CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the

Arizona Department of Mines and Mineral Resources Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

BRIEF REPORT ON THE SHEEP TANKS MINES.

GENERAL.- The Sheep Tanks Mines are located in northern Yuma County, State of Arizona, Townships 1 North and 1 South, Range 15 West, Gila and Salt River Meridian.

The present camp is due south of Vicksburg, a distance of 28 miles, or 26 miles due south of U. S. Highway 60. Vicksburg is a station on the Los-Angeles-Phoenix branch of the Atchison, Topeka and Santa Fe Railway. Horn, a station of the Southern Pacific Railway, is about 36 miles southeasterly from the present camp. The mine road from Vicksburg has no heavy grades and is in good condition for motor transportation.

The claims are situated in the Little Horn Mountains in the heart of the Arizona desert, and were originally twelve in number covering an area of approximately 197 acres; at the present time nine (9) claims are submitted with this report; they cover an area of 180 acres and have been surveyed for patent. An abstract of title may be obtained from the Yuma Title Abstract and Trust Company, of Yuma, Arizona.

In addition to the foregoing claims there are also three millsites upon which five wells of varying depths have been drilled for a water supply.

HISTORY.- The first location at Sheep Tanks was on January 1st, 1909, by J. G. Wetterhall upon the present Resolution claims. Very little development work was done, however, until 1927. During 1929 ore shipments of a total of 801 tons were made to the Hayden smelter with a total gold-silver value of $54,508.05 (at current quotations), with an average gold-content of 1.627 oz., and 15.63 oz. of silver per ton, or an average gold-silver value of $68.05 per ton.

In 1931, the Anozira Mining and Milling Company, which later became the Sheeptanks Consolidated Mines Company, purchased the twelve original mining claims. During 1931 and 1932 a considerable amount of prospecting and development work was done and the mining area considerably extended.

Sufficient milling ore having been developed, a pilot mill of 100 tons daily capacity was erected and placed in operation in the autumn of 1933. In September, 1933, while this mill was being erected, ore shipments of a total of 120.93 tons were made to the El Paso smelter; this ore averaged $50.28 per ton (at current quotations), with an average gold-content of 1.1665 oz., and 13.308 oz. of silver per ton, or a total gold-silver value of $6,080.36 The milling plant operated for only a few days in November, 1933, as the Directors decided that certain changes should be made in the original flow-sheet. Milling operations were resumed on February 1st, 1934, and continued until August 20th, 1934, when the plant was closed down. During this period of about seven months a total of 15,167 tons was milled from the upper Resolution Tunnel orebody, with a total gold-silver recovery of approximately $200,000.

Some development work was carried on after the shutdown of the milling plant but, on April 1st, 1935, all operations ceased and the company went into voluntary liquidation. It was reported by the Board of Directors that no further commercial ore was available. All of the equipment, machinery, power and pipe lines were sold; Edwin W. Mills purchased the group of mining claims and the three millsites, which were duly conveyed to him by quit-claim deed, under date of August 29, 1935, and the same duly recorded at the County Recorder's Office, Yuma, Arizona.

The purchaser of the equipment, machinery, etc., was given one year in which to remove the same, consequently Mr. Mills did not come into actual possession of the mining claims and millsites until July 1, 1936. Since that time additional prospecting and sampling has been carried on.

From April to July, 1939, ore shipments of a total of 507.87 tons were made from the ground stoped for milling operations during 1934, and in the area in which the former Directors declared that there was no more ore available. This ore had a total gold-silver value of $11,026.36 with an average gold-content of 0.491 oz., and 6.844 oz. of silver per ton, or an average gold-silver value of $21.71 per ton. Further ore shipments have not been made as it is the intention to start milling operations again as soon as possible.

GEOLOGY.- The immediate Sheep Tanks area is characterized by a series of Tertiary volcanic flows of andesite, rhyolite, breccias, tuffs and intrusive rocks. A detailed description of the Sheep Tanks geological conditions, by Dr. Eldred D. Wilson, of the Arizona Bureau of Mines, is given in the University of Arizona Bulletin, Vol. IV, No. 2, February 15, 1933.

With reference to the Tertiary volcanic rocks, Dr. Wilson states as follows:

"Breccia: Unconformably overlying the rhyolite and diorite-porphyry, and apparently in fault contact with the dacite, are irregular areas of breccia that outcrop as shown on Plate 16. Its maximum thickness is difficult to determine, but probably amounts to less than 200 feet. Throughout, this breccia is rather intensely silicified and stained by iron and manganese oxides. Its basal portion consists largely of angular fragments of rhyolite, from small size to several inches in diameter, cemented by vuggy, fine-grained silica. Upward the fragments consist largely of shattered, locally silicified material of andesitic composition resembling the diorite-porphyry. Whether this breccia, prior to its cementation, originated from fault movement or from volcanic activity has not been determined. It is the host-rock for the Sheep Tanks gold deposit."

ORE OCCURRENCE AND MINERALIZATION.- The ore is highly siliceous and contains minute quantities of galena and oxidized lead minerals, copper and zinc, in addition to visible free gold, and much limonite and hematite. Pyrolusite is widely disseminated throughout the orebodies, and it has been found that a certain percentage of the silver-content is combined with the manganese. This silver mineral has not yet been definitely determined. A high percentage of the gold-content is free, and it is readily amenable to treatment by amalgamation, flotation and/or cyanidation.

Reports made upon the original group of twelve claims by Messrs. Ira B. Joralemon and Oscar H. Hershey indicated a wide-spread mineralization over an area of not less than 2,500,000 square feet. The thickness of this mineralization was estimated to vary from a few feet to 40 feet. (At the time of the report by Mr. Joralemon a total of only 700 feet of development work had been made.) At the present time, due to a greatly amplified program of development work, over 8000 feet, it may be safely stated that this area of mineralization now exceeds 5,000,000 square feet.

ORE ESTIMATES.- It is estimated that there is available at the present time a total of 120,000 tons of ore in the Resolution Hill area with an average gold-content of 0.26 oz., or $9.10 per ton, and an average silver-content of 4.5 oz., or $3.19 per ton, or a total gold-silver value per ton of $12.29 or a gross total gold-silver value of better than $1,470,000.

In addition it is estimated that not less than 600,000 tons have been partially developed with a gold-silver value of not less than $6.00 per ton, say 0.10 oz. of gold and 3.25 oz. silver per ton, or a total gold-silver value of not less than $3,600,000. This makes a gross total of not less than 720,000 tons of ore within the Resolution Hill area with an estimated total gold-silver value of more than $5,000,000, or approximately $7.00 per ton in gold and silver values.

From the knowledge gained by prospecting and exploration within the extent of the area of mineralization of these nine claims, it is quite within the bounds of reason to estimate from 10,000,000 to 12,000,000 tons of ore which may be developed within this area, with an average gold-silver value of not less than $5.00 per ton, at current quotations. The potential possible ore is of considerable magnitude.

MANGANESE.- Manganese dioxide, in the form of pyrolusite, is widely disseminated throughout the entire Sheep Tanks area. Bodies of this mineral have been found with as high as 18 per cent manganese-content. Based upon the results from many assays and analyses it is estimated that an average manganese-content of not less than 4 per cent can be maintained throughout the ore-bearing areas. This being the case, the manganese can be recovered as a valuable by-product instead of going to the tailings dumps as waste material. Through a number of tests which have been made it has been definitely determined that this manganese-content will add approximately $5.00 to the value of every ton of ore mined and milled, based upon the utilization of the same in the manufacture of manganese compounds and alloys. Inasmuch as no mining nor milling costs are directly chargeable to the recovery of the manganese, it is evident that the production of the same can be made at a low cost, with resultant low production costs of manganese compounds and alloys.

OTHER CONSTITUENTS OF SHEEP TANKS ORE.- A spectrographic analysis of a representative ore sample showed the presence of commercial quantities of iron(hematite and limonite), aluminum, chromium and other elements which further experimental and research work may show they can be recovered as profitable by-products, thus providing an additional source of revenue from the ore mined and milled.

OPERATING COSTS.- Inasmuch as practically all the tonnages of ore mentioned under ORE ESTIMATES can be mined without any hoisting, pumping, or timbering costs in connection with mining operations, it follows that low mining costs may be obtained. Upon the basis of a tonnage of 1200 tons every 24 hours it has been estimated that total mining costs may range from $0.30 to $0.50 per ton.

It has been estimated that milling operations, based upon the foregoing tonnage, will range from $0.50 to $0.75 per ton milled, depending upon the plan of flow-sheet followed. Thus it may be estimated that total mining and milling costs will not exceed $1.20 per ton, based upon a daily tonnage of 1200 tons.

WATER.- Thus far sufficient water has been developed only for the operation of a milling plant of 100 tons daily capacity, by means of four shallow wells some 8000 feet to the southward of the present mine camp. However, there are good reasons to believe that a sufficient supply of water for the operation of a 1200-ton milling plant can be developed within a reasonable distance to the northward of the present mine camp.

CONCLUSIONS.- The Sheep Tanks property is a mining venture of unusual possibilities, and offers the definite prospect of returning large dividends on the amount invested.

Respectfully submitted,

Edwin Walter Mills,
Consulting Mining Engineer.

Sheep Tanks Mines,
November 6, 1939.

Postal address:
Salome, Arizona.

THE THOMSEN MANGANESE PROCESS

for the treatment of the

SHEEP TANKS MINE ORES

YUMA COUNTY

ARIZONA

Submitted by
Edwin M. Mills
Sheep Tanks Mine
Salome, Arizona

At meeting held at Phoenix, Arizona
April 9, 1943.

INTRODUCTION.- During the years 1914-1918, the writer of this brochure was actively engaged in the manufacture of manganese sulphate and a wide variety of other manganese compounds. Starting with a very pure ore and sulphuric acid, we soon experienced the scarcity of both due to war conditions which ultimately led to the development of the process about to be described.

The application of this information to Sheep Tanks ore will be self evident when we consider that not only is the manganese salvaged, but in addition the recovery of both gold and silver is much facilitated.

CHARACTER OF ORE.- Approximately 75% of the ore consists of a hard, dense quartz; the balance is made up chiefly of the oxides of iron and manganese with a few veinlets of crystallized calcium carbonate and sulphate. A little of the manganese is present as carbonate and silicate, and there is a slight contamination of oxidized copper minerals. The gold appears to be an associate of the iron mineralization, the silver with manganese and secondary silica.

CRUSHING AND GRINDING.- Numerous tests indicate that excellent extraction of both gold and silver as well as manganese can be obtained by passing all the pulp through 100 mesh prior to acid treatment and cyanide lixiviation. Finer grinding would doubtless increase the yield somewhat, but it is felt that the increase in power, drop in capacity, and harder filtration will not compensate for the higher yield.

In coarse crushing the ore will be found quite friable, owing to many seams of manganese, but in fine grinding the dense primary quartz will make its demands.

The pulp, diluted to 20% solids, settles reasonably well, but the thickener overflow will be colored black by a little manganese that is almost colloidal in nature. The loss in values thus occasioned will probably be inconsequential and it may be possible to avoid such loss entirely by returning the overflow to the grinding-classifying circuit. Should this practice be found inexpedient and the loss considerable, then we can vary the operation as follows:

Let onepound of lime be added to the mill for each ton of ore and the corresponding amount of manganese solution introduced into the classifier overflow. The manganese hydrate thus produced will act as a coagulant, the settling rate will be doubled, and the overflow will be water-white. Should water economy ever be desired then this overflow should be re-used without hesitation.

To deliver pulp of proper fineness and consistency will require the customary installation of crusher, mill, classifier and thickener. As this is standard practice no suggestions will be made.

CHEMICAL TREATMENT.- The next step in the operation is to dissolve out the manganese by means of sulphur dioxide. The pulp, thickened to proper density, enters the absorber. The laboratory cannot prescribe what this will be as it becomes a compromise between two opposing factors, to-wit: the denser the pulp the better, from the standpoint of manganese solution strength and subsequent filtration; but the thinner the pulp the better it becomes from the standpoint of agitation, pumps, and the airlifts needed to circulate the pulp within the absorber.

The sulphur dioxide may be obtained by the roasting of a sulphide ore or more easily by the direct combustion of sulphur. In the latter case the equipment should be similar to the sulphur burners of

the sulphite pulp mill. In place of the costly lead coolers we may with advantage substitute a 25-horse power vertical boiler and use the gas somewhat hot. The cooling effects of the airlifts will counterbalance this input of heat and also that derived from chemical action. Optimum conditions for manganese solution by means of sulphur dioxide is about 75 degrees Centigrade, but may be varied within wide limits. We must consider also that a hot pulp filters easily.

With these suggestions in mind, the operator must adjust the conditions within the absorber according to the actual results obtained in practice and not in any hard and fast manner. A pilot plant serves its highest function when it delivers to the operator such data as is otherwise unobtainable.

It would be unwise to attempt to render more than 90 percent of the manganese soluble, at least at the start. A small amount of residual manganese will act as a safeguard against too much action on both iron and lime. Such action must, of course, result in loss of sulphur and will also give rise to a more impure manganese solution.

The gas from the sulphur burners should be as high as possible in sulphur dioxide and as low as possible in sulphur trioxide. The lower oxide has a most decided selective effect upon manganese as compared with iron and lime while the trioxide is about on a par as to lime and reversed on manganese. In the event that the gas be made by roasting sulphides, instead of by burning sulphur, then it might become imperative to scrub the gas prior to use.

THE ABSORBER.- For a 100-ton mill a 12' x 12' tank, fitted with an agitator, is indicated. The lower half constitutes a reservoir for the

pulp undergoing treatment, the upper half is the absorber proper. By means of baffle-plates, the gas is made to take a zigzag path over the surface of the pulp which, in addition, is continuously showered through the gas by means of airlifts. The space between the baffles is filled with wooden grids, of 2 x 4s, and the circulating pulp is thus made to present the maximum surface to the gas. It is suggested that the air-lifts be worked by compressed air at the start, but it will be self evident that burner gas would be more desirable. This modification will necessitate acid-proof equipment in place of a compressor already available.

The air-lifts, eight in number, are spaced equally around the circumference of the tank and are only wooden boxes held together with dowels. It is the intent of the entire design to present no substance to the action of either pulp or gas save wood, and in connections to use either rubber or stainless steel. The most adaptable wood is Douglas fir. The supplementary sketch will make the description clear.

FILTRATION.- To separate the manganese solution from the pulp will now involve the use of filters. These must be of acid-proof construction, but where no scouring effect is involved, lead may be freely used. Any type may be selected but the suggestion is made that a "leaf" type, mounted above the next tank in series, will be advisable. About 1000 square feet of canvas surface is required.

It will be essential that the manganese solution be removed with the most scrupulous care. It will, therefore, be necessary to employ double filtration, utilizing in the first washing the weak wash water obtained in the second step. We shall thus avoid all possible contamination on one hand and undue dilution on the other hand.

The strong manganese solution, obtained from the first filter, is now passed on to the solar evaporator; the pulp is ready for cyanidation.

CYANIDE TREATMENT.- Laboratory tests indicate that solution of the gold is almost complete in 12 hours, but that good silver extraction requires at least 36 hours. Unfortunately, this longer contact results in the re-precipitation of some of the gold, thus reducing the yield.

It is suggested, therefore, that cyanidation be effected in two circuits, the first yielding principally gold, the second principally silver. If we employ, therefore, as our equipment four tanks, each holding approximately 50 tons of ore, with filters mounted between tanks 1 and 2, we shall have a contact of about 12 hours in the first circuit and about 36 hours in the second. This overall contact of 48 hours should result in the extraction of 95 percent of the gold and over 85 per cent of the silver. These figures are a little higher than laboratory findings, but it has been my experience that after a mill is thoroughly adjusted it will always give an extraction somewhat better than the laboratory.

A little protective alkali should, of course, be added to the first cyanide tank, otherwise it should follow standard practice throughout.

It should not be forgotten that by the use of this double filtration we obtain most of the gold in a form acceptable at the mint, while only a little gold remains locked up with the silver. The opportunity of losses of gold through the carelessness of operators is also much minimized, and final tailing losses of soluble gold are likewise reduced.

THE SOLAR EVAPORATOR.- This device is an adaptation of the old German "GRADIERHAUS", somewhat further developed by the writer in the West Indies, where it was used for the purpose of evaporating sea water and for cooling condenser water. It consists of a stack of brushwood, held in place by a wooden frame, placed in a shallow tank. The fluid in the tank is continuously raised to the top of the brushwood stack and distributed over its upper surface by means of a central launder. When a batch is brought up to saturation it is let off into the storage tank for the manganese driers.

Such a pile of brushwood, 4' wide, 12' high and 200' long, was erected by the writer at Salinas, Puerto Rico, and was found to have an evaporative effect equivalent to somewhat more than 1 ton of water per foot of length in 24 hours. Calculated from this data we find that a 50-foot structure will be required at Sheep Tanks. It should be placed in a pan of wood 55 feet long, 6 feet wide, and 12 inches deep, and the sides should be protected by splash boards similar to those used on atmospheric water coolers. The circulation may be effected by an airlift or by a lead-lined pump.

PURIFICATION.- The treatment upon the brushwood structure is not only one of evaporation but of purification as well. The continued exposure to sun and wind has a highly oxidizing effect in which iron and copper salts act as efficient catalysts. The manganese thionates are therefore largely converted into sulphates; calcium sulphite is oxidized to sulphate and by evaporation thrown out of solution, and both iron and copper precipitated as basic salts. A little lime may be needed to complete the reaction within the required period of time.

The precipitate formed will in part attach itself to the

brushwood and in part settle to the bottom of the shallow tank. Any suspended impurities may be removed by means of a sand box acting as a strainer or filter as desired. Such an installation will, of course, be interposed between the evaporator and the storage tank for the driers before referred to. Should any gold go into solution in the treatment with sulphur dioxide, then it would doubtless be re-precipitated in this treatment. If such should not be the case, then an insignificant addition of sulphide or carbon would render it complete. The entire possibility is, of course, regarded as a most unlikely contingency and would not be mentioned at all save for the fact that it was introduced into a conversation.

DRYING MANGANESE.- There is sufficient waste heat in the exhaust of the Diesel engine to effect the final stage of the recovery of the manganese as the sulphate. It is therefore suggested that the two 5' x 16' driers be erected in accordance with the writer's past practice. The waste gases from the Diesel would then be piped to this installation which should be placed as close to the latter as possible to avoid both back pressure and loss of heat. The dried manganese would go to crude storage awaiting market demands.

REFINING MANGANESE SULPHATE.- The crude salt thus obtained is now re-dissolved in water, agitated with a little manganese hydrate, prepared separately, filtered and again evaporated to dryness. In this case we must use direct firing or else we must use air heated by the exhaust, not the exhaust itself, for any carbon would render the manganese sulphate unsaleable. To effect this evaporation we require an additional drier similar to the former installation on crude.

Grinding and packing in barrels completes the operation. A "farmer's mill", such as is used to grind feed, was my own installation

and is quite satisfactory.

The filter, etc., used in refining are of such small capacity that they may be built in a few days by local help. For this reason this item is not more closely scanned. It is assumed that this department will come into existence as fast as the market warrants.

CONVERSION OF MANGANESE SULPHATE.- There is, however, a field into which any quantity of manganese can be fed without fear of glutting the market. This is the field of raw material for ferro-manganese. If manganese sulphate be roasted it becomes converted into a manganese oxide with over 70 percent metallic content. Such material is of prime quality for ferro-work and as long as the present tariffs are in force it can be produced and marketed at a profit. Should these protections be withdrawn then the proposal becomes unworkable. As such work has not been done by me out of the laboratory it is only mentioned in passing. The sulphur set free could doubtless also be used again. There is also the field of higher manganese compounds which constitute a most lucrative "side line" to any manganese endeavor but it would be too much to do more than to mention the same. These substances, chiefly used as driers in the paint industry, are the borate, resinate, oleate, linoleate, and tungstate of manganese. The chloride and artificially prepared dioxide are also marketable salts; the latter has quite some application in the manufacture of printing inks and paints under the trade name of "Van Dyke Brown."

SUMMARY.- The plates, sketches, and plans now available or to be drawn up in the preparation of the design for the 100-ton pilot mill, should be considered as a part of this paper and are, of course, essential for a complete understanding of the subject matter of this brochure. As these drawings are at present needed in San Francisco, I am sending this descriptive section in advance.

Respectfully submitted.

March 24, 1933.

(Signed) Alfred M. [illegible]

Denver, Colorado
July 25, 1932

Sheeptanks Consolidated Mines Company
364 I. W. Hellman Building
Los Angeles, California

Gentlemen:

As per instructions given in your letter of May 26, 1932, I have examined your properties in Yuma County, Arizona, and submit herewith my report.

SHEEPTANKS CONSOLIDATED MINES COMPANY

LOCATION:

The property of the Sheeptanks Consolidated Mines Company is located in Yuma County, Arizona, about 38 miles south of Salome, a station on the Atchison, Topeka and Santa Fe Railway.

The climate is warm and dry and permits of all year operations.

EXTENT:

The Company holds 125 unpatented mining claims. Of these claims, 82 have been taken up recently, mainly to prevent encroachment of others upon the district and as a protection for operating needs which might arise.

With the exception of two short tunnels on the Black Eagle claim and a few small pits, the development has been confined to the west central portion of the located claims, where the best ore exposures were found. The Resolution Mine ore is developed on the Resolution claim.

GEOLOGY AND ORE OCCURRENCE:

The rocks of the district are all volcanic in origin. They consist of andesite -- both as flows and dikes -- rhyolite, acid intrusives, some porphyry, and, on the northern edge of the claims, a thin basalt flow.

The various flows and intrusions were introduced at different times and all were accompanied by a good deal of fracturing and faulting. This movement has had the effect of destroying the continuity of the andesite which embraced a zone favorable for ore deposition, so that the andesite is now found in irregular and comparatively small areas separated from each other by rhyolites and other intrusives.

The values occur in a zone in the andesite flow which was physically and mechanically favorable for the deposition from rising solutions carrying gold and silver.

After deposition of ore in the particular zone within the andesite,

further faulting, probably occasioned by rhyolite intrusions, has dislocated the ore zone within the andesite ore bearing areas. This is clearly shown by the attached east-west and north-south geological sections attached to this report.

For these reasons the horizon is not found in one continuous body. Likewise, the andesite flow itself has been divided into areas in which there is probably faulting similar to that in the Resolution Mine. Any further ore to be found in the district would be confined to the favorable andesite flow, and hence the size of the ore bodies would be limited to the extent of the andesite flow areas and broken up within those areas by faults.

Each andesite area of the original flow favorable to ore deposition presents, therefore, a separate and distinct exploration unit.

ORE RESERVES:

During my examination of the property, Mr. McElvenny was sampling the workings in the Resolution Mine. The samples were being taken properly and carefully cut across the mineralized zone, and from the results of his work and the corresponding assays, which must be accepted, it is estimated that the ore reserves in the Resolution Mine consist of 10,000 tons assaying 0.52 oz. gold and 9.0 oz. silver per ton.

If the assay maps at the property, based upon sampling previous to that of Mr. McElvenny, could have been confirmed, the ore reserves would have been estimated at 200,000 tons assaying 0.40 oz. gold and 5.0 oz. silver per ton. In such case, the mineable area would have been that shown included by the dotted red lines on the attached general plan, and there would have been a reasonable expectancy of finding further extensions to the positive reserves in the areas marked A1, A2 and B1 on that plan.

The actual commercial ore is confined to a relatively small area on and around the upper levels 2243 and 2237 of the mine, which area is shown in red on the accompanying general plan.

With the ore thus limited well within the outlines of the favorable zone marked A, the potential expectancy of ore extensions in areas A1, A2 and B1 disappears.

ORE POSSIBILITIES:

Outside the Resolution Mine location, the same andesite flow as that in which the Resolution Mine ore occurs is found in the areas shown on Mr. Hershey's geological map, as well as outlined by the orange colored lines on the general plan attached to this report.

Had the results of the recent thorough sampling been less disappointing, it would have been possible to recommend exploration, particularly in the areas marked D and E in the plan, such prospecting to be carried on from the profits gained from the treatment of already developed ore. Under the

circumstances, however, it is my opinion that these locations do not merit further attention.

Black Eagle seems to be an entirely different type of deposition, which is probably secondary in origin and of limited extent -- even more limited than the outlined andesite flow, which is quite thin in this section and underlain very near the surface by a typical rhyolite to a large extent. None of the reported assays are encouraging.

The Smyrna has a large andesite area and some exposures of the mineralized zone. These exposures are narrow and separated and do not hold out much hope.

ORE TREATMENT:

The ore offers no difficulty in treatment. The Groch Engineering Company, Ltd. have made several tests, the details of which are given in their report dated March 1, 1932.

Test 8098 of the mentioned report shows that 98.3% of the gold and 57.6% of the silver can be recovered by amalgamation and cyanidation. Study of the test data indicates that cyanidation alone could be employed without much, if any, difference inthe recoveries reported from amalgamation and cyanidation.

Any treatment process, however, would require water, which is not immediately available. With the small ore reserves shown by the sampling, the cost of developing a water supply for such reserves would be excessive and unwarranted.

The quantity of manganese to be recovered from the ore is so small that it does not affect the conclusions reached by a consideration of the gold and silver values alone.

PLANT CAPACITY; PLANT SITE;
TRANSPORTATION; OPERATING COSTS:

In view of the ore reserves and possibilities, which are too small to warrant the expense of erecting local plants for ore treatment, the questions of capacity, site of plants, transportation and operating costs are not pertinent.

With ore reserves of the importance indicated by the former mine assay records, a plant of 150 tons per diem could have been erected conveniently close to the camp site after water had been provided and the present entrance to the property via Salome would have met all requirements. Under such conditions and with economical methods and maximum concentration of departments, the operating costs should not have exceeded $4.00 per ton of ore for all local expenditures. The mine preparation, erection of treatment and power plants and accessories would have cost $180,000.00 (or less if second hand equipment had been purchased), as shown by tentative designs made by me. Under these conditions and with reserves promised previous to having the final results of sampling, the property would have made an attractive and profitable mining enterprise.

CONCLUSIONS

The total value of the developed ore reserves does not warrant the expenditure for developing a water supply and for equipment necessary for realization.

The geological conditions of the district are unfavorable for the expectancy of large ore bodies. The Resolution ore body is located in what appears to be the most favorable mineralized section of the district. The exploration of this section has shown that the commercial ore is limited and that the extensions are unimportant. In view of these conditions, exploration in other parts of the district could not be expected to produce better results than have been obtained here. Any ore which might be found would probably be in similar small pockets. It is my opinion, therefore, that further expenditure in the exploration of the property of the Company is not justified.

There are some rich assays reported in the partially stoped section on the 2237 level, and from this part of the mine a few hundred tons of ore assaying well enough to bear direct shipment to the smelter might be extracted. Under present labor conditions, a sub-lease without any Company overhead expenses might be resorted to if the terms and conditions for the purchase of the property permit such a policy.

Very truly yours,

(Signed) O. R. WHITAKER

Ira B. Joralemon

SHEEP TANK MINE
YUMA COUNTY ARIZONA

Property and Location: The Sheep Tanks Mine and adjoining property held under option by C. M. d'Autremont are located in northern Yuma County, Arizona. The Camp is 30 miles by rough road south of Vicksburg, on the Santa Fe Railroad, and about 35 miles north of the Southern Pacific cutoff from Yuma to Phoenix.

The claims lie in the rugged Sheep Tanks Mountains, in the heart of the Arizona desert. The hills rise 200 to 400 feet above the fairly gently sloping canyons. Roads can easily be built up these canyons, making all parts of the property readily accessible.

All supplies must be hauled to the camp, which consists of four tents. The nearest water is in a well 7 miles away. The topography indicates a good chance of finding water enough for a small mill by drilling above a lava ridge that extends almost across the valley about a mile and a half east of camp.

Geology: The Sheep Tanks Mountains are formed chiefly of a series of volcanic rocks, generally andesitic, with rhyolite beds. There are two main divisions of the andesite. The Lower Andesite is rather light colored, with a few green beds. It is made up of fairly well crystallized lava flows, varying from white rhyolite to dark green andesite. The top beds of this series are stained bright red by iron oxide, due to oxidation of pyrite. This Lower Andesite is barren as far as is known.

The Upper Andesite consists of volcanic breccia flows with a total thickness of at least 150 feet. It is more silicious and harder than the Lower Andesite, and so caps many of the hills. Usually this breccia is stained on the surface by manganese, giving the formation a black color that distinguishes it from the lower flows. All of the ore developed in the district is in the bottom 50 or 75 feet of this Upper Andesite.

South of the property, forming the crest of the Sheep Tanks Mountains, is a mass of light colored trachytic material which is probably intrusive. The andesitic beds dip away from it on all sides. The trachyte is apparently the cause of the Sheep Tanks uplift.

Surrounding this mass of older volcanic rocks are hills of

the recent basalt that covers much of the surrounding desert.

While the general structure of the mountains is a dome sloping away from the trachyte intrusion, there are many irregularities. Most important of these is an anticline, with an axis North 55 degrees East, pitching gently to the northeast. This anticline shows in the Upper Andesite capping the hills southwest and northeast of the camp. Between these hills most of the Upper Andesite has been eroded, leaving small blocks dropped by faulting 50 to 200 feet below their normal position. Northwest and southeast of this anticline the Upper Andesite caps most of the hills, but is badly faulted and crushed.

The geological sketch map shows the large outcrops of Upper Andesite.

Mineralization: The most important mineralization thus far discovered is on the crest of the anticline described above. In the block southwest of the camp, the lower 50 feet of the Upper Andesite breccia flows have been extensively replaced by quartz, with much iron oxide stain. A portion of this material carries enough gold to make ore. This block in which the ore occurs is cut off on the southwest by a fault, near the trachyte intrusion. On the other three sides the Upper Andesite is eroded away. This block in which the ore occurs is about 500 feet square. Mineralization is strongest near the crest of the fold, becoming weaker down the sides. On the northwest side the Upper Andesite is eroded away before mineralization ends, so ore is exposed on the surface. On the southeast the formation continues for several hundred feet beyond the probable ore, but with very slight mineralization.

In the portion of the same anticline crossing the hill northeast of camp there is considerable silicification and iron staining of the lower part of the Upper Andesite. Two short tunnels are said to have cut only very lean material. More work may find ore. The structure continues for 500 feet northeast, and residual patches of silicified breccia extend on northeast for 600 additional feet to the center of the East Pass No. 1 Claim. In an erosional remnant of Upper Andesite on this claim, in line with the main anticline, Mr. Allison, the owner, has found a little rich gold ore.

There is surface mineralization of the Upper Andesite in several of the blocks northwest and southeast of the main anticline. On the Black Eagle Claim a 4-foot vertical quartz vein is said to assay $10.00 in gold. Further prospecting may find small orebodies

in these blocks.

Development and Orebody: Save for shallow cuts and tunnels, the only development in the Sheep Tanks property is in the southwest block of the main anticline, in the southeast end of the Resolution Claim. About 480 feet of drifting and cross cutting has been done in the main tunnel, and 200 additional feet in the lower East Tunnel.

The Main Tunnel workings have partly developed a gold orebody on the crest of the main anticlinal fold. The ore consists of crushed, silicified andesite breccia, with much limonite, and minute quantities of galena and oxidized lead minerals. Most of the gold is free, and can frequently be seen as specks or crystals in the quartz. In addition to the gold, the ore carries from 1 to 15 ounces of silver per ton. Gold values are very irregular varying in a few feet from $2.00 to $90.00 per ton.

Not enough work has been done to determine the shape, size or average grade of the ore. The Main Tunnel runs southwest a little south of the crest of the fold, and due to the northeast pitch, gradually gets deeper in the beds. At 165 feet length the ore passes up out of the back of the tunnel. Many samplings by reliable engineers indicate that the 165 feet in ore averages about $25.00 per ton in gold and silver.

A general sample for treatment tests, made up by combining ore from channels taken every 10 feet throughout the developed orebody, averaged $20.67 in gold and 11.35 ounces, or $6.47, in silver. The orebearing bed outcrops 150 feet southwest of the last exposure in the tunnel, and is so thoroughly mineralized that it seems reasonably certain that ore will continue to this point.

The east and west crosscuts run across the crest of the anticline for a total width of 100 feet. For a few feet in the bottom of the west crosscut the lower, lean beds appear. The rest of the crosscuts developed ore averaging about $20.00 in gold and silver, with ore in the east face and in the top of the west face.

The east tunnel is 140 feet east of the Main Tunnel and 60 feet deeper. It is slightly lower in the bedding than the ore in the Main Tunnel. It found no ore save for a streak at the portal. It is probably too far down the east limb of the fold to get ore, in addition to being too deep.

Two short tunnels 120 feet west of the Main Tunnel, found good looking silicified breccia carrying a few dollars in gold.

They are at the west edge of the ore.

Three hundred feet still further west a third short tunnel followed a streak of galena and lead carbonate with fair silver and gold values.

The Main Tunnel has proved the orebody to be 165 feet long by 100 feet wide. Surface outcrops and shorter tunnels and pits make it likely that the ore is 400 feet long by at least 200 feet wide.

The thickness of the ore is not developed. The greatest thickness actually proven at one point is 14 feet, while winzes or drillholes prove 12 feet thickness at 6 or 8 other points. Vertical sections show that the orebearing breccia bed that outcrops at the portal of the Main Tunnel forms the surface over most of the ore. It is covered by higher, barren beds only in the northeastern and southwestern parts of the area. The bottom of the ore, 165 feet from the portal of the tunnel, is 35 feet deeper in the bedding and 35 feet from the surface. All of the intervening beds are ore in the tunnel, and in 6-foot drill holes above it, save for one barren drill hole. There seems to be an excellent chance that the 35 feet of breccia from the bottom of the ore in the tunnel to the surface will all be of commercial grade, save for thin coating of secondary calcite and lean material in the top 3 or 4 feet. Rich ore breaks through this lean surface material at several points.

Ore Estimate: The developed orebody at the Main Tunnel is 165 feet long, 100 feet wide, and 12 feet thick. The developed tonnage is 13,200 tons averaging about $25.00 per ton in gold and silver.

It is reasonably certain that there will be many times this amount of ore in the main orebody. The thickness will probably average 25 feet. The length is likely to be 400 feet and the width 200 feet. The amount of fairly probable ore is therefore 130,000 tons. The grade of this ore is uncertain, but will probably be from $15.00 to $20.00 per ton.

The portion of the anticline northeast of camp, and the other fault blocks of Upper Andesite may furnish additional tonnage.

Mining and Treatment: The orebody is not sufficiently developed to make it possible to plan the mining. If, as seems likely, ore comes to the surface, with a thickness of 35 feet at the center, tapering toward the edges, it can be mined in an open cut from a track around the nose of the anticline. Stripping would then be necessary in

only two places, and the mining cost should be under $1.00 per ton. If the ore is thinner, and capped by 10 to 20 feet of barren breccia, it can best be mined in open stopes, leaving pillars that can be robbed at the end of mining. In this case the cost of mining would be $1.50 to $2.00 depending on the regularity of the ore.

The best site for a mill is on an even slope on the Dark Horse No. 2 Claim, 1500 feet from the main orebody. Ore could be taken to this site very cheaply by a gravity rope tramway.

The method of treatment must be determined by tests. As the ore is thoroughly oxidized, cyaniding by percolation should give a good recovery. But it is possible that amalgamation followed by flotation may give a better silver recovery, and so be advisable.

Ore could be shipped to the Magma smelter for a total cost of about $12.50 per ton for mining, hauling, freight, and smelting. This is so much more than any possible cost of milling that it would be extremely wasteful except in the case of rich bunches.

Recommended Procedure: The following procedure is recommended:-

1. Raise to the surface from the Main Tunnel, to determine the thickness of the ore. The first raise should be 215 feet from the portal, where a raise has already been started. This will add 50 feet to the developed length as well as proving the thickness. It should be followed by raises or drill holes up spaced 50 feet apart. Downward drill holes would be less satisfactory, as values in the brecciated ground might either be concentrated or lost in cracks.
2. Drill for water above the reef a mile and a half east of camp. If no water is found here, drill other likely places.
3. Have thorough metallurgical tests made on the average sample taken at the time of the examination on which this report is based.
4. From the results of this work, the detailed plan of mining and treatment can be made.

Conclusion: At the worst the Sheep Tanks is a little rich mine that will yield a profit of $200,000, exclusive of purchase price, by mining and shipping the better ore.

It seems almost certain that the mine is far better than this, and that it will justify a 50 to 100 ton mill. A profit of $500,000 can be expected with much confidence, and several times this amount can reasonably be hoped for.

(Signed) Ira B. Joralemon

San Francisco, California
December 15, 1928

PRELIMINARY REPORT

S H E E P T A N K S M I N E

The property is situate 25 miles southerly from Vicksburg Station, Yuma County, Arizona. The station is on the branch of the Santa Fe Railroad line, locally called the Parker cut-off. The mine is also 34 miles northerly from Horn Station on the Southern Pacific Railroad. There is a good truck road connecting the mine with both railroad points. Elevation at the mouth of the main mine tunnel is 2625 ft.

The property consists of 11 lode mining claims, held by original location, and covering an area of 172. acres. These locations are the prior locations in the district. There is no conflict on the exterior lines of the property.

GEOLOGY

The immediate district of some considerable area is characterized by a late andesite flow, at no point in the district can sufficient depth be seen to determine the depth of this flow. This andesite flow was later tilted and subjected to such stress action as to cause a numerous series of faults. The main ones of which preceded the mineralization followed apparently by a later series and numerous compensating faults which assisted by later erosion, made the somewhat peculiar "saddling," visible about the mine workings. So far as observed all of the post-ore faults are normal and of slight displacement. The only possible exception to this being the large northerly and southerly fault through the westerly area, and at the back of the main tunnel.

There are several veins exposed by erosion within the property line, and in the very superficial workings invariably return an appreciable value in gold and silver. Three of the larger of these veins have been partially prospected, and some numerous surface openings made, and on one of these is the principle ore showing of the property. The three largest veins and the ones that I consider the most promising, are the vein on the Black Eagle claim with a northerly southerly strike, assaying mill ore values through widths of from 5 to 12 feet. A vein in the Smyrna claim with an easterly and westerly strike, southerly dip, and exhibiting commercial ore values in widths of from 6 to 20 feet, and last the vein in the Resolution claims with a northwesterly to southeasterly strike, with an easterly dip of from 30 to 40 degrees, where the workings to date have exposed smelting and mill ore bodies in widths of from 25 to 35 feet.

The ore occurance in the Resolution claims is epigenetic in character in a zone of brecciated andesite. This vein in

which the principle exploratory work has been done is visible on the surface for some 800 to 900 feet. No work, however, has been done, nor any attempts made to trace the continuity.

There has been about 500 feet of underground work (not all well directed) consisting of a main tunnel diagonally through the vein. The course of the working being such that it is neither a direct crosscut nor a drift upon the vein. There is, however, exposed for 125 feet in the main tunnel in top, bottom and sides of the drift, an ore returning on correct sampling assays- an average in gold and silver of over $30.00 per ton. There some streaks exposed for some lengths in widths of three feet- $150.00, 6½ feet $94.00, streaks of from 8 to 14 inches of $450.00, small seams of 1, 2 and 3 inches up to $3800.00 per ton. A complete cross section of the ore body exposed in this tunnel gives a 38 foot direct cross section.

There is in the area immediately exposed by this tunnel and three smaller connecting workings, at least 6000 tons of smelting ore and mill ore tunnage of 15,000 tons at least. The smelting ore will exceed an average value of $30.00 per ton, and mill ore above approximate of $10.00. As to the further possible ores on the level northerly and southerly from these workings, I consider it too problematical and would not care to give an estimate at this time.

A direct cross-cut tunnel is now being driven from a point southeasterly, and down the hill from the mouth of the upper tunnel. This will cut the ore body at a point that will give in excess of 150 feet of ore backs below the present main tunnel. The face of this new cross-cut is now in low grade ore, general samples running from $4.00 to $9.10 per ton. I estimate an additional 75 feet of work to expose the smelting ore body on that lower level.

ECONOMICS

The road from Vicksburg Station and from Horn station are fair desert truck roads; the last 2 to 3 miles of each having been well graded and some heavy rock work, ending in a turn way just below the tunnel ore dumps.

The nearest developed water of amount sufficient for milling is 6½ miles away by truck road, but the two long washes coming easterly by the property are within a mile and a half, both give every surface indication of making large water development at a nominal depth.

The ore is an andesitic quartz containing a low percentage of manganese, which apparantly carries the major part of the silver value. The gold occurs practically free, well disseminated and offers no obstacle to ordinary modern mill practice. Small cyanide tests on the ore gave better than 94% of the gold value.

The property is equipped with a small compressor, engine air drills, water tanks, some several tent houses, blacksmith shop, and usual run of mine tools--for a small force.

The total price asked for the property is $150,000.00, of this amount $100,000.00 is covered by bond and lease extending to April-1930, there being due on this bond $7500.00 December 1st, 1928; $25,000.00 October 1st-1929. The remainder of the bond on April 1st-1930. The $50,000.00 remainder of the above total price can be made in payments with some cash down sufficient for the protection of the ore in sight, and the remainder in terms to be mutually agreed upon.

The only mining restrictions in the above mentioned bond and lease, is a requirement of 150 shifts per month in actual mine operation or development, and a royalty of 10% on the net of all ore shipped or milled, the net to be considered smelter or mill returns less railroad freight and smelter charges. There are no other mining restrictions within the contract.

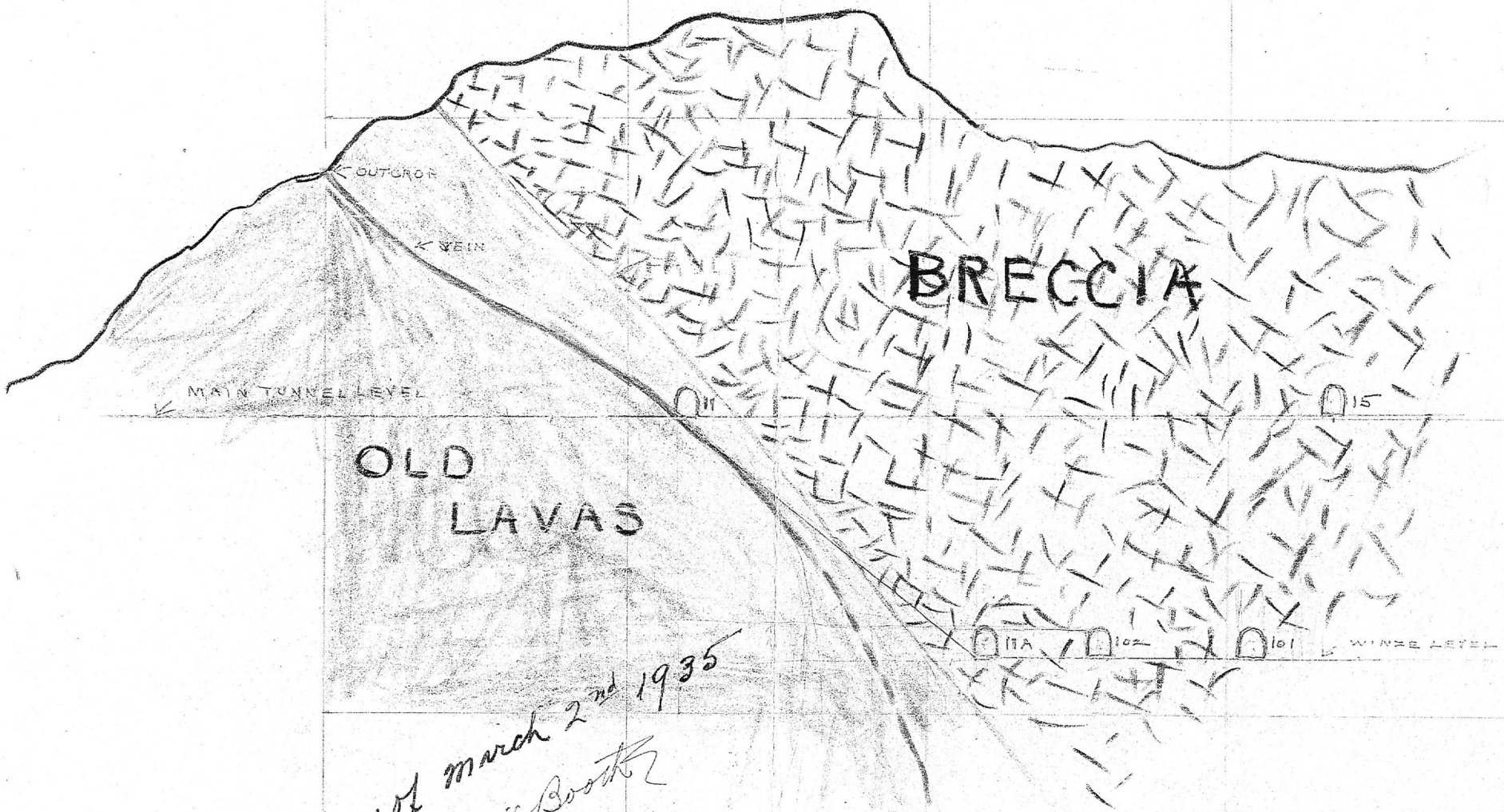
CONCLUSION

This property is characteristically of the bonanza type as heretofore exposed and worked in four properties of large production, contiguous to this area, and I wish to state that this showing is spectacular to say the least.

Bert P Bivins

Los Angeles, Calif.,
October 2, 1928.

Can't make out the name above - Staff.



as of march 2nd 1935
John H Booth

ELEVATION
LOOKING N 47° W
SHOWING PROBABLE
STRUCTURE.

OK.

July 26, 1943

Mr. Ed Mills
Salome, Arizona

Dear Ed:

I am enclosing a copy of a letter I have just received from Seth Brady, also a copy of my reply to him.

I believe it would be worthwhile to give Brady permission to photostat or copy the data he has on hand and then return the originals to you or to me.

Very truly yours

J. S. Coupal, Director

JSC:ach
encls.

June 15, 1943

Mr. Seth Brady
811 West Seventh Street
Room 405
Los Angeles, California

Dear Seth:

I have just received a letter from Edwin W. Mills of Salome which reads in part as follows: "Mr. Brady does not seem to be interested in Sheep Tanks, so please request him to return the brief report and photographs as promptly as possible."

Seth, as I sent these to you with the understanding that they would be returned as soon as you arrived at a decision or had created some interest, I am asking you to at least let me know of any progress and if not, would appreciate your returning the copies, at once, to me.

With best wishes and kindest personal regards, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk

June 15, 1943

Mr. Ed Mills
Salome
Arizona

Dear Ed:

Thank you for your letter of June 13. I am requesting Mr. Brady to return the reports and photographs immediately unless he plans to do something with it at once.

I am disappointed in the fact that we have not heard from Brady.

I note with interest your remarks about Sheep Tanks.

With best wishes and kindest regards, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk

ELLSWORTH COUNCIL

ARIZONA SMALL MINE OPERATORS ASSOCIATION

INCLUDING

SALOME - WENDEN - VICKSBURG

YUMA COUNTY, ARIZONA

Salome, Arizona
June 13, 1943

Mr. J. S. Coupal, Director,
Department of Mineral Resources,
413 Home Builders Building,
Phoenix, Arizona.

Dear Sam:

Thank you for your letter of June 11th, and for the information that I requested in my previous letter to you.

We had a very good meeting here last Friday evening and Mr. Holt gave us an interesting demonstration of his ultra-violet ray lamp.

I also brought up the matter of getting replies to to the power questionnaires, and I will do all I can to get the information regarding the power users in this district to you promptly.

In case that Mr. Brady does not seem to be interested, please request him to return the Brief Report and the photographs as promptly as possible.

I wrote to J. W. Hedges about two weeks ago regarding Sheep Tanks, but thus far I have had no reply from him. He may possibly be absent from Tucson. Two engineers from the Bureau of Mines, a Mr. Kumpke and a Mr. Hughes, have been working out from Salome for the past week in the vicinity of Alamo Crossing on the Bill Williams River. They expect to leave tomorrow for Kingman.

This morning I received a letter from Lowell B. Moon, Acting Assistant Director, Bureau of Mines, Washington, in reply to my letter of May 27th to Dr. R. S. Dean, Assistant Director. Mr. Moon stated in his letter as follows: "It is gratifying to learn that the Bureau results substantiate the findings of Mr. Thomsen in many respects and your explnation of various deviations appear to be well considered.

"As you have pointed out, solar evaporation could be carried out much more effectively in Arizona than at many other points and this would have its influence on the possibility of treating Sheep Tanks ore at a profit."

Hoping to see you again before long, and with all good wishes to you, I am,

Yours faithfully,

Edwin W. Mills, Chairman.

June 11, 1943

Mr. Edwin W. Mills
Arizona Small Mine Operators Association
Salome, Arizona

Dear Ed:

I have just received your letter of June 10.

I find that the Regional Manager of the War Production Board is Mr. Harry Fair. His address is 1355 Market Street, San Francisco, California.

I hope your council will get busy on the request for power information.

I am again writing Seth Brady asking for a reply.

With best wishes and kindest regards, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk

ELLSWORTH COUNCIL

ARIZONA SMALL MINE OPERATORS ASSOCIATION

INCLUDING

SALOME - WENDEN - VICKSBURG

YUMA COUNTY, ARIZONA

Salome, Arizona
June 10, 1943

Mr. J. S. Coupal, Director,
State Department of Mineral Resources,
413 Home Builders Building,
Phoenix, Arizona.

Dear Sam:

Thank you for your note of June 3rd with enclosure of six additional copies of Notice of Intention to Hold.

We are looking forward to meeting again tomorrow evening with Elgin Holt.

Would you mind telephoning to Information Clerk, War Production Board, Security Building, Phoenix, to request the name and address of the Regional Manager, War Production Board, San Francisco? A certain member here has asked me to get this information for him.

With all good wishes to you, I am,

Yours faithfully,

Edwin W. Mills,
Chairman.

P. S.-

I had been hoping that some word might arrive from Mr. Brady. Let me know just as soon as you hear anything. Thank you.

E. W. M.

4-7101
Navy Aux - Reg Dept
1355 Market St
SF

June 11, 1943

Mr. Seth Brady
811 West Seventh Street
Room 405
Los Angeles, California

Dear Seth:

I have just had a letter from Edwin W. Mills of Salome asking if I had heard anything from you. I have had to reply "no".

I do think you should at least acknowledge the report on Sheep Tanks so that I may know it is in your hands and would certainly like to be advised of any action you have taken or any results you have obtained.

Very truly yours,

J. S. Coupal, Director

JSC:kk

June 4, 1943

Mr. Seth Brady
Room 405
811 West Seventh Street
Los Angeles, California

Dear Seth:

I would like to hear whether or not you received the information on Sheep Tanks Mine and what reaction you got out of it from the people you contacted.

Mr. Mills brought this data in and I would like to be able to report something to him when he next comes to Phoenix.

With best wishes and kindest personal regards, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk

May 24, 1943

Mr. Seth Brady
811 West Seventh Street
Room 405
Los Angeles, California

Dear Seth:

I would appreciate hearing from you as to the reaction on the Sheep Tanks data sent you last week.

I again repeat, please keep this intact particularly the photographs so that we may return them.

Very truly yours,

J. S. Coupal, Director

JSC:kk

May 12, 1943

Mr. Seth Brady
811 West Seventh Street
Room 405
Los Angeles, California

Dear Seth:

I am sending under separate cover a report by Edwin W. Mills on the Sheeptanks Mine together with four large-size photographs and two smaller ones.

Mills has just called at the office and for your information I would like to state the following: Mr. Mills is a graduate mine engineer from Harvard in 1902. For reference he gives the name of Mr. Lucien Eaton, 79 Voses Lane, Milton, Massachusetts. Mr. Eaton is a mining engineer of high standing and has known Mr. Mills and his work for a good many years. Mr. Mills was manager of the Seoul Mining Company at Holkol, Chosen, Korea from 1911 to 1916. He developed and operated this property and claims it as his most outstanding accomplishment. The Company mined 1,100,000 tons of gold-copper ore of a gross value of $9,000,000. From 1931 to 1943, with the exception of the year 1934 when Mr. Mills was in Haiti, Boston and Washington on mining consulting work, Mills has stayed with the Sheeptanks property.

There may be some questions in the report which you would question and on these points all I can say is that they should be discussed personally with Mr. Mills and can best be done by a visit to the property.

Careful tests have been made showing that the manganese in the ore is amenable to SO_2 and a high recovery is made. This should be a very important by-product from the property.

The gold and silver values are sufficient to warrant consideration of a 1200 ton plant. In order to recover a reasonable percentage of the silver occurring in the ore, some steps have to be taken to remove the manganese. In taking these steps the manganese can be recovered as a by-product and whether the manganese so recovered is reduced to metallic manganese, manganese sulphate, or a high manganese dioxide depends upon the market and the costs for so doing.

One feature which Mr. Mills stresses is the fact that by solar evaporation in this particular district weak solutions may be concentrated to recover the manganese at a comparatively low cost.

The property has been sampled very fully and apparently a large tonnage of commercial ore is practically proven. The proposal to put up a pilot plant to prove out and iron out all of the wrinkles in a process which will recover the gold and silver and make a valuable by-product of the manganese is sound. There are sufficient tailings to justify this operation and once the process and the commercial value of the property is proven, the larger scale plans can be undertaken.

I know that Mr. Mills is very capable and has conducted tests and investigations over a series of years. I urge that you arrange with your client, or anyone who has the vision and the ability to tackle a good sized mine operation, to visit Mr. Mills and the property.

There are good accommodations at Schefflers Motor Court at Salome and good meals can be had there.

If you plan to make the trip I suggest that you wire Mr. Edwin W. Mills, Salome, Arizona, at least a day in advance. Please bear in mind that the telegraph office at Salome is only open from 6:00 a.m. to 3:00 p.m. and is closed on Sundays.

Please let me have your reaction to this as I feel confident it is worthy of your serious attention.

With best wishes and kindest regards, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk
Enclosure

P. S. The report and maps are sent to you with the express understanding that you will not let them get out of your hands and that you will make absolutely sure that they are returned to me just as soon as you find you cannot get reasonably quick action at least for an investigation in the field.

MS-26 SHEEP TANKS, Edwin W. [illegible]ls, [illegible]alome, Arizona

Your name and address has been furnished to -

Albert Poston, 3107 Brighton Ave., Los Angeles, Calif.

who has made inquiry for the same with reference to mining property listed with the Department of Mineral Resources

DEPARTMENT OF MINERAL RESOURCES

J. S. COUPAL, Director

STATUS OF DORMANT MINES

MINE NAME: Sheep Tanks

LOCATION: Ellsworth District

OWNER ~~AND/OR LEASEE~~: Edwin W. Mills

ADDRESS: P.O. Box 637, Salome, Arizona

APPROXIMATE PRODUCTION (Year of 1945):

COPPER _____ Lbs. LEAD _____ Lbs.

ZINC _____ Lbs. (OTHER) _____

CHECK THE CHIEF CAUSE OF YOUR DISCONTINUED PRODUCTION:

(A) Easily available ore worked out.
(B) Increased costs, but have quantity similar to past grade of ore.
(C) Too close a margin to develop more ore.
(D) _____

_____

If you have ore ready to mine please give your estimate of the amount of metal (name each metal) that you could produce in one year (after allowing 60 days to get started) if there were premiums above present market prices. Name amount with a low premium, and amount at a high premium; such as:

Copper at 22½¢ plus 5¢ premium..... 1,000,000 Lbs.
Copper at 22½¢ plus 10¢ premium..... 1,500,000 Lbs.

_____

_____

If you do not have ore ready to mine please discuss the following:

(A) Do you think a reasonable development program would produce a justified tonnage of commercial ore at above mine?

_____

_____

(B) With a premium price (guaranteed for one year) could you carry out such a development program yourself? What premium?

_____

_____

(C) If you could not do this yourself, would a quick drilling program by some government agency (at government expense) be sufficient?

(D) Or would you prefer a loan plan similar to the arrangements during World War II?

How about a combination plan in two stages such as follows?

✓ Stage 1: Government engineers review project and, if a little drilling appears to be justified and a preliminary key to the situation, such drilling program to be agreed upon by owner and government engineer, paid for by the government, but let by contract. Yes.

✓ Stage 2: If results of drilling (or without drilling) justify underground development and/or production equipment, same to be obtainable via a mortgage loan on property. Yes

Please discuss the above:

SUGGESTIONS:

DATE August 22, 1950 SIGNATURE Edwin W. Mills

BRIEF REPORT ON THE SHEEP TANKS MINES.

GENERAL.- The Sheep Tanks Mines are located in northern Yuma County, State of Arizona, Townships 1 North and 1 South, Range 15 West, Gila and Salt River Meridian.

The present camp is due south of Vicksburg, a distance of 28 miles, or 26 miles due south of U. S. Highway 60. Vicksburg is a station on the Los-Angeles-Phoenix branch of the Atchison, Topeka and Santa Fe Railway. Horn, a station of the Southern Pacific Railway, is about 36 miles southeasterly from the present camp. The mine road from Vicksburg has no heavy grades and is in good condition for motor transportation.

The claims are situated in the Little Horn Mountains in the heart of the Arizona desert, and were originally twelve in number covering an area of approximately 197 acres; at the present time nine (9) claims are submitted with this report; they cover an area of 180 acres and have been surveyed for patent. An abstract of title may be obtained from the Yuma Title Abstract and Trust Company, of Yuma, Arizona.

In addition to the foregoing claims there are also three millsites upon which five wells of varying depths have been drilled for a water supply.

HISTORY.- The first location at Sheep Tanks was on January 1st, 1909, by J. G. Wetterhall upon the present Resolution claims. Very little development work was done, however, until 1927. During 1929 ore shipments of a total of 801 tons were made to the Hayden smelter with a total gold-silver value of $54,508.05 (at current quotations), with an average gold-content of 1.627 oz., and 15.63 oz. of silver per ton, or an average gold-silver value of $68.05 per ton.

In 1931, the Anozira Mining and Milling Company, which later became the Sheeptanks Consolidated Mines Company, purchased the twelve original mining claims. During 1931 and 1932 a considerable amount of prospecting and development work was done and the mining area considerably extended.

Sufficient milling ore having been developed, a pilot mill of 100 tons daily capacity was erected and placed in operation in the autumn of 1933. In September, 1933, while this mill was being erected, ore shipments of a total of 120.93 tons were made to the El Paso smelter; this ore averaged $50.28 per ton (at current quotations), with an average gold-content of 1.1665 oz., and 13.308 oz. of silver per ton, or a total gold-silver value of $5,080.36 The milling plant operated for only a few days in November, 1933, as the Directors decided that certain changes should be made in the original flow-sheet. Milling operations were resumed on February 1st, 1934, and continued until August 20th, 1934, when the plant was closed down. During this period of about seven months a total of 15,167 tons was milled from the upper Resolution Tunnel orebody, with a total gold-silver recovery of approximately $200,000.

Some development work was carried on after the shutdown of the milling plant but, on April 1st, 1935, all operations ceased and the company went into voluntary liquidation. It was reported by the Board of Directors that no further commercial ore was available. All of the equipment, machinery, power and pipe lines were sold; Edwin W. Mills purchased the group of mining claims and the three millsites, which were duly conveyed to him by quit-claim deed, under date of August 29, 1935, and the same duly recorded at the County Recorder's Office, Yuma, Arizona.

The purchaser of the equipment, machinery, etc., was given one year in which to remove the same, consequently Mr. Mills did not come into actual possession of the mining claims and millsites until July 1, 1936. Since that time additional prospecting and sampling has been carried on.

From April to July, 1939, ore shipments of a total of 507.87 tons were made from the ground stoped for milling operations during 1934, and in the area in which the former Directors declared that there was no more ore available. This ore had a total gold-silver value of $11,026.36 with an average gold-content of 0.491 oz., and 6.844 oz. of silver per ton, or an average gold-silver value of $21.71 per ton. Further ore shipments have not been made as it is the intention to start milling operations again as soon as possible.

GEOLOGY.- The immediate Sheep Tanks area is characterized by a series of Tertiary volcanic flows of andesite, rhyolite, breccias, tuffs and intrusive rocks. A detailed description of the Sheep Tanks geological conditions, by Dr. Eldred D. Wilson, of the Arizona Bureau of Mines, is given in the University of Arizona Bulletin, Vol. IV, No. 2, February 15, 1933.

With reference to the Tertiary volcanic rocks, Dr. Wilson states as follows:

"Breccia: Unconformably overlying the rhyolite and diorite-porphyry, and apparently in fault contact with the dacite, are irregular areas of breccia that outcrop as shown on Plate 16. Its maximum thickness is difficult to determine, but probably amounts to less than 200 feet. Throughout, this breccia is rather intensely silicified and stained by iron and manganese oxides. Its basal portion consists largely of angular fragments of rhyolite, from small size to several inches in diameter, cemented by vuggy, fine-grained silica. Upward the fragments consist largely of shattered, locally silicified material of andesitic composition resembling the diorite-porphyry. Whether this breccia, prior to its cementation, originated from fault movement or from volcanic activity has not been determined. It is the host-rock for the Sheep Tanks gold deposit."

ORE OCCURRENCE AND MINERALIZATION.- The ore is highly siliceous and contains minute quantities of galena and oxidized lead minerals, copper and zinc, in addition to visible free gold, and much limonite and hematite. Pyrolusite is widely disseminated throughout the orebodies, and it has been found that a certain percentage of the silver-content is combined with the manganese. This silver mineral has not yet been definitely determined. A high percentage of the gold-content is free, and it is readily amenable to treatment by amalgamation, flotation and/or cyanidation.

Reports made upon the original group of twelve claims by Messrs. Ira B. Joralemon and Oscar H. Hershey indicated a wide-spread mineralization over an area of not less than 2,500,000 square feet. The thickness of this mineralization was estimated to vary from a few feet to 40 feet. (At the time of the report by Mr. Joralemon a total of only 700 feet of development work had been made.) At the present time, due to a greatly amplified program of development work, over 8000 feet, it may be safely stated that this area of mineralization now exceeds 5,000,000 square feet.

ORE ESTIMATES.- It is estimated that there is available at the present time a total of 120,000 tons of ore in the Resolution Hill area with an average gold-content of 0.26 oz., or $9.10 per ton, and an average silver-content of 4.5 oz., or $3.19 per ton, or a total gold-silver value per ton of $12.29 or a gross total gold-silver value of better than $1,470,000.

In addition it is estimated that not less than 600,000 tons have been partially developed with a gold-silver value of not less than $6.00 per ton, say 0.10 oz. of gold and 3.25 oz. silver per ton, or a total gold-silver value of not less than $3,600,000. This makes a gross total of not less than 720,000 tons of ore within the Resolution Hill area with an estimated total gold-silver value of more than $5,000,000, or approximately $7.00 per ton in gold and silver values.

From the knowledge gained by prospecting and exploration within the extent of the area of mineralization of these nine claims, it is quite within the bounds of reason to estimate from 10,000,000 to 12,000,000 tons of ore which may be developed within this area, with an average gold-silver value of not less than $5.00 per ton, at current quotations. The potential possible ore is of considerable magnitude.

MANGANESE.- Manganese dioxide, in the form of pyrolusite, is widely disseminated throughout the entire Sheep Tanks area. Bodies of this mineral have been found with as high as 18 per cent manganese-content. Based upon the results from many assays and analyses it is estimated that an average manganese-content of not less than 4 per cent can be maintained throughout the ore-bearing areas. This being the case, the manganese can be recovered as a valuable by-product instead of going to the tailings dumps as waste material. Through a number of tests which have been made it has been definitely determined that this manganese-content will add approximately $5.00 to the value of every ton of ore mined and milled, based upon the utilization of the same in the manufacture of manganese compounds and alloys. Inasmuch as no mining nor milling costs are directly chargeable to the recovery of the manganese, it is evident that the production of the same can be made at a low cost, with resultant low production costs of manganese compounds and alloys.

OTHER CONSTITUENTS OF SHEEP TANKS ORE.- A spectrographic analysis of a representative ore sample showed the presence of commercial quantities of iron(hematite and limonite), aluminum, chromium and other elements which further experimental and research work may show they can be recovered as profitable by-products, thus providing an additional source of revenue from the ore mined and milled.

OPERATING COSTS.- Inasmuch as practically all the tonnages of ore mentioned under ORE ESTIMATES can be mined without any hoisting, pumping, or timbering costs in connection with mining operations, it follows that low mining costs may be obtained. Upon the basis of a tonnage of 1200 tons every 24 hours it has been estimated that total mining costs may range from $0.30 to $0.50 per ton.

It has been estimated that milling operations, based upon the foregoing tonnage, will range from $0.50 to $0.75 per ton milled, depending upon the plan of flow-sheet followed. Thus it may be estimated that total mining and milling costs will not exceed $1.20 per ton, based upon a daily tonnage of 1200 tons.

WATER.- Thus far sufficient water has been developed only for the operation of a milling plant of 100 tons daily capacity, by means of four shallow wells some 8000 feet to the southward of the present mine camp. However, there are good reasons to believe that a sufficient supply of water for the operation of a 1200-ton milling plant can be developed within a reasonable distance to the northward of the present mine camp.

CONCLUSIONS.- The Sheep Tanks property is a mining venture of unusual possibilities, and offers the definite prospect of returning large dividends on the amount invested.

Respectfully submitted,

Edwin Walter Mills,
Consulting Mining Engineer.

Sheep Tanks Mines,
November 6, 1939.

Postal address:
Salome, Arizona.

N1526

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
OWNERS MINE REPORT

Date November 15, 1939

Mine Sheep Tanks

District Alamo-Kofa, Northern Yuma County

Location Townships 1 North and 1 South Range 15 West, Gila and Salt River Meridian 28 miles south of Vicksburg, Ariz.

Former name

Owner Edwin Walter Mills

Address Salome, Arizona

Operator Edwin Walter Mills

Address

President

Gen. Mgr.

Mine Supt.

Mill Supt.

Principal Metals Gold, silver and manganese

Men Employed

Production Rate Proposed: 1200 tons every 24 hours

Mill: Type & Cap.

Power: Amt. & Type Diesel and/or electric

Operations: Present. Sampling and experimental metallurgical work

Operations Planned Mining and milling on a scale commensurate with the available tonnage.

Number Claims, Title, etc. Six groups constituting a total of 63 claims: of these 14 have been surveyed for patent. Abstract of title may be obtained from Yuma Title Abstract and Trust Company, Yuma, Arizona.

Description: Topog. & Geog. At the eastern end of the Little Horn Mountains; typical desert Tertiary hills, with steep slopes and narrow arroyoas. Scant vegetation and country easily prospected.

Mine Workings: Amt. & Condition

(over)

Geology & Mineralization The immediate Sheep Tanks area is characterized by a series of Tertiary volcanic flows of andesite, rhyolite, breccias, tuffs and intrusive rocks. Ore is highly siliceous and highly oxidized; gold, silver and manganese.

Ore: Positive & Probable, Ore Dumps, Tailings

	120,000	tons,	gold-silver	value	of	$12.00	per	ton
	600,000	"	"	"	"	6.00	"	"
Ore Dumps:	12,000	"	"	"	"	5.00	"	"
Tailings:	15,000	"	"	"	"	6.00	"	"
Potential Ore:	10,000,000	"	"	"	"	5.00	"	"

Mine, Mill Equipment & Flow Sheet 800 feet of 12-lb. track; four 16-cu.ft. ore cars.
No mill equipment available at present.
Amalgamation and cyanidation.

Road Conditions, Route Good dirt road, no heavy grades, suitable for motor transportation, 26 miles due south from U.S.Highway 60.

Water Supply From four shallow wells (151' to 270' in depth), 8000 feet south of present camp, sufficient water for 80-100 tons every 24 hours.
An ample supply of water can be developed within a reasonable distance of the mine along the road leading to Vicksburg, Arizona.

Brief History First location on January 1, 1909. No active work until 1928-1929 when some 800 tons of high-grade ore were shipped; other ore shipments made during 1933; during period of seven months in 1934 some 15,167 tons were milled with an average gold-silver value of better than $20.00 per ton. Company voluntarily liquidated in 1935. 507 tons of good ore shipped during April-July, 1939.

Special Problems, Reports Filed To insure good silver recovery, manganese content should be leached by SO_2, or otherwise treated, before cyanidation of gold and silver content. Favorable reports by Ira N. Joralemon and Oscar H. Hershey, and other engineers. Also available are various mine maps, and assay plats.

Remarks Low mining costs may be obtained, as mining operations can be carried on with no charges for hoisting, pumping or timbering. Climatic conditions permit of year-round mining operations. An ore tonnage of milling ore of considerable magnitude is assured.

If property for sale: Price, terms and address to negotiate. Sampling and ore-testing option from 60 to 90 days at rate of $10.00 per day. Lease for 30 years on royalty basis, as follows:

Mint returns, gold-silver up to $10 per ton	-	10 per cent
" " " " $10 to $15 per ton	-	12½ per cent
" " " " over $15.00 per ton	-	15 per cent
Net returns on manganese recovered and sold	-	10 per cent

Edwin Walter Mills, Salome, Arizona

Signed..... Edwin Walter Mills .....

Use additional sheets if necessary.

THE THOMSEN MANGANESE PROCESS

for the treatment of the

SHEEP TANKS MINE ORES

YUMA COUNTY

ARIZONA

Submitted by

Edwin W. Mills

Sheep Tanks Mine,

Salome, Arizona

at meeting held at Phoenix, Arizona,

April 6, 1943

INTRODUCTION.- During the years 1914-1918, the writer of this brochure was actively engaged in the manufacture of manganese sulphate and a wide variety of other manganese compounds. Starting with a very pure ore and sulphuric acid, we soon experienced the scarcity of both due to war conditions which ultimately led to the development of the process about to be described.

The application of this information to Sheep Tanks ore will be self evident when we consider that not only is the manganese salvaged, but in addition the recovery of both gold and silver is much facilitated.

CHARACTER OF ORE.- Approximately 75% of the ore consists of a hard, dense quartz; the balance is made up chiefly of the oxides of iron and manganese with a few veinlets of crystallized calcium carbonate and sulphate. A little of the manganese is present as carbonate and silicate, and there is a slight contamination of oxidized copper minerals. The gold appears to be an associate of the iron mineralization, the silver with manganese and secondary silica.

CRUSHING AND GRINDING.- Numerous tests indicate that excellent extraction of both gold and silver as well as manganese can be obtained by passing all the pulp through 100 mesh prior to acid treatment and cyanide lixiviation. Finer grinding would doubtless increase the yield somewhat, but it is felt that the increase in power, drop in capacity, and harder filtration will not compensate for the higher yield.

In coarse crushing the ore will be found quite friable, owing to many seams of manganese, but in fine grinding the dense primary quartz will make its demands.

The pulp, diluted to 20% solids, settles reasonably well, but the thickener overflow will be colored black by a little manganese that is almost colloidal in nature. The loss in values thus occasioned will probably be inconsequential and it may be possible to avoid such loss entirely by returning the overflow to the grinding-classifying circuit. Should this practice be found inexpedient and the loss considerable, then we can vary the operation as follows:

Let onepound of lime be added to the mill for each ton of ore and the corresponding amount of manganese solution introduced into the classifier overflow. The manganese hydrate thus produced will act as a coagulant, the settling rate will be doubled, and the overflow will be water-white. Should water economy ever be desired then this overflow should be re-used without hesitation.

To deliver pulp of proper fineness and consistency will require the customary installation of crusher, mill, classifier and thickener. As this is standard practice no suggestions will be made.

CHEMICAL TREATMENT.- The next step in the operation is to dissolve out the manganese by means of sulphur dioxide. The pulp, thickened to proper density, enters the absorber. The laboratory cannot prescribe what this will be as it becomes a compromise between two opposing factors, to-wit: the denser the pulp the better, from the standpoint of manganese solution strength and subsequent filtration; but the thinner the pulp the better it becomes from the standpoint of agitation, pumps, and the airlifts needed to circulate the pulp within the absorber.

The sulphur dioxide may be obtained by the roasting of a sulphide ore or more easily by the direct combustion of sulphur. In the latter case the equipment should be similar to the sulphur burners of

the sulphite pulp mill. In place of the costly lead coolers we may with advantage substitute a 25-horse power vertical boiler and use the gas somewhat hot. The cooling effects of the airlifts will counterbalance this input of heat and also that derived from chemical action. Optimum conditions for manganese solution by means of sulphur dioxide is about 75 degrees Centigrade, but may be varied within wide limits. We must consider also that a hot pulp filters easily.

With these suggestions in mind, the operator must adjust the conditions within the absorber according to the actual results obtained in practice and not in any hard and fast manner. A pilot plant serves its highest function when it delivers to the operator such data as is otherwise unobtainable.

It would be unwise to attempt to render more than 90 percent of the manganese soluble, at least at the start. A small amount of residual manganese will act as a safeguard against too much action on both iron and lime. Such action must, of course, result in loss of sulphur and will also give rise to a more impure manganese solution.

The gas from the sulphur burners should be as high as possible in sulphur dioxide and as low as possible in sulphur trioxide. The lower oxide has a most decided selective effect upon manganese as compared with iron and lime while the trioxide is about on a par as to lime and reversed on manganese. In the event that the gas be made by roasting sulphides, instead of by burning sulphur, then it might become imperative to scrub the gas prior to use.

THE ABSORBER.- For a 100-ton mill a 12' x 12' tank, fitted with an agitator, is indicated. The lower half constitutes a reservoir for the

pulp undergoing treatment, the upper half is the absorber proper. By means of baffle-plates, the gas is made to take a zigzag path over the surface of the pulp which, in addition, is continuously showered through the gas by means of airlifts. The space between the baffles is filled with wooden grids, of 2 x 4s, and the circulating pulp is thus made to present the maximum surface to the gas. It is suggested that the air-lifts be worked by compressed air at the start, but it will be self evident that burner gas would be more desirable. This modification will necessitate acid-proof equipment in place of a compressor already available.

The air-lifts, eight in number, are spaced equally around the circumference of the tank and are only wooden boxes held together with dowels. It is the intent of the entire design to present no substance to the action of either pulp or gas save wood, and in connections to use either rubber or stainless steel. The most adaptable wood is Douglas fir. The supplementary sketch will make the description clear.

FILTRATION.- To separate the manganese solution from the pulp will now involve the use of filters. These must be of acid-proof construction, but where no scouring effect is involved, lead may be freely used. Any type may be selected but the suggestion is made that a "leaf" type, mounted above the next tank in series, will be advisable. About 1000 square feet of canvas surface is required.

It will be essential that the manganese solution be removed with the most scrupulous care. It will, therefore, be necessary to employ double filtration, utilizing in the first washing the weak wash water obtained in the second step. We shall thus avoid all possible contamination on one hand and undue dilution on the other hand.

The strong manganese solution, obtained from the first filter, is now passed on to the solar evaporator; the pulp is ready for cyanidation.

CYANIDE TREATMENT.- Laboratory tests indicate that solution of the gold is almost complete in 12 hours, but that good silver extraction requires at least 36 hours. Unfortunately, this longer contact results in the re-precipitation of some of the gold, thus reducing the yield.

It is suggested, therefore, that cyanidation be effected in two circuits, the first yielding principally gold, the second principally silver. If we employ, therefore, as our equipment four tanks, each holding approximately 50 tons of ore, with filters mounted between tanks 1 and 2, we shall have a contact of about 12 hours in the first circuit and about 36 hours in the second. This overall contact of 48 hours should result in the extraction of 95 percent of the gold and over 85 per cent of the silver. These figures are a little higher than laboratory findings, but it has been my experience that after a mill is thoroughly adjusted it will always give an extraction somewhat better than the laboratory.

A little protective alkali should, of course, be added to the first cyanide tank, otherwise it should follow standard practice throughout.

It should not be forgotten that by the use of this double filtration we obtain most of the gold in a form acceptable at the mint, while only a little gold remains locked up with the silver. The opportunity of losses of gold through the carelessness of operators is also much minimized, and final tailing losses of soluble gold are likewise reduced.

THE SOLAR EVAPORATOR.- This device is an adaptation of the old German "GRADIERHAUS", somewhat further developed by the writer in the West Indies, where it was used for the purpose of evaporating sea water and for cooling condenser water. It consists of a stack of brushwood, held in place by a wooden frame, placed in a shallow tank. The fluid in the tank is continuously raised to the top of the brushwood stack and distributed over its upper surface by means of a central launder. When a batch is brought up to saturation it is let off into the storage tank for the manganese driers.

Such a pile of brushwood, 4' wide, 12' high and 200' long, was erected by the writer at Salinas, Puerto Rico, and was found to have an evaporative effect equivalent to somewhat more than 1 ton of water per foot of length in 24 hours. Calculated from this data we find that a 50-foot structure will be required at Sheep Tanks. It should be placed in a pan of wood 55 feet long, 6 feet wide, and 12 inches deep, and the sides should be protected by splash boards similar to those used on atmospheric water coolers. The circulation may be effected by an airlift or by a lead-lined pump.

PURIFICATION.- The treatment upon the brushwood structure is not only one of evaporation but of purification as well. The continued exposure to sun and wind has a highly oxidizing effect in which iron and copper salts act as efficient catalysts. The manganese thionates are therefore largely converted into sulphates; calcium sulphite is oxidized to sulphate and by evaporation thrown out of solution, and both iron and copper precipitated as basic salts. A little lime may be needed to complete the reaction within the required period of time.

The precipitate formed will in part attach itself to the

brushwood and in part settle to the bottom of the shallow tank. Any suspended impurities may be removed by means of a sand box acting as a strainer or filter as desired. Such an installation will, of course, be interposed between the evaporator and the storage tank for the driers before referred to. Should any gold go into solution in the treatment with sulphur dioxide, then it would doubtless be re-precipitated in this treatment. If such should not be the case, then an insignificant addition of sulphide or carbon would render it complete. The entire possibility is, of course, regarded as a most unlikely contingency and would not be mentioned at all save for the fact that it was introduced into a conversation.

DRYING MANGANESE.- There is sufficient waste heat in the exhaust of the Diesel engine to effect the final stage of the recovery of the manganese as the sulphate. It is therefore suggested that the two 5' x 16' driers be erected in accordance with the writer's past practice. The waste gases from the Diesel would then be piped to this installation which should be placed as close to the latter as possible to avoid both back pressure and loss of heat. The dried manganese would go to crude storage awaiting market demands.

REFINING MANGANESE SULPHATE.- The crude salt thus obtained is now re-dissolved in water, agitated with a little manganese hydrate, prepared separately, filtered and again evaporated to dryness. In this case we must use direct firing or else we must use air heated by the exhaust, not the exhaust itself, for any carbon would render the manganese sulphate unsaleable. To effect this evaporation we require an additional drier similar to the former installation on crude.

Grinding and packing in barrels completes the operation. A "farmer's mill", such as is used to grind feed, was my own installation

and is quite satisfactory.

The filter, etc., used in refining are of such small capacity that they may be built in a few days by local help. For this reason this item is not more closely scanned. It is assumed that this department will come into existence as fast as the market warrants.

CONVERSION OF MANGANESE SULPHATE.- There is, however, a field into which any quantity of manganese can be fed without fear of glutting the market. This is the field of raw material for ferro-manganese. If manganese sulphate be roasted it becomes converted into a manganese oxide with over 70 percent metallic content. Such material is of prime quality for ferro-work and as long as the present tariffs are in force it can be produced and marketed at a profit. Should these protections be withdrawn then the proposal becomes unworkable. As such work has not been done by me out of the laboratory it is only mentioned in passing. The sulphur set free could doubtless also be used again. There is also the field of higher manganese compounds which constitute a most lucrative "side line" to any manganese endeavor but it would be too much to do more than to mention the same. These substances, chiefly used as driers in the paint industry, are the borate, resinate, oleate, linoleate, and tungstate of manganese. The chloride and artificially prepared dioxide are also marketable salts; the latter has quite some application in the manufacture of printing inks and paints under the trade name of "Van Dyke Brown."

SUMMARY.- The plates, sketches, and plans now available or to be drawn up in the preparation of the design for the 100-ton pilot mill, should be considered as a part of this paper and are, of course, essential for a complete understanding of the subject matter of this brochure. As these drawings are at present needed in San Francisco, I am sending this descriptive section in advance.

Respectfully submitted,

March 24, 1933.

(Signed) Alfred M. Thomsen.

BRIEF REPORT ON THE SHEEP TANKS MINE

GENERAL: The Sheep Tanks Mine is located in northern Yuma County, State of Arizona, Townships 1 North and 1 South, Range 15 West, Gila and Salt River Baseline and Meridian.

The present camp is due south of Vicksburg, a distance of 29 miles, or 27 miles due south of U. S. Highway 60. Vicksburg is a station on the Los Angeles-Phoenix branch of the Atchison, Topeka and Santa Fe Railway. Horn, a station on the Southern Pacific Railway, is about 36 miles southeasterly from the present mine camp. The mine road from Vicksburg and U. S. Highway 60 has no heavy grades and is in very good condition for motor transportation.

The mining claims are situated in the Little Horn mountains in the heart of the Arizona desert, and were originally twelve in number covering an area of approximately 197 acres. At the present time fourteen claims are submitted with this report; they cover an area of approximately 260 acres, and they have been surveyed for patent. An abstract of title may be obtained from the Yuma Title Abstract and Trust Company, Yuma, Arizona.

GEOLOGY: The immediate Sheep Tanks area is characterized by a series of Tertiary volcanic flows of andesite, rhyolite, breccia, tuffs, and intrusive rocks. A detailed description of the Sheep Tanks geological conditions, by Dr. Eldred D. Wilson, of the Arizona Bureau of Mines, is given in the University of Arizona Bulletin, Vol. IV, No. 2, February 15, 1933.

With reference to the Tertiary volcanic rocks, Dr. Wilson states: "Breccia - Unconformably overlying the rhyolite and diorite-porphyry, and apparently in fault contact with the dacite, are irregular arears of breccia that outcrop as shown on Plate 16. Its maximum thickness is difficult to determine, but probably amounts to less than 200 feet. Throughout, this breccia is rather intensely silicified and stained by iron and manganese oxides. The basal portion consists largely of angular fragments of rhyolite, from small size to several inches in diameter, cemented by vuggy, fine-grained silica. Upward the fragments consist largely of shattered, locally silicified material of andesitic composition resembling the diorite-porphyry. Whether this breccia, prior to its cementation, originated from fault movement or from volcanic activity has not been determined. It is the host-rock for the Sheep Tanks gold deposit."

ORE OCCURRENCE AND MINERALIZATION: The ore is greatly oxidized throughout and is highly siliceous and contains minute quantities of galena and oxidized lead minerals, copper and zinc, in addition to visible free gold, and much hematite and limonite. Pyrolusite is widely disseminated throughout the orebodies, and it has been found that a certain percentage of the silver content is combined with the manganese. This silver mineral has not yet been definitely determined. Inasmuch as the gold content is free and bright, it is readily amenable to treatment by amalgamation and cyanidation.

Reports made upon the original group of twelve mining claims by Messrs. Ira B. Joralemon and Oscar H. Hershey indicated a wide-spread mineralization over an area of not less than a total of 2,500,000 square feet. The thickness of this mineralization was estimated to vary from a few feet to forty feet. (At the time of the report made by Mr. Joralemon a total of only 700 feet of development work had been made.) At the present time, due to a greatly amplified program of development work, over 8,000 lineal feet, it may be safely stated that the areas of mineralization now exceed 5,000,000 square feet.

HISTORY: The first location at Sheep Tanks was on January 1, 1909, by J. G. Wetterhall, upon the present Resolution claims. Very little development work was done, however, until 1927. During 1929 shipments of a total of 801 tons were made to the Hayden smelter with a total gold-silver value of $54,508.05 (at current quotations), with an average gold-content of 1.627 oz., and 15.63 oz. of silver per ton, or an average gold-silver value of $68.05 per ton.

In 1931 the Anozira Mining and Milling Company, which later became The Sheeptanks Consolidated Mines Company, purchased the twelve original mining claims. During 1931 and 1932 a considerable amount of prospecting and development work was done and the mining area considerably extended.

Sufficient milling ore having been developed, a pilot mill of 100 tons daily capacity was erected and placed in operation in the autumn of 1933. In Setpember, 1933, while this mill was being erected, ore shipments of a total of 120.93 tons were made to the El Paso smelter; this ore averaged $50.28 per ton (at current quotations), with an average gold content of 1.1665 oz., and 13.306 oz. of silver per ton, or a gross total gold-silver value of $6,080.36.

The milling plant overated for only a few days in November, 1933, as the Directors of the Sheeptanks Consolidated Mines Company decided that certain changes should be made in the original flow-sheet. Milling operations were resumed on February 1, 1934, and continued until August 20, 1934, when the plant was closed down. During this period of about seven months a total of 15,167 tons was mined and milled from the upper Resolution Tunnel ore body, with a total gold-silver recovery of approximately $180,000.00.

The mining company went into voluntary liquidation during 1935, and Edwin W. Mills came into possession of all the mining claims and four millsites on July 1, 1936. Since that date additional prospecting and sampling have been carried on. During the month of October, 1936, fifty samples were taken to check the values of the stope faces which were left after the cessation of milling operations. The assay results showed 0.305 oz. in gold and 6.59 oz. in silver per ton, or $10.66 in gold, $4.68 in silver, a total of $15.34 per ton at current quotations.

During the period of from April to July, 1939, ore shipments of 507.87 tons total were made from the stopes which had been mined during 1934; this ore had a total gold-silver value of $11,026.36 with an average gold-content of 0.491 oz., or $17.19, and 6.844 oz. of silver, or $4.52 per ton, or an average gold-silver value of $21.71 per ton.

During the months of March, April and May, 1940, ore shipments were made from certain dumps and easily worked ground in order to ascertain the net returns from low-grade ores shipped to Hayden smelter; 776.018 dry tons were shipped with a total gold-silver value of $7,437.35 with an average gold content of 0.1885 oz. and 4.198 oz. silver per ton, or $6.60 in gold and $2.98 in silver, a total of $9.58 per ton.

Further ore shipments have not been made as it is the intention to resume milling operations as soon as possible.

With reference to milling operations during 1934, the following is of interest: (from U. S. Bureau of Mines):

Gold, Silver, Copper, Lead and Zinc in Arizona
MINERALS YEARBOOK,1935 - STATISTICAL APPENDIX
YUMA COUNTY

p 240

"Kofa District - The 100-ton mill on the property of the Sheeptanks Consolidated Mines Company operated from February 1, to August 20, 1934, and treated 15,167 tons of gold ore by cyanidation; during this time the property became a large producer of gold."

ORE ESTIMATES: It is estimated that there is available at the present time a total of 120,000 tons of ore in the upper Resolution Hill area with an average gold content of 0.26 oz., or $9.10 per ton, and an average silver content of 4.50 oz., or $3.19 per ton, or a gold-silver value of $12.29 per ton, with a total gross gold-silver value of better than $1,470,000.00.

In addition it is estimated that not less than 600,000 tons have been partially developed with a gold-silver value of approximately $8.00 per ton, say 0.15 oz. of gold and 4.00 oz. of silver per ton, or a gross total gold-silver value of not less than $4,800,000.00. Thus a gross total of not less than 720,000 tons of ore may be estimated as available above the

Main Tunnel Level in the Resolution Hill area with an estimated gold-silver value of more then $6,200,000.00 or better than $8.00 per ton in gold-silver values.

From the information gained by prospecting, exploration and development work within the boundaries of the areas of mineralization of these fourteen (14) mining claims it is possible to estimate a total of from 12,500,000 to 15,000,000 tons of ore which may be developed within these mineralized areas, with an average gold-silver value of not less than $4.00 per ton, at current quatations. The potential possible ore tonnage is of considerable magnitude.

TAILINGS AND ORE DUMPS: The tailings dump of some 15,000 tons was stacked by conveyor belts and consequently is readily accessible for further metallurgical treatment. A considerable number of samples from this dump has given assay results of from 0.06 to 0.17 oz. of gold, that is, from $2.10 to $5.95 per ton, with an average silver content of 6.3 oz., or $4.48 per ton, or a total gold-silver value ranging from $6.58 to $10.43 per ton. Thus, the total gold-silver value of the tailings dump may be estimated at from $90,000.00 to $150,000.00.

There are five ore dumps with an aggregate total of around 10,000 tons with an estimated gold-silver value of not less than $6.00 per ton.

MANGANESE: Manganese dioxide, in the form of pyrolusite, is widely disseminated throughout the entire Sheep Tanks area. Bodies of this mineral have been found with a manganese content ranging as high as eighteen (18) per cent. Based upon results from many assays and analyses, it is estimated that an average manganese content of not less than four (4) per cent can be maintained throughout the entire mineralized areas. This being the case, the manganese can be recovered as a commercial by product instead of going to the tailings dump or pond as waste material.

From a number of various metallurgical tests which have been made it has been determined that the recovery of this manganese content will add from $12.00 to $25.00 to the gross value of every tone of ore mined and milled, bases upon the utilization of this manganese content in the production of crude manganese sulphate, or manganese sinter, or artificial manganese oxide, or electrolytic manganese, or in the manufacture of manganese compounds and alloys.

Inasmuch as no mining nor milling costs are directly chargeable to the recovery of the manganese, it is quite evident that the recovery of the same can be made at a low cost, with with resultant low production costs in producing manganese sulphate, manganese sinter, artificial manganese oxide, electrolytic manganese, or in the manufacture of manganese compounds and alloys.

A two-ton sample of the tailings dump was tested at the Salt Lake City Station of the Bureau of Mines, and an analysis showed a manganese content of 5.3 per cent. A later ore sample from Sheep Tanks showed a manganese content of 6.3 per cent.

Previous tests made at the Reno Experimental Station of the Bureau of Mines indicated that the Sheep Tanks ore was more suited to the electrolytic process for the deposition of metallic manganese from sulphate solutions. Now that this electrolytic process has been duly perfected it is a natural consequence to expect that this process will soon play an important part in the production of electrolytic manganese from the manganese content of the Sheep Tanks ores.

Tests are now in progress at the Salt Lake City Station of the Bureau of Mines for this purpose, and it is expected that the final results will soon be available.

Not only will the recovery of the manganese yield profitable and vitally necessary by-products, but the percentage of recovery of the silver content of the ore will be greatly increased. Now is an opportune time for an all-out development of the Sheep Tanks property toaid very definitely in building up an important source of supply of manganese in various forms so necessary for the successful furtherance of the present national defense program as related to strategic minerals and metals.

Other Constituents of SHEEP TANKS ORES: A spectrographic analysis of a representative ore sample indicated the presence of commercial quantities of hematite and limonite, and also alumina, chromium and other elements which further experimental and research work will show that they can be duly recovered as commercial by-products, thus providing additional sources of revenue from the ores mined and milled.

OPERATING COSTS: Inasmuch as practically all of the tonnages of ore indicted under ORE ESTIMATES can be mined without any hoisting, pumping or timbering operations, it follows that low mining costs may be obtained. The topography of the mineralized areas previously mentioned is such that mining operations may be carried on by means of power shovels with refultant cheap mining costs. As there is practically no overburden no stripping operations are necessary.

Upon a basis of a milling plant of a daily capacity of 1200 tons it is estimated that total mining costs may range from $0.30 to $0.50 per ton.

It is estimated that milling operations, based upon the foregoing tonnage, will range from $0.50 to $0.70 per ton milled, depending upon the plan of flow-sheet followed.

It has been estimated that total mining and milling costs will not exceed $1.20 per ton, based upon a daily operation of 1200 tons.

It is expected that the results of the tests now being carried on at the Salt Lake City Station of the Bureau of Mines will aid materially at the determination of operating costs for the production of the various manganese by products previously mentioned in this report.

WATER AND POWER: Thus far sufficient water has been developed only for the operation of a milling plant with a daily capacity of 100 tons, by means of four shallow wells about 7500 feet southerly from the present mine camp.

However, there are strong and favorable indications to warrant the belief that a large supply of water can be developed by wells to be drilled within a short distance to the northward of the present mine camp, and readily accessible from the present mine road leading to U. S. Highway 60.

For large scale mining and milling operations it will be possible to obtain low-cost electrical power from transmission lines leading from the Parker Dam on the Colorado River to the Gila Project. This branch power line will be approximately 25 miles in length, and it can be constructed at a reasonable cost.

CONCLUSIONS: A large tonnage of ore is immediately available for mining and milling operations on a comparatively large scale with attendant low operating costs.

Instead of the Sheep Tanks property being classed as a gold-silver-manganese property, it is now, owing to the national importance of manganese, very definitely a manganese-gold-SILVER property, with the manganese content of considerable greater value than the silver-gold content of the ores.

The climatic conditions are very good and permit of year-round operations. The mining property is readily accessible by a good mine road connecting with U. S. Highway 60, and good transportation facilities are afforded by both highway and railway.

Sufficient water and power can be made available for all requirements.

The Sheep Tanks property is a mining venture of unusual merit and possibilities, and offers the definite prospect of becoming a large producer of manganese products.

Respectfully submitted,

Edwin Walter Mills
Consulting Mining Engineer

Sheep Tanks Mines,
Yuma County, Arizona
April 15, 1942

PRELIMINARY REPORT

S H E E P T A N K S M I N E

The property is situate 25 miles southerly from Vicksburg Station, Yuma County, Arizona. The station is on the branch of the Santa Fe Railroad line, locally called the Parker cut-off. The mine is also 34 miles northerly from Horn Station on the Southern Pacific Railroad. There is a good truck road connecting the mine with both railroad points. Elevation at the mouth of the main mine tunnel is 2625 ft.

The property consists of 11 lode mining claims, held by original location, and covering an area of 172. acres. These locations are the prior locations in the district. There is no conflict on the exterior lines of the property.

GEOLOGY

The immediate district of some considerable area is characterized by a late andesite flow, at no point in the district can sufficient depth be seen to determine the depth of this flow. This andesite flow was later tilted and subjected to such stress action as to cause a numerous series of faults. The main ones of which preceded the mineralization followed apparently by a later series and numerous compensating faults which assisted by later erosion, made the somewhat peculiar "saddling," visible about the mine workings. So far as observed all of the post-ore faults are normal and of slight displacement. The only possible exception to this being the large northerly and southerly fault through the westerly area, and at the back of the main tunnel.

There are several veins exposed by erosion within the property line, and in the very superficial workings invariably return an appreciable value in gold and silver. Three of the larger of these veins have been partially prospected, and some numerous surface openings made, and on one of these is the principle ore showing of the property. The three largest veins and the ones that I consider the most promising, are the vein on the Black Eagle claim with a northerly southerly strike, assaying mill ore values through widths of from 5 to 12 feet. A vein in the Smyrna claim with an easterly and westerly strike, southerly dip, and exhibiting commercial ore values in widths of from 6 to 20 feet, and last the vein in the Resolution claims with a northwesterly to southeasterly strike, with an easterly dip of from 30 to 40 degrees, where the workings to date have exposed smelting and mill ore bodies in widths of from 25 to 35 feet.

The ore occurance in the Resolution claims is epigenetic in character in a zone of brecciated andesite. This vein in

which the principle exploratory work has been done is visible on the surface for some 800 to 900 feet. No work, however, has been done, nor any attempts made to trace the continuity.

There has been about 500 feet of underground work (not all well directed) consisting of a main tunnel diagonally through the vein. The course of the working being such that it is neither a direct crosscut nor a drift upon the vein. There is, however, exposed for 125 feet in the main tunnel in top, bottom and sides of the drift, an ore returning on correct sampling assays- an average in gold and silver of over $30.00 per ton. There some streaks exposed for some lengths in widths of three feet- $150.00, 6½ feet $94.00, streaks of from 8 to 14 inches of $450.00, small seams of 1, 2 and 3 inches up to $3800.00 per ton. A complete cross section of the ore body exposed in thistunnel gives a 38 foot direct cross section.

There is in the area immediately exposed by this tunnel and three smaller connecting workings, at least 6000 tons of smelting ore and mill ore tunnage of 15,000 tons at least. The smelting ore will exceed an average value of $30.00 per ton, and mill ore above approximate of $10.00. As to the further possible ores on the level northerly and southerly from these workings, I consider it too problematical and would not care to give an estimate at this time.

A direct cross-cut tunnel is now being driven from a point southeasterly, and down the hill from the mouth of the upper tunnel. This will cut the ore body at a point that will give in excess of 150 feet of ore backs below the present main tunnel. The face of this new cross-cut is now in low grade ore, general samples running from $4.00 to $9.10 per ton. I estimate an additional 75 feet of work to expose the smelting ore body on that lower level.

ECONOMICS

The road from Vicksburg Station and from Horn station are fair desert truck roads; the last 2 to 3 miles of each having been well graded and some heavy rock work, ending in a turn way just below the tunnel ore dumps.

The nearest developed water of amount sufficient for milling is 6½ miles away by truck road, but the two long washes coming easterly by the property are within a mile and a half, both give every surface indication of making large water development at a nominal depth.

The ore is an andesitic quartz containing a low percentage of manganese, which apparantly carries the major part of the silver value. The gold occurs practically free, well disseminated and offers no obstacle to ordinary modern mill practice. Small cyanide tests on the ore gave better than 94% of the gold value.

The property is equipped with a small compressor, engine air drills, water tanks, some several tent houses, blacksmith shop, and usual run of mine tools--for a small force.

The total price asked for the property is $150,000.00, of this amount $100,000.00 is covered by bond and lease extending to April-1930, there being due on this bond $7500.00 December 1st, 1928; $25,000.00 October 1st-1929. The remainder of the bond on April 1st-1930. The $50,000.00 remainder of the above total price can be made in payments with some cash down sufficient for the protection of the ore in sight, and the remainder in terms to be mutually agreed upon.

The only mining restrictions in the above mentioned bond and lease, is a requirement of 150 shifts per month in actual mine operation or development, and a royalty of 10% on the net of all ore shipped or milled, the net to be considered smelter or mill returns less railroad freight and smelter charges. There are no other mining restrictions within the contract.

CONCLUSION

This property is characteristically of the bonanza type as heretofore exposed and worked in four properties of large production, contiguous to this area, and I wish to state that this showing is spectacular to say the least.

Ben R Bines

Can't make out the name clear - Staff.

Los Angeles, Calif.,
October 2, 1928.

S.E. 1/4 SEC. 36 T.1.N. R.15.W.
S.W. 1/4 SEC. 31 T.1.N. R.14.W.
GILA & SALT RIVER BASE LINE
RED TOP Nº 5
BLACK EAGLE
RED TOP Nº 1
RESOLUTION Nº 5
SEMATOSA Nº 2
RESOLUTION
RESOLUTION Nº 3
RED TOP FRACTION
DARK HORSE Nº 3
DARK HORSE Nº 2
DARK HORSE Nº 1
DIPLOMATE
RESOLUTION Nº 1
RESOLUTION Nº 4
Nº 2.
Nº 1
Nº 25
Discovery Shaft
Discovery Cut
Mill
Power Ho.
Camp
Road
Power Line
Pipe Line
B.P.
B.E.
R.T.
SEM.
POW.
D.H.
L.W.C.
G.K.
G.P.
B
CLAIM MAP OF
SHEEPTANKS CONSOLIDATED MINES COMPANY
YUMA COUNTY ARIZONA
SCALE ~ 1" = 200 FT.
Scott Engineering Co Nº 491-A.

OUTCROP

VEIN

FAULT

BRECCIA

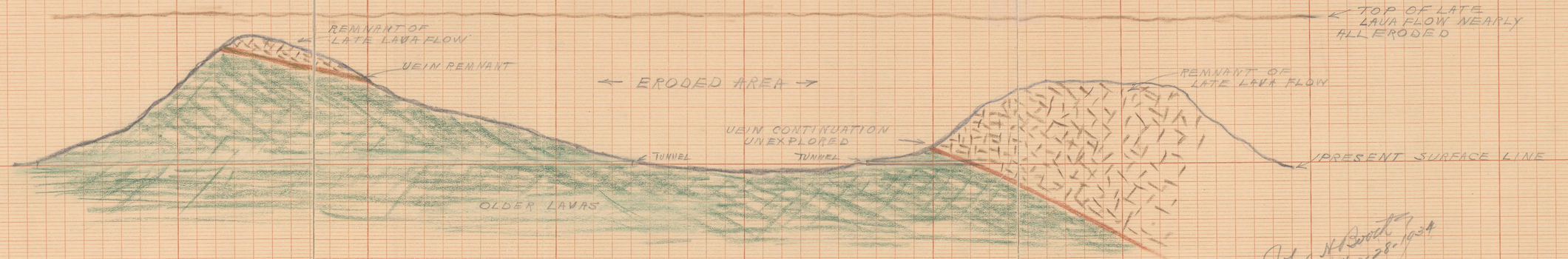
MAIN TUNNEL LEVEL

OLD LAVAS

as of march 2nd 1935
John H Booth

ELEVATION
LOOKING N 47° W
SHOWING PROBABLE
STRUCTURE

O.K.



John N. Brooks
Nov 28-1934

THEORETICAL GEOLOGY

SHEEP TANKS MINE

ELEVATION LOOKING NORTH WEST