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Copy

Application of
C.L. Orem

(Exhibit "A" (e) 1. Reports)

REPORT

on the property of the

HELMET PEAK MINING AND MILLING COMPANY.

Dr. C.J. Sarle.

LOCATION:

The property of the Helmet Peak Mining andMilling Company is situated in the Pima Mining District, Pima County, Arizona, near the north-easterly edge of the Sierrita Mountains, at an elevation of about 3,600 feet above tide, and 21 miles south and west of the city of Tucson. The property centers about the corner to Sections 10, 11, 14 and 15, in Township 17 South, Range 12 East. Locally, this portion of the Pima District is known as "Olive Camp."

An excellent highway between Tucson and the mining camp of Twin Buttes, four miles to the south, passes the property, a mile to the east of the mine, with which it is connected by a good mine road. Sahuarita, eight miles east, a station on the Tucson-Nogales Branch of the Southern Pacific, is the shipping point.

HOLDINGS:

The property comprises 12 unpatented lode claims, six owned by the company and six held under bond and lease. Those claims owned by the company are collectively known as the "Harper-Martinex Group", and are named: South Camden, South Camden Nos. 1 and 2, Refufia, Refufia Nos. 1 and 2. The claims under bond and lease comprise the "Emory Group", and include the Tit-for-Tat, Contention, Prosperity, Camden, Camden Nos. 2 and 3. These twelve claims are continguous and have an area of nearly 240 acres, extending eastward and westward for about a mile and three quarters and with a maximum width of almost half a mile.

TOPOGRAPHY AND GENERAL GEOLOGY OF THE REGION AND SIERRITA MOUNTAINS.

The dominant relief features in the topography of this general region are north-south to northwest-southwest trending fault-block mountain ranges, with broad, intervening, alluvial-floored valleys or plains.

The Sierrita Mountains form one of several relatively small mountains, roughly aligned, which separate the Altar-Abra Valley, on the west, from the Santa Cruz Valley, on the east. These mountains, like the ranges paralleling them to the eastward and westward, were formed by crustal fracturing and uplift in late Tertiary and early Pleistocene times.

Since then, weathering and erosion have profoundly modified their form and relief. Thus, by erosion, the original Sierrita Mountain mass has been deeply dissected and its flanks have retreated several miles from their original position. Over this area, an outwardly sloping rock floor, a lowland, has been developed about a mere remnant of the original mountain mass. From the summit of the flat cone, or mountain pediment, thus developed by erosion, the remnant stands as an irregular, declivitous ridge seven to eight miles in length and four to five miles in width, dominated slightly

by Samaniago Peak, whose summit rises to approximately 6500 feet above tide. Here and there, however, peaks of more resistant rocks, due to differential erosion, rise above the plain. For example, on the westerly side, the central mass is flanked by a narrow belt of foothills. At other points, as on the eastern side, other eminences rise from this plain, such as the Twin Buttes, Helmet Peak, San Xavier Ridge, Democrat Peak, and Mineral Hill. Peripherally, the rock plain passes beneath alluvial slopes, detritus deposited by ephemeral streams, formed by stormwaters running from the mountain slopes to the Alter-Abra and the Santa Cruz valleys. Far out on these alluvial slopes, the only visible indications of the nature of the rock floor beneath, or for that matter, that the Sierrita Mountains formerly extended so far valleyward, are a few hills of rock, left by circum-erosion. But towards the mountain axis the detritus covering this beveled rock slope become a mere veneer, through which low hills and ridges, between sand-filled wash-bottoms, reveal extensively the underlying rock formations.

The profound erosion to which the Sierrita Range has been subjected has laid it open to its core, revealing its innermost structure and constituent formations. Great thicknesses of rock, once covering the entire uplift, has been wholly removed from the central area and reduced to disconnected marginal remnants or scattered inliers, many of these fragments only escaping due to their position in the fault mosaic.

A reconnaissance of the range shows the rock series in order of age to be as follows:

Resting upon a basement of much older Pre-Cambrian granites, gneisses, and some schists, generally much cut by aplitic and pegmatitic dikes and sometimes by grano-diorite, is a Paleozoic marine series of strata, mainly limestones, originally several thousand feet in thickness, referable in age to Upper Cambrian, Devonian, Mississippian, and Permo-Pennsylvanian. Mesozoic strata, once originally many thousand feet in thickness, overlie the Paleozoic series. This series consists of an almost endless alternation and repetition of layers and benches of arkosic conglomerates, arkosic sandstones and shales with occasional zones of thin limestones. This is mainly a fresh water continental deposit, as shown by its lithelogical character and fossils. Marine, Commanchean, Cretaceous fossils, found in this series in the Paragonia Mountains, some fifty miles to the southeastward, however, establish the age of the series. Mantling the eroded surfaces of the older formations are remnants of a thick series of Tertiary andesites and rhyolites - surface flows. Of these, there appears to have been an older and younger series. Dikes and sills of related type, found cutting the older underlying formations, particularly the Mesozoics, are probably syngenetic. Upon these , but more localized, were early Quarternary volcanics, - mainly besalt, though including some andesites and interbedded rhyolitic tuffs.

The core of the range is a great Tertiary granite batholith, varying in phase from a coarse, porphyritic biotite granite to a fine grained biotite granite, and to a highly silicious coarse grained rock containing little biotite. The first phase is most typically developed in the Piedmont area along the eastern side of the central mass and in the vicinity of Twin Buttes. The second phase shows in the eastern and western slopes of the central mass. The third phase is found in the Olive Camp region. Probably some of the porphyritic minor intrusives of the area are genetically connected with this granite.

FORMATION OF THE SIERRITA MOUNTAINS:

The formation of the Sierrita Mountains probably should be considered as a process, initiated early in Tertiary time, passing through a climacteric stage in closing, Tertiary and early Pleistocene times, - a very long period, though short geologically considered.

The process began with a general elevation or crustal upwarping of the country, and the opening of large fissures in the rock crust, through which ascending lavas, reaching the surface, spread widely. Finally crustal readjustments began in which faulting played the leading role and the region, so it speak, collapsed to essentially its present attitude. In this adjustment the thick Tertiary lava cap, as well as the underlying older formations were heaved into linear and anastomosing ridges, of tilted fault blocks, with parallel trending, depressed areas between, thus forming the present mountain ranges and valleys.

This mountain-forming process was by no means cataclysmic, but involved a long period of time, even for its least stage of final minor adjustment. It was not so rapid but that many antecedent streams in southern Arizona were able to maintain their uninterrupted way, erosional down-cutting of their channels keeping pace with the growth of the mountains athwart their courses. Likewise in the case of the Sierrita Mountains, the uplift outstripped the agencies of degradation, general erosion had made deep inroads into the mass before active uplift had ceased. Moreover, structural readjustments, within and about the range, may still be expected at intervals as time goes on.

## THE SIERRITA GRANITE BATHOLITH, AND ITS GENETIC CONNECTION WITH ORE DEPOSITS:

Simultaneously with the final faulting and uplift of the Sierrita Range, a subjacent, upward movement of acidic lavas, on a gigantic scale, took place. This extremely hot, viscous, fluidal mineral-solution, under enormous rock pressure, hydrostatically buoyed up the fault blocks, wedging itself upward between their bases, forcing them upward and outward in all directions. Many blocks, loosened from their neighbors, are seen to have foundered in the still pasty mass beneath, and others, top-heavy, turned over on their side, some even partially inverting. The magmatic movement may have occurred in successive stages, the intervals between permitting a certain amount of magmatic differentiation.

The batholith imparted a dome shape to the Sierrita uplift. This is obscured now, however, by its present dissected condition.

Another effect of the ascent of the magma was to dynamically metamorphose the sedimentary rocks, now exposed in the residual foothill ridges, along the western base of the central mass. Here sediments and accompanying intrusives were greatly compressed against a large upfaulted massif of Pre-Cambrian granite which abuts their western side. The rocks were folded and contorted, the limestones squeezed into segments, often showing flow-structure and marbleization. The terrigenous rocks were extensively mashed and sheared, and in places converted into slates and even schists. Closely following this, ascending mineralizing solutions, emanating from the underlying granitic magma, deposited the ores, now being prospected in this belt, in the Papago Mining District.

On the eastern side of the range, in the Pima Mining District, though the rock formations are locally contorted and folded, yet the evidences of dynamic metamorphism, such as schistosity and slaty cleavage, are practically wanting. The evidences of igneous metamorphism, on the other hand, are seen almost everywhere. The alteration was mainly effected by a suffusion of the rocks by hot solutions, - perhaps gases and vapors, - the volatile constituents of the granitic magma making their way upward, in part forced out by its gradual crystallization, or congelation, into granite.

Through the action of these solutions, considerable portions of the limestones have been crystallized into marble, silicified and garnetized; portions of clayey limestones have been extensively altered to garnet and epidote; sandstones converted into quartzites, epidotized and garnetized; arkosic sandstones in places leached and the contained feldspars recrystalized into sericite, until it is often difficult to distinguish them in the

field from altered quartz-porphyry, or a mashed and reconstructed rhyolite; shales extensively hornfelsitized, porcelainized and silicified; and large masses of the rock have been charged with finely disseminated pyrite, which in weathering has widely stained the rocks. But such alteration is by no means as universal as this lift of igneous metamorphic changes might suggest, for many of the rocks superficially show little alteration -- well-preserved fossils even being found in some of the limestone masses.

Such widespread evidence of intrusive igneous metamorphism of the rocks of a region usually presages the presence of ore deposits. The significance to us of the occurrence of this granite batholith is the large number of valuable deposits of ore found in the disrupted and intruded overlying older rock formations, formed by mineralizers escaping into them, or forced into them, from the fluid granite magma before and during its crystallization.

Thus where the fluid acid magma came directly into contact with steep wall-like faces of the fault blocks, expecially if limestone or calcareous shales, contact-metamorphic ore bodies were formed, large masses of garnet and sulphide ores being formed along the contact at the expense of the latter rocks. At the same time ore solutions working through the mineralogically more congenial portions of the rock and into the shattered zones, made extensive metasomatic replacement of ore in them, often reaching such areas by traveling some distance from the contact through fissures and along fault contacts.

In this manner the large contact ore bodies in the Paleozoic limestones at Mineral Hill and the Vulcan Mine, two miles north, and the partially developed ore bodies of the west and South San Xavier, a mile to the north and east of Helmet Peak Mining and Milling Company's property, were formed; likewise, the ores in limestone of the Glance, Queen, North Star, and Senator Morgan mines at Twin Buttes, four miles to the south.

The large and valuable ore deposits of the San Xavier Mines, a mile to the north of the Company's property, in gray Pennsylvanian limestone, was formed by solutions ascending from the subjacent magma, following the fault plane between this limestone and upedged Mesozoic sandstones, shales, and intruded sills of volcanic rock.

Again, where the solutions ascended through fissures in less soluble roof rocks, the walls confined the solutions and valuable veins and shoots of ore were formed. Many veins of this type have been worked in the Olive Camp. Examples of such veins are the Olivetta vein, Annette, Wedge, Richmond, Emma E. and Schumacker, located just north of the Company's holdings; the Tit-for-Tat, Contention and Prosperity veins on their ground; the Freis veins and the Alpha vein to the south; and the Paymaster veins to the southwest. Other veins, cropping, have not yet been worked, and many not showing at the surface, doubtless will be encountered in cross-cutting, as the district is more systematically developed.

A fourth and very important type of ore deposit is found in the district. At present it is represented by a single known occurrence, though with future exploration and development in depth of Olive Camp it is confidently expected to become the source of a large production of base ores. There are bodies of disseminated ores occurring in crushed and brecciated zones in the less easily permeable and replaceable rocks. Of this type, is the ore body now being developed by the Helmet Peak Mining and Milling Company on their property. Here the mineralizing solutions, ascending from the granite magma, have formed a large ore body in brecciated andesite.

The contact-metamorphic ores of the district are essentially copper-iron sulphides, with depth; through a zonal arrangement of ore minerals is found to take place upward, where erosion has not destroyed the upper portions of deposits. In this sequence the relatively pure copper-iron ores give place upward to a mixture of copper and zinc, then to zinc-copper-lead and zinc lead-silver, and lastly, to lead-silver. In this case the low temperature minerals have ascended to the higher or peripheral zone.

As a result of the magmas of Southern Arizona in general being relatively copper-iron rich, and as these minerals come down at a relatively high temperature, and precipitation and enrichment are heaviest near the source of the mineralizing solutions, it is the rule that these ore bodies increase in size downward. The lead-silver end of the series usually carries the higher values, but the copper ores, though of lower grade, generally make up for this many times over in quantity.

The fissure veins of the Olive Camp, essentially lead-silver and tetrahedrite-silver-lead ores, which were worked between 1886 and 1893, should be regarded as the upper, attenuated ends of ore bodies, grading downward through zinc-copper ores to copper-iron ores of much greater volume. Discontinuance of operations on these veins was due mainly to encountering the mid-zone of copper-zinc ores, which because of their complexity, and no practical way of treatment at that time, could not be economically handled. The abandonment of the camp, however, was due to the falling price of lead and silver.

## GEOLOGY OF OLIVE CAMP AND COMPANY'S PROPERTY.

Olive Camp lies in the northeastern part of the pedimentary area, or flanking, erosional lowland of the Sierrita Mountains. Low, flat divides, rising here and there into rounded rocky hills, separate shallow, eastwardly draining washes and arroyos. Patches of alluvium occur, but in general the rock formations are fairly well exposed.

On the north and northeast the area is bounded by faults, along which rise eroded blocks of Paleozoic strata, whose visible portions are composed of great thicknesses of Pennsylvanian (Carboniferous) and Permo-Pennsylvanian gray limestones. Helmet Peak on the northeast, one of these fault-blocks, rises several hundred feet above the general plain, while crossing the area on the north, in east-west line, are San Xavier Ridge, on the east, and Marble Mountain, on the west.

The formations flooring Olive Camp consist of Mesozoic sedimentary rock, early Tertiary andesite and late Tertiary granite. (See Geological Map of Olive Camp).

The Mesozoic strate form a belt nearly a mile wide, which underlies the northern end and the eastern side of the Camp. Southward the outcrop broadens, its westerly edge swinging southwestward. The strata stand nearly vertical and aggregate many hundreds of feet in thickness. Their strike and dip is variable. In the northern part of the belt the strike ranges from 40° to 65° east of north; southwestward it departs widely from this in places. Considerable portions of the rock are so shattered, weathered and metamorphosed that their original structural planes are recognized with difficulty and frequently the formation has been mistaken for an igneous rock.

The rock varies from heavy-bedded arkosic conglomerate and gritty arkosic sandstone, often quartzitized and sericitized; to, usually thin-bedded, fine-grained, gray sandstone or quartzite, interbedded with purple shale. There are also some thin beds, of gray to brown, impure gritty limestone.

Occasionally sills of felsite or porphyry and sometimes of more basic rock occur in plane with the stratification.

The andesite in Olive Camp fills a broad bay-like reentrant in the western edge of the Mesozoic belt. Its northern edge, curving to the southeast, crosses the property of the Helmet Peak Mining and Milling Company about three hundred feet northeast of the mine. The western half of the Company's holdings, therefore, lies on the Tertiary andesite and the eastern,

on the Mesozoic sedimentary rocks. The andesite as a whole is massive, though portions, distinquished by containing andesite fragments congealed in the andesite, therefore an andesite breccia, may be stratiform.

Whether the contact of the andesite with the Mesozoic sediments is intrusive, or brought about by faulting, has not been fully determined. Andesites do occur, however, intrusive into the Mesozoics. In some cases though these occurrences, expecially where the rock is coarsely porphyritic, are judged to be of a later period than that of the formation of the msjor mass of andesite. In places the contact between andesite and sedimentary rock is marked by a zone of brecciation and superficially, at least, by leaching.

The granite forms a sinuous southwestward trending contact along the western edge of both the Mesozoic rock and the andesite of this area. Thence it spreads widely as the floor of the pediment.

The granite, in its typical development, is a gray, medium-grained, biotite granite, containing large feldspar phenochrysts. Near contacts with the older formations it is often very silicious, the mica appearing much reduced in amount. In some cases observed of actual intrusion of the granite into the older rocks the difference appears to be merely textural, the grains alittle finer and the large feldspar phenochrysts absent.

Half a mile northeast of the Helmet Peak Mine, a small area of outcropping granite occurs in the midst of the up-edged Mesozoic strata. It represents a tongue of the molten magma which penetrated these rocks some hundreds of feet, before slowly crystallizing and cooling. Other examples of intrusion of the granite magma into the Mesozoic strata may be seen in the sides of a deep arroyo, just south of the U.S. Mineral Monument No. 2, situated on Democrat Hill, a mile north of the Company's property. A short distance west of the property is an occurrence of the granite intruding the andesite.

These examples of intrusion, by upwelling granite magma, of the older formations observed in Olive Camp and elsewhere, together with the wide area of granite, which erosion has exposed in the heart of the Sierrita Mountains, shows the whole Pima Mining District as underlain at depth by this granite and that the fault-blocks, formed by the breaking up of the old Paleozoic and Mesozoic sediments and Tertiary volcanic country rock, rest upon or are imbedded in its surface. (See Stereogram of Olive Camp).

ORE DEPOSITS OF OLIVE CAMP:

It has been stated that the ore bodies of the Pima Mining District were formed by mineralizing solutions escaping from the molten, crystallizing granite magma, into older roof rocks, during a late stage in the uplift of the Sierrita Mountains.

The copiousness of these solutions and their richness in metallic elements is attested by the large bodies of copper-iron and copper-iron-zinc su sulphides mixed with garnet, found in linestone, where the magma contacted the Paleozoic sedimentary rocks, as in the Mineral Hill-San Xavier and Twin Buttes Camps. Also by the large body of ore, as in the San Xavier Mine, formed by metasomatic replacement of limestone, caused by solutions migratint to a distance from the granitic magma to more soluble portions of the lime.

Although no occurrences of eigher of these types of ore deposits have yet been found in Olive Camp, its intermediate position and closeness to these camps and the evidences of widespread mineralization shown by the many argentiferous-galena and argentiferous-tetrahedrite veins, which have been worked in this camp, together with the subjacent occurrecce of the common mineralizer, the granite, implies a high degree of probability that large ore bodies will be discovered in the Olive Camp once deep and systematic mining is undertaken there.

Mention has been made of a more or less definite arrangement of the ore minerals, recurrently met in the ore deposits of Southern Arizona. This circumstance is often voiced in the expression, "She'll go to copper with depth". In this sequence, somewhat overlapping, relatively pure copper-iron minerals at depth give place upward to copper-iron-zinc, copper-zinc-lead, and zinc-lead-silver to lead-silver ores.

At the same time the ore bodies usually increase in size with depth. This is partially due to the magmas of the region being relatively rich in the base metals, and also high temperature minerals which precipitate comparatively near the source of mineralization and at greater depth, while the lead-silver ores, relatively low temperature minerals and in lesser amount, are precipitated as the much reduced upward continuation of the ore body.

Work on many of the veins of Olive Camp was discontinued after the high grade silver ores were mined out and the complex base ores had begun to appear with depth - between 200 and 300 feet. On many of these veins work was carried far enough, however, to indicate that the zonal arrangement of ores, or metals, holds here and that at some greater depth, had mining been continued, the pure copper-iron sulphides would have been encountered, and presumably in volume which would more than have made up for their lower tenor, had the methods of milling of these ores been as well understood at that time as it is today.

In other words, these veins may well be investigated today as it will almost certainly prove that some if not all of them are but the upper attenuated ends of larger bodies of base ores.

The veins of Olive Camp vary in trend between northeast and east. Some cross veins, like the Olive, occur. They occur in fractures and fault planes, in both the Tertiary andesite and the Mesozoic argillo-arenaceous sediments; in the latter of ore in plane with the bedding.

The major part of the worked veins of Olive Camp have been listed on page 6 of this report. Some lie north of the Helmet Peak Mining and Milling Company's property, some south, The property lies at about the center of the vein area. The Tit-for-Tat-Contention vein and the Prosperity vein are on the company's property. The Ti

The Tit-for-Tat-Contention vein lies west of the Helmet Peak Mine. It is in the andesite and stands vertical and trends N. 65° E., and was developed for about five hundred feet and to a depth of perhaps two hundred feet. The Prosperity workings lie three hundred to four hundred feet north of the mine, in a Mesozoic quartzite conglomerate. It apparently lies in the plane of stratification, striking N. 70° E., approximately, and dipping north at a 50° angle, which flattens considerable with depth. The vein was worked from three inclined shafts, to a depth, on the incline, of 310 feet. Some good shipping ore is said to have been left in the bottom of these workings.

I have been unable to ascertain what the production of either of these veins was. The dumps are large and the production probably compared favorable with that of similar veins of the camp, having dumps indicating about the same amount of development.

The Annette vein, about 1200 feet northeast of the Prosperity vein, strikes N. 80° E., dipping 55° N., is in Mesozoic strata and is said to have produced $65,000 in ore. The Olivette, adjoining, but with strike S. 20° E., and dip 70° W., is reported to have yielded $750,000 in shipped ore.

These mines were worked between the years 1886 and 1893. Since that time, none of them have been operated, except the Richmond, which is now being developed by the Swastika Copper and Silver Mining Company.

Estimates by oldtimers, of the total production of these partially worked veins of Olive Camp, approximate, in round figures, $3,000.00.

Unworked veins occur, and probably many which are blind will be encountered when systematic exploration and development of the camp is undertaken. Several showings on the company's holdings deserve careful investigation. The camp was abandoned only when the price of silver and lead fell. But, as stated, valuable as these ores are, and well worth developing, the major future values of this camp, in my opinion, are likely to lie in the development possibilities of huge bodies of base ore with depth. There is no reason to suppose that, with all these surface showings, mineralization within this area was not as intensive as that indicated by the large contact-metamorphic and metasomatic replacement ores of the district, given the right conditions for the entrance and catchment of the mineralizers.

In lieu of the easily replaceable limestone and considering the relatively inhospitable nature of the andesite and Mesozoic sediments to replacement, some other favorable offsetting condition must be afforded. These requirements seem to have been met by the occurrence of zones of close fracturing and brecciation in these rocks, permitting a diffusion of the mineralizing solutions, and the formation of disseminated ores in breccia. One such example, apparently, has been discovered in the large ore body now being developed by the Helmet Peak Mining and Milling Company.

In many cases conditions recognizable by the geologist, followed by systematic drilling, will almost certainly develop other similar ore bodies on the company's property.

Some confidently hold the view that the surficial rocks of Olive Camp are deeply underlain by the Paleozoic sedimentary series. If so, then bodies of contact-metamorphic and metasomatic replacement ores in limestone, where the relations to the granite magma were right, may occur beneath Olive Camp and the company's property, quite as large or larger than any of the similar known deposits of the Mineral Hill-San Xavier and Twin Buttes camps.

PRESENT DEVELOPMENT OF THE PROPERTY:

About 1300 feet of linear work has been done in developing the ore body. This includes a main shaft, 150 feet deep, sunk in the ore, its bottom about 25 feet from the footwall; a 70 foot shaft in the ore body, near the hanging wall, opposite and 125 feet from the main shaft; and a 52 foot shaft, 175 feet from the main shaft and 125 feet along the hanging wall side from the 70 foot shaft. Drifts have been run from all of these.

From the bottom of the main shaft, a drift cutting to the footwall turns westerly, in ore, following the wall. From this two crosscuts have been carried into the ore. From the foot of the 70 foot shaft a drift has been run diagonally into the ore. The bottom of the 52 foot shaft lies 18 feet from the hanging wall, in ore. From it a drift has been run both ways, one diagonally to the hanging wall, the other into the body of the ore. (See geological sketch map).

ORE BODIES OF HELMET PEAK MINING AND MILLING COMPANY:

The ore body which the Company is developing underlies, so far as yet outlined, the westerly end of the Camden No. 2 claim. Here an elongate, roughly oval hill, long axis lying about 20' east of north, rising perhaps fifty feet above the wash along its westerly side, caps the ore body. The rock of which this hill is composed, has on first inspection the appearance, in texture and light color, of an altered rhyolite or quartz porphyry. It is probably a highly altered and silicified, brecciated andesite. This interpretation is borne out by the large angular masses of andesite encountered in the ore body beneath in mine development.

This capping portion contains considerable lead carbonate, sulphate and oxide; but below, within 20 to 25 feet, carries in the grayish mass, finely disseminated pyrite; then shortly in the angular spaces in the breccia, the sulphides of lead, zinc and iron appear prominently. The presence of considerable calcite and cypsum, and the fairly friable character of the gangue, would suggest, on first consideration, that this upper portion represents a partially leached zone. But while it is evident that some leaching has occurred, these lime minerals with some quartz druses may quite as well have been produced by ascending hot solutions, largely robbed of their high temperature ore minerals at a lower level in their ascent. The action of the residual mother liquor may have leached the lime from the feldspars of the andesite and deposited it partially as a carbonate and partially as a sulphate. The ores show little if any secondary alteration, and all ore sulphides and certainly have the appearance of being primary.

However, solutions of metals, produced for primary sulphide ores in the leaching zone, descending and reprecipitated in the presence of abundant pyrites, should again take the sulphide forms, but most of them would be in forms recognizable as secondary sulphides.

The brecciated zone carrying these ores lies between two well defined steeply inclined fault planes. The footwall on the southwesterly side is somewhat irregular and has an average dip of about 85°. The hanging wall dips at about 70°. They diverge in strike slightly towards the west. The width of the brecciated zone, as shown by the crosscut, from the bottom of the 150 foot shaft, is approximately 150 feet. The difference in dip of foot and hanging wall makes the ore body perceptibly widen downward. The ore is disseminated through this brecciated mass. The walls so far as present development shows, confined the ascending mineral solutions and defined the upper part of the ore body.

The ore in the drift along the footwall, on the 150 foot level, and in the crosscuts from it, shows a distinct tendency to zonal arrangements of the metals. For the first three to four feet out from the wall, the copper content of the ore is high. The zinc content then increases and then gradually the lead. This arrangement is also apparent in the drift, from the bottom of the Billings' shaft, to the hanging wall. An apparent exception to this arrangement of the metals is seen in copper-rich ore encountered in the last 15 feet of the crosscut, extending into the ore, from the bottom of this shaft, the copper values still showing strong in the breast of the crosscut.

Bunches of argentiferous-tetrahedrites are appearing on the 150 foot level, and it is confidently expected, from many observed occurrences of this ore, that it will increase in amount for the next 100 feet, before beginning to decrease.

The orebody, as depth is gained and water level is approached, may be expected to become of higher grade. But, as the ore is primary, no real significance can be attached to the position of the present water level and an influence upon ore values. It is believed that as primary ore the values then obtaining may be expected to hold to depths comparable to that of the large bodies of contact-metamorphic and metasomatic replacement ores of the district, and to increase in size downward. Centrally, the lead-silver values should be expected to persist in this ore body to depths as great at least as in the smaller ore shoot in the fault and fissure veins of the camp. Zinc should increase in amount before giving way to the copper-iron and iron sulphides.

The wash along the southeast flank of the hill, in which the shaft is sunk, appears to have developed on a line of structural weakness, in the rocks and other ore bodies, in zones of shattered and brecciated andesite should be sought by cross-cutting. When sufficient depth in the main workings has been reached with depth and consequent more intensive mineralization, such lateral ore bodies may become more or less confluent with the present ore body.

TABULATION OF ASSAYS

Showing

Width Cut.

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NOTE: The position of these assays is shown on the accompanying geologic sketch map, of the Helmet Peak Mining and Milling Company, (See Exhibit "A" (a) 1. Maps)

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| Number of Assay | % Cu. | % Pb. | % Zn. | Oz. Au. | Oz. Ag. | Width Cut | Gross Value |
|---|---|---|---|---|---|---|---|
| 1 | 1.05 | 0.2 | 1.0 | Trace | 0.5 | 6.0 Ft. | $ 5.09 |
| 2 | 0.20 | 1.0 | 1.4 | " | 0.5 | 21.0 " | 4.89 |
| 3 | 0.46 | 1.0 | 1.6 | " | 0.6 | 9.0 " | 5.79 |
| 4 | 0.40 | 1.0 | 3.2 | 0.01 | 1.6 | 9.0 " | 8.80 |
| 5 | 0.66 | 1.4 | 2.5 | 0.02 | 3.4 | 5.3 " | 10.55 |
| 6 | 0.65 | 1.4 | 4.0 | 0.01 | 1.8 | 6.0 " | 11.52 |
| 7 | 0.41 | 1.2 | 2.3 | 0.01 | 1.1 | 5.7 " | 7.55 |
| 8 | 4.05 | 0.3 | 1.0 | 0.01 | 2.1 | 14.5 " | 14.88 |
| 9 | 1.62 | 2.0 | 3.9 | 0.02 | 3.8 | 11.7 " | 16.61 |
| 10 | 0.05 | Tr. | 0.7 | 0.01 | 0.1 | 14.2 " | 1.43 |
| 11 | 0.61 | 0.4 | 1.5 | 0.01 | 1.2 | 4.7 " | 5.58 |
| 12 | 2.11 | 0.2 | 0.5 | Tr. | 0.8 | 5.0 " | 7.52 |
| 13 | 4.92 | 0.3 | 1.8 | 0.01 | 2.7 | 4.5 " | 18.87 |
| 14 | 2.75 | 0.2 | 1.8 | 0.01 | 2.0 | 12.0 " | 12.17 |
| 15 | 0.59 | 0.2 | 0.9 | 0.01 | 1.1 | 12.0 " | 4.22 |
| 16 | 0.25 | 0.5 | 2.0 | 0.01 | 1.2 | 12.0 " | 5.48 |
| 17 | 0.15 | 0.1 | 2.5 | Tr. | 0.5 | 12.0 " | 4.59 |
| 18 | 0.05 | 0.1 | 0.5 | 0.01 | 0.2 | 13.0 " | 1.39 |
| 19 | 0.11 | 0.3 | 1.8 | Tr. | 0.4 | 18.5 " | 3.74 |
| 20 | 0.32 | 0.9 | 4.0 | 0.01 | 0.8 | 26.0 " | 9.08 |

Assays by E.A. Jacobs,
Registered Assayer,
Tucson, Arizona

(Prices based on market quotations for Aug. 25th, 1926, E. & M.J.P. , Cu. 14.025, Pb. 8.90, Zn. 7.35, Ag. 62 5/8).

When mining has been carried, say, to the 400 foot level in the mine, it might be advisable to drift beneath the old Prosperity workings, cutting possible ores along the contact in the brecciated zone, between the andesite and the Mesozoic sedimentaries, and opening up the base oresof the Prosperity vein at depth.

Knowledge gained in the continued development of the Helmet Peak ore body may be expected to furnish information of service in looking for similar ore bodies elsewhere on the property.

The curving contact between the andesite and Mesozoic clastics is regarded as potential ore ground. A tunnel which has been started in the base of the "Red Hill", near the western end of the South Camden No. 2 claim, E. 50 ° S. from the Helmet Peak shaft, in a leached and brecciated zone in this contact, offers possibilities warranting continuing of work. Should expectations be realized, and ore found with depth here, it will probably lead to development of this contact back around toward the mine.

There are other good surgace indications of metalization on this large property, which should be given more study. I prophesy that eventually a careful geological study and mapping of the structures of these twelve claims will be made, and a careful exploration with the drill be carried out; for conditions indicate that the chances for valuable ore bodies with depth are exceedingly good in Olive Camp and on this property in an area which past developments have proved highly mineralized.

ORE RESERVES:

From the present workings Mr. Harper, Superintendent, estimates that there can be produced 105,000 tons of milling ore, with a gross value of $8.00 per ton. I have carefully gone over these estimates with him, both underground and on the map of the workings, and have taken check assays. The accompanying tabulation gives these assays, footage and values, and the numbers on the Geologic Sketch Map show their positions.

If the areas cut in taking assays Nos. 1 to 9 and 12 to 14, inclusive, and No. 20, representing the 50, 70 and 150 foot levels, are considered, it is believed safe to regard these as roughly defining a curved zone of milling ore, 325 feet long, approximately 40 feet wide and 100 feet deep, lying between the 50 and 100 foot levels. Based upon the average value per foot of openings available, this block containing 100,000 tons would have a gross value of $10.00 per ton. As stated, the samples are averaged according to the width of ore they represent, and constitute as accurate an average of this zone as the present development permits. Mr. Harper's estimate is therefore regarded as very conservative.

There are zones of muchhigher grade ore than this average: for example, assay No. 8, cut across 14.5 feet, runs $14.88; No. 9, across 11.7 feet, $16.61; and No. 13, across 4.5 feet, $18.87.

Many other assays have been taken, especially in the main crosscut, from the foot of the 150 foot shaft. These all show a general mineralization of this large brecciated zone, tho not of a grade high enough for milling. The present development, considering the size of the orebody, cannot be considered as more than indicating a part of the milling ore which will be found between the 50 and 150 foot levels.

DEVELOPMENT ADVISED:

The present drift in ore along the footwall, on the 150 foot level should be carried on in exploration of the ore in this direction. From this draft a crosscut should be driven to a point beneath the Billings (the 52 foot) shaft and a raise made, connecting through it with the surface.

The main shaft should be sunk as rapidly as possible to waterlevel, probably another 100 feet. The footwall, allowing for dip, should here be perhaps 10 to 12 feet from the bottom of the shaft. Cutting to the footwall, drifts should be run both ways. A crosscut also should be driven from the shaft to the hanging wall, and other crosscuts made on either side of it at 50 foot intervals, from the footwall across the ore body. Then, as soon as development permits, a raise should be driven from this level to the 150 foot level to connect with the Billings shaft.

The Billings shaft thus deepened will then insure good ventilation and drainage of the mine, and also can be used in raising waste, thereby relieving congestion at the main shaft, while handling ore.

This program carried out, besides greatly increasing ore output, should raise the grade of ore, facilitate selective mining and milling of the ore, and at the same time furnish ample water for milling.

The exploration work being done in the brecciated and leached zone at the contact between Mesozoics and andesites at the foot of the "Red Hill", on the westerly end of the South Camden No. 2 claim, should be continued, - a shaft sunk and a crosscut run.

For the development of several other ore possibilities observed on this property, plans later can be evolved.

Sufficient capital should be assured, before this program of immediate development is started, to insure its economical execution.

All development work should be pushed as fast as possible to place the mine on a large producing basis, in the shortest possible time. This will require experienced, competent mine operators, eager for results.

Much credit is due the present Superintendent, Mr. Harper, for the able mannerin which he has succeeded, under great economic difficulties, in opening up and showing the merits of the property.

Detailed geological maps should be made of the surface and of the present workings, and the map kept up to date as a guide to the most economical development of the property.

The development work should be followed closely by accurate and systematic assaying. All of the data thus secured should be placed on an assay map for future reference, to further insure the economical mining of the ores as developed and as an aid in the opening up of the better sections of the new ground.

Accurate Metallurgical tests should be run on average representative lots of the ore, by a reliable metallurgical engineer, to determine the best methods of treatment, before selecting equipment for the mill.

PRESENT EQUIPMENT:

The present mining equipment consists of a 50 h.p. Commercial Engine, an 8" x 10" Rand Duplex Compressor, a 6 h.p. Fairbanks - Morse Hoisting Engine, a Stoper, two jackhammers, two mounted rock drills, (all of Ingersoll-Rand make), and a Denver Rock Drill. The 150 foot, compartment and a half, Main Shaft is well timbered. A No. 3 Worthing Blake Knowles type pump is installed in this shaft at the 150 foot level, and it is equipped with air and water pipe lines. There are about three mine buckets. There is also a 1500 gallon water tank. A Ford, one-ton, truck, owned by the company, is used for hauling equipment and supplies from Tucson.

ADDITIONAL EQUIPMENT REQUIRED:

A larger hoist will be required in deepening the main shaft to waterlevel and to handle the ore and waste when development starts on the deeper level. The 6 h.p. hoist now in use should be installed at the Billings shaft. Then as soon as a raise has been driven connecting with this shaft it can be used in raising waste from the 150 foot level.

As soon as drifting and crosscutting on the new level has been started, a 50 ton pilot mill should be erected. Milling of the ore mined in this development should cover a considerable part of the expense of operation, and increasingly so as the work is extended and new faces are opened.

The ore reserve of 105,000 tons, estimated from present development, will supply a mill of 50 tons capacity, without allowing for lost time, over five years. So soon as sufficient water has been assured, the capacity of the mill can be increased by adding a second 50 ton unit.

WATER AND TIMBER:

From evidence derived from mining on adjoining properties, water adequate for milling may be expected from development of the mine at a depth not to exceed 300 feet.

Timber and fuel will have to be hauled either from Sahuarita station, 8 miles, or from Tucson, 21 miles.

CONCLUSIONS:

The present development work shows a property of great promise, justifying liberal financing for the purpose of further development.

While the present workings have shown the ore exposed to be a portion, merely the apex, of a large ore body widening downward, the work cannot be considered as in any direction reaching the limits of the ore zone or as showing how large the area underlain by ore may be.

Ample cheap labor, low haulage and shipping costs, and ore bodies permitting of cheap stoping methods in mining and other conditions as favorable as in other camps in the country, all make for reasonable mining and milling costs.

Under average market prices of metals and the comparatively recent improvements made in the milling of such complex ores, a good profit is assured from the large tonnage of the present and better grades of ore, which development may be confidently expected to open up at depth.

The large number and wide distribution of strong veins which have been mined superficially for their rich lead-silver ores in Olive Camp, proves it beyond question to be an exceptionally richly mineralized area. That those veins in the majority of cases lead down to much larger bodies of commercial base ores has been explained. The large bodies of contact-metamorphic and metasomatic replacement ores of copper and copper-zinc sulphides, mined in contiguous camps, point, with a high degree of probability, to other ore bodies of these metals, of the same order of magnitude, existing at depth in Olive Camp. The central position of the Helmet Peak Mining and Milling Company's property, in this area, the excellent showing development of their ore body has already made, and other strong surface indications, found on their large holdings, warrant confidence that their mining operations will meet with gratifying economic results.

Signed: C.J. SARLE
C.J. SARLE,
Mining Geologist,

Tucson, Arizona,
August 25th, 1926.

Application of
C.L. Orem

(Exhibit "A" (e) 2. Reports)

REPORT ON THE PROPERTY

of

THE HELMET PEAK MINING AND MILLING COMPANY

J. M. Libbey

The property of the Helmet Peak Mining & Milling Company is situated in the well known "Olive Camp" section of the Pima Mining District, Pima County, Arizona.

Situated a distance of about 21 miles in a Southwesterly direction from Tucson, the property is easily accessible by good roads.

A well maintained highway, leading from Tucson to Sahuarita, Amadoville, Nogales and other points on the Nogales Branch of the Southern Pacific Lines, passes within a mile distance of the Helmet Peak Company's property.

A good road connects with the highway affording available shipping points along the line as may be required.

The Twin Buttes Camp, two or three miles to the Eastward, has railroad connection with the Nogales Line at Sahuarita, providing a convenient outlet for the surrounding country.

PROPERTY HOLDINGS

The property held by the Helmet Peak Company, comprises a group of seventeen mining claims.

Seven of these claims are patented and the balance are being held under contiguous claim locations.

GENERAL STRUCTURE

The surface ground of the property lies mainly within the area of older Andesites, although in some parts, out-croppings of highly altered sedimentary rocks are in evidence.

Considerable folding and shearing action is observable and the older sedimentaries and basal aggregates show evidence of extensive intrusions by later igneous rocks.

The metal bearing areas are found in the brecciated sections of the Andesite aggregates where cross faulting and shearing has accompanied the intrusion of Granitic and Dioritic porphyries and the subsequent adjustment in place.

The mineralizing solutions have undoubtedly had their origin in the underlying intrusive mass and in their migrations therefrom have caused a partial replacement of the contiguous formation in such parts as were favorable for that actions.

ORE OCCURENCE

The mineralized area within which the most important development work has been done, lies within an extensive shear zone having a Southwesterly Northeasterly trend through the Camden No. 2 and Elsie Claims.

Secondary fissuring and cross-faulting accompanying the shearing and adjustment periods has resulted in extensive areas of brecciated rock mass which furnished favorable locations for replacement action and the deposition of ore bodies.

The boundariesof the shear zone, outlined by the surface and underground development, indicate a zone of mineralization approximately 200 feet in width, with a length traceable for several hundred feet on either side of the working shafts.

The ore measures outlined by the present stage of development lie within the shear zone, with considerable regularity and demonstrate that mineralizing solutions have traversed certain series of fissures closely related to the faulting and intrusive periods.

Replacement action in brecciated areas and favorable sections of the sheeted Andesite by solutions bearing Silver, Copper, Lead and Zinc has formed the ore bodies now exposed in the mines.

Extended development work has emphasized the relation of the cross fracturing and sheeting of the rock mass to the nature of the ore deposits.

Throughout the underground workings is shown the tendence for the better class of ore to be found in the sheeted blocks adjacent, to certain well defined shear planes or fissures.

This condition is analagous to the occurrence of replacement ore bodies in the sedimentary rocks.

## CHARACTER OF ORE

The ores developed at this time are essentially complex in nature; but are not refractory in character.

Tests have shown that the ore would yield readily to modern metallurgical treatment.

The valuable minerals Galena, Chalcopyrite, Tetrahedrite and Sphalerite occur throughout the ore measures in the form of disseminated minerals, nodules and segregated masses.

A strong tendency is shown for like minerals to group to-gether, that is; to segregate into nodules and lenses of separate minerals.

In some areas the Copper-silver minerals will predominate in value and in others the Lead-Silver or Zinc-Silver will predominate.

It is the accepted theory, that; in this section of Arizona the copper minerals will finally replace the Lead Zinc minerals at depths approaching the origin of mineralization and that the resultant primary ores will be essentially copper bearing.

The more recent development on the lower levels of this mine substantiate this theory as the proportion of copper mineral in the unaltered primary ore is gradually increasing asthe work approaches the underlying Granitic rocks to the Southward and below.

As this basal structure is approached at depth the degree of mineralization and proportionate value of the minerals should be increased.

Neighboring mines of the Twin Buttes area on the East and the Mineral Hill area on the North have at times produced large quantities of high grade copper ore.

Their ralative position is closer to the basal granitic rocks than the workings of the Helmet Peak Company and it is therefore safe to predict that the latter company will find mineralizing conditions at a lower geological horizon.

## DEVELOPMENT

The principal development work has been done within the ore zone upon the Camden No. 2 Claim and the Elsie Claim.

Work has been done at other points; but that is not covered in detail at this time.

The Billings Shaft, about fifty feet in depth has been previously worked on a moderate scale and the portion now accessible shows about one hundred feet of lateral development work.

The Zinc Shaft, about seventy feet in depth has been sunk near the westerly edge of the ore zone.

Shaft No. 1 on the Camden No. 2 Claim, is 600 feet in depth, well timbered the full length, equipped with station platforms, ladders and all accessories necessary for development work or mining.

Shart No. 2 on the Elsie Claim about five hundred feet Southwesterly from Shaft No. 1, is 400 feet in depth, well timbered all the way and fully equipped for work.

Tributary to Shafts No. 1 and No. 2 about 3500 feet of lateral has been done in the ore zone.

## ORE MEASURES

During the course of development a number of assay samples have been taken from time to time in order to determine the tenure of metal content and value of ores encountered.

Sections which showed distinct mineralization and appeared to be ore; were mainly sampled.

Approximately fifty percent of the lateral development footage shows distinct mineralization and has been sampled as ore.

Owing to the fact that the various ore areas, outlined on the levels have not been connected up directly with upraises or zinzes, the actual thickness of the ore areas which would govern the actual amou t of ore contained in the blocks, is more or less problematical.

In the estimate of tonnages the apparent thickness of the mineralized sheeted rock mass as disclosed by the sample cuts is a factor that can be effectively used for the third dimension.

## 50' LEVEL - BILLINGS SHAFT & 150' LEVEL

The available ore in the Billings Shaft area and sections of the 150' Level of Shaft No. 1 has been previously estimated at 100,000 tons.

An average of assays shown on this section, -

| Gold | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|
| .01 oz | 1.2 oz | .25% | 1.9% | 3.8% |

The gross value of the metallics contained is $8.90 per ton.

## 250' LEVEL SHAFT NO. 1 AND SHAFT NO. 2

The development work on the 250' Level has opened up an extensive mineralized area between Shaft No. 1 and Shaft No. 2.

The estimated amount of ore in this area as outlined by the openings and assay sampling is approximately 100,000 tons.

An average of the metallic content of the area as shown is, -

| Gold | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|
| .01 oz. | 1.5 oz | 0.27% | 1.3% | 3.0% |

The value of the metallics by this average is $7.37 per ton.

## 250' LEVEL TO 300' LEVEL

Later development work upon the 300' Level and 400' Level of Shaft No. 2 has opened up an interesting section.

The general formation exposed on these levels is more uniform in texture, shows less alteration by circulating ground waters and the sheeting is more pronounced.

The minerals in the ore on these levels show more of a tendency to segragate into bunches and bands of higher grade ore.

The block of ground lying between the 250' Level and the 300' Level, tributary to shaft No. 2, indicates an available tonnage of approximately 15,000 tons.

The average of assays taken along the exposures of this block shows a metallic content of, -

| Gold | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|
| .02 oz. | 1.3 oz. | .72% | 1.5% | 3.5% |

The gross value of these metallics is $9.78 per ton.

## 300' LEVEL TO 400' LEVEL SHAFT NO. 2

Between the 300' Level and 400' Level at Shaft No. 2 the present stage of development outlines a block of ore which would contain approximately 5,000 tons.

An average of the assays taken on this block shows metallics, -

| Gold | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|
| .02 oz. | .53 oz. | 0.82% | 0.9% | 6.4% |

The grossvalue of the metallics in this average is $12.53.

## 400' LEVEL SHAFT NO. 1

On the 400' Level of Shaft No. 1 a partially developed ore body is outlined; which from the area and exposures sampled is estimated to contain approximately 5,000 tons.

The average metallic content of the samples taken is, -

| Gold | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|
| .01 oz. | .9 oz | .64% | 0.8% | 3.1% |

The gross value of metallics contained is $7.67 per ton.

## SUMMARY OF ORE MEASURES

### Assays

| Location | Gold oz. | Silver oz. | Copper %- | Lead % | Zinc % |
|---|---|---|---|---|---|
| 50' & 150' | .01 | 1.2 | 1.07 | .7 | 1.9 |
| 250' North | .01 | 1.2 | .25 | 1.9 | 3.8 |
| 250' 1 & 2 | .01 | 1.5 | .27 | 1.3 | 3.0 |
| 250' to 300' | .02 | 1.3 | .72 | 1.5 | 3.5 |
| 300' to 400' | .02 | .5 | .82 | .9 | 6.4 |
| 400' Shaft No. 2 | .01 | .9 | .63 | .8 | 3.1 |
| General Average | .01 | 1.3 | .50 | 1.2 | 3.3 |

## Tonnage

| Location | Estimated Tons | Gross per ton | Gross value |
|---|---|---|---|
| 50' & 150' | 100,000 | $7.60 | $760,000.00 |
| 250' North | 35,000 | 8.90 | 311,500.00 |
| 250' 1 & 2 Shafts | 100,000 | 7.37 | 737,000.00 |
| 250' to 300' No. 2 | 15,000 | 9.78 | 146,700.00 |
| 300' to 400' No.2 | 5,000 | 12.53 | 62,650.00 |
| 400' Shaft No. 1 | 5,000 | 7.67 | 38,350.00 |
| | 260,000 | | 2,056,200.00 |

## 600' LEVEL SHAFT NO. 1

The section of the shaft between the 400' Level and the 600' Level being temporarily impassable, conditions there can not be definitely described at the time.

From reports of daily work it is evident that the rock structure on this level becomes more regular and comformable and the action of circulating water not so evident.

Mineralization similar to the levels above was found in some sections and undoubtedly a continuance of development, at this level, would be of vital importance and furnish valuable data regarding the possible change in the mineralizing action at increased depth.

## SELECTIVE MINING

Taken in the aggregate, the large tonnage represented in the ore measures is of a grade which anticipates the recovery of the metallic values by metallurgical treatment.

Tests have been made which show the ores to be ameneable to concentration and the product marketed at a margin of profit.

In the vein areas certain sections show sampling values sufficient to suggest the possibility of developing and mining these sections separately and incidentally blocking ou the true ore measures.

Along this line of development an upraise could be driven from the 400' Level, west of Shaft No. 2, at the point from which samples No. 404 and 405 were cut, to follow the inclination of the sheeted ore deposit toward the 300' Level above.

In a similar manner an upraise could be run from the 300' Level to the 250' Level above to good advantage.

Upraises following the apparent slope of the ore deposits, from one level to another, would add valuavle data concerning the possible continuity of the ore bodies indicated at the various levels.

In the area tributary to the Billings Shaft, good assay values are shown and it is reported that commercial ore was being uncovered in the lower workings at an earlier time.

It seems that certain sections could be mined selectively at a margin of profit, either through the shaft itself or by connecting up with the underground workings of Shaft No. 1.

A cross-cut tunnel driven from the 150' Level a distance of about 125 feet would cut the general formation beneath the Billings Shaft and prove up this area effectively.

## GENERAL

It is the consensus of opinion, that; the future of this property, in the light of a potential shipping mine, depends on the degree of concentration of the metal content either through a construction of the boundaries or a more general segregation of the mass value at an increased depth.

From the results obtained from the estensive development work that has been done upon the property to date, it is evident that the factor of increased depth of exploration is of primary importance.

It is assumed in reason, that mineralization will become more intensified as the source thereof is approached and that fissures and sheeted rock masses will become more generally ore-bearing and show a relatively increased concentration of the contained minerals.

The origin of the mineralization undoubtedly lies within a zone between the ore area now manifest and the granitic sill which underlies the series, and the mineralizing fissures may be simply offshoots from much larger ore bodies below.

To effectively prove the truth or fallacy of the supposition a vertical section of the rock series to the Granite sill beneath should be obtained.

This could be arrived at most economically and effectively by drilling the ground.

The logical action would be to send down a drill hole, as a pilot, from some point of vantage and the subsequent development be regulated according to the results obtained from the drilling.

Judging from the large area and tonnage of milling ore now exposed in the mines, it is a logical belief that ores of more concentrated mineralization will surely be found at some point in the ore zone.

## EQUIPMENT & MACHINERY

The mines of the Helmet Peak Company are well equipped on the surgace and underground to carry on mining and development operations.

Shaft No. 1 Surface equipment consists of a 25 H.P. Fairbanks Morse Gasoline Hoist, a 50 H.P. Commercial Gasoline Engine with duplex belt driven air compressor, blacksmith shop and necessary tools.

The machinery is well housed and an office building and small cook shack is provided.

Shaft No. 2, Surface equipment consists of a 25 H.P. Fairbanks Morse gasoline hoist and a Chicago Pneumatic hot head air compressor.

Both shafts have good headframes dumping chutes and surface equipment for handling ore and waste and pumps are installed in Shaft No. 1 in favorable locations to handle all water encountered in both shafts.

An adequate equipment is maintained for drilling in either or both shafts or tributary lateral work.

All arrangements are made so that development work or ore extraction could be carried on effectively and economically on a scale commensurate with the size of the plant and equipment.

Respectfully submitted

(Signed) J.M. Libbey
Registered Mining Eng'r.

Tucson, Arizona
September 1st, 1927

Application of
C.L. Orem

(Exhibit "A" (e) 3. Reports)

Helmet Peak Mining & Milling Co.
Tucson, Arizona.

Gentlemen:

Since your mine was sampled and reported upon, as of September 1st, 1927, a considerable amount of extended development work has been done upon the 250 Ft. Level.

Approximately 500 feet of additional drifting and crosscutting has been done in the Westerly section of that level and an estensive area of mineralized ground has been encountered therein; which materially increases the available tonnage of commercial ore in the mine.

General conditions, in evidence, are favorable for the continuance of the metal values through the further extension of the lateral and vertical dimensions.

Assured Ore

The mineralized area in the Westerly section of the 250 Ft. Level, as outlined by present development, and which can be classified as Commercial Ore, has a vein area of approximately 5,250 square feet.

The ore-bearing rocks, lying in a sheeted or bedded form, have been exposed, by the work, to a thickness of 60 feet; supplying the factor of known vertical extent.

The resultant content of the block, indicated by these factors is seen to be approximately 26,000 tons.

The mineralization, of commercial value, occurs in the form of Sulphides of Copper, Lead and Zinc, with additional valuesin Silver, and Gold.

The character of the ore bearing material and the mineralization is similar to the ore area in the northerly section of this level.

Samples were cut from the ore exposures within the westerly block and assayed with the following results, -

Average of samples No. 25 to 31 Incl, Length of cut-10 ft., Interval between cuts - 4 feet, from westerly end of block, - Gold .15 oz. Silver 2,10 oz. Copper .5%, Lead 1,69%, Zinc 3.83%.

At the present price of metals, the Gross Value would be $9.55 per ton.

Average of samples No. 32 and 37 Incl. Length of cut 8 to 12 ft. Interval between cuts - 4 ft. from Northerly end of block, - Gold .15 oz. Silver 1.12 oz. Copper .05%, Lead .2%, Zinc 3.05%.

At the present price of metals the Gross Value would be $5.01 per ton.

The average value of the block outlined would be $7.45 per ton Gross.

From the estimated tonnage of 26,000 a Gross Value of the Block is calculated at approximately $194,700.

To summarize the amount of available ore in the mine, assured at this time, we have in, -

| | |
|---|---|
| The 250' Level North - 35,000 tons @ $8.53 gross | $298,550 |
| The 250' Level West - 26,000 tons @ $7.45 gross | 194,700 |
| The Billings Shaft - 3,500 tons @ $8.13 gross | 28,450 |
| And a gross total of | 521,700 |

The above estimates are based on the present low market price of metals.

As previously stated, - by inspection, the ores should yield readily to treatment and adequate laboratory tests would indicate the amount of margin of profit to be expected from mining and milling of the ore.

POSSIBLE ORE

In the new area opened up by the later development work, the proportion of the commercial ore bears a ratio of 30% to the whole area.

Assuming that the ore zone extends to the surgace, a supposition amply justified by visible conditions, then it is assumed that the commercial ore ratio will maintain throughout the ore zone extended.

With these factors as a basis, the calculated amount of commercial ore to be anticipated within the estension of the westerly block will be approximately 97,000 tons.

To summarize the Possible Commercial ore in the mine, to date, from the 250' Level to the surface, we have in, -

| | |
|---|---|
| The 250' Level North - 110,000 tons @ $8.53 gross | $938,300 |
| The 250' Level West - 97,000 tons : $7.45 gross | 722,650 |
| The Billings Shaft - 3,500 tons @ $8.13 gross | 25,450 |
| And a Gross Total of | 1,786.400 |

In round numbers the anticipated gross value of commercial ore in the mine from the 250' Level to the surface as outlined by present development, may be set at between $1,750,000 and $2,000,000.

Extended development at greater depth willnaturally increase the actual amount of available ore and will also greatly augment the theoretical amount of possible ore to be anticipated.

In General

The most Westerly section beint developed at the time of the sampling, showed a strong tendency for the minerals to segregate into bands, or veins, and the samples taken from the ore exposures showed an unusual degree of enrichment in spots.

It will not be surprising to find the ore occurring in veins and deposits of workable size and of a value sufficient to permit of direct shipment to the smelter.

It is a noticeable fact that considerable leaching action has taken place along the shear planes and jointings of the rock and this action has undoubtedly impoverished the ore deposits on this horizon, to a considerable extent.

Development at greater depth will, no doubt, show that the ore zone will be more uniformly mineralized and that the ore deposits will be more dependable in form and degree of mineralization.

The various areas opened up by the development work done upon the 250' Level of the mine, indicate very plainly that the ore deposits occur within a well defined mineralized zone, having a linear extent of over five hundred feet and which will extend downward to a depth well worthy of consideration.

CONCLUSION.

The results obtained from this later work have surely justified the expenditure and also assure the ultimate success of more extended development at greater depth and lateral extension from all levels.

Respectfully Submitted
(Sgd) J.M. Libbey
Registered Professional Engineer No. 235

Tucson, Arizona
October 25th, 1927

Application of
C.L. Orem

(Exhibit "A" (e) 4. Reports)

UNIVERSITY OF ARIZONA

TUCSON

COLLEGE OF MINES AND ENGINEERING

DEPARTMENT OF GEOLOGY AND MINERALOGY

Dr. Raymond J. Leonard

November 21st, 1929.

Mr. Albert L. Fritz, Civil Engineer,
Tucson, Arizona

Dear Sir:

In accordance with your request, I have presented an opinion on certain phases of the geology of the Olive Camp area of the Pima Mining District, Pima County, Arizona.

It is the intention to discuss here not the detailed geology of individual properties, but rather the larger geological features of the area and district generally, which are of fundamental importance in the matter of ore occurrence.

The discussion and opinion are based on brief personal observations made in the field, aided by a study of reports prepared by mining engineers and geologists for mining companies, by reports and maps prepared in the course of advanced degree studies by graduate students in Geology at the University of Arizona, and by the literature and government maps of the area and region.

The rocks of the immediate area comprise Pre-Cambrian (?) granite, Mesozoic (Cretaceous) arkosic sedimentary beds, intrusive granitic rocks, and volcanic rocks which are chiefly andesite. The volcanics are either late Cretaceous or early Tertiary in age. Just outside of the area, particularly to the northward, occur thick formations of Paleozoic limestone and quartzite.

The major structure of the area can not be definitely determined by available surface and near-surface geology. It is clear, however, that a great amount of fracturing, accompanied no doubt b at least some faulting has occurred throughout the area.

It is possible that folding is the most extensive type of minor deformation within the area and the cause of fracturing and faulting. Or it may be that the fractures were generated by stresses resulting from the uneven settling of a large crustal block following the transfer of a large volume of volcanic material from depth-seated to superficial positions. Or perhaps vertical upthrust of intruding magmas may have caused fracturing and faulting.

Mineralization apparently has been widespread. The rocks along fractures observed, whether on the surface or underground, have been more or less extensively altered. Ore deposition, in varying degrees, seems to have occurred wherever a master fracture was available to act as a channel way for ore-bearing solutions. The ore deposits are, in the main, of the fissure-filled type, localized along major fractures, at the intersection of fractures, and in brecciated zones.

It is fairly certain that intrusive granitic rocks underlie at variable depth the entire district of which Olive Camp area forms a part. These intrusive rocks were probably the source of all primary mineralization in the district. The ore deposits that have been developed in the past in the Olive Camp area have been chiefly small high-grade silver-lead bodies, formed mainly by fissure-filling, but perhaps to some extent by wall-rock replacement, in the near-surface Cretaceous sedimentary and volcanic formations. In areas to the north and south important copper and zinc ore developments have been made and from which considerable tonnages of ore have been mined in the past. These deposits are principally replacement bodies in

Paleozoic limestone. It appears, therefore, that replacement bodies in limestone form the important type of ore deposits for the district.

The questions of major structure, and character and thickness of formations forming that structure, thus appear to be the essential questions relative to the probability of extensive ore occurrences at depth in the Olive Camp area.

If the ore-bearing limestone formations of the Mineral Hill-San Xavier area to the north and of the Twin Buttes area to the south are continuous or occur under Olive Camp area, then the probability of occurrence of important commercial ore deposits at depth in the latter area is greatly increased.

The problem would then become one of probably depth to the favorable horizon and the determining of dominant or master fracture zones.

Mr. John Carter Anderson, in his report on the Swastika property, page 4, sets forth certain evidence and a statement of belief that limestone does occur below the superficial formations of the area. That there is more than a possibility that these Paleozoic limestone formations do exist below the surface formations in the Olive Camp is not an idle statement nor one made for convenience.

Even brief field study of the stratigraphy and structures in this area and that immediately to the north, in the San Xavier area, justify the statement that this stratigraphic condition might exist. But more convincing still are similar indications in the results of recent detailed geologic mapping in this area to the immediate north.

The Olive Camp area appears to be depressed geologic structure - either a down-warped (synclinal) or a down-faulted area. The Paleozoic limestone formations of the San Xavier area distinctly dip to the south (20° to 25°), apparently plunging under the Olive Camp area. The contact between Paleozoic limestone and Cretaceous arkosic beds occurs along the southern border of the San Xavier area. The origin of this contact is not clearly indicated; it may be normal formational contact, produced by a break or time interval in the deposition of sediments which formed the beds; or it may be a fault contact, produced by a major rupture. If this contact is an unconformity, as the first case suggests, the limestones extend to the southward uninterruptedly below the Olive Camp area. In the event that it is a fault contact, the limestones with their overlying sedimentary beds and volcanic formations, in the Olive Camp block have been faulted downward.

There is some basis, of course, for expecting that additional underground development may disclose other small high-grade silver-lead ore shoots, such as were formerly worked in the area, or perhaps larger veins and breccia bodies of ore of commercial grade and size. But it is more logical to expect that, if commercially important ore deposits are to be developed in the area, they will occur as metasomatic replacement and contact deposits in limestone.

The probelem of developing possible large ore bodies in the Olive Camp area thus resolves itself, in this opinion, to first ascertaining the presence or of underlying limestone beds. Preferably, such development should be carried on by drilling operations. And in so doing, if the location of drill holes is carefully planned, it is probable that relatively near-surface vein or breccia type deposits of value may be encountered while the deeper prospecting is in progress.

The depth at which the limestone, if present, may occur is highly problematical; if in a synclinal structure, it may lie comparatively shallow, if block-faulted, it may lie much deeper-2,000 feet or more.

Yours very truly,
(Signature)
Raymond J. Leonard.