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TO: Kimberly, Nevada

TO: C. I. Cook, General Manager

DATE: September 30, 1944

SUBJECT: THE ROUND MOUNTAIN DISTRICTINTRODUCTION

This report is based on: (1) a few days reconnaissance of the district — surface and underground, (2) study of maps and reports most of which were found in the engineering office of the Nevada Porphyry Mines, Inc., and (3) conversations with persons associated with past work and with others who have had occasion to plan possible future operations.

Many obscure facts have important bearing on the property's analysis, and the ramifications of past operations and the scope of future possibilities are such that details cannot be avoided in presentation of a proper picture.

Information at hand is incomplete or approximate in many respects and practically none of it has been checked. However, for purposes of preliminary study it is assumed that available data are essentially factual.

SUMMARY AND CONCLUSIONS

Round Mountain is one of the "boom" gold camps of early Nevada history. Discovered in 1906, the district was worked continuously for 30 years, producing in the vicinity of eight millions in gold bullion. The lode ore was mined selectively in narrow stopes and from small glory holes. Though the deepest workings are only 350 feet below the surface, the mines comprise over 20 miles of workings. The reason depth was not attained was not always a lessening of values. Rather, the system of tramming and hoisting became so complicated as to strangle operations.

Most of the gold is free, and 85 percent extraction was made by simple stamp-amalgamation milling. The gold occurs erratically along fractures and intricate networks of joints in a body of rhyolite exposed over an area about two-thirds of a square mile. This mineralized rhyolite body is covered on three sides by alluvial fan deposits; its extent beneath them cannot be estimated. Though certain of the fractures and sets of joints carry higher values, the entire rhyolite mass is impregnated with gold, and not often do average values of large blocks drop below \$0.50 per ton.

The results of a sampling job carried on during 1929 and 1930 by the owner of the property, Nevada Porphyry Gold Mines, Inc., are available. These assay data appear to indicate attractive chances to develop several million tons of \$2 to \$3 ore accessible to open cut mining. However, there is reason to suspect the accuracy of this information.

During 1936 and 1937 the property was sampled extensively by the A.O. Smith Co. Unfortunately, their detailed results are not a-

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available, but in a report at hand signed by their geologist, Mr. R.N. Hunt, a reputable and ethical engineer, it is stated that they were able to develop 12 to 15 million tons of open pit ore averaging but \$1.25 per ton. After having invested several hundred thousand dollars, they abandoned the project without having finished their contemplated sampling program. Supposedly, this was due to an unfavorable option agreement. Regardless of the low values reportedly obtained by the Smith people, there are opportunities to develop large tonnages of open pit ore and small tonnages of high grade ore. Though programs of prospecting, exploring, and developing these potentialities would be expensive, it is recommended that a preliminary investment of \$100,000 in sampling the lode deposits is warranted.

Approximately 2,000,000 yards of plus 80-cent placer gravel has been worked in the past—largely by hydraulicking. A good deal of careful prospecting has partially blocked out an estimated 37,000,000 yards of gravel containing 25 cents per yard in gold recoverable by ordinary washing practice. A stationary washing plant of 10,000 yard capacity involving extensive use of conveyors has been designed by competent placer engineers. The estimated operating cost of 12 cents per yard may be a bit low, but the scheme is generally sound and a total profit in excess of \$3,000,000 before taxes, royalty payments, etc. has been predicted. In addition, recent test work has shown that one of the jig products from the washing plant assays high in gold "locked" in the sands and can be cyanided very profitably.

The placer project is particularly attractive and it is strongly recommended that approximately \$20,000 be spent in additional churn drill hole checking and test work. Since the placer is more of an assured profitable operation than the lode, it should receive first attention and be brought into productivity as soon as possible. Profit derived here would offset investment in lode exploration.

#### LOCATION AND TOPOGRAPHIC ENVIRONMENT

The district is situated in central Nevada on the west flank of the Toquima Range. Round Mountain lies somewhat out from the edge of the range proper and rises conical-shaped about 600 feet above the gently sloping alluvial fan which nearly surrounds it. Stebbins Hill, a north-trending spur, is 250 feet lower. A ridge rising just above the alluvium extends eastward approximately two miles where it joins the main range. The Fairview mine is located on this ridge. The Sunnyside mine, center of most mining activity of the past, is on the west side of Round Mountain.

The town of Round Mountain occupies the flat on the northeast side of the peak less than a mile distant from the mines. The elevation of the town is 6300 feet. Normally very little rain falls during summer months and winter snowfall is moderate. The temperature rarely falls to zero in the winter and occasionally reaches 100 degrees in summer.

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### HISTORY

The district was discovered in February, 1906. There followed the usual boom with organization of a number of small companies with big ideas. The usual stock trading and promotional schemes prevailed during the early history of the camp.

Lode mining was soon underway and \$89,032 was produced from 6,448 tons in 1907. For the next 30 years the district was continuously productive though individual properties were operated intermittently. The University of Nevada Bulletin, "Nevada Metal and Mineral Resources", credits the district with a total production of \$7,834,828.

The Round Mountain Mines Co. early assumed the lead in production by erection of the 150-ton Sunnyside amalgamation mill, which maintained uninterrupted operation until 1936. Up to April, 1929, production from this property, for company account, amounted to \$3,484,112 extracted from 487,462 tons, an average mill head of \$7.15 per ton. Lessees produced \$888,147. Placer mining accounted for an additional \$1,236,381 from 1,307,548 yards, or \$ .945 per yard. During this period \$400,000 was paid in dividends and over \$750,000 was expended for plants, improvements, and equipment, of which approximately \$330,000 was for pipe lines from Jefferson, Shoshone, and Jett canyons.

Bullion sales for the last seven years the Sunnyside mill was operated are not at hand, but they probably are roughly proportional to the above figures—a similar daily tonnage was handled with the returns from a lower grade of ore being offset by the higher gold price.

The next largest producer was Fairview Round Mountain Mines Co., which expended \$35,000 in mill and mine plant equipment. Nearly a million dollars in bullion was produced, and dividends of \$190,000 were distributed.

In April, 1929, the following companies consolidated as Nevada Porphyry Gold Mines, Inc.:

Round Mountain Mines Co.  
Fairview Round Mountain Mines Co.  
Fairview Extension Mining Co.  
Round Mountain Homestake Mining Co.  
Nevada Gold Development Co.

This merger effected single ownership of the entire district (see attached map), excepting a few fringe claims of questionable worth.

In addition to continuance of operation of the Sunnyside and, for a time, the Fairview plants, the new company conducted a program of sampling the entire district in an attempt to determine the low grade, large tonnage possibilities. This work was financed by issuance of stock.

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In 1936, Nevada Porphyry ceased operations coincident with granting a lease and option on their entire holdings to the A.O.Smith Co., an eastern manufacturer. The agreement involved a total purchase price, reputedly, of \$2,500,000, and included heavy option payments.

The Smith Co. employed two to three hundred men for several months in a most extensive program of sampling. Early in 1937 the project was abandoned for reason that Nevada Porphyry would not grant extension of an option payment due. As evidenced by the work done, the Smith Co. invested several hundred thousand dollars in its sampling activities.

During 1940 and 1941, the Manhattan Gold Dredging Co., which is managed and partially owned by the Natomas Co., drilled a number of prospect churn drill holes in the placer deposit, expending about \$50,000. Their lease lapsed, apparently through carelessness.

In April, 1943, Mr. G. M. Standifer, of the Dayton Dredging Co., obtained from Nevada Porphyry a 20-year lease, with option of an additional 15 years, for 10 percent royalty. No payments except for taxes are required until April, 1945, after which time monthly royalties of \$1,000 are guaranteed.

#### FACILITIES

##### Water Supply:

Water was plentiful for hydraulicking during several months of the year. This water was obtained by pipe lines from Jefferson and Jett canyons. The latter is still in good condition. The line with a minimum diameter of 15 inches crosses Big Smoky Valley from the Toiyabe Range to the West. The source is about 600 feet higher in elevation than placer operations. It has been estimated that 1000 gallons per minute can be obtained from Jett Canyon during March, April, May, and June. It may be found that by proper preparation of intakes—concrete dams to bedrock—several hundred gallons per minute can be obtained year-round from Jett, Jefferson, and Barker (seven miles north of Round Mountain) creeks combined. This would require installation of several miles of pipelines. This water supply could be augmented during the dry season by pumping from wells in the valley floor about three miles west of the mines and 500 feet lower in elevation. U.S.G.S. Water Supply Paper No.433, assures abundant water here standing 50 feet below the surface.

##### Power:

Power used was generated by the Nevada-California Power Co. near Bishop, California, and transmitted over high tension lines to the mine. Cost is based on a sliding scale, ranging from 3.25¢ per kilowatt hour for the first 1000 to 1.14¢ for all over 327,000 kilowatt hours consumed per month. Possibly a more favorable schedule could be arranged for larger operations.

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Transportation & Communication:

A paved highway extends northward about 50 miles from Tonopah to within three miles of the mine.

There is a post office in the town, and at present it is connected with Tonopah by telephone, though the line is probably in poor condition.

Housing:

There are some 30 small but habitable houses in the town. They are served by power and water, but there is no sewage disposal system.

PROPERTY OWNERSHIP

Nevada Porphyry owns and has leased to Standifer the following mining properties:

	<u>No. of Claims</u>	<u>Acres</u>
Patented Lode	49	626.9
Unpatented Lode	65	436.78
Unpatented Placer	43	3170.
Total	<u>157</u>	<u>4233.68</u>

The areal distribution of these different types of claims is shown on the attached map.

There appear to be discrepancies between the listings of claims in Standifer's lease and the data shown on our photostatic copy of the map accompanying his lease. Too, there may be some unclaimed, interior fractions. The details of claim legality, boundary positions, etc. need clarification both by field surveying and examination of county and land office records. However, the need for this work is not urgent.

In addition to the holdings shown on the accompanying map, Nevada Porphyry owns a number of mining claims and some ranch lands for water rights and protection of reservoir sites, all of which are included in Standifer's lease.

GEOLOGICAL CONSIDERATIONS

Lode:

In general aspect the geology of the district is simple. The ore deposits are confined to one rock type — rhyolite. This rhyolite mass composes Round Mountain and extends beneath the alluvium for an unknown distance west and north. Southward, also, rhyolite is overlain by valley wash, but it appears in a small spur of the range and contacts Paleozoic sedimentary rocks about two miles south of Round Mountain. Where exposed along the low ridge trending east from Round Mountain, rhyolite is found continuing for about a mile. Here it contacts a large body of granite. The contact appears to dip westerly at a low angle.

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The total area of rhyolite outcropping is approximately two-thirds of a square mile. Wherever seen on the surface or underground in this area, the rhyolite is altered and mineralized to varying degrees and is traversed by faults, slips, and networks of joints.

The joints are well marked due to the occurrence of limonite, hematite and, rarely, manganese, in and along them. Occasionally, they carry small amounts of quartz, either as banded veinlets or comb-like crystals. The quartz is closely associated with gold occurrence. In the deeper mine openings some pyrite is present, but to depths of at least 300 feet oxidation is practically complete. Though most of these fractures are at random orientation, parallelisms usually are apparent. Certain of these parallel systems, referred to in the district as "stringer zones", are important loci of higher gold values. The spacing of joints varies from an inch to about two feet.

Alteration of the rhyolite is characterized by conversion of the feldspar phenocrysts and groundmass to sericite and kaolin with the coarse, irregular-shaped quartz phenocrysts being slightly corroded. All stages of this transition are present. Though alteration was essentially contemporaneous with deposition of gold, better values are not necessarily associated with zones of more advanced alteration.

Gold bearing solutions permeated the entire mass of rhyolite, gaining access along the multitude of fractures. A trace assay of gold is seldom obtained and averages of any one zone or large dump rarely fall below \$ .50 per ton. However, the gold is largely confined to the fractures.

Movement occurring along certain of these fractures has formed gouge from a fraction of an inch to several feet in thickness. The larger faults are widely spaced and have been the more active channel-ways of mineralization. Some of the most prominent faults dip at low angles—15 to 30 degrees—and these have been mined as veins, providing a large proportion of the district's production. Exceptionally high grade ore frequently occurs at the intersections of these low angle faults with certain systems of parallel, steep joints and faults. Around this high grade ore are found better average values which diminish gradually away from the intersections.

The Los Gazabo has been the most productive of the low angle veins. It outcrops at the collar of the No.1 inclined shaft (see map). It has been mined for 900 feet down its flat dip—15 degrees—and about 600 feet along its irregular east-west strike.

The Placer vein outcrops 800 feet south of the Los Gazabo and is roughly parallel to it. This vein was not discovered until bedrock was exposed by placering.

The Gordon vein reaches the surface at the collar of the Gordon shaft (see map). It strikes northeasterly and dips northwesterly at 30 to 40 degrees.

In the area between the outcrops of the Los Gazabo, Gordon, and Placer veins there are four "stringer zones", or systems of parallel, more or less vertical joints, which have been productive. They all strike northwesterly. These are: (1) the No. 2 zone, which extends from the No.2

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shaft to the No.1 shaft, (2) the Automatic zone, which is 200 feet southwest of the No. 1 shaft, (3) the 800 zone, which outcrops about 600 feet west of the No.1 shaft, and (4) the Placer zone, which lies a few feet northeast of the No.4 shaft. Several hundred thousand tons of ore at average grades of \$3.00 to \$6.00 per ton have been mined from glory holes situated along these zones. The width of one glory hole is nearly 200 feet.

The intersections of the steep joint systems and faults with the low-angle veins rake northwesterly. This feature seems to be the principal guide to ore, and would have important bearing on exploration and development.

The Keane vein, which produced some good ore, outcrops low on the northwest side of Stebbins Hill and dips south at 5 to 20 degrees. It intersects the Los Gazabo vein on the 900 level about 350 feet below the surface. The evidence as to whether or not either vein continues past the intersection is obscure.

In the hangingwall of the Keane vein there are several parallel vertical joints striking N 60 E, which carried high values. These were stoped by lessees for widths usually of three to four feet, although most of the gold probably was confined to one or two joints, and a screened product assaying from \$75 to \$150 per ton was sent to the mill. These high grade joints are 75 to 100 feet apart. Near the crest of Round Mountain similar wide-spaced joints of the same attitude as those on Stebbins hill produced high grade ore. It is to be noted that among those joints carrying high grade are other joints parallel to them and similar in all appearances, but containing only low values.

The lowest elevation at which ore was produced was on the 800 stringer zone. This is only 400 feet vertically below the surface but nearly a thousand feet below the productive seams near the crest of Round Mountain. Many ore shoots in the district have been bottomed and it is unlikely that any single shoot of good grade ore has a vertical range in excess of 500 feet. However, not much evidence of a general diminution of values or weakening of mineralization was observed in the deeper workings. Values similar to those in areas mined may be found continuing in depth.

Placer:

Small placer deposits have been worked around the south side of the Fairview mine area; some work has been done on the northeast side of Stebbins Hill; but most of the placer gold is found around the western flank of Round Mountain. Here the alluvial surface slopes toward the valley at about two degrees and bedrock dips beneath the gravel with a slope of 10 to 15 degrees.

Where exposed in banks left by placer mining, the pay gravel is composed of loosely consolidated, angular rhyolite fragments and sand. Sorting is poor and bedding is indistinct. Around the southern flank of Round Mountain the rhyolitic gravels are covered by 30 or 40 feet of wash from the large granite mass in the range proper. The fragments in this material are rounded. Sorting is more evident with layers of



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large granite boulders occasionally deposited, and bedding is more apparent than in the rhyolitic wash. These granite gravels are nearly devoid of values.

In contrast to the common stream placer deposits in which gold is distributed along certain channels for long distances, these rhyolitic gravels are essentially residual, the gold having been moved but a few feet. During periods of torrential precipitation the thin covering of auriferous sand and fragments on the steep bedrock slopes is washed a few feet down and spread over the alluvial slopes in sheet-like deposits. Under these conditions there is but little opportunity for channeling; nor is it likely that a significant degree of concentration or rewashing of the gold takes place. The major portion of the gold carried by successive floods is dropped close to the upper edge of the alluvium with the result that the richer gravels are deposited in shingle-like layers progressively up the dip of bedrock. Since the material comprising these gravels is transported but a few feet and subjected to very little attrition, much of the gold is still "locked" in the sand and rock fragments and is not recoverable by ordinary gravel washing procedure.

In the outlying areas where churn drill prospecting has shown the gravels to be 250 to 300 feet thick (over 1000 feet laterally from bedrock exposures) it is of interest to note that a band of comparatively rich gravel from 50 to 100 feet thick rests on bedrock. Due to the manner in which these gravels were deposited it is unlikely that the major portion of this gold was derived from the known gold-bearing zones in bedrock. Rather, it is thought that much of this gold was eroded from gravel-covered lode deposits which have not yet been explored.

### METALLURGICAL CONSIDERATIONS

#### Lode:

Two stamp amalgamation mills were operated for many years. These are the Sunnyside, situated close to the No. 1 shaft, and of 150 tons capacity, and the Fairview, which was at the Fairview mine (see map), and had a capacity of 30 tons daily. Extraction of at least 85 percent of the gold was obtained. The principal loss was in iron oxide-coated gold along with a little auriferous pyrite. Considering the small scale of the operations it was inadvisable to attempt separation from the tailings and retreatment of this material. It may be found that with a large operation than formerly employed, a high grade concentrate could be separated from the tailings and cyanided. Such a procedure would dovetail with the proposed method of handling the jig sands from the gravel washing plant (described below).

Considering the simplicity of operation, the low cost (capital and operating), and the relatively high extraction obtainable by amalgamation, it is probable that this process would be the foundation of future mill design.

Since the gold occurs along the joints, and the cores of altered rhyolite between the joints, carry only minor values, the "fines" contain more gold than does the coarse product of mining. The sizeable production



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of gold by the small scale lessee mining operations was accomplished by screening the ore. The "fines" thus obtained assayed between \$75 and \$150 per ton (present price). A large proportion of material sent to the Sunnyside mill was first crushed and two-thirds of the tonnage was rejected on a one-inch trommel. The minus one-inch product thus obtained assayed at least 100% higher than the mined product.

A series of simple tests would determine whether or not products of ore grade could be derived by screening from material of sub-ore grade as mined. If it is found that this procedure is feasible, the effect on the economics of pit mining would be consequential. For example, the nature of the distribution of gold through the mineralized zones is such that the tonnage of ore available to open pit mining probably will be found to be limited principally by the proportional amount of waste which economically can be handled. If the waste which must be handled could be made to "pay its way" even in part, a much greater tonnage of ore then would become available for mining and milling.

Placer:

Extraction of the free gold in the placer deposits presents no unusual problems insofar as a washing plant is concerned. Tests have been made by the Dayton Dredging Co. and a flow sheet employing sluices and jigs has been designed.

A considerable amount of gold in the placer deposits is not free. It is claimed that the sand concentrate of the cleaner jig, which represents less than one percent of the material to be handled by the washing plant assays about \$13 per ton and can be cyanided at large profit with low capital investment. The Dayton Dredging Co. is now conducting investigations along these lines for Coppermines' account. It should be noted in this connection that the amounts of these sands and the values locked in them are almost certain to vary from place to place in the placer deposit. Consequently, samples for testing should be obtained from a number of locations in the deposit.

FORMER MINING METHODS AND DEVELOPMENTLode:

In the past, development and mining were conducted under difficulty due to the following operating conditions which had to be coped with:--(1) The mill capacity was small, about 150 tons. This required a relatively high average grade of ore for profitable operation -- thought to have been in excess of \$5 per ton. (2) The mill was poorly situated on Round Mountain near the east side of the area in which mining was carried on. It was directly over some of the stopes and higher in elevation than all of them, though mill sites at lower elevation were available and would have permitted gravity handling of a large portion of the ore. (3) The main operating shaft, No.1, was inclined north at 15 to 20 degrees with the result that shaft stations of deeper levels are situated hundreds of feet north and east of the more productive ore zones.

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These awkward conditions were imposed by the fact that the first mining was done on the flat-dipping Los Gazabo vein. The main shaft followed this vein down and the mill was located conveniently near the collar of the shaft. It appears that the other ore bodies mined were discovered subsequently. None of these discoveries was of sufficient value to warrant moving the mill, and mining was adapted to the available tramming and hoisting facilities of the No.1 inclined shaft. Ore was hoisted also from the No. 2 and Gordon shafts, but these operations were comparatively small.

A total of 375,000 tons of low grade ore was mined from the various glory holes on the property. Most of this ore was crushed and trommeled before being sent to the mill. In one operation of this type the crusher and trommel were set up underground and the rejects stacked in old stopes. In another case, the No.4 glory hole, the procedure was even more complicated. The broken ore was (1) drawn from chutes beneath the glory hole, (2) trammed to the No. 4 shaft, (3) hoisted 120 feet to the surface, (4) crushed and trommeled, (5) dropped back underground, (6) trammed over 2000 feet to the No.1 shaft, and (7) hoisted 280 feet to the mill.

From the deeper levels, particularly the 800, several ore shoots were followed down with prospect winzes. As ore was found it was mined, the prospects serving as operating winzes with consequent limitation of operating depth. In several instances abandonment was forced before the bottom of the ore shoot was reached.

The net results of the complex mining systems used are many miles of workings which attain no significant depths but criss-cross an area over 2000 feet square on close-spaced vertical intervals.

The above descriptions are intended to illuminate an important point. The mining methods employed, and not necessarily a diminution of values, determined the depths to which ore shoots were mined. Though thousands of feet of lateral exploration was carried on for the purpose of developing reserves of ore, no systematic attempts were made to explore at depth ahead of mining. Locally, ore shoots were bottomed, but it is likely that ore zones of a grade comparable to those formerly mined will be found that extend several hundred feet deeper.

Placer:

Most of the placer gravel was handled by seasonal hydraulicking. Banks were washed into sluice boxes by "giants". Boulders were hoisted aside and stacked. Bedrock crevices were scratched, picked, and brushed clean, but bedrock was not blasted.

This method was used on all gravel above the lowest elevation at which sluice boxes could be placed. Some deeper gravel was handled mechanically. Conveyors dumped into a trommel. The undersize discharged into sluices and the coarse material was stacked by conveyors.

### FORMER SAMPLING OPERATIONS

#### Lode:

A great deal of the early exploratory work was guided by panning a sample from each round broken. If any assays of samples were made, the records of these have not been found as yet. Consequently, no ideas can be formulated regarding the average values contained in the rock penetrated by the older mine openings.

In 1929 and 1930, Nevada Porphyry expended over \$100,000 in (1) channel sampling certain underground workings, (2) driving several hundred feet of new crosscuts which then were sampled, and (3) sampling all of the dumps in the district. This work was done with a view toward determining the distribution of low grade ore. Maps detailing most of this sampling are at hand.

It is evident from inspection of the sample pits and cuts on several dumps that this work was properly done. However, the values contained in most of these dumps do not necessarily provide averages to be expected, say, in mining the volume of material around the workings which supplied the dump. The reasons for this are: --(1) Many of these workings followed along high grade seams, rather than crosscutting them. (2) A good deal of the material on these dumps represents rejects from which most of the values may have been screened.

The accuracy of the drift samples taken can not be judged because little information is available regarding the methods used. It is thought that most of these samples were channel cuts along the walls of drifts. As is described below, this method of sampling is not entirely adequate for this type of gold occurrence. Consequently, this information is not positive; it merely is indicative of the average values contained in the rock.

For eight months during 1936 and 1937 the A.O. Smith Co. carried on sampling of the property on a remarkable scale. A small pilot mill and a large assay office were erected. The assay office was equipped to handle several hundred assays a day. The average fusion contained 30 assay-tons, permitting valuation practically to the nearest cent.

We have available a thesis written on the sampling done by the A.O. Smith Co. which describes and compares the methods used. As determined purely by inspection of the evidences of their sampling in the workings and on the surface, a number of criticisms could be levied on their work. However, from the information conveyed in the thesis it is judged that their work was carefully and scientifically carried on. They checked the various sampling methods against each other wherever feasible, and the results lend good assurance that most of their methods yielded particularly accurate results. These data would be very valuable to Coppermines, and it is suggested that considerable expense could be justifiably entailed in procuring them. If available, these data would serve two worthwhile purposes. (1) They would indicate those zones of better values along which exploratory sampling could be initiated. This would eliminate much of the preliminary "wildcatting" which otherwise will be an expensive requirement of exploration. (2) After a certain amount of checking, it is believed that it will be found that much of their assay information can be used directly in ore calculations. Of course, such use would involve weighting the assay data according to their positions in the structural framework of gold-carrying fractures.

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Of 26,000-odd samples taken by the Smith Co. the emphasis was on first, channel samples along walls of underground workings and, second, bulk or tonnage samples cut in large surface trenches. The latter type was handled in the pilot mill and is the most reliable with the exception that if mechanical enrichment of the gold occurs in the open fractures near the surface, the values obtained can not be projected to depths. These two methods were augmented by (1) driving crosscuts in which the entire round provided a bulk sample, (2) cutting channels in the face of each round, (3) taking a grab sample (one shovelfull per car) from each round, (4) cutting side channels, (5) slabbing the sides of drifts to provide bulk samples, and (6) drilling a few diamond and churn drill holes.

It is noted that five churn drill rigs were on the job, but only a dozen or so holes were drilled. If an adjustment of their option payment had been obtained it is understood that considerably more sampling would have been done. It seems probable that churn drilling would have received the emphasis in subsequent work.

Recently the Dayton Dredging Co. has drilled four prospect churn drill holes in the lode--three near the 800 stringer zone and one in the hanging wall of the Gordon vein. The deepest of these was 324 feet. The diameter of the holes was only six inches and no casing was used. Some salting may have occurred but the results can be used for purposes of indication.

Hole No.1

0 to 135'	- \$ .86
135' to 183'	- 6.82
183' to 243'	- 1.03
243' to 279'	- 4.73
279' to 324'	- .84

Hole No.2

0 to 24'	- \$ .44
24' to 84'	- 3.13
84' to 108'	- .37
108' to 192'	- 3.72
192' to 300'	- 1.08

Hole No.3

6' to 264'	- \$1.07
264' to 300'	- Trace

Hole No.4

0 to 216'	- \$ .02
216' to 252'	- 11.67
252' to 291'	- .19

Placer:

The Manhattan Gold Dredging Co. has drilled over 40 prospect churn drill holes in the placer deposits surrounding Round Mountain. The Dayton Dredging Co. has drilled an additional five holes. As judged by conversational descriptions of methods used, the samples obtained were representative. Casing was driven a few inches ahead of the bottom of the hole. This segment was then churned with a chisel bit and completely removed with a suction bailer. The information acquired by this work is considered reliable.

ORE POSSIBILITIESLode:

The ore possibilities resolve into two classifications:--

- (1) low grade ore available to large scale, open pit mining, and (2) higher grade ore along narrow veins accessible to selective mining beneath present mine workings. The latter offers considerable difficulty to investigation inasmuch as the higher grade ore zones are widely spaced and are not amenable to churn drill or diamond drill prospecting. The presence of higher grade ore along low angle veins may be indicated by churn drill samples, but by no means can an assured tonnage of such material be blocked out by churn drilling. The steep veins can be evaluated only by underground exploration, and the low angle veins too must eventually be developed underground. It is believed that mapping of those higher grade zones already mined or exposed by workings will permit prediction of the location of favorable zones to prospect. But it should be noted that the cost per ton for exploration and development will be relatively high.

Though gold is distributed throughout the rhyolite mass, a preceding section of this report notes the following relationships between structure and concentrations of gold; -- (1) Better values occur along certain low angle faults and steep fractures. (2) The intersections of these two systems are loci of high grade ore. (3) Values diminish gradually but irregularly away from the intersections. (4) The intersections rake at gentle angles in a direction roughly parallel to the strike of the steep structures --northwest. Estimation of the low grade ore possibilities is concerned with these four characteristics of mineral distribution and their relation to the following operational limitations: (1) the lowest ore grade economically permissible, and (2) the highest waste-ore stripping ratio permissible.

In most instances it is difficult to evaluate the underground sampling data at hand in light of the structural and economic conditions enumerated above because no underground mapping of the mineralizing structures has yet been done. For example, one line of drift samples at hand averages \$7.59 per ton for a distance of 115 feet, and a drift crossing nearly at right angle to it averages \$4.32 for 130 feet. If each of these drifts follows a high grade fracture both averages are meaningless. If one of them crosscuts a zone of steep, parallel joints carrying the values, a sizeable tonnage of open pit ore is indicated since these drifts are but 100 feet below the surface. Throughout the area which includes most of the underground workings (about 2000 feet square) many examples are found similar to the one described above. Though values seldom are this high, averages in excess of \$2.00 per ton for drift lengths of 50 to 400 feet are recorded in a number of places. One drift, which is known to crosscut the gold-bearing fractures, averages \$3.93 for a width of 250 feet. Another crosscut parallel to this one and 300 feet farther along the same fracture zone averages \$3.27 for a width of 380 feet. Other crosscutting drifts show high and low values alternating in 50-foot sections but average \$2, more or less, for several hundred feet. In the rock bordering and separating the zones described above, the averages usually range from \$ .50 to \$1.50 per ton.

If judgement were to be based only on study of the assay data at hand, then the following generalized statement could be made:--Assuming that (1) the bottom cutoff of ore is about \$1.50, (2) the waste-ore ratio is approximately 1:1, and (3) pit mining is carried to a depth of about 200 feet, the opportunities to develop several million tons

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of ore averaging \$2.00 to \$3.00 per ton appear to be good. However, it should be emphasized that little is known about the sampling methods employed by Nevada Porphyry; consequently, the reliability of these samples is questionable.

About the only information available regarding the results of the A.O. Smith Co. sampling job is contained in a letter written to the Nevada Porphyry directors by Mr. R. N. Hunt, geologist in charge of the Smith Co. work. This letter was intended to persuade the directors to allow an extension or alleviation of a large option payment due. The following paragraph is quoted from this letter:

"At Round Mountain we may count upon 12,000,000 to 15,000,000 tons of material having a value of \$1.25 per ton. This tonnage is in four bodies. One which we know as the Horseshoe ore body, containing four-fifths of the total. In its maximum dimensions it measures 900 x 1200 x 325 feet in depth. There are adjacent areas of \$1.00 to \$0.75 material. Incompletely known, there are possibly another 10,000,000 tons of \$0.75 to \$1.00 material. These 12,000,000 to 15,000,000 tons of higher grade include lesser and erratic tonnages of still better values. As spots and cores in surrounding lower grade material there may be 6,000,000 to 7,000,000 tons of \$1.50 ore. The unfortunate fact is that any rounded out tonnage such as a workable low grade ore body must be, is diluted by so much low grade and even barren material, as to rapidly reduce cores and streaks of better values to very low figures.....The ore body is a coarse mosaic of barren and pay blocks. The better grade cannot be removed without taking the low grade blocks."

This statement by Hunt is considered to be entirely reliable. Therefore it is to be concluded that large tonnages of material within the areas prospected by the Smith Co. will be found to contain but \$1.50 per ton at best. This opinion refers only to that area in which lode mining has been more or less extensive. The lode opportunities beneath the alluvial covering outside of this area have not been prospected and may be extensive. This possibility is particularly significant in regard to the large placer deposit which has been developed (described below). The removal of this gravel as planned has excellent opportunity of exposing important zones of open pit ore.

In general then it can be stated that the lode gold deposits offer certain attractive possibilities as regards both the low grade, open pit and the higher grade, selective mining mineralized zones. But the task of exploring and developing these zones will be costly and must be approached cautiously and without undue optimism.

Placer:

A large volume of placer has been prospected around the west flank of Round Mountain by 33 churn drill holes, mostly drilled by the Manhattan Gold Dredging Co., and 3 shafts. This deposit occupies a halfmoon-shaped area 4400 feet long in a north-south direction and 1400 feet wide (see map). The greatest depth to bedrock is 330 feet. Mr. W. H. Watters, engineer for Standifer, estimates that it includes 37,587,775 cubic yards which contains a per yard average of 25.1 cents in gold recoverable by ordinary washing procedure. Within certain portions of this area the

drill holes are very widely spaced. Also, the western margin has not been satisfactorily delimited. A number of additional holes are needed before the pay gravel is completely blocked out and the average of contained values assured.

Other prospect holes were drilled around the north and east flanks of Stebbins Hill, but the values encountered were not very good.

#### PROPOSED FUTURE OPERATIONS

##### Lode:

Since no lode ore bodies actually can be "measured" or blocked out from data at hand, no specific proposals regarding the scale of mining and milling operations can be made. If the distribution of values as indicated by our information is substantiated by exploratory and development sampling, an operation in excess of 1000 tons per day would be warranted. It is not an unreasonable expectation that eventually several thousand tons may be handled daily by open pit mining.

Production from selective underground mining would be small. The higher grade ore zones are widely spaced and considerable exploratory and development work would necessarily precede and accompany actual stoping. The former operations exemplify this.

##### Placer:

The placer deposit has been explored and tested to a degree that has permitted the Dayton Dredging Co. to make detailed plans for its exploitation. It has been determined that dredging is not applicable due to (1) the slope of bedrock and (2) the considerable depth of a large portion of the pay gravel.

Mr. Watters has designed a stationary washing plant of 10,000-yard daily capacity which employs conveyors for moving gravel from an open pit to the washing plant and for stacking the tailings. The most unusual feature, and perhaps the key to success or failure of the operation, is two large inverted cones or mill holes (the deposit is worked in two sections and the washing plant is moved once) which are situated within the deposit at about the deepest point in each section. First a long incline is driven from the surface near the washing plant to the point beneath the gravel where the neck of the cone is to be situated. A blasting chamber and pan feeder are installed here and a conveyor is put in the incline. A vertical raise is driven to the surface and widened to the proper cone dimensions. The normal mining procedure then is begun. This consists of digging the gravel in 40-foot layers a strip at a time, each strip radiating from the cone to the margin of the deposit. A strip is mined by a power shovel which dumps into a grizzly-hopper-feeder loading a short pendulum type conveyor. This in turn supplies the main pit conveyor dumping into the inverted cone. Extensions are added to the main conveyor as the distance from the cone to the shovel increases.

Tailings are stacked by long, extensible conveyors which supply



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pendulum conveyors. The latter type moves in arcs and deposits the washed gravel uniformly over broad areas in relatively shallow dumps, thus minimizing the expense of hoisting.

A report and accompanying map by Watters provide an analysis of the method and detailed estimates of capital and operating costs. Following are his figures:

(Quote, Watters' report)

SUMMARY OF EQUIPMENT & OPERATING COSTS FOR PAY GRAVEL

(Equipment is that required at the start of operations)

Items of Equipment	Cost of Equipment	Est. Oper. Cost	
		Per Day	Per Cu. Yd.
2 Deep well pumps, Max. of 1000 GPM	\$ 12,000	\$34.68	.3468
1 120-B Shovel-dragline, propor. part	93,000	262.25	2.6225
1 same for spare, overburden etc.	93,000		
1 D-8 Dozer-ripper, use around shovel	11,200	62.00	.6200
1 Portable Grizzly-hopper-feeder	40,000	49.43	.4943
1 Boulder Trailer	5,000		
1 D-8 Dozer Tractor to tow Trailer	10,000	55.00	.5500
1 Main Pit Conveyor, Max. of 1200'	48,000	35.66	.3566
1 Gravel Pocket or Cone, 1st position	6,200	--	--
1 Pan Feeder at bottom of cone	25,000	29.03	.2903
1 Inclined Shaft & Feeder Room	12,000	--	--
1 Inclined Conveyor, 1200' centers	58,800	74.64	.7464
1 Washing Plant complete	175,000	184.00	1.8400
1 Tailings Conveyor System with D-8 Dozer & 100 HP Steam Boiler	136,000	185.42	1.8542
3 Thickeners, reclaim slime water	80,000	16.10	.1610
2 Trucks, one a pickup	2,500	12.00	.1200
Transformers, power lines, lights	15,000	22.30	.2230
1 Shop complete	35,000	53.33	.5333
1 Lot of Spare Parts	25,000	--	--
Supervision		65.00	.6500

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<u>Items of Equipment</u>	<u>Cost of Equipment</u>	<u>Est. Oper. Cost</u>	
		<u>Per Day</u>	<u>Per Cu. Yd.</u>
Indirect Operating Expense, S.F. Office		23.33	.2333
Labor Insurance; Compensation, Federal Old Age & Unemployment		41.35	.4135
<u>Total</u>	\$882,700	<u>\$1205.52</u>	<u>12.0552¢</u>

AVERAGE OPERATING COST FOR PAY GRAVEL & OVERBURDEN

Overburden, 5,567,000 cu.yds. @ 7¢	\$ 389,690
Pay Gravel, 32,020,775 " " @ 12.0552¢	3,860,168
<u>Total &amp; Av. 37,587,775</u>	<u>11.31¢</u> <u>4,249,858</u>

While the average operating cost for handling the total yardage, overburden and pay gravel, works out at 11.31¢ per cu.yd. it is considered best to use 12¢ per cu.yd.

Note: Total estimated cost of the two 120-B shovel dragline units is \$218,000, of which \$32,000 is charged to overburden and \$186,000 to pay gravel.

CAPITAL OUTLAY FOR EQUIPMENT AFTER STARTING OPERATIONS.

<u>Items of Equipment</u>	<u>Est. Cost</u>
1 D-8 Dozer with Ripper                      Renewal	\$ 11,200
1 Boulder Trailer                                      "	5,000
2 D-8 Dozer Tractors                                      "	20,000
2 Main Pit Conveyor Belts                                      "	53,000
1 Gravel Pocket or Cone, Orig. in 2nd posit.	4,500
1 Inclined Shaft & Feeder Room                      "              "	10,000
1 Inclined Conveyor Belt, Renewal, 1st posit.	45,000
1 Inclined              "              "              Orig. in 2nd position	37,800
2 Tails Convey, System Belts, Renewals	85,000
2 Trucks, one a pickup                                      "	2,500
1 Move, everything from 1st to 2nd position	30,000
5 Trucks, each 10 cu.yds., for overburden	64,750
1 D-8 Dozer Tractor for overburden work	10,000

<u>Items of Equipment</u>	<u>Est. Cost</u>
2 120-B Shovel draglines for overburden, proportional part of \$218,000	32,000
Total	<u>\$410,750</u>

Note: The \$32,000 would be paid out at the start of oper.  
for the two shovels.

#### ESTIMATED OPERATING PROFIT

Total Gross Value recoverable from Pay Gravel \$9,379,663

Oper. Cost, 37,587,775 cu.yds. @ 12¢	\$4,510,533	
Equipment cost at start	882,700	
Equipment cost after starting	<u>410,750</u>	5,803,983
Estimated operating profit		<u>\$3,575,680</u>

Operating cost given above does not include taxes, royalty payments, interest, property insurance, depreciation & prospecting.

Estimated operating life of the property, determined by the rate of working pay gravel, is 9 years. Pay gravel is expected to be worked at the rate of 10,000 cu.yds. per day and overburden would be removed at the same time whenever necessary or convenient.

#### CONCLUSION

This property has considerable merit, chiefly because it contains unusually high values for a placer property. Working of the property involves a few problems but not very serious ones.

The digging rate in pay gravel must be maintained at 10,000 cu.yds. daily, or close to it, to make a successful operation. There seems to be nothing in the way to prevent it.

(Unquote, Watters' report)

The writer is not prepared to criticize these data except insofar as the following generalities apply: (1) Capital costs are reasonable. (2) Operating costs should be up-graded somewhat. (3) Though the details of the operation must be scrutinized, it appears generally to be operable. (4) The analysis obviously is the result of careful and competent consideration.

#### PROPOSED INVESTIGATIONS

##### Placer:

The placer deposit has received considerable attention in prospecting, laboratory test work, and plant design. As far as the Dayton Dredging Co. is concerned, preliminary work is complete and the project

would have reached the operating stage as soon as governmental restriction permitted. However, Coppermines must do a certain amount of check work, and it is felt that the deposit has not been completely blocked out. The Dayton Dredging Co. has been allowed to work a crew of five men under the direction of their engineer, Mr. Crocker. They will continue work under Coppermines' direction.

It has been decided that Mr. Crocker's crew first will sample two shafts. One is 107 feet deep and can be sampled relatively easy. The other is 257 feet deep and probably will require considerable expense before it is in shape for sampling. The samples obtained will be put through the small test-jig plant which Mr. Crocker has erected. The products from this plant will serve for metallurgical experimentation on the problem of cyaniding the jig product from the proposed washing plant.

Next, about four churn drill holes should be drilled in shallow portions of the placer with the small rig now on the property. This work will serve to (1) check the previous churn drill results, and (2) fill in some rather wide gaps in the spacing of holes.

Along the west and southwest margins the placer gravel body has not been thoroughly delimited. Also, hole spacing is wide and the deeper portions of the deposit have fewer holes. Nearly one-third of the calculated tonnage is theoretically blocked out by only four or five holes. Additional drill holes and, possibly, shafts are needed here. A larger rig is desirable for drilling these deeper holes.

All prospect holes in the placer should be drilled into bedrock at least 100 feet if possible. The diameter of the holes in bedrock should be as large as is practical concomitant with the difficulty of driving large size casing through the gravel.

#### Lode:

In prospecting, exploring, and developing the lode deposits to the point at which installation of a mill would be justified -- either a small mill for selective, underground mining, or a large one for open pit -- the problems are manifold and the investment will be large. However, considerable information can be acquired by preliminary work without undue risk of capital.

There are two fundamental considerations in sampling the lode deposits. (1) All samples should be of considerable bulk so that proportionate amounts of nearly barren rock are included with the richer seams. (2) Each sample or average of samples then must be weighted or attached a significance according to its position in the structural framework of the richer veins and zones as determined by detailed geologic mapping.

Driving new crosscuts in which all of the material from each round constitutes a sample probably would be the most accurate method of blocking out the open pit ore zones. However, this would be relatively inflexible and particularly expensive -- possibly a quarter-million dollars would have to be expended for a thorough exploratory program of this kind.

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Another method would be slabbing the walls of workings already in existence, but too few of these workings crosscut the zones properly. Due to the unavailability of the A.O. Smith Co. records, much of this type of work would be duplicating theirs.

It is considered that churn drilling would provide more information at lower cost, at least for preliminary exploration, than other sampling methods, providing the following operational precautions are observed:---  
(1) Large diameter holes are drilled. (2) Each hole is cased frequently until it is determined whether or not salting occurs due to sloughing. (3) Drilling water is lowered down the hole in a bailer instead of poured. (4) A thick, viscous sludge is maintained in drilling. (5) A suction type bailer is used -- if not exclusively, at least to clean out the bottom of the hole after each run. (6) Extreme care is exercised in handling each sample after it is bailed.

Shortly after a drilling campaign is begun the assay results of a couple of holes should be checked by raising along them from underground workings or sinking a shaft along them. This will determine whether or not the many opportunities for mechanical error are being avoided and true samples are being obtained. Also, churn drilling should be accompanied and checked by a certain amount of bulk sampling underground -- either slabbing the sides of nearby crosscuts, or driving new crosscuts. This will check the effectiveness of churn drill holes in delineation of the true distribution of values.

The area in which churn drilling could develop ore bodies is large. Also, the results of a single hole by no means could be considered as conclusive evidence of the favorability or unfavorability of a certain area, say 400 feet square, for ore occurrence. This is particularly applicable as regards the narrow but higher grade veins which may be found at depth. Therefore, a very large number of churn drill holes will be required to investigate most of the possibilities even in a preliminary way.

There are a number of zones which appear to be more favorable for the occurrence of sizable tonnages of open pit ore. Preliminary drilling logically would be directed toward these areas rather than a uniform, wide-spaced checker-boarding of the entire area. Each favorable area should be penetrated by about five holes at approximately 100-foot spacing. Four of these holes would be shallow -- 300 feet more or less -- and would be concerned primarily with prospecting for open pit ore. One would be continued to depth to determine the general character of mineralization and to test in a general way for higher grade veins. In this manner a fair idea of the distribution of values to be expected in the better zones could be obtained with 15,000 to 20,000 feet of drilling. This work, exclusive of underground sampling and the many small but expensive jobs which will arise, will cost about \$75,000.

If this preliminary work is encouraging, the better areas would be returned to and checker-boarded with close-spaced holes to define and delimit ore bodies. A hole spacing of 50 feet may be desirable if values are as erratic as is expected.

The steps of preliminary examination and sampling will not be

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detailed here because such procedures necessarily would be adjusted according to results obtained.