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Dubois, Wyoming
Aug. 17, 1944

Dr. R. D. George
Department of Geology
University of Colorado
Boulder, Colorado

Dear Dr. George:

At Lander I recently received a copy of your letter to Dr. Thomas in which you requested information on the Carissa, Kenyon, and U. S. gold mines in the South Pass district. While at Atlantic City a few days ago I secured the following data:

Carissa: not operating during the war. Mr. Marshall Graham, 367 Garfield Street, Lander-Telephone 278-J- is at present receiver for this property and could presumably give you the necessary details.

U.S. Mine: not in operation. Early in August '44 this property was sold by Mr. James Carpenter, Carpenter Hotel, Atlantic City, to Mr. W.T. Ranney, Box 2, Highland, California.

Kenyon: this mine reported by Mr. James Carpenter to have been abandoned for some years.

For detailed history regarding the history of properties in the Atlantic City-South Pass district I advise that you communicate with Mr. Carpenter. He is a lifelong resident of that area and actively engaged, even at present, in sporadic operation of some of the properties up there and in business transactions, such as sale and leasing, with interested parties from outside.

I hope the above information will be of use. If we can be of service at a later date by all means let us know.

Very truly yours,

John C. Haff
Wyoming Geological Survey

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UNIVERSITY OF COLORADO

Boulder, Colorado

Department of Geology

August 7, 1944

The State Geologist
The Wyoming Geological Survey
Laramie, Wyoming

Dear Sir:

I have received a request for information regarding the present status of the properties named below:

Carissa, Kenyon, U.S. Gold Mines.

The last I knew of the Carissa, it was in litigation and a hearing in court was pending. That is ten or more years ago.

The last I knew of the Kenyon was in a report that some eastern men had spent some money on the property, and had decided to go on and open it in a fiarly effective way.

Can you give me addresses and names of owners, operators or others officially concerned?

I shall be very grateful for any information you can furnish.

Yours truly,

(Signed) R. D. Geroge

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THE GEOLOGICAL SURVEY OF WYOMING
UNIVERSITY OF WYOMING
LARAMIE

August 9, 1944

John C. Haff
Lander, Wyoming

Dear Jack:

Enclosed herewith is a copy of a letter regarding the Carissa and Kenyon Gold Mines in the South Pass district and a copy of my letter to Dr. George.

Will you make an attempt to obtain the information in which he is interested when you are in the South Pass district and answer Dr. George directly? It would be desirable for us to have a copy of your letter.

Sincerely yours,

Bill

Horace D. Thomas
State Geologist

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A general report on the Carissa mining property, owned by the Federal Gold Mining Company, which covers in a brief way the mine, metallurgical and mining methods, and basis for estimating costs, follows:

DESCRIPTION AND LOCATION.

The property of the Federal Gold Mining Company consists of the following lode and placer claims that are connected and form an area of about 275 acres.

Lode Claims: Mono, Mono No. 2, Jeanette, Charles Dickens, J.C.S., Alpine, Wolverine, Oro Fino, Ben Hur, Polly Perkins, Eight of Diamonds.

Placer Claims: Lucky Strike, Hermit, Carissa Gulch.

The strike of the Carissa vein is through the first six of the claims listed. The placer claims and the balance of the lode claims are side locations and are chiefly valuable for their surface rights. The property is entirely free from encumbrances.

These mining claims are located just north of South Pass City, Fremont County, Wyoming, in the eastern foothills of the Wind River Mountains. The altitude is about 8,000 feet.

FACILITIES.

TRANSPORTATION: Lander, which is the terminus of the Wyoming branch of the Chicago & Northwestern Ry., is located 35 miles north of the mine. The connecting road is open to automobile travel from about the first of May until the last of October on the average year. The Government contracts a mail stage six days weekly during the entire year. The road to Rock Springs, which is on the U. P. Ry., at a distance of 90 miles south of the mine, is generally open to automobiles for about eitht months of the year, but it probably could be kept open for the entire year with little effort. This road is well maintained and has very light grades. Easily loaded freight in quantity can be brought in during the open months for one cent per pound.

POWER: There are several sources within or close to the district from which power may be obtained. However, the placing of Diesel or semi-Diesel engines at the mine would be the cheapest first-cost plant, and available cheap oil would allow power production at a figure well under the cost of power in the average mining camp. Several Diesel engine companies have submitted figures to show that power can be produced here at a cost ranging from $40.00 to $55.00 per H. P. - year. depending upon the price of oil. Crude oil can be purchased in quantity at the Dallas field, about 23 miles distant, or an oil especially adapted for Diesel engines can be had from Lander at 3-1/2¢ per gallon. An experienced Casper truck operator has offered to contract hauling to the mine for $1.50 per bbl. The Worthington Pump & Machinery Corporation has recently placed on the market an improved engine that costs about the same per horsepower as a steam plant, and they claim that it is far more economical to operate than previous oil engines. I am convinced that the maximum cost of power produced on the property by oil engines will not exceed $50 per H.P. - year.

Undeveloped water power is available on Sweetwater River, about nine miles southwest of the mine, and on Little Popo Agie River, about fifteen miles northwest. The minimum flow of the Little Popo Agie will develop about 900 H. P. A diversion canal 2-1/2 miles long will deliver the water at a point where an effective head of 750 feet can be obtained.

Buffalo Basin Oil and Gas Field is located 30 miles southeast of South Pass and at the present time it produces a large volume of gas which is going to waste. I understand that this gas can be had for four cents per thousand.

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WATER: The property is supplied with good water from Hermit Creek by means of a pump station located on Company ground and through a pipe line 1400 feet long with a vertical raise of 160 feet. The mine furnishes a little water, 3,000 gals. every twenty four hours during the dry season, that can be used for milling purposes.

TIMBER AND OTHER SUPPLIES: Timber for all purposes can be obtained from the national forest at points located from ten to fifteen miles from the mine. By placing a saw mill in the forest, dimension timber should be delivered at the mine for a total cost of $20 per thousand.

Limestone, surrounded by plenty of scrub timber for burning purpose, is found on the Lander road within ten miles of the mine. This is an important item in a cyanide mill.

Ribs of hard, tough silicious slate are found in the vein walls that often assay up to $3 per ton, and this material can be dressed to make excellent tube mill pebbles. The gold in this rock should cover the cost of mining and preparation for the tube mill. This is also an important item when a mill is located at considerable distance from a Ry.

LABOR: Skilled labor would have to be brought into the district for large operations. Wages at the present time average about the same as in the mining camps of the Black Hills of South Dakota, and the district is free of labor unions.

CLIMATE: Climatic conditions are much the same as those of the Northern Black Hills. The summers are dry and cool, the falls are generally open up to November, and the winters and springs are often marked by considerable snowfall, which is much heavier from South Pass toward Lander than it is in the direction of Rock Springs.

TOPOGRAPHY: The district is one of considerable relief, but the contour generally is not abrupt. Any substantial mining depth must be gained through shaft work. Almost any point can be reached by wagons or trucks.

GEOLOGY AND ORE-DEPOSITS:

The Carissa mine is located in an area of metamorphic rocks that has a width of about ten miles and a length of from fifteen to twenty miles, with a northeasterly trend to its major axis. To the northwest this area is flanked by the granites and diorites of the Wind River Mountains and to the south and east it passes under the limestones and sandstones of the Carboniferous. The rocks occurring in this area are made up largely of a metamorphic complex, which may be classified in general as schists. These rocks have been intruded by dikes of various composition and by several small masses of granite. The dikes are greatly altered and metamorphosed, and the Carissa dike is now classified as amphibolite. The intrusive granite is a fine-grained gray rock, the chief minerals of which appear to be quartz, mica and a gray feldspar, probably of the soda variety. Some of the feldspar has been altered and secondary quartz and sericite are evident. The basic dikes of the district are apparently older than the intrusive granite. In the main, the rocks of the immediate Carissa district are schists, which appear to be strongly metamorphosed sediments. Cericite is the chief mineral of secondary alteration. Massive beds of fine-grained micaceous sandstone and beds of a calcarous nature are also found in the immediate district and to the northwest of the main area of the sedimentary rocks there is a large zone of basic chlorite schists, but in general, the sediments are thinly bedded and the stratifications easily seen. The second structure is parallel to the original bedding where schistosity is present. In the South Pass district the layering in the schists show northeasterly strikes and very steep dips. However, to the west of the main mine workings, near the locality where the schists give place to the Wind River granite, low dips toward the northeast are seen. The old incline shaft on the Alpine claim shows the dip to be about 45 degrees. The intrusive dikes seem to conform with the general structure.

The Carissa lode has been developed within a wide zone of shearing, and it conforms with the zone in strike and maintains about a central position. The mineralization is apparently developed within the plane of greatest disturbance and fracturing. For a considerable distance on each side of the vein, the rock has been foliated

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by pressure and given a slaty structure. Quartz has been deposited irregularly over this zone, apparently by forcing openings for itself and to a lesser extent, by replacement, and has given the zone a banded structure. Field relations suggest that the quartz may be of a later pegmatitic phase of the intrusive granite. All mineral occurrences of the immediate district are found associated with pegmatitic quartz of similar character. While all such deposits are also found not far from and approximately parallel to basic dikes, yet all indications point to a physical relationship only. The zone of shearing has no commercial value outside of the vein and immediate walls, but its relationship to the vein is interesting. the northern side of this zone is partly defined by the Carissa dike, the south wall of which is 130 feet north of the main mine workings, and on the south side it fades into the country rock at a distance of a hundred feet or better to the south of the vein. The zone and dike strike with the formation at about N 70 degrees E. The dike has a general width of over one hundred feet and can be traced for a distance of three miles. It probably ranged between a diorite and gabbro in its unaltered state.

The Carissa vein has approximately the same strike as the zone of shearing, and the dip varies from 85 degrees north to vertical. The ore-occurrence is marked by features that are distinctive of the deep-seated type of gold-quartz veins; namely, overlapping lenses in schists; a white to bluish, crystalline quartz with a vitreous luster; one sulphide, arsenopyrite, predominates; the loci of formation is close to veindikes of pegmatitic quartz; the amount of silver is of no commercial importance; the gold practically all occurs in the free state. The quartz of the vein was apparently later, more fluid and of a slightly further stage in differentiation than the quartz of the zone of shearing. The latter quartz is often associated with coarse muscovite and occasionally with a small amount of feldspar, and it has not silicified its walls to the extent that the vein quartz has. The present underground developments, approximately 800 feet in length on the longest level, have proved three distinct overlapping lenses that are apparently more or less tabular in form on their dip. At the points of overlapping the vein is much wider than usual, as may be seen at the old discovery shaft where the vein shows a total width of nearly fifty feet. Along other parts of each lense at least one wall is well defined on all openings. The vein-filling within each lense consists of quartz stringers and small lenses within greatly silicified slate, and this filling carries about 3% of arsenopyrite, with an occasional small amount of pyrrhotite. On the upper three levels the ore is mixed, that is, partly oxidized and partly unaltered; the fourth level shows a very little oxidation in places, and the fifth level practically none. As with all free-gold ores, the Carissa average-grade ore is made up of streaks and bunches of higher grade intermingled with low-grade, and the best ore is found in distinctive shoots within the main lenses. No manganese occurs in the vein-filling or within the walls, and the ore on the lower two levels at least is undoubtedly primary in nature. The carissa gulch was worked for placer between the mine and Willow Creek, about one quarter of a mile in length, and was found to be very rich.

The Carissa vein has its strongest surface expression over its strike on the Mono Claim, although to the west of the Mono the surface is covered with Tertiary wash for some distance that covers the vein to a depth of twenty feet or better. The Carissa structure is a strong one that has much favorable ground to be prospected and developed on its strike beyond the faces of the longest level.

The Carissa deposit has apparently been formed under zonal conditions quite similar to those of some of the gold-quartz veins of California, and it resembles some of the free-gold deposits of that state in many respects. The gold-quartz veins of the deeply formed zones carry lower-grade values in their upper horizons than many of the Tertiary gold-quartz veins, but when the horizon of altered ore is passed, the values in the former generally persist to much greater depth and without becoming refractory than in the latter. Development in depth can generally be carried on with confidence as long as strong structural features continue, as the values often persist with structural strength and the gold ramains relatively loosely held in the vein-filling. Metallurgical problems do not become more complex with depth. The Carissa vein is as strong on the lowest level as on any of the upper levels, so there is every reason to believe that the same structural condition will continue with about the same tenure of values for much greater depth.

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EQUIPMENT.

The present equipment is small and inadequate for other than development and test purposes. The buildings are located close to the shaft and have been kept in fairly good repair. The mill, shaft house and blacksmith shop are housed under the same roof. The office, manager's house and assay office are combined in one eight room building. Two cabins, a small store house and a pump house complete the list. South Pass City has always housed the greater part of the men working at the mine.

MINE DEVELOPMENT.

The surface is marked for a distance of over 2,000 feet by shallow shafts and pits sunk on the vein outcrop. Several of these shafts were used in the past for openings into the old shallow workings. They are generally in a caved condition today and are of no value except for air connections. Most of the old surface workings that are located on the vein show ore of milling grade.

The mine has had five levels opened through a double compartment shaft, which has been sunk for four hundred feet on the center core of the lode. The shaft follows the dip, 85 degrees north, to the third level, or for 200 feet, thence to the bottom it is vertical for 200 feet.

THE FIRST LEVEL only had a length of 95 feet. The old stope ust to the east of the shaft, both above and below the level, can be still entered through this lateral.

THE SECOND LEVEL is 361 feet long; 189 feet west of the shaft and 172 feet east.

THE THIRD LEVEL is 435 feet long; 45 feet west of the shaft and 390 feet east.

THE FOURTH LEVEL IS 775 feet long; 360 feet west of the shaft and 415 feet east. This is the longest level in the mine and has not run through the lateral extension of the ore.

THE FIFTH LEVEL is 635 feet long; 260 feet west of the shaft and 375 feet east.

In the main, all of these levels have been driven on the vein, which is easily distinguished from the balance of the shear zone. However, both the fourth and fifth levels have passed out of the vein from the bottom of the respective raises to their east breasts. A wide shattered condition exists here and the vein is found further to the north, as is shown on the surface, in the east end of the third level, and in the crosscut driven north from a point just east of the raise on the fourth level. From the east end of this wide fractured condition the vein again takes its original strike and continues a course much closer to the dike than at points further west. As the Marshall stope starts in the wide zone and continues within the vein in its new course and has a strike and dip conforming to the shoot of ore opened by the north branch of the east end of the third level, it is reasonable to assume that it is the same shoot. To cut this same shoot on the fifth level the east breast must be driven in a more northerly direction, or a crosscut started to the north.

The shear zone has been exposed for a total width of nearly three hundred feet by crosscuts. While a sample assaying from forty cents to one dollar per ton can be found most any place within this zone, there are no other extensively mineralized channels, similar to the plane of the vein, found within the zone. Not only have the shearing stresses been greater and the rock more completely crushed within the plane of the vein, but there is evidence of movement along this plane after the period of first mineralization, and some little evidence that this movement was followed by a second period of mineralization that was confined within the vein walls.

SAMPLING.

Past operations on the Carissa have always been on a small scale and very little ore that would plate less than $15.00 per ton was mined. In pursuance of this policy the levels have been gouged and small stopes carried only as long as this high grade lasted. Outside of the larger stopes, this high grade tonnage has been small, but its removal has left the backs of the levels in a lower grade ore than is representative of the mine. I feel certain that mining operations would show a higher average than can be obtained by sampling the backs in the mine in its present condition. Bottom samples, of course, should prove this contention, but they would be hard to take on account of irregular bottoms.

To do justice to the mine, large samples should be cut from seven to ten pounds to each foot of width. The coarse free gold is unevenly distributed and seems to be associated with the hardest part of the vein filling. The value of this gold is considerable, but its uneven distribution seems to give a larger percentage of low assay results when small samples are cut than with most ores.

ORE RESERVES.

The total tonnage that can be placed in the ore reserves of a developed or partly developed mine will naturally depend upon methods and costs. The tonnage stated in the paragraphs given below on measurable and probable ore is based on the assumption that only the higher-grade ores in the mine will be used. However, there is a considerable possibility that an all-amalgamation scheme of milling may be applied (see under METHODS), so the possible and positive lower-grade ore reserves are taken up in the paragraphs on possible ore.

There are 75,000 tons of ore measurable in three dimensions that will average $7.75 per ton. I have taken the average width of ore as exposed by the drifts, which is 6.33 feet, in calculating the tonnage measurable in three dimensions. On the sectional assay map accompanying this report the ore thus calculated is shown by lines drawn over the levels, on which are marked the length, average width, and average value of the ore as found in the respective blocks and levels. Over the second level west the block as figured would be represented by a triangle, the base of which is the length of the level and the apex terminating at the surface. The old Marshall stope will be seen just east of the discovery cut. This stope is open but would have to be cleaned out before the bottom could be sampled. I am informed by the miner who extracted the ore from this stope that the bottom was left in seven feet of six to seven dollar ore. The north branch of the east end of the third level averages eight dollars per ton, and the cross cut north on the fourth level, previously described, has exposed fifteen feet of about the same value. The ore calculated in this shoot can be represented by two triangles, the common base being represented by the length of ore exposed on the third level and the apex of one terminating at the bottom of the fourth level. The balance of the tonnage measurable in three dimensions is bounded by the lines previously explained.

There are about 37,000 tons of ore which can be considered as probable ore of about the same average value as the measurable ore. This is based upon the assumption that the ore will extend for the entire distance that has been proved on the fourth level, that the known ore-bodies extend fifty feet below the fifth level without a break, and that the surface ore between the open cut and Marshall stope will extend down at least twenty-five feet. The average width of all levels is used and allowance made for low-grade areas. From the vertical position of the fourth level, as well as from assay results and past developments on the other levels, this seems like a reasonable assumption.

Between the surface and the fifth level there exists a considerable possible tonnage of ore outside of the measurable and probable ore, the rough estimation of which must be based upon an analysis of the whole mine, which follows:

The average width of ore extracted in past mining operations has been about ten feet, or 3.66 feet wider than the average drift and sample width. There is no doubt but what the ore is wider than the drifts in many places and that actual

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mining operations will prove the average width to be somewhere between the drift and stope widths. Where the wide fractured condition is shown on the surface and the third level the ore is very spotty, and the chances are that much ore can be mined here that has not been included in other reserves. To the west of the working shaft milling ore has been mined from the surface workings up to the west end line of the Mono claim, and the chances for finding milling ore here above the second level that has not been included in the measurable ore are very good.

It is certain that some of the possible ore does exist that will assay around $7.75 per ton, and the same may be said of the probable ore. Just what this tonnage will amount to must be proved by mining operations, but it is very reasonable to assume that it may easily bring the positive tonnage of $7.75 ore to above 100,000 tons.

Due to the fact that there is a possibility of applying the all-amalgamation scheme of ore-treatment successfully, areas of lower grade ore deserve consideration. Such areas are covered by the lower grade sections of the vein and low grade ore in the immediate walls of the vein, as no ore is in evidence in the cross cuts outside of the immediate walls. Twenty-five thousand tons of measurable ore that will average slightly better than two dollars per ton are found in the low grade sections of the vein. Past mining operations go to show that small bunches of higher-grade are very liable to be found with this ore if mined and that the real value will be higher. The walls of the stopes will assay from two to six dollars per ton. Many of the cross-cuts will average from two to three dollars per ton for a few feet inside of the walls. Where the lenses overlap considerable widths of spotty ore is found. The tonnage and value of this low grade material can be rather definitely determined by drilling the walls of the stopes and levels. It is possible that the tonnage of ore could be more than doubled in mining from $4.50 to $5.00 ore over that which can be obtained by mining $7.75 ore. This is at least a possibility that should be considered along with larger tests on all-amalgamation. The same shrinkage stope method can be used in mining, and the increased tonnage would allow for considerable cheaper costs.

METHODS:

MINING: As previously stated, very little ore has been mined that would plate less than $15 per ton, and most of this ore was mined by hand work and open stopes. The stopes are still standing open without even the help of stulls to support the walls. No timber is required to hold the drifts and raises open. The present shaft can be used for larger operations by straightening it from the third level to the surface, which can be easily done by raising and storing the broken rock in an available stope until the job is finished. Shrinkage stoping should be used for future mining operations, as it is a cheap method and has an ideal application where the walls stand well and the width and pitch of the vein is similar to the Carissa. Timber for drift stulls, lagging, ore chutes and raises is all that would be needed in this type of stoping. The method can be used with equal ease whether only the higher-grade ore-shoots are mined or whether wider widths and the whole vein is taken. Milling-grade ore is found on at least one end of all the old stopes, and some of them have ore on both ends and over the back, so shrinkage stoping can be started with a considerable storage capacity before any ore need be drawn. The present surface plant is ample to carry on considerable development and the work of preparing the mine for mining operations, during which time a new plant should be provided. Wood fuel is used under the boiler for the steam plant, which would be too expensive for other than the purpose suggested.

In regard to development methods, the Carissa vein so far as has been developed has presented no difficulties. All conditions indicate that future development will be carried on with equal ease of operation.

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MILLING: The present mill is a ten stamp - 950 lbs. each, amalgamating plant that is in operative condition and can be used for large size tests if desirable. Old mill sheets are not available, but I am informed by a former manager, Mr. B. N. Tibbals, that the extraction ranged from fifty-five to eighty percent, depending upon the fineness of crushing. Mr. Tibbals claims that an eighty percent extraction was easily obtainable on ore from the fifth level by simple amalgamation, providing a sixty mesh screen was passed.

In order to solve as far as possible by small tests all details that are necessary for future mill design, a long series of tests were carried out on Carissa ore. The details of those tests are available but will not be given in this report. A few of the most important results obtained from them, however, are of interest and will be given along with a short discussion on milling methods.

The ore from the Carissa mine is made up largely of quartz and slaty quartz with a specific gravity of about 2.75. On the fourth and fifth levels the ore is practically unaltered and contains about 3% of pyritic sulphides. The ore is hard, but it shatters easily and can be crushed readily under stamps. Part of the gold occurs in a coarse state, and the balance is very finely disseminated. The gold is associated both with the quartz and sulphides, but it is apparently loosely locked in each. Tests were carried out on unoxidized ore from both the third and fifth levels. No real difference in the character of the ore or in amenability of treatment was noticed.

Amalgamation tests prove the interesting fact that practically all the gold is in the free state. Fine grinding is necessary to high extraction by this method, as well as by cyanidation. Ore crushed through twenty mesh will amalgamate between forty and fifty percent of the gold, eighty to eighty-five percent through one hundred mesh, and ninety-one percent through one hundred and fifty mesh. All amalgamation tests were made in a rolling bottle on about a three pound sample. The extraction was checked by weighing the bullion saved and by head and tail assays.

Whether or not an all-amalgamation scheme of milling can be put in successful operation, will depend entirely upon whether or not the same intimate contact can be made between the gold and mercury in practice that can be made in bottle tests. By stage amalgamation, the first after passing the stamps and the second after fine grinding, the success of the scheme is very possible. Results can be definitely proved by placing a small tube mill with an amalgamating head in the present mill and treating a few tons of ore from different parts of the mine. I am of the opinion that the chances for success are sufficient to warrant the expenditure of the small amount of money and time necessary to make the tests, especially as the success of the method guarantees very cheap milling costs and makes available a much larger tonnage of ore.

The combination of amalgamation and cyanidation is definitely certain of success on the Carissa ore. This has been proved both by careful tests and by the milling practice at the Duncan mine in this district. In relation to the cyanidation of the Carissa ore, the following are of importance:

"The ore is nearly free from the common colloid matter that so often gives trouble in thickners, the hydrated aluminum silicates. The ore when passed through a 150 mesh screen, which is the critical mesh for rapid cyanidation, is more in the nature of a sand than of a true slime. The settling rate is very fast -- not over nine square feet of bottom area will be required per ton of ore.

The ore is free from cyanicides, any substances outside of the precious metals and those involved in the workings of the process that will unite chemically with cyanide or tend to decompose it. Active acidity is very low. The chemical and mechanical consumption of cyanide will probably not exceed 3/4 of a lb. to the ton of ore treated. The indicated lime consumption is about 2 lbs. per ton of ore.

The tests and duncan mill results prove that the following practice can be very successfully applied to the Carissa ore. Crush in a dilute cyanide solution, from 3/4 to 1-1/2 lbs. per ton, and amalgamate after passing 16 to 20 mesh, then grind through 150 mesh, which is to be followed by an eight to ten hour agitation in a 1-1/2 lb. cyanide solution and the pulp passed through counter-current, continuous decantation to a filter press.

COSTS

It is outside of the scope of this report to go into all the details of estimating working costs, as they are necessarily based on the scale of operations as well as upon methods and local conditions. However, it is important that such conditions as affect methods and are otherwise pertinent to the estimation of costs be given and comparisons made.

DEVELOPMENT COSTS are dependent on the conditions of the ground, method of attack, size and continuity of ore-shoots and difficulties presented in following the ore. The method of attack is self-evident; no timber is required to hold the ground open; the ore-bodies have proved to be well defined in a strong structure and are easily followed. The average cost per foot for all kinds of underground work in the Carissa has been less than $15 per foot, and all of this work was carried on while the mine was operated in a small way. On a larger scale of operation it is certain that the average cost per foot would not be over $22, if the work was being done today. Taking for a basis an average cost of $22 per foot and applying it to the present openings, we have a development cost per ton of ore of between forty and eighty cents, depending upon what grade will be mined for ore.

MINING COSTS that prevailed here in the past are of little help in judging what future costs will be. The ore can be mined by the use of one of the cheapest methods of stoping. The vein-filling is hard, but it breaks easily and a large tonnage per man-shift should be broken. Timber costs per ton, which is a very large item in some mines, will certainly be but a few cents here. With the development kept to a point where the largest economical production can be maintained, a well-arranged plant, and the use of all possible labor-saving devices, then mining costs per ton should be very low. These costs certainly can be kept between $1 and $1.50 per ton, depending upon the grade of ore mined.

MILLING AND MARKETING COSTS compose the major part of total production costs on many mining properties. Right here is where the Carissa has the big advantage over a refractory-ore mine. Marketing costs may be dismissed with the statement that it will be only that necessary to ship bullion. The character of ore in any gold mine is a most important factor. A gold ore from which a large percentage of its values must be concentrated and smelted must necessarily be of a much higher-grade than ore from which the values can be cheaply extracted in the form of bullion, as the marketing costs per crude ton in the former are often much higher than the total milling costs are for a simple ore. Even when a heavy sulphide ore is amenable to cyanidation, the milling costs are generally much higher than they would be when an ore like that of the Carissa is treated, so it would take greater values to make the same net profit. During the year of 1919 all of the free-milling and cyaniding ores treated in the state of Colorado only averaged about $7 per ton, which is a much lower average value than was contained in the refractory ores treated in that state during the same year.

Milling costs here will be dependent upon whether the ore can be treated by an all-amalgamation process or whether cyanidation must be used, and upon the scale of operation. Power costs per ton for milling will range between twenty and thirty-five cents and the cost for chemicals per ton for cyanidation will be very close to thirty-five cents. Anyone who has had milling experience can easily visualize the two milling methods in question and calculate labor and other supply costs for different scales of operation. There is no reason for anything but the greatest simplicity of design in any case, and the balance of the milling costs should be as low as in any milling plant of the country of similar design and capacity.

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ANY GENERAL ESTIMATION OF COSTS to be of any value at all must be based upon local conditions existing at the property under consideration--the conditions upon which development, mining and milling methods must be based. The physical conditions of the Carissa vein are certainly such that cheap development and mining costs are assured, and the physical and chemical conditions of the ore are such that the values may be extracted in the form of bullion by simple milling methods. To be sure, labor and supply costs are higher than they were a decade ago, and the only way that these can be equalized is by simple design of plant that can be more economically operated, the use of recently developed labor-saving devices, and by good management. This condition not only applies to the gold mine but to other metal mines as well.

CONCLUSION

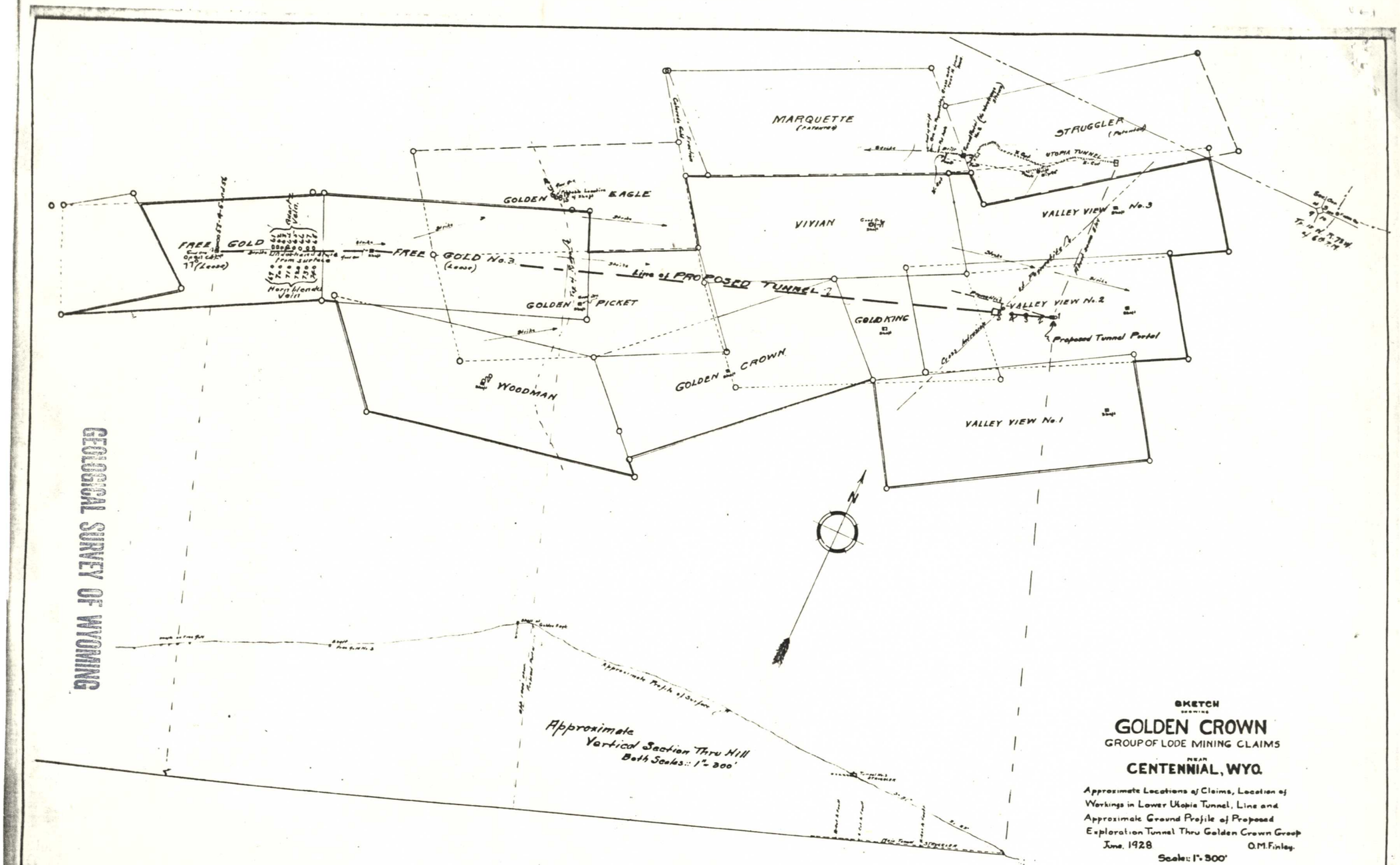
The worth of a mining property is governed by several conditions, the chief of which are: Factors governing development and mining costs, milling costs, and the future prospects for the property. While blocked tonnage is a very large factor, it should not be the controlling one except where other conditions are equal. Where the results of future development can be counted on to a great degree of assurance the property has an intrinsic value that a larger blocked tonnage cannot give under the reverse conditions.

The future prospects for the Carissa are excellent. I base this statement on the primary nature of the ore on the lower levels and from my belief that it will continue substantially the same for greater depth. The reasons for such belief are taken largely from a study of the vein structure and type habit. Conditions formative of a structural condition as extensive as this implies considerable disturbance, the results of which can hardly have a superficial expression only. All underground factors point to a continuity of the present fractures or related fractures in depth. The low and medium-grade ores of the deep-seated type of gold-quartz veins more frequently persist with structural-strength, and without becoming refractory, than do gold ore of the shallower vein zones. Without doubt, the close-to-surface ores here were enriched more or less by mechanical concentration, as is the usual condition with gold ores found in this type of deposit.

The economic daily production of the mine will depend upon the grade of ore mined, which in turn will depend upon milling methods. The mine has good prospecting ground on the strike of the vein in both directions, and its possibilities have only been partly determined in both strike and dip.

(Signed) HARRY T. CURRAN, E.M.

January 31, 1926.



SKETCH
SHOWING

GOLDEN CROWN

GROUP OF LODE MINING CLAIMS

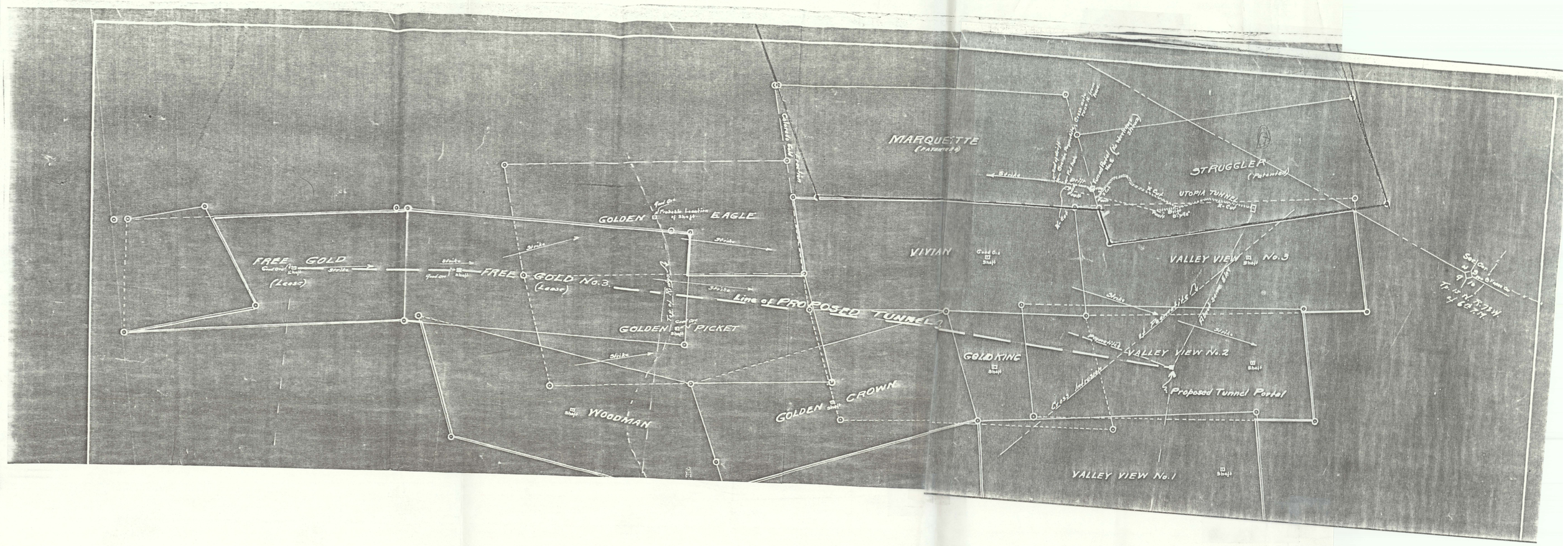
NEAR

CENTENNIAL, WYO.

Approximate Locations of Claims, Location of Workings in Lower Utopia Tunnel, Line and Approximate Ground Profile of Proposed Exploration Tunnel Thru Golden Crown Group

June, 1928 O.M. Finley.

Scale: 1" = 500'



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