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File
NEW YORK CITY
57 WILLIAM ST.

SALT LAKE CITY, UTAH
815 NEWHOUSE BLDG.

UNITED STATES SMELTING REFINING & MINING EXPLORATION COMPANY

CABLE ADDRESS, "SMELTINGCO"

ONE STATE STREET

BOSTON, MASS.

PLEASE ADDRESS REPLY TO
P. O. BOX 1785
SALT LAKE CITY, UTAH

Gold Road Mine
Mr. G. M. Colvocoresses,
1108 Luhr's Tower,
Phoenix, Arizona.

Dear Mr. Colvo:

I am much interested to learn, from your letter of the 11th inst., that, besides the Ahumada company who are now "at bat", you have the Mexican Corporation "on deck", in case Ahumada "fans out". The Mexican Corporation are very substantial people, and have had abundant experience with quartz veins at Pachuca, so that they should be well qualified to pass on Gold Roads.

In regard to the estimate of \$25,000 to \$35,000 for the proposed development work at Gold Roads, this covers all the objectives. For the two objectives in the central portion of the mine, to which you refer, and which can be reached by drifting easterly from the east face of the 300 ft. level of the No. 1 shaft, \$15,000 should suffice, - including the cost of repairing the shaft, installing equipment, overhead and actual work. I estimate the direct cost of drifting at \$5.00 per ft., since it should be possible to contract labor and explosives at \$4.00 per ft, while the cost of rail and pipe should not exceed \$1.00 per ft. The vein, although hard, is brittle, and should break between three and four feet per round.

However, the objective to the west, within the ground of the West Gold Road Mining Co., should be explored simultaneously, since the same equipment and overhead will apply, so that the additional cost of this work should not exceed \$5,000. As a matter of fact, it was stipulated in our agreement with that company, in return for the option, that we would require any leaser on the Gold Road Mine to undertake a certain minimum, covered by the work proposed, in the West Gold Road mine.

The last objective, at the eastern end of the Line Road tunnel, is rather a separate operation, and can probably be deferred, if desired. This is estimated to require \$5,000, also.

It is my opinion that, if the matter is approached carefully and efficiently, the work can be done for less than \$25,000; but I have made the estimate from \$25,000 to \$35,000 to cover contingencies.

While we have no watchman or other official representative at Oatman or the mine, there are many persons in and about the district, who would be able to guide the engineers of the Ahumada

company through the accessible workings of the mine. The former foreman of the mine, Joe Onetto, lives at the camp, but has grown enormously stout, and may not be in good physical shape for the considerable ladder-climbing that would be necessary. An Italian, - Adolf ? - who formerly worked at the mine, and now lives at the camp, could probably guide anybody through the workings, as he accompanied me on my trips. A man named Dunton, who has a service station and garage at the mine, and who represents the purchaser of the mine buildings and equipment, has the keys to the Line Road tunnel and the various buildings.

I have some geological and sample maps of the levels, but they are incomplete and the only ones I have. Hence, while available if desired, I would rather not send them, except in the event that the general situation impresses the prospective lessee favorably, and corroborative evidence of such statements as I have made as to structure and values are desired.

Very sincerely yours,

R. T. Walker

July 13, 1932.

Mr. H. E. Caffrey,
Post Office Box 668,
Williams, Arizona.

Dear Mr. Caffrey: SUBJECT: GOLD ROAD MINE.

under I am enclosing herewith a long report on the Gold Road Mine including maps and photographs just as the same was sent to me by R. T. Walker, chief geologist Salt Lake City Division of the United States Smelting Refining & Mining Exploration Company, and I am also enclosing a copy of the option which has been given to me by their general manager, Mr. D. D. Muir, and which holds until August 8th with the understanding that it is subject to extension. This option I will assign to the Ahumada Company if they so desire after your engineers have made a preliminary examination of the property and on condition that you will pay to me approximately \$250.00 for time and expenses involved and also agree to allot to me 5% of the net profits which your company may earn from the operation of the Gold Road Mine both while you may operate your lease and also after having purchased the property.

The terms of this option are not intended to be iron clad and may be altered to some extent in accordance with your wishes and I feel that the officers of the U. S. Company would be disposed to make any reasonable changes in detail that might be desired.

As I understand the history of the Gold Road, it was purchased by the U. S. Company in 1911 on the assumption the it would prove to be the basis of a large and profitable mining operation, but it was not efficiently managed by ~~that~~ company and their operations (except in the matter of working costs) did not compare favorably with similar operations of other mines in this district.

Although the U. S. Company earned a profit of nearly \$500,000. they seem to have been disappointed with the results and having failed entirely to find some of the ore bodies which were were expected to exist and which they apparently had passed by in a careless manner. They eventually closed down the property in the belief that only a small tonnage of ore remained, and this mostly of a ~~low~~ low grade.

Recent developments in the Oatman district, especially in the Tom Reed Mine indicated new possibilities in the Gold

#2--HEC

Road and a careful examination of the property made by Walker and his assistants led Walker to reach an entirely different conclusion and he recommended that the U. S. Company should reopen the mine with a view to exploring for substantial portions of the main-vein which seemed to have been displaced by faulting in the upper levels. Walker believed, however, that the production of the mine was not likely to exceed 250 tons of ore per day, and the directors of his company concluded that the scale of their operations would be too small to greatly interest their company and preferred to offer this property for sale or lease to other responsible people.

Aside from the possibility of discovering the main-vein in the faulted zone Walker believes there is an additional chance of proving up other ore bodies both by extending the underground work laterally in the upper levels of the mine and by continuing to develop at greater depth the present workings. He believes it quite probable that the mine may eventually develop together with the other property which is included in the option, a total of one million tons of \$10.00 ore above the present workings and also a substantial tonnage of \$5.00 or \$6.00 ore which might be operated with a small margin of profit making the total probable profits in the order of \$5,000,000. or more, and on this basis the purchase price seems reasonable since it is in fact to be paid in the form of royalties and the out of pocket of the new operation will be repaid from the first earnings of the mine.

Although Walker ^{said} that \$25,000. or more should be spent in exploration and development, I understand that he believes that only \$10,000. to \$15,000. will be required to determine the correctness of his assumption as to the location of the faulted portion of the main-vein and, therefore, the gamble would seem to be limited to this amount of money since, if the vein was not found the lease could then be abandoned. Otherwise the additional expenditure for both the development and the milling and mining equipment would only be made after there was a pretty definite assurance that the same would be repaid from operating profits and plenty of money is always available to equip for operation a substantial body of gold ore, the value of which, unlike other metals, is not dependent on market fluctuations.

Personally I am quite familiar with the Oatman district which I have visited many times and I have been over the surface of the Gold Road and can confirm much of what Walker says concerning the geology and ore occurrences. I have never been underground in the Gold Road, but I have known Walker and his work for the past nineteen years, and have much confidence in his ability and judgment. I believe that your engineers after examination will agree in the main with Mr. Walker's conclusion and think highly of the possibilities of this property.

#3--HEC

The Gold Road appears to fit ^{your} the requirements as I understand them better than any property which has recently come to my attention in Arizona. There are doubtless other equally as good opportunities particularly in California and elsewhere, but their investigation generally requires a larger and more expensive exploration campaign such as I have been carrying on for California clients for some years past and which has recently resulted in our optioning the property in Sierra County which I mentioned to you in conversation and the real value of which is still somewhat uncertain.

In the case of the Gold Road much of the development work has already been done and the remaining gamble is comparatively small with a chance of a big reward if it proves successful. The terms appear to be extremely reasonable and all of the of the development and operating could be handled most efficiently by your present staff whom I understand you are anxious to keep busy in the future.

Should you decide to take over the development and operation of this property I understand that there are substantial bodies of lower grade ore easily accessible which could be mined and milled very speedily and with a small margin of profit as soon as new mining and milling equipment had been installed and you could probably obtain much of this equipment from Ahumada or from Ajo. This would probably bring in a certain income while you were developing the higher grade ore bodies and perhaps the same for stoping.

In conclusion I hope you will be able to give this matter very prompt attention. If for any reason you should decide that this is not likely to meet your requirements will you please advise me promptly and return the enclosed report of which I have only the one copy. Otherwise I trust you will be able to have the preliminary examination made by Mr. Brooks and his assistants in the very near future, and I sincerely hope that this will prove so satisfactory as to encourage you to continue your work and exercise the option which I shall then be prepared to assign to you as mentioned above. I sincerely hope that this operation will prove profitable for all parties concerned.

Best personal regards.

Yours very truly,

P. S.--Please continue to address any routine letters to me at this office, but if you wish any special information regarding the mine write direct to R. T. Walker, Post Office Box 1785, Salt Lake City, Utah, Walker knows that I am presenting the Gold Road to your company and will co-operate with you in every way possible.

OATMAN DISTRICT

Gold Roads Mine

Sold Roads file

At Oatman, Arizona---conference with R. T. Walker 3/7 & 3/8 '32.

Owned by U. S. Mining and Smelting Co. for whom Walker recently make a thorough examination and recommended that his Co. should reopen and operate the property. The U. S. Co. however decided that this was likely to prove too small an operation and authorized Walker to try to sell it to other parties and the United Eastern Co. are now giving the matter consideration but if they fail to act Walker may take it up with me and it might interest the Mexican Corp. or Main and his friends in California.

Prospective purchaser may obtain a ten year lease and from first proceeds repay themselves for all expenditure after which the profits to be split 50-50 and after \$200,000 profit had been earned they would be given a deed to 57% interest in the property.

Walker's investigation leads him to believe that aside from the chance of finding new ore bodies with depth (below 800' level which is present bottom of mine) there are some good shoots of ore to be found between the faults in the upper workings which might contain 100,000 to 300,000 tons.

Average grade of ore produced was \$9.50 in gold and costs were as low as \$6.00 including cyanide.

Entire new plant must be provided and lower levels unwatered and much caved ground reopened. So would probably cost \$25,000 to determine if Walker's theories are correct and upward of \$100,000 to prepare and equip the mine for operations as basis of 100 tons per day, which might later be doubled.

(do not think terms are very liberal and grade of ore does not promise any large margin of profit, but worth following up if opportunity is offered.)

Gold Roads, 7/16. '35-

CATMAN DISTRICT
Gold Roads Mine

R. J. Kalkreuth says that they have now blocked
out in the old & new workings 275,000 tons of $\frac{1}{2}$ oz.

ore & that their working costs should not exceed
\$3.00 per ton including 10% losses of value in milling.

They also have 700,000 tons of mill tails averaging
0.06 oz. gold per ton and about 100,000 tons carrying 0.12

oz. per ton. Their tailings they plan to sluice to a
new mill where they will be ground thru 200 mesh &

cyandized. They also plan to reopen the mine & mill
the ore.

G O L D R O A D S

Excerpts of letter dated July 2nd, 1932

To G. M. Colvocoresses

From Mr. R. T. Walker
United States Smelting Refining & Mining Exploration Co.
Boston, Mass.

Mailing address:
P.O. Box 1785
Salt Lake City, Utah.

As the first question, which will arise in the mind of any prospective purchaser, is why the United States S. R. & M. Company, with its abundant resources, does not itself desire to operate the property, I wish to set forth in some detail the circumstances which attended the operation of the property by our company.

When the property was purchased in 1911, by the U.S., it was assumed to be a simple fissure vein, without structural complexities, which would necessitate the attention of a geologist. It was supposed that the most important requisite was to achieve low costs, and for this purpose a mechanical engineer, who was unacquainted with mining, but who had earned a good record in the previous employ of the company in low cost mill operation, was appointed to the superintendency of the property. In the development of the mine, faults were encountered, which had not been expected and the effect of which was incorrectly interpreted, resulting in important segments of the vein being lost, with consequent decrease in the reserves of ore which had been anticipated. As a result of this, it proved difficult to supply the mill with sufficient ore to keep it running at full capacity; and in the effort to do this and prevent costs from rising, a considerable tonnage of very low grade ore was mined, which not only yielded no profit, but actually incurred a loss. Carelessness in handling some of the large stopes also resulted in dilution of the ore with waste which sloughed from the walls. From information that I have obtained regarding the general mining practice, from competent former employees, I have no doubt that proper mining methods would have in-

creased the profit to somewhere between one and two million dollars, instead of about half a million dollars as was actually earned.

No geological examination was ever made of the property by any member of the geological staff of this company prior to the suspension of operations, and with the eventual termination of operations there the mine was supposed to be exhausted, save for a few blocks of ore in the sills of certain levels below the oreshoots which were not supposed to total over 100,000 tons. The results of the operation of the mine were very disappointing to our company, who, when it was purchased, had confidently looked forward to profits of several million dollars; consequently the property has always been in bad repute with our eastern officials, since its final closing.

Until two years ago the property was managed through our San Francisco office, and the officials of the Salt Lake office knew nothing about the details of the mine. Two years ago, when the San Francisco office was discontinued, and all the properties which it managed were transferred to the jurisdiction of the Salt Lake office, the Gold Road mine came within the scope of our activities, and I was instructed to examine such workings of the property as were accessible. I fully expected to perform only the role of coroner to the property, but, to my surprise, I found in the map files information showing that the top of one of the principal orebodies had been cut off by faulting and had never been recovered, while my examination of the workings showed that other segments of the vein had been missed, and a study of the structural relations of the orebodies to the veins revealed excellent opportunities for the existence of undiscovered orebodies.

I reported this situation, of course, to my official superiors, but it was decided not to undertake any work at the property at the present time; and while I was not informed as to the reason for such action, I have occasion to believe that the company desires to use its resources first for acquiring silver-lead-zinc properties, which are tributary to the Midvale smelter, and hence which will be serviceable in maintaining our investments

in this section. They have decided, therefore, to lease the property to responsible parties, who will perform certain stipulated development work. If suitable leasers are not obtainable, it is their intention, as I have recently been informed, to eventually operate the property themselves.

Mr. Roddewig's option having expired, no other person at the present time is authorized to handle the property. The fact that it is generally known to be open to lease, has, I presume, inspired other parties to wrongfully represent themselves as authorized to submit it.

G O L D R O A D S

Note by G. M. Colvocoresses,

October, 1937.

Referring to the attached report by Walker and copy of
to
portion of his letter/me of July, 1932, it should be said that at
that time the U.S. Co. were anxious to sell or lease the mine, but
the terms on which it was offered did not seem attractive, and
quite naturally no other party was anxious to take over a mine which
the U. S. Company owned but would not operate.

Subsequently and after the price of gold had advanced
the U. S. Company changed their policy and have since reopened the
mine and equipped it with an excellent mill. By last accounts
their operations were quite successful and I do not think this mine
is now on the market but the information may be of general interest
in connection with the Oatman District.

GEOLOGY AND ECONOMICS OF THE GOLD ROAD MINE

Oatman, Arizona

OATMAN DISTRICT PRODUCTION:

The Gold Road Mine is situated in the Oatman or San Francisco Mining District, on the western slope of the Black Range, in Mohave County, Arizona.

From 1902 to 1931, inclusive, the auriferous veins of this district produced 2,761,750 tons of ore (including some re-treated tailings), from which metals to the value of \$35,744,918, were recovered, - all but about \$1,000,000 of this amount being in gold. Although there are numerous veins in the district, 98% of the total production has come from two parallel veins about a mile apart: The Tom Reed vein and the Gold Road vein. The Tom Reed vein has been productive over a length of about 8,000 feet, with its commercial limit in one direction as yet uncertain; while the Gold Road vein has been explored for a distance of about 6,000 feet with its productive limits at both ends still undetermined. The available production statistics for these two veins are as follows:

Property	Years	Tons	Gross Prod.	Dividend
United Eastern Gold Mining Co. (Comprising the United Eastern and Big Jim ore bodies)	1917-1924	732,528	\$14,558,210	\$5997200
Tom Reed Gold Mines Co. (Comprising Tip Top, Ben Harrison and Aztec orebodies)	1908-1931	945,903	13,088,885	3334000
Total		1,678,431	27,647,095	9331200

Gold Road vein:

Gold Road Mine	1903-1929	891,433	7,336,989	489,088
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* Earnings under United States S. R. & M. Co. ownership only; earnings under previous ownerships unknown.

GENERAL GEOLOGY:

The formations of the Oatman district are almost wholly igneous and consist of Tertiary lava flows, tuffs, and breccias, which accumulated upon a basement of Pre-Cambrian granite. The

volcanic ejecta issued principally from a group of vents, which center in the high ridge between the Tom Reed and Gold Road veins, and which for convenience of reference are collectively termed the "Oatman volcano". In immediate proximity to this volcano, lava flows, tuffs and agglomerates accumulated to a total thickness of some 4,000 to 5,000 feet, thence tapering away in all directions.

The earlier emissions were of an intermediate chemical character, and have been divided into three parts: the lowest being designated the "Alcyone trachite", the next the "Oatman andesite", and the uppermost the "Goldroad latite".† These extrusives are probably differentiates of the same underlying magma, as both chemically and mineralogically the differences between them are not large, - the separation having been made primarily to facilitate geological mapping, rather than as indicating any strongly marked stratigraphic breaks.

After the emission of the Goldroad latite, there was a period of quiescence, which was followed by renewed volcanic activity, marked by effusions of rhyolitic and latitic lavas and tuffs; and it was at this time that the Sitgreaves tuff, which overlies the Goldroad latite in this area, was formed. At some time during the interval of dormancy an erosion, which succeeded these eruptions, the mineralization of the district took place and the auriferous veins were formed.

The concluding igneous activity in the district is represented by flows of basalt which probably originated from a group of craters some miles to the east of Oatman, as no basaltic vents are visible in the district itself or elsewhere on the western slope of the Black Range.

After the cessation of all volcanic activity, north-south faulting elevated the area in which the Oatman district is situated and thus created the present Black Range, while areas on either side were depressed to form the Sacramento valley on the east and the Colorado River valley on the west. During its elevation, the Black Range fault block was also tilted easterly at a

* U.S.G.S. Bulletin 743, "Geology of the Oatman-Gold Road District, Arizona", by Dr. F. L. Ransome, p. 11 et seq.

gentle angle. It has been deeply dissected by subsequent erosion, which has been most extensive on its western slope, because of the fact that the Colorado River valley block was more deeply depressed than the Sacramento valley block. To this fact is due the exposure of the surfiferous veins of the Oatman district, while on the eastern slope of the range areas of rhyolite and basalt still cover the lower and productive horizons and may possibly conceal extensions of the Oatman vein systems.

VEINS:

The veins of the Oatman district are compound fault fissures, which have been mineralized by solutions depositing quartz and calcite in voluminous amount, with adularia as a minor constituent. Gold and silver are the only metals present in commercial quantity, and sulphides of the base metals are almost entirely absent. The gold and silver occur in about equal proportions by weight, and hence at the ratio of over 98 to 1 by value, at present metal prices.

According to the Arizona Bureau of Mines*, the period of mineralization in the Oatman district is divisible into five epochs, as indicated by different types of quartz deposition. In each successive epoch there was a progressive increase in the gold content, so that the quartz of the last stage was responsible for most of the commercial mineralization of the district, and in general the value of the ore is roughly proportional to its abundance.

Characteristic Features of the Five Stages of Quartz Deposition

Stage	Texture	Color	Range of Values Per Ton	Ratio of gold to Silver	Relative disb'n in the vein
1st	Coarse to fine grained	Colorless; white; amethystine.	Up to \$1.20	1 to 6	Abundant
2nd	Fine-grained; often shows casts of calcite	White; rarely yellow	Up to \$1.70	1 to 6	Abundant
3rd	Fine-grained. Banded	Various colors	\$1.20 to \$8.00	2 to 3	Relatively scarce
4th	Fine-grained; often shows casts of platy calcite.	Pale green to yellow	\$4.00 to \$20.00	1 to 2	Abundant only in ore shoots
5th	Fine to medium grained; usually honey-yellow banded	Pale to deep honey-yellow	\$20.00 up	4 to 1	Abundant only in ore shoots

* Ariz. Bureau of Mines, "Geology and Ore Deposits of the Oatman and Katherine Districts, Ariz.", by Carl Lausen. P. 72.

After the last stage of quartz deposition, but before the basaltic eruptions, there was a voluminous deposition of calcite. This calcite, however, is without metal content of its own, although it sometimes cements a breccia of earlier quartz fragments, and in such places it may be minable as ore because of the gold in these fragments.

While some of the veins are simple filled fissures, most of them are compound lodes, consisting of a number of closely spaced individual veins or stringers, which are separated from one another by country rock, and which intersect, divide, and reunite in a complex manner. The walls of the lode are sometimes silicified, and are sometimes brecciated and recemented by vein minerals. The veins are tightly adherent or "frozen" to the country rock, save where post-mineral strike faulting has formed slip planes along one or both walls.

The veins are somewhat sinuous both on strike and dip. In the Gold Road mine, where the possible relationship of orebodies to vein structure has been more fully investigated, the orebodies seem to predominate where the vein is concave towards the hangingwall, both on strike and dip, as shown in Exhibit "H". In these concavities the vein attains widths up to 30 feet, while between them the quartz sometimes decreases to a few inches in thickness or may even disappear entirely for a short distance. This is not an uncommon structural feature in sinuous veins, and appears to be due to the fact that renewed movement along the fissure tends to take short-cuts across bends or embayments, thus creating at such localities sheeted or brecciated zones, which are structurally more favorable for mineralization and replacement, than where the later movement simply retraces the course of the earlier fracture. This structural condition appears to explain the occurrence of the orebodies of the district as separate lenses with uncommercial intervals between them. It also shows why some of the important orebodies (such as the United Eastern orebody) had no outcrop, for if erosion chanced to truncate a vein at an inter-lens barren interval there would naturally be no exposure of ore at the surface, despite its existence below; and it likewise explains the eventual termination of ore-lenses with depth, although providing assurance of the possibility of the recurrence of other lenses below them. The intervals between the lenses appear to be roughly of the same order of magnitude

as the dimensions of the lenses themselves, although there is no uniformity in this respect. The larger lenses attain lengths of from one thousand to two thousand feet and have afforded from a quarter of a million to half a million tons of ore.

Since the most voluminous deposition of quartz took place in the early stages of the period of mineralization, while gold was most plentiful in the later stages, the size of the quartz lens is no guarantee of value, and many of them have been too low grade to be mined. Hence, although the occurrence of quartz lenses at more or less regular intervals along the veins may be expected, there is no present means of anticipating whether or not they will be commercial. In any individual lens also the distribution of gold is not uniform. As a general rule, - which, however, may have many exceptions, - the upper portions of the lenses seem to be of higher grade than the lower portions, - so that in several instances mining has had to be suspended on account of decrease in grade before the bottom of a lens was reached.

The veins of the Oatman district occur in all the geological formations with the single exception of the basalt, which appears to be post-mineral. Most of the commercial orebodies which have so far been exploited in the Oatman district, chance to occur in the Oatman andesite, for which reason this formation has been popularly assumed to be intrinsically the most favorable host rock. This conclusion, however, owes its currency principally to the fact that in the area where mineralization has been most intense, the Oatman andesite happens to have been exposed by erosion, and to constitute the surface rock, so that most of the orebodies so far mined have naturally occurred in this formation. From a theoretical standpoint, the chemical and physical similarity of the Alcyone trachite and the Goldroad latite to the Oatman andesite tends to discredit this popular belief, while the fact that in other districts in the Black Range veins of similar character occur in other formations, points to a similar conclusion. The evidence of the Gold Road vein is particularly illuminating in this respect, as this is one of the few veins of the district which has penetrated three formations and is the only one in which development work has revealed the behavior of the vein in each. In the Sitgreaves tuff the Gold Road

vein is only a few inches wide. At it passes downward through the Goldroad latite it gradually increases in width, and in the Oatman andesite it attains large dimensions. However, there is no abrupt change in size where the vein passes from one formation to the other, nor is there any difference in character, save that the vein tends to occupy a more clean-cut fracture in the harder and more brittle Goldroad latite, while in the softer Oatman andesite there is more of a tendency for replacement of the walls. The vein is uncommercial in the Sitgreaves tuff, but ore of equally high grade occurs where it traverses both the Goldroad latite and the Oatman andesite. The preponderance of evidence favors the assumption that the wallrock had little influence on the disposition of the ore, and that the controlling factors were the decrease in temperature and pressure as the mineralizing solutions approached the pre-mineral surface at the top of the Sitgreaves tuff. The same thinning and impoverishment of veins near the original depositional surface and their enlargement and commercial mineralization below are observable in many mining districts.

This conclusion that the vertical range of mineralization in the Oatman district is governed by the original thermal gradient, and only to a minor extent, if at all, by chemical and physical differences in the formations penetrated, is of two-fold importance: It encourages the expectation that orebodies may be hidden beneath the Sitgreaves tuff and the overlying basalt, which blanket the ore-bearing horizons east of the Oatman district; and it suggests that commercial mineralization may extend much more deeply along the veins than has heretofore been admitted. In some Tertiary gold camps, such as Cripple Creek and the Comstock Lode, a 3000-foot vertical range of commercial mineralization has been demonstrated, below what commercial sections of the veins may have been previously removed by erosion. If the base of the Sitgreaves tuff is assumed to be the upper limit of commercial mineralization at Oatman, a corresponding vertical range might carry commercial mineralization through the Oatman andesite into the Alcyone trachite and possibly into the underlying granite as well. Under this hypothesis the paucity of ore in the veins in these latter formations to the west and southwest of Oatman is interpreted as representing simply a lateral diminution of mineralization from a focus near the

Oatman vent, rather than vertically decreasing mineralization below an assumed favorable horizon bottomed by the Oatman andesite.

POST-MINERAL FAULTS:

There has been considerable post-mineral faulting in the Oatman district, although few of the faults are of very large displacement. The faulting is all of normal type, and has taken place in two periods: (1) An earlier period prior to the last deposition of calcite, and therefore antedating the basaltic eruptions. These faults commonly contain more or less calcite. (2) A later period subsequent to the last calcite deposition and also to the basaltic eruptions. These faults are accompanied by fresh gouge and recent slip planes, and cut the calcite as well as the veins.

GOLD ROAD MINE: HISTORY AND PRODUCTIONS:

The Gold Road mine was discovered in 1902, and was operated by several different companies prior to its sale in 1911 to the United States S. R. & M. Company. The latter worked the mine for a period of five years and three months, commencing in 1911 and ending in 1916, and also for a subsequent period of one year and nine months commencing in 1923 and ending in 1924. Since 1924 the mine has been dormant save for small and intermittent operations by lessees, none of whom have possessed sufficient capital to make any serious attempt at development work.

The production of the mine as distributed among these several periods of operations has been as follows:

Ownership	Years	Tonnage	Estimated Heads/Ton	Gross Production	Earnings
Prior Owners	1903-1911	327,165	\$12.50	\$3,416,299.	?
U.S.S.R.&M. Co.	1911-1916	500,104	7.70	3,196,341.	\$442,752.54
Lessees	1917-1922	352	?	3,203.	?
U.S.S.R.&M.Co.	1923-1924	60,965	12.50	683,977.	46,335.85
Lessees	1925-1928	<u>2,847</u>	<u>?</u>	<u>37,169.</u>	<u>?</u>
Grand Total		891,433	9.80	7,336,989	

The accompanying longitudinal section of the Gold Road mine (Exhibit F), shows the portion of the vein mined during these

several periods. The areas tinted yellow were stoped prior to the acquisition of the property by the U. S. S. R. & M. Company, while those tinted red were mined by the latter company up to the termination of its first period of operations in 1916. The suspension of operations at this time brought about by a combination of circumstances. Through the effects of post-mineral faulting, which were at that time not completely understood, important sections of the vein were missed in development work. In consequence of this, ore reserves were reduced below expectations, and in the effort to keep the 300-ton mill operating at full capacity, considerable low-grade ore was mined to no profit. Rather high tailing losses were incurred because - as is now known - of insufficiently fine grinding in the mill. Finally, the increase in operating costs and decrease in human efficiency during the war period so cut into income as to make it impossible to keep up development work in advance of extraction. The water which filled the lower levels of the mine after the suspension of operations in 1916, was never again removed; but there was a short campaign of operations in 1923 and 1924 to develop and mine, through the Line Road tunnel, ore recoverable in the southeastern part of the mine above the water level, and the stopes of this latter period have been tinted brown on the map.

Studies of the district by the U. S. Geological Survey and the Arizona Bureau of Mines in later years have thrown new light upon its geology, while an investigation of vein structure and post-mineral faulting in the Gold Road mine has revealed important possibilities that were previously unknown. The improvement which has taken place in the technic of cyanide practice and in mining methods in the district promises materially better recoveries and some reduction in costs for any future operations.

GOLD ROAD VEIN:

The Gold Road vein strikes northwesterly and southeasterly, and dips northeasterly at between 70° and 80°. It is traceable on the surface for a total extent of 11,000 feet, but for about half of this distance its outcrop is masked beneath "wash" and slide rock. The Gold Road mine occupies the middle section of the vein, 6,500 feet in length; while the Gold Road Red Top Mining Company and the West Gold

Road Mining Company own the ends of the vein to the southeast and northwest respectively. In the two latter properties, very little work has been done and no commercial ore as yet discovered.

The Gold Road vein is a strong compound lode, which is somewhat sinuous both on strike and dip. The ore occurs in a succession of lenses, separated by intervals where the vein is narrow and low in grade. These lenses appear to favor those sections of the vein where it is concave, both on strike and dip, towards the northeast or hanging-wall side. The Gold Road vein traverses three formations: the Sitgreaves tuff, the Goldroad latite, and the Oatman andesite. While there is no abrupt change from one formation to the other, the Gold Road vein gradually narrows in width as it is followed upward and approaches the pre-mineral surface at the top of the Sitgreaves tuff, - ranging from a maximum of 30 feet in the Oatman andesite to only a few inches in the Sitgreaves tuff. Commercial ore is limited to the Goldroad latite and to the Oatman andesite, and there appears to be no difference in the grade of ore in these two formations, despite the disparity in vein width.

The orebodies mined consist of three large lenses and a number of small ones. The three large lenses all occur in the Oatman andesite and are known as the "No. 1 Orebody", the "Sharp Orebody", and the "Rice Orebody". The several smaller stopes east of the Rice Orebody, but about on the same level, appear to be portions of the Rice Quartz lens, separated by ore too low grade to be minable. The stopes along and above the Line Road tunnel consist of a number of small lenses, some of which merge on their margin.

The lower grade of the ore mined from the Gold Road vein as compared with the production from the Tom Reed (See page 1) is due in part to the fact that, on account of the superior hardness of the walls of the Gold Road vein, it is possible to stope it by cheaper methods than can be used in the Tom Reed vein, hence permitting the mining of lower grade ore. It seems to be true, however, that the average grade, as is indicated by the following sample records of the 500-foot level through the Sharp orebody and the western end of the Line Road tunnel, before these sections were stoped:

500-foot Level, Sharp Orebody.

<u>Co-ordi- nates.</u>	<u>Length</u>	<u>Aver. Width</u>	<u>Aver. Value</u>
800-900	100'	6.0'	\$4.97
900-1000	100'	6.8'	5.67
1000-1100	100'	6.8'	10.33
1100-1200	100'	7.4'	8.88
1200-1300	100'	5.7'	7.93
1300-1400	100'	5.9'	9.91
1400-1500-	100'	7.6'	11.12
1500-1600	100'	6.4'	11.07
1600-1700	100'	6.3'	12.95
1700-1800	100'	5.1'	17.16
1800-1900	100'	7.4'	23.86
1900-2000	100'	7.2'	10.47
Total	1200'	6.55'	11.19

(The above samples were limited to the width of the drift, whereas the orebody as later stoped was much wider, attaining widths up to 30 feet.)

Eastern Part of Line Road Tunnel.

<u>Co-ordi- nates</u>	<u>Length</u>	<u>Aver. Width</u>	<u>Aver. Value</u>
3820-4020	200'	3.2'	\$24.00
4020-4116	96'	2.75'	8.170
4116-4172	56'	1.7'	4.50
4172-4342	140'	3.7'	17.70
4342-4417	75'	2.0'	6.70
4417-4492	75'	2.2'	4.56
4492-4592	100'	2.2'	22.80
4592-4662	70'	2.5'	1.32
4662-4757	85'	3.25'	11.40
Fault			
4756-4857	100'	3.0'	35.00

(Beyond this point the vein is interrupted by a fault and has never been explored. Only the sections of the vein, higher than \$100.00 in value, were stoped.)

The preceding tables serve also to illustrate the large dimensions of the orebodies in the Oatman andesite, as represented by the Sharp orebody, and the narrower widths and shorter lengths of the commercial lenses in the Goldroad latite, as indicated by the samples along the Line Road Tunnel.

The Gold Road vein system includes, besides the main Gold Road vein, a number of mineralized "spur" veins, which depart from it at very acute angles. With but one exception, these latter are small and inconsequential, and so far as known, lose all traces of mineralization within a short distance. The one exception, known as the North vein, is traceable for about 3,000 feet, and contains one important orebody, - the Sharp orebody, - while the Rice orebody, and the neighboring stopes belonging to the same lens, are probably upon it also. From the point of juncture, the North vein gradually diverges as it is followed northwesterly, and half a mile from the juncture is about 200 feet distant from the main vein. Northwestery from the mouth of the Line Road tunnel, the North vein is entirely masked by "wash", so that the outcrop of the Sharp orebody is hidden; while in the same general area the main Gold Road vein - in this section known as the South vein - is also covered except in a few places. These conditions have been partly responsible for the interesting structural situation which is discussed in detail on the following page.

GOLD ROAD VEIN: POST-MINERAL FAULTING:

An important strike fault, known as the Sharp fault, which in places divides into several strands, accompanies the Gold Road vein more or less closely, while a number of faults of small displacement cross the Gold Road vein and off-set it from a few inches to a maximum of twenty five feet. All the faults are of normal type. Some of them contain post-mineral calcite, while others are of still later formation and show only gouge and recent slip planes.

The Sharp fault has a somewhat sinuous course and crosses the Gold Road vein obliquely in several places; consequently it is in the hangingwall of the vein at some places, follows the vein for certain distances and elsewhere is in the footwall. As the total displacement on the Gold Road vein, which includes whatever pre-mineral movement there may have been, is about 400 feet, the dip-slip on the Sharp fault must be somewhat less than this amount. Fresh slip planes on the fault reveal striae raking southeasterly at about 45° , which suggests that the effect of the horizontal component of movement along the fault has been to shift the hangingwall southeasterly with respect to the footwall.

The effect of the Sharp fault and of the smaller cross faults has been to divide the vein into a number of fault segments; and while the movement has been small in most cases it has augmented the natural complexity of the structure due to the compound nature of the lode and the lenticular arrangement of the oreshoots, and has been largely responsible for commercial segments of the vein having been missed by development work during the previous operation of the mine.

This is most conspicuously illustrated in the case of the Sharp orebody. As previously stated the outcrop of this orebody is masked by "wash", and it was discovered only by drifting southeasterly on the 500-foot level from the No. 1 shaft. The Sharp fault crosses the Gold Road vein beyond the fault and to pick up the North vein instead. On the supposition that this was the main vein, all subsequent development work in the central section of the mine was concentrated on the North vein, leaving the corresponding section of the main vein, (here known as the South vein) unexplored; and although the mistake was

later suspected, no corrective action to develop the South vein in this area had been undertaken when conditions forced the suspension of operations in 1916. In stoping the Sharp orebody upwards from the 500-foot level, it was found to be cut off between the 200 and 400-foot levels by a northerly dipping strike fault - the Sharp fault. Because of the present inaccessibility of this stope, the fault in question cannot now be seen at this point, but its existence and effect are recorded in the mine maps of the date (exhibit J and K) and are corroborated by the testimony of former employees. The only attempts made to recover the orebody beyond the fault were in the No. 2 shaft and the 1643 raise, in both of which a vein was found up-dip above the Sharp fault. At that time this was supposed to be the continuation of the vein on which the Sharp orebody had been stoped, but since the vein was uncommercial in both exposures no further effort was made to develop it. Recent mapping of the position of the North and South veins on the surface, together with the known fact that the Sharp fault is one of normal type, suggests that the vein found above the fault was the South or main Gold Road vein. If such is the case, all the portion of the North vein above the fault, including the upper extension of the Sharp orebody, reposes undiscovered beneath the surface "wash" which masks it; while all the South or main Gold Road vein between the east end of the No. 1 orebody and the No. 3 shaft is wholly unexplored save for the two points where it has been cut by the No. 2 shaft and the 1643 rise.

Near the southeastern end of the property, at a point where a small post-mineral explosion pipe has obliterated the vein for a short distance, the Sharp fault also swings obliquely across it. The surface exposures show that the displacement cannot be large, but the vein has not as yet been recovered underground beyond this point, since the only development work in this section has been along the Line Road tunnel and is in the footwall of where the vein should be.

GOLD ROAD MINE: ECONOMICS:

The Gold Road mine is about 30 miles distant from Kingman, Arizona, which is the nearest railroad point, and with which it is connected by the fine National highway known as the Old Trails Highway. The elevation of the mine is about 3,000 feet. The climate is arid and

the temperature hot in summer but pleasant in winter. The mine makes 50 gallons of water per minute, which is sufficient for the requirements of a 250-ton mill on the basis of a consumption of one ton of water per ton of ore, as per current Oatman district practice. If desired, this supply can be supplemented from two springs on the eastern side of the Black Range upon which the Company possesses water rights and has erected a pumping plant and pipe-line. Electric power is available through a transmission line from a steam-generated electric power plant at Kingman; but the cost of power from this source is rather high, approximating two cents per K.W.H. The walls of the Gold Road vein are sufficiently firm in most places to permit shrinkage stoping; whereas in the Tom Reed vein the cut-and-fill method must usually be employed, with consequent higher costs.

The following table shows the average cost of operations at the Gold Road mine from 1911 to 1916, inclusive, - during which period about 500,000 tons were mined and milled at the rate of about 280 tons per day:

			<u>Value</u>
Mill Heads (Estimated)			\$7.67
Mill Tails (Estimated)			<u>1.25</u>
Gold Recovery	(.307 oz.)	\$6.34	
Silver Recovery	(.148 oz.)	<u>.08</u>	
Mill Recovery			6.42
Marketing			<u>.03</u>
Net Bullion Value			6.39
Mining Costs:			
Exploration	\$0.68		
Mining Operation	1.75		
Mine Gen'l Expense	.84		
General Overhead	<u>.22</u>		
		\$3.49	
Milling Costs:			
Crushers	.06		
Tram to Mill	.03		
Stamp Batteries	.29		
Tube Mills	.55		
Classifying and thick'g	.10		
Agitation	.14		
Slime Filtering	.04		
Zinc Room	.04		
Melting Room	.07		
Lime	.06		
Cyanide	.15		
Zinc	.11		
Pumping	.11		
Mill General Expense	.13		
General Overhead	<u>.13</u>		
		\$2.01	
Total Costs:			<u>5.50</u>
Net Profit:			\$0.89

By comparison, the average operating cost of the United Eastern Mining Company on the Tom Reed has been \$8.08 per ton, which indicates the more favorable character of the Gold Road vein for low cost operation. The low percentage of mill recovery indicated, - amounting to about 85%, - was due to the fact that the gold occurs in the ore in very minute particles, and that the ore was too coarsely ground and too short a period of contact with solution was permitted to effect a satisfactory extraction. Subsequent experience at the Tom Reed mill has shown that by finer grinding and longer contact, a 95% recovery can readily be made; while with recent improvements in mining and milling methods and equipment it should be possible to better the former costs, under otherwise comparable conditions. Assuming a \$10.00 mill head, - which is very nearly the average of the past production of the Gold Road mine, - the following estimate is considered reasonable at the present time, depending of course upon the development of sufficient ore to justify the scale of operations suggested.

	100 Tons Per Day	250 Tons Per Day
Heads	\$10.00	\$10.00
Tailings	.50	.50
Recovery	<u>9.50</u>	<u>9.50</u>
Mining	\$3.50	\$3.00
Milling	2.00	1.60
Overhead	<u>.50</u>	<u>.40</u>
	<u>6.00</u>	<u>5.00</u>
Net Profit:	\$ 3.50	\$ 4.50

All of the equipment and buildings at the mine have been sold, and most of the equipment which is not obsolete or worn out has been removed; but the buildings are still standing, in fair condition, while the mine workings are still equipped with track and air-pipe (as of June, 1932). The mill building shelters a partially finished 100-ton Dorr counter-current cyanide plant, the installation of which was commenced by the last lessee. The No. 1 shaft will require repairs to the extent of a few thousand dollars before it can safely be used. The timbering of the No. 3 shaft down to the water level was destroyed by fire recently, but the shaft itself is in hard rock and has not caved. However, since the No. 1 shaft is the only one connected by tramway with the mill, and since all the lower levels slope towards it, this shaft is the

is the most convenient operating center.

About 100,000 tons of early tailings, averaging \$2.00 per ton (half of which is in soluble form), are available for re-treatment at an estimated profit of about 40¢ to 50¢ per ton, should the restoration of the mine to a productive condition justify the rehabilitation of the mill.

OBJECTIVES:

The possibilities of the Gold Road mine may be divided into three classes, according to accessibility: (a) Those above the water level, which now stands about 350 feet below the collar of the No. 1 shaft; (b) those between the water level and the bottom of the existing workings; (c) those below the bottom of the existing workings.

The examination upon which the present report is founded was made within the past 18 months, and hence was necessarily confined to the accessible workings above the water level. Consequently definite recommendations at the present time can be made only for such objectives as can be reached above the water level; but should exploration for these objectives result successfully, the interval between the water level and the present lowest workings will then merit further development, and the use of the accumulated water in the mine for the purpose of milling new ore discovered above the water level will provide the necessary opportunity. Likewise, should subsequent development of this lower portion of the mine prove profitable, still deeper exploration along the vein in search of those orebodies which theoretically should exist at greater depths would be justified. In other words, each step in the progressive exploitation of deeper sections of the Gold Road vein is predicated upon the successful consummation of the exploration program of the section immediately above. The accompanying section along the Gold Road vein system (Exhibit M) shows in a generalized way the unexplored portions of the vein and the areas therein which appear to offer the greatest opportunity for immediate attack.

Of the four principal objectives accessible above the present water level, three can conveniently be reached through the No. 1

shaft. It will be necessary to replace some timbering in the shaft and to entirely restore the 300 level station; but the 300 level itself is open to both faces and is equipped with mine track and air-pipe.

"B" on Exhibit M:

As has been previously explained, the South or main Gold Road vein is unexplored - save where penetrated by the No. 2 shaft and the 1643 raise - for a distance of about 1400 feet between the No. 3 shaft and the face of the 300 level from the No. 1 shaft. While nothing can be predicted with assurance regarding this section of the vein, the normal distribution of ore lenses suggests that one may be expected in this interval, and the fact that large orebodies have been mined from each side of it would seem to give it good speculative value. It can conveniently be explored by driving southeasterly along the vein from the present face of the 300 foot level, where what seems to be this vein is exposed. As shown on Exhibit N, about 750 feet of drifting should be sufficient to determine the existence of this assumed orebody.

"A" on Exhibit M.

The faulted top of the Sharp orebody is a tempting objective, in view of the fact that the orebody abutted against the fault for about 500 feet on strike, and that - as I am informed by former officials of the mine - the orebody where cut off was as good if not better than the average of the stope, - the ore in the 1643 raise averaging about \$30.00 per ton. Considering the fact that most of the ore lenses along the Tom Reed vein, together with the No. 1 orebody on the Gold Road vein, have vertical dimensions of from 700 to 900 feet, it is not impossible, if the Sharp orebody was originally of comparable height, that its faulted extension may extend to the surface and may contain some 100,000 tons of ore. This can conveniently be explored by cross-cutting to the North vein, just west of the Sharp stope, from the extension of the 300 level to the southeast, which has been proposed for the preceding objective. As shown on Exhibit N. 500 feet of cross-cutting and drifting should suffice for the recovery of this orebody.

"D" on Exhibit M.

There are possibilities for the existence of one or more "blind" orebodies in the property of the West Gold Road Mining Company, which adjoins the Gold Road mine to the northwest, and into which the Gold Road vein extends. Throughout a distance of about 2000 feet between the west end line of the Gold Road mine and the point where the Gold Road vein is off-set by the Mallery fault (See Exhibit G), the outcrop of the vein is covered by "wash", and its potentialities have never been investigated except by a 600-foot shaft, sunk barely 100 feet from the Gold Road property line. According to the owner of the property and only development work performed from this shaft consisted of two short cross-cuts, one of which cut a fissure which was supposed to be of the Gold Road vein, but only about 20 feet of drifting was performed on this fissure. Such work, of course, is wholly inconclusive and might readily fail to encounter commercial ore, since this shaft was sunk just about where the normal barren interval between the No. 1 orebody and the next lens to the west - if one exists - should occur. Furthermore near the west end line of the Gold Road mine there are two cross-faults, known as the East and West Mill faults, of apparently some 50 to 75 feet combined dip-slip, which should tend to jog the Gold Road vein to the south, - possibly to a sufficient extent so that it might have been missed by the cross-cuts from the shaft. A significant fact, in this connection, is the entire absence of any quartz or calcite fragments from the dump of the West Gold Road shaft.

There is, therefore, a reasonable possibility that an orebody exists along the hidden section of the Gold Road vein in the West Gold Road Mining Company's property, - having a comparable relationship to the No. 1 orebody as the United Eastern orebody - which also was "blind" on the surface - fore to the Tom Reed orebodies. This possibility can conveniently be investigated by extending the west drift on the 300-foot level from the No. 1 shaft into the West Gold Road property for a distance of about a thousand feet along the vein, as shown on Exhibit N. According to the average spacing of ore lenses, one should be found in this distance, if it exists.

The owner of the West Gold Road property has agreed

to an option on the following terms: A three-year lease, with no payments during this period; a price of \$20,000 if paid in one year, \$25,000 if paid in two years, and \$30,000 if paid in three years; a royalty of 10% on bullion shipments, to apply on the purchase price; lessee to assume payment of current taxes; 45 shifts per month to be worked, with the understanding that work performed in the Gold Road ground from the west face of the 300 level will apply on this requirement.

"C" on Exhibit M.

At the southeast end of the Gold Road mine the vein was simultaneously interrupted by the Sharp fault and by a post-mineral explosion pipe, which surface exposures show to be of small dimensions and beyond which the vein outcrops for some 2,000 feet. No exploration work has been performed underground beyond this pipe, except on the Line Road tunnel; and on this level the southeastward extension of the drift beyond the explosion pipe was driven in the footwall and did not encounter the vein. Since the most easterly stopes in the mine which abutted against and was cut off by this explosion pipe, averaged about \$25.00 per ton, there seems reason to expect commercial ore to extend beyond it. The surface outcrop is still strong in this direction, although it here traverses the Sitgreaves tuff, which is believed to be above the upper limit of commercial mineralization. As shown on Exhibit N some 400 feet of cross-cutting and drifting, just beyond the explosion pipe, should suffice to recover the vein and demonstrate its possibilities in this section. Owing to the fact that the Line Road tunnel, as it progresses southeasterly will be getting into stratigraphically higher ground, where narrower widths of vein would be expected, the proposed work might not develop large orebodies, but if it should reveal the existence of ore of commercial grade, although of narrow width, it would prove the extension of mineralization in this direction, and would thus justify further exploration work in this end of lower levels, - not only for the extension of the orebody mined above the Line Road tunnel, but also for another possible lens ("E" on Exhibit M) still further to the southeast. A cave of about forty feet in length near the Line Road tunnel would have to be caught up or drifted around before this work could be done. The tunnel is equipped with mine track,

air-pipe, and cars.

SUMMARY:

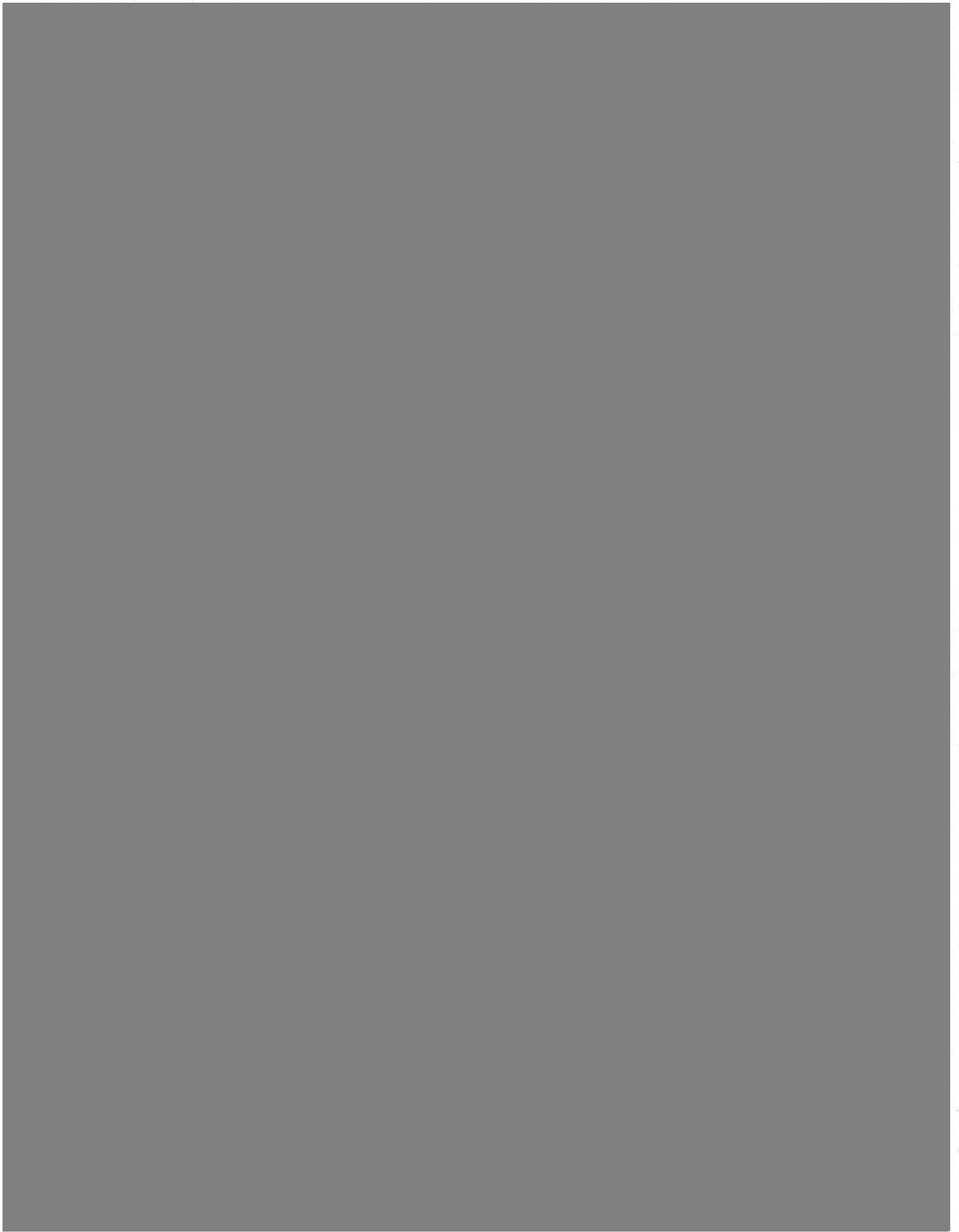
New and important geological information as to the Oatman district in general and the Gold Road vein in particular justifies the belief that the Gold Road vein, within the Gold Road mine and the properties which adjoin it at either end, offers possibilities much greater than its former production. The occurrence of the orebodies as isolated lenses, usually containing from a quarter of a million to half a million tons each, provides assurance of a large tonnage, when such a commercial lens is encountered; and the fact that the lenses seem to occur at more or less regular intervals along the vein affords definite objectives for development work, although of course there is no certainty that any single lens will be commercial. Within the upper thousand feet of the Gold Road vein there are at present four such definite objectives, all of which can be investigated without incurring the expense of unwatering the mine. The estimated cost of performing the preliminary development work outlined in the preceding pages, including the price of such temporary equipment as will be necessary, is between \$25,000 and \$35,000. Should anyone of these objectives respond favorably it should repay this expense and provide a working profit; while the total possible extent of commercial mineralization along the vein both laterally and in depth affords the opportunity of its becoming a producer of record comparable with that of the Tom Reed vein.

(signed) R. T. WALKER.

June 30th, 1932.

mine file

Gold Road Cyanide Plant



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