probably be necessary. At a 15% copper market, figuring 2.5 for loss and refining charges and a 90% extraction in milling, this would give:

1.25% means 25 lbs. copper per ton 90% extraction leaves 22.50 lbs.

22.50 x (15 2.5) is \$2.80 values per ton, Mining cost \$0.80 to \$1.00 Milling .50 to .65. Ratio 20 to 1.

Overhead and development 0.25 to 0.30.

Smelting 0.25 to 0.30 at \$5.00 to \$6.00 per ton of concentrates.

Total cost \$1.80 to 2.25.

Leaves profit of from \$0.55 to \$1.00 per ton. This does not take into consideration the accessory value in gold and silver and the possible profit to be derived from the molybdenum contents, which would make the showing considerably more attractive. Of course, a very heavy expenditure would be necessary to develop and equip a mine of this type and amortization and interest charges would probably equalize the profit from these accessory values.

The deposit is similar to the porphyry coppers, while in true porphyry the ore is confined to a limited horizon of secondary chalcocite enrichment. The ore in the Loma Prieta is strictly primary and there is absolutely no reason why it should not go down as far as mining operations can be conducted. Since the mineralization is primary and ascending, an improvement in grade, with increasing depth would not be at all surprising.

For the same reason it is ultra conservative to limit the ore in sight to the actual deepest level. It is advisable to do so now,

because the ore is not really blocked out, but as soon as this should have been done, I would consider it absolutely permissible to figure at least 100' below the bottom level for ore in sight, which, with the present indicated 2000 tons per vertical foot would mean another 200,000 tons.

It is more than probable that all, or nearly all of the chalcocite porphyry copper deposits have been found, but the Loma Prieta type is only beginning to be recognized as future possibilities. I have been designating this type as "Rhyolite" Copper Deposits. Nacozari is, up to now, the only successful mine of this type in the southwest. The grade here is, of course, much higher, but the progress made in late years, both in mining and milling methods, allows a steady lowering of the economic limit for this kind of ore and the Rhyolite Coppers will assume growing importance.

To determine the grade of the ore, both levels were sampled carefully with hammer and hoil, by cutting 5' grooves along the walls. Only in the S. E. drift on the 150' level, where a fairly strong vein is followed, were the grooves cut across the back of the drift. While this method of sampling is very well adapted to the porphyry coppers, with their soft knolinized rock and the fairly uniform impregnation, I consider it not good at all for this type, with its extremely hard rock and uneven mineralization, but used it because I could not devise another method of sampling, which would give a better record at not prohibitive expense. I believe that even with the more careful sampling by expert samplers the uncertainty of this method would be at least 10% a factor which might be vital in ores of this low grade. I am rather satisfied that my assay returns are low, with very few exceptions, and that the ultimate test will show the ore to be of slightly higher grade ore and the area of this grade to be greater. A good check on this could be had by sinking sample pits through the dump to determine the grade of the ore from these, allowing for the high grade ore, which has been shipped and carried off.

I have a record of samples taken under Mr. Peach's direction, to which I would attach just as much weight as to my own. I give them for comparison. Mr. Peach's samples were taken in 10' blocks, while mine were taken in 5' blocks. Both sets of samples cover the identical area on the 400' level.

N. W. Drift:

Peach average: 1.17% Cu. Towner average 0.89% Cu.

S. E. Drift: 1.63 1.31

S. W. Drift: 1.52 1.17

Both sets of samples should be accorded the same weight and the true average be taken as the middle between them. I have not done so, but based my computations on my own samples exclusively, which gives lower grade or less tonnage. For the samples taken in the shaft, I have used Mr. Peach's samples, which were taken during the process of sinking, as the shaft is now lagged and timbered and sampling not feasible. Sampling and testing by drilling, either diamond or churn drill, would be far more satisfactory than any attempt to determine the extent of the ore bodies by sinking and drifting or their grade by hand sampling. By this method, the property could be tested far more cheaply and quickly than by the past work. This past work was absolutely necessary to establish the type and character of the deposit.

#### CONCLUSIONS AND RECOMMENDATIONS:

From the work done up to now and the geological evidences available, I believe that the Loma Prieta has an excellent chance to develop into a very important mine.

While no guess is admissible as to what tonnage can ultimately be developed, I believe that at least 5,000,000 tons will be required to make the mine a success and that this amount can be proven up.

To develop and equip the mine properly, very strong capital will be needed and I believe that it can be secured on the present showing. Ultimately the present company will have to enlist outside capital and I do not see any reason why this should not be tried right now.

There is no reason though, why the present company should not proceed to raise further funds and continue development work. While I believe that the ultimate testing should be done by drilling, probably diamond drilling, from the present 400' level and later on churn drilling from the surface, it might be advisable to continue for sometime with underground work. Drifting in N W and S E direction, on the 400' level, holds out very good promise of extending the ore zone and of netting at the same time, some shipping ore.

On the 100' level, two very good showings of high grade ore are found - one right at the shaft and the other in the little crosscut from the S E drift. Both are worth further investigation. Drifting along them should pay a profit, if the grade of the ore holds up and at the same time, develop the mine. The present tunnel work on the Copper Glance claim is a prospect, which should be continued, as it is likely to net some shipping ore and will furnish information on that part of the property, which is one of the best claims the company has. While drifting south on the 400' level would probably open good ground and the drift N W would soon get into very promising Rob Roy claim, I believe this work could be done just as well and cheaper, with the diamond drill. Only a very small part of the Company's holdings have been tested so far and I am not at all satisfied that this is the best part, but look for better results both on the Rob Roy and the Copper Glance. Of course, both of these claims are fractions and badly hemmed in by Commercial holdings.

What the contact zone at the Bradshaw Hill will show is impossible to predict, but it surely deserves thorough testing. My advice is that the Company raises all the money possible to continue active development and at the same time, submit the present results to big people, which might be interested to undertake further development and eventually the equipping of the property. Under no circumstances, would I advise the sale of the property outright, but make arrangements so that the present company retains an interest in the mine, because this is the only way whereby the present stockholders can earn commensurate reward for their courageous and splendid work in opening the mine and demonstrating its possibilities.

Respectfully submitted,  
Tucson Arizona, 7/14/17                      Signed W. Tovote

LOMA PRIETA MINES COMPANY

SUMMARY AND CONCLUSIONS:

The Loma Prieta Mine has opened a copper deposit, very similar to the porphyry coppers, but while in the true porphyry the ore is strictly secondary and limited to a horizon of secondary enrichment, anywhere from 50' to 300' in vertical extent, the ore in the Loma Prieta is absolutely <sup>primary</sup> and no limitation in depth is to be anticipated, as far as the same geological conditions pertain and mining can be followed economically. In fact, if any changes are to be anticipated, it is possible, that the grade might improve with increasing depth. The grade is very low, but I am convinced that it will prove economical. Besides, I believe that the ore will actually prove higher in grade, than my samples indicate, because the ore is extremely difficult to sample and the usual method of groove sampling does not seem adapted to this character of ore. Far more convincing evidence could be had by testing carload lots taken from the dumps.

Even my sampling, the lowest on record, indicates from 500,000 to 750,000 tons of ore averaging 1.25% Cu. with additional values in gold, silver and molybdenum, probably above the 400' level, with very good possibilities for far larger quantities to be developed in greater depth as well as in other ore bodies. This is based on my samples, as I say. Should I substitute the samples taken by Mr. Peach's administration, and verified by a series of dump samples, then the tonnage of this grade would be considerably greater or the grade of the same tonnage considerably higher.

In any case, the showing made by the past work is so gratifying, that prospect work should be continued to capacity, as the chances that the Loma Prieta might develop into a real great copper mine, are very good.

## LOMA PRIETA MINES COMPANY

Report by W. Tovote, E. M.

The Loma Prieta Mines Company is a stock company, organized under the laws of the State of Arizona. The authorized capitalization is 1,500,000 shares, of which about 1,000,000 are issued, the balance remaining the the Treasury.

Judge T. G. Norris, of Prescott is President.

Mr. A. B. Peach, of Prescott, is Superintendent.

### PROPERTY:

The Company owns 27 unpatented and one patented mining claims in the Copper Basin District, Yavapai County, Arizona. The property is about 12 miles south of Prescott. It is adjoined and partly surrounded by holdings of the Commercial Mining Company, a subsidiary of the Phelps-Dodge Corporation.

The nearest Railroad point is Skull Valley, about 8 or 9 miles to the south, a station on the Santa Fe, Prescott and Phoenix R. R. The road connecting the mine with the Railroad is of easy grade, but rather cut up by the heavy ore teams hauling ore from the Commercial Mine. It is part of the State Highway, connecting Wickenburg and Prescott.

The property has an approximate elevation of 3300 feet, and is situated at and near Copper Basin Wash, the principal drainage of this section. The topography is not sharp and consists of low rolling hills, dissected by usually broad erosion valleys and drainage channels, and forms the lowest foothills of the high mountains to the north, between Copper Basin and Prescott.

The surface is in most places deeply covered by soil and gravel and supports an abundant vegetation, principally oak brush, manzanita and a cacias. Formerly it was probably a forest of pine, juniper and oak trees, but most of the larger trees have been cut down.

Water is very shallow and stands normally less than 20' below the surface. The water is strongly mineralized and not well adapted for domestic purposes, but is used in the boilers and would be good and sufficient for milling purposes.

**HISTORY:** The Copper Basin country is an old mining district. Gold, Silver, Lead and Zinc and Quicksilver are known to occur, but the principal metal found in the district is copper and usually associated with molybdenite. The

most important mine of the district is the Copper Basin Mine of the Commercial Mining Company. Large areas of rather high grade copper conglomerate at the surface led to its discovery. It has produced a very large tonnage of ore and could ship 150 tons per day of nearly 4% copper ore, if the smelters would allow such a tonnage.

The Copper Basin Mine is working exclusively oxidized ore and no serious attempt has been made to develop the sulphide horizon, which is to be expected below - this in spite of the fact that the oxide ore does not show a great deal of secondary enrichment and that a fairly high grade sulphide ore is to be expected below in the main ore shoots. The largest ore body developed here and partly stope, measured 200' x 100', without indicating its limits.

Other properties in this immediate vicinity have been tested to some extent and quite a few have been very good promise, but the water was generally too much of a handicap for the small prospector and most of the work has been confined to shallow surface diggings.

In 1916, the Loma Prieta Mines Co. was formed and acquired its present holdings. Development in depth was resorted to and kept up in spite of severe handicaps. While the technical administration was not very good in the beginning, it has been excellent for the last year and a great amount of work has been accomplished, demonstrating the occurrence of very large sulphide bodies in depth. The new company has done pioneer work and indicated possibilities, which its older and richer neighbor failed to grasp.

**THE MINE:** The Loma Prieta Mine is opened by a two compartment shaft with levels at 140' and 390', besides short drift at 35' and 80'. Some sulphide ore was found in the drift on the 33' level, but it was still partly oxidized and of small extent. In the shaft, the ore was encountered at about 60' and has continued to the bottom of 414'. The grade is generally low, but streaks and bunches of high grade ore are found frequently, which helps to raise the average tenor.

On the 150' level a total of 263' drifting and crosscutting has been done, of which 225' are in ore, averaging 1.50% cu. with additional values in gold, silver and molybdenum.

The shaft has been sampled from 150' below the collar down to the bottom of 414' and averages over this distance 1.30% cu. As mentioned before, the ore goes up in the shaft to about 60' below the surface and near the shaft is timbered and lagged, but it is safe to assume that the grade will at least hold up to the other average.

While the 150' level indicates an area of only between 8000 and 9000 sq. ft., which might be considered milling grade of ore, the ore shoot here is not developed to its limit. On the 400' level, however, the ore shoot, which has been prospected up to now, is fairly well limited and surrounded by material, which, under any circumstances, would be too low grade to consider ore. Still there are better streaks through this low grade area, which might possibly increase and strengthen in other horizons and lead up to other ore bodies.

The indicated workable area on the 400' level, measures approximately 25000 sq. ft. and would represent 2000 tons of ore for every foot vertically.

We can therefore, assume that the Loma Prieta has at present a probable tonnage of not less than 500,000 and not over 750,000 tons of ore, assaying between 1.25% and 1.50% cu. The values in gold, silver and molybdenum, as indicated by compound, assays of 105' and 400' levels are:

Au.	Ag.	Mo.	Assayer says not enough Mo. to make determination.
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It is very probable that the amount of ore could be materially increased by drifting in easterly and westerly direction. It must be well understood, though, that this ore is not ore in sight, but only probable ore and considerable lateral and vertical work would be necessary before this ore is definitely proven and blocked out, as engineering standards require exposure on all four sides before considered ore actually in sight. However, the showing is extremely encouraging for the amount of work done and proof is furnished that large low grade masses of copper ore exist.

This is besides, only one of a number of ore shoots that are indicated by the surface geology, obscured as this is by gravel cover and vegetation.

**GEOLOGY:** The principal formation in Copper Basin is a granitic rock, of probably Mesozoic age. It ranges in composition from granite porphyry to Monzonite. Quartz is not all times present and the orthoclase seems in excess of the plagioclase feldspar. Dark ferro-magnesian minerals, prin-

cipally biotite and amphiholes, are usually plentiful.

In this granitic massive are found lenses of semischistose acid and basic rocks, probably inclusions of older formation younger than the main granite porphyry massive are dikes of a dark monzonite-porphyr . This rock does not only occur in dike form but more frequently in irregular masses and bunches and seems very closely connected with the main intrusion. The youngest rock in the district and probably the most important, in relation to the ore deposits is an acid, fine grained intrusive of rhyolitic habitus.

This rhyolite is found in three main massive and in numerous dikes. A series of white quartz dikes and areas of silicification, traversing the basin are in all probability part of the same volcanic actions and constitute the last activity of the subsiding period of volcanism.

The rhyolite is normally of a dull whitish color and shows only quartz and feldspar to the unaided eye. It is practically identical in the massive and the dikes. The greatest area of rhyolite is found just outside of the basin proper and forms the rugged porphyry mountain alongside of the Skull Valley road on Frank Cass's ground.

In the basin are the rhyolite mass of Bradshaw Mill, which is on the Loma Prieta ground and another one, farther southwest on the West side of Copper Basin Wash.

It is very probable that these mountains are only high points of the rhyolite intrusion, exposed by later erosion and in depth the whole basin is pervaded by masses and dikes of this rock.

Rhyolite dikes are found in three main systems: N. 60 to 90 W., E. 20 to 30 W., and N. 15 to 35 E. The same directions are repeated in the complicated system of fracturing and fissuring, which traverses the basin and served as deposition channels for the metallic sulphides, a fact which suggests the close relation between the rhyolite intrusion and the sulphide mineralization.

While the N. 20 W. fissures normally dip steeply to the West and the N. 70 W. to the South, the N. 20 E. fractures show no uniformity, but show dips in both directions. Generally though the west dipping fractures of this system are very flat, while the east dipping ones are steep. Their

Their arrangement suggests strong lateral pressure, which in sedimentary rocks would have been relieved by folding.

All the different veins, fissures and fractures seem to intersect each other with no apparent displacement and seem to be therefore, contemporaneous and due to the same sources. While individual fissures can sometimes be traced for long distances and considerable ore has been produced from such fissure veins, these are not the most important sources for ore in the Copper Basin District. Far more important are the wide fracture zones of small and disappearing fissures which traverse the monzonite in all directions and show as areas of crumbling granite with brown limonite seams on the surface. Zones like this are indicated several hundred feet wide and persist over long distances, even if the individual fractures are weak and of small extent. They would probably be designated as LODES or Shear Zones.

The most important parts of these lodes are, where two different systems intersect each other. The fracturing here increases frequently to strong brecciation in the country rock. A brecciation, which has been cemented by later mineralization. Both the main monzonite and the later monzonite dikes are affected by this brecciation and fracturing.

All evidence points to the conclusion that the rhyolite intrusion was very forcible and abrupt; that it shattered and shifted the older rocks and that the last stages of this volcanic activity introduced mineral solutions, both metallic and non-metallic, which recemented some of the fracturing and invaded the monzonite along fissures and breccia zones and caused the present ore deposits.

While, as mentioned before, intersections of two lode systems tend to increase the area and intensity of the mineralization, individual lodes might contain workable ore for some distance away from intersection points, but will gradually impoverish. I do not believe though, that any part of these lodes can be found, that does not show a trace of copper. The intersection zones and especially those where the fracturing was strong enough to produce brecciation, will, at all times show a certain quantity of high grade I do not expect, unless a strong fissure vein follows or crosses the lodes. Up to now, only a few such strong veins have been proven in Copper Basin and all of them on Commercial ground. The strongest and most per-

sistent of which is the Barberino vein, which should pass into the Loma Prieta ground on the Anna claim, but has not been proven till now. These veins strike N. 15 to 20 W. Next in importance are veins of N. 70 W strike; of these a rather good one is indicated on the patented Copper Glance claim of the Loma Prieta holdings.

Others of the same system pass probably in vicinity of the Loma Prieta shaft, but cannot be traced well on account of the covered surface.

I have tried to embody the principal features of the surface geology on the map accompanying this report. It covers only a part of the total area and besides, is necessarily very incomplete, because, as mentioned before, the heavy covering of gravel and vegetation renders an exact representation impossible. From the data available, it is evident that the Anna, the Mary, on which the shaft is located, the Rob Roy and the Shenandoah claims are some of the best potential ground, which the company owns and that work on these claims will have very good chances of success. A very good piece of ground is also the Copper Glance fraction, the isolated patented claim situated beyond the Commercial Mine, but the ground is handicapped by being detached and of small extent.

From purely geological reasons, I would think that the area adjoining the rhyolite mass of Bradshaw Hill would ultimately prove very good prospecting ground also, but I was unable to trace anything definite on the surface, because talus and debris covering are deeper there than anywhere else.

From the evidence available in the few exposures along creeks, roads and prospect workings, it is indicated that an area about 2000' wide is traversed by lodes and dikes N. 15 to 35 W. strike, which are crossed by a series of N. 60 to 80 W. veins and fracture zones. Mineralization and brecciation are strongest at and near the intersection zones, which would form the logical points to prospect. It is reasonable to assume that all these intersection points will show ultimately ore bodies similar to that exposed in the shaft, but there is no reason why further work should not prove a larger extent and area of higher grade ore as well in the present as in future ore shoots.

**THE ORE:** The ore proven until now is a deposition of metallic and non-metallic minerals in the shattered and brecciated monzonite. There

are several periods of mineralization, which overlap and grade into each other.

The first is silification and deposition of vein quartz, rarely quartz and orthoclase, indicating the pegmatitic character of this first mineralization. In connection with it is found sometimes, molybdenite especially bound to a semi-chalcedonic variety of the quartz. Pyrite deposition begins a little later in conjunction with the quartz. Still later and after silification has come practically to a standstill, chalcopyrite was introduced with later molybdenite. The last deposition is that of the carbonate minerals of the dolomite ankerite group, often in conjunction with chalcopyrite. Very rarely, a last abortive silica-deposition is indicated. The effect of this mineralization is as well a hardening of the invaded rock, due to the introduction of silica, as a softening, due to the simultaneous decomposition of the rock minerals, especially the feldspars, possible ore shoots are therefore indicated on the surface by prominent quartz reefs on the one hand and by depressions, due to less resistance to erosion on the other. Ultimately, I believe, the latter will prove the more important.

Pyrite is the most widely distributed of the minerals. It has penetrated the monzonite, together with quartz for long distances, and even has gone far beyond the quartz along slips and joint planes. At all times it carries a certain amount of copper, probably an admixture of chalcopyrite.

The main values in the ore are in the form of a very pure chalcopyrite, which is found in grains, seams and rather massive bunches. The molybdenite is very thoroughly intergrown with the ore and is found also fairly massive.

Sometimes the molybdenite extends beyond the copper area and a rather high grade and clean product of this valuable mineral could be sorted out, which I consider an important economical factor. All the ore, which might contain 1.0% Mo. and better, could be treated by differential flotation for the Mo. contents. The prices offered for molybdenite concentrates of 50% Mo. \$2. if fairly free from iron, copper, arsenic and phosphorus, is now \$1.15 and better per pound of metal, on long time contracts.

The ore generally improved very much in grade in brecciated areas and

along stronger veins. The brecciated areas are rather irregularly distributed, but a system of this occurrence could probably be worked out ultimately. They seem to be intimately connected with fracturing in N. 20 to 30 E. direction. Dolomite and molybdenite, as well as high grade chalcopyrite are nearly always found in them.

Strong veins have not yet been disclosed by the work done, except one vein zone, shown both on the 150' level and the 400' level, near the shaft. Here some very good ore is found. This vein strikes N. 60 #., but it is not very strong and has not been followed to any extent. It certainly seems advisable to follow this vein out farther, as it might improve as well and produce some ore of shipping grade, as lead to new ore shoots. I expect that ultimately, other and stronger veins will be found besides.

There is a tendency in the mine for high grade ore to appear in very flat veins and bunches and if this tendency can be established further, lateral work, as done principally up to now, would tend to lower the average of the ore and vertical work would give a better and more nearly correct idea. Work along the high grade streaks, on either level, would be very advisable, both for information and possible financial returns.

#### TYPE AND ECONOMIC CHARACTER OF THE ORE:

The ore is a straight sulphide ore, sparsely distributed in the granitic country rock. It should lend itself exceptionally well to concentration by flotation and should allow a very high ratio of concentration.

I believe that ore with 1.25% cu., if found in sufficient quantities, would be workable. To work this grade of ore, a tonnage of at least 5,000,000 tons would probably be necessary. At a 15% copper market, figuring 2.5 for loss and refining charges of a 90% extraction in milling, this would give:

1.25% means 25 lbs. copper per ton 90% extraction leaves 22.50 lbs.

22.50 x (15 2.5) is \$2.80 value per ton, Mining cost \$0.80 to \$1.00

Milling .50 to .65. Ratio 20 to 1.

Overhead and development 0.25 to 0.30.

Smelting 0.25 to 0.30 at \$5.00 to \$6.00 per ton of concentrates.

Total cost \$1.80 to 2.25.

Leaves profit of from \$0.55 to \$1.00 per ton. This does not take into consideration the accessory value in gold and silver and the possible

profit to be derived from the molybdenum contents, which would make the showing considerable more attractive. Of course, a very heavy expenditure would be necessary to develop and equip a mine of this type and amortization and interest charge would probably equalize the profit from these accessory values.

The deposit is similar to the porphyry coppers, while in true porphyry the ore is confined to a limited horizon of secondary chalcocite enrichment. The ore in the Loma Prieta is strictly primary and there is absolutely no reason why it should not go down as far as mining operations can be conducted. Since the mineralization is primary and ascending, an improvement in grade, with increasing depth would not be at all surprising.

For the same reason it is ultra conservative to limit the ore in sight to the actual deepest level. It is advisable to do so now, because the ore is not really blocked out, but as soon as this should have been done, I would consider it absolutely permissible to figure at least 100' below the bottom level for ore in sight, which, with the present indicated 2000 tons per vertical foot would mean another 200,000 tons.

It is more than probable that all, or nearly all of the chalcocite porphyry copper deposits have been found, but the Loma Prieta type is only beginning to be recognized as future possibilities. I have been designating this type as "Rhyolite" copper Deposits. Nacozari is, up to now, the only successful mine of this type in the southwest. The grade here is, of course, much higher, but the progress made in late years, both in mining and millig methods, allows a steady lowering of the economic limit for this kind of ore and the Rhyolite Coppers will assume growing importance.

To determine the grade of the ore, both levels were sampled carefully with hammer and holl, by cutting 5' grooves along the walls. Only in the S. E. drift on the 150' level, where a fairly strong vein is followed, were the grooves cut across the back of the drift. While this method of sampling is ver well adapted to the porphyry copperys, with their soft knolinized rock and the farly uniform impregnation, I consider it not good at all for this type, with its extremely hard rock and uneven mineralization, but used it because I could not devise another method of sampling, which would give a better record at not prhhibitive expense. I believe that

I believe that even with the more careful sampling by expert samplers the uncertainty of this method would be at least 10% a factor which might be vital in ores of this low grade. I am rather satisfied that my assay returns are low, with very few exceptions, and that the ultimate test will show the ore to be of slightly higher grade ore and the area of this grade to be greater. A good check on this could be had by sinking sample pits through the dump to determine the grade of the ore from these, allowing for the high grade ore, which has been shipped and carried off.

I have a record of samples taken under Mr. Peach's direction, to which I would attach just as much weight as to my own. I give them for comparison. Mr. Peach's samples were taken in 10' blocks, while mine were taken in 5' blocks. Both sets of samples cover the identical area on the 400' level.

N. W. Drift:

Peach average: 1.17% Cu.    T. vote average 0.89% Cu.

S. E. Drift:                    1.63                                    1.31

S. W. Drift:                    1.52                                    1.17

Both sets of samples should be accorded the same weight and the true average be taken as the middle between them. I have not done so, but based my computations on my own samples exclusively, which gives lower grade or less tonnage. For the samples taken in the shaft, I have used Mr. Peach's samples, which were taken during the process of sinking, as the shaft is now lagged and timbered and sampling not feasible. Sampling and testing by drilling, either diamond or churn drill, would be far more satisfactory than any attempt to determine the extent of the ore bodies by sinking and drifting or their grade by hand sampling. By this method, the property could be tested far more cheaply and quickly than by the past work. This past work was absolutely necessary to establish the type and character of the deposit.

CONCLUSIONS AND RECOMMENDATIONS:

From the work done up to now and the geological evidences available, I believe that the Loma Prieta has an excellent chance to develop into a very important mine.

While no guess is admissible as to what tonnage can ultimately be

developed, I believe that at least 5,000,000 tons will be required to make the mine a success and that this amount can be proven up.

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There is no reason though, why the present company should not proceed to raise further funds and continue development work. While I believe that the ultimate testing should be done by drilling, probably diamond drilling, from the present 400' level and later on churn drilling from the surface, it might be advisable to continue for sometime with underground work. Drifting in N. W. and S. E. direction, on the 400' level, holds out very good promise of extending the ore zone and of netting at the same time, some shipping ore.

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Respectfully submitted,

(Signed) W. Tovote

Tucson, Arizona 7/14/17

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