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REPORT ON

EUREKA CORPORATION LTD.

By

Ira B. Joralemon

August 20, 1949

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Ruby Hill Fault

SUMMARY

From 1869 to 1882 the high grade oxidized orebodies under Ruby Hill, near Eureka, Nevada, produced more than $40,000,000 in silver, lead, and gold. About 1,300,000 tons of ore are said to have been mined. Later production has been comparatively small, and chiefly from low grade ore. Eureka Corporation, Ltd. now owns or holds under lease all of the portion of the Eureka District in or near Ruby Hill.

The Ruby Hill ore occurred in irregular bodies, the horizontal projection of which occupied about a quarter of an area 2200 feet long from northwest to southeast by 1200 feet wide. On the southwest the orebearing dolomite came to the surface. On the northeast it was cut off at about the 900 Level by the large Ruby Hill Fault. The orebearing rocks northeast of this fault were dropped in two large fault blocks. Block I-B, northwest of the Bowman cross fault, was dropped about 700 feet. Save for one barren drillhole far to the north, no development has been done in the orebearing horizon in this block. Block I-A, southeast of the Bowman Fault, was dropped 1300 feet. Five diamond drillholes in an area 400 feet long by 300 feet wide in this block indicated a possible 200,000 tons of heavy sulphide ore that averages 0.192 ounces gold, 5.92 ounces silver, 3.74%

note

lead, and 9% zinc for 51.7 feet in thickness. The best hole averaged 0.388 ounces gold, 11.53 ounces silver, 5.9% lead, and 10.93% zinc for 65 feet in thickness. This indicated ore occupies less than a tenth of the promising area northeast of the Ruby Hill Fault.

Preliminary metallurgical tests on samples from the drillholes indicate that the net payment at the mill from shipment of concentrates, with lead at 13 cents per pound and zinc at 10 cents, would be $14.75 per ton of ore of the average grade, and double this amount per ton of ore of the grade cut by the best drillhole.

Eureka Corporation, Ltd. sunk the 2413 foot Fed Shaft to make this deep ore available. About 700 feet from the ore a crosscut on the 2250 Level encountered a great flow of water that flooded the shaft. Pumping up to 9000 gallons per minute failed to recover the 2250 Level. The principal reasons for the failure were:

1. The 2250 Level was 1250 feet below the original water table. The resultant rapid flow under great head enlarged the watercourses, bringing in mud and grit that made it impracticable to keep pumps running.

2. No drillholes were kept open, to permit measuring the drop in water table.

3. A water door on the 2250 Level was not strong enough to stand the great pressure.

4. No drillhole was run ahead of the face, to permit gradual draining of large open fissures.

5. It is possible that part of the water pumped to the surface ran down crevices and was recirculated.

From the pumping record and from experience in other mines, it seems likely that the 2250 Level ore can be made accessible by unwatering the mine a few hundred feet at a time, pumping a total of 4 to 6 billion gallons of water at the rate of 5,000 gallons per minute.

There are three excellent chances of finding large orebodies at much higher levels. This would permit bringing the mine to production at a far lower cost than that required to unwater the 2250 Level. The three promising places are:

1. In Block I-B, northwest of the Bowman Fault, above the 1700 Level.

2. In higher beds 400 to 600 feet above the ore developed by drilling in Block I-A.

3. In a fault block of dolomite under the quartzite that underlies the old Ruby Hill orebodies, from the 1200 to the 1700 Level.

These three possibilities can be tested by churn and diamond drillholes at comparatively small expense.

The following program is recommended, with details of later stages modified to suit results of earlier stages:

1. Do 1800 to 3500 feet of churn drilling from surface and 1000 to 1800 feet of diamond drilling from the 800 Level, Pad Shaft, to test the three possibilities for finding ore on or above the 1700 Level. Time required, 8 months to 1 year. Estimated cost, $40,000 to $80,000.

2. Unwater the mine to the 1700 Level, and crosscut to the orebearing formations. Time required, not to exceed 18 months. Estimated maximum cost, including pumping, $870,000. If there was recirculation of water in the earlier pumping, the cost will be much lower. If, as seems likely, large orebodies are found above the 1700 Level, about $500,000 additional must be spent to provide a second exit and to prepare the mine for production.

3. Unwater the mine to the 2250 Level and crosscut to the orebody already developed by drilling. Time required, about one year. Estimated maximum cost, $720,000. As in the second stage, the cost will be much less if there was recirculation of water pumped in 1948. If ore is found on or above the 1700 Level, Stage 3 can be carried out gradually, out of part of profits. If no ore is found above the 1700 Level, about $1,000,000 additional must be spent for second exit, auxiliary levels, etc., before large scale production can start from the 2250 Level.

4. As soon as possible, ship high grade ore to a custom mill and smelter. The estimated net return at the mine from ore of the grade of the 65 feet cut by Drillhole E, with lead at 15 cents and zinc at 10 cents per pound, would be $17 per ton. This would more than cover the cost of mining, pumping, and overhead while a treatment plant is being designed and built. The size, character, and position of orebodies must be known before such a plant is planned. After it is in operation, with production at the rate of 500 tons per day, all costs at Eureka should total $10 to $12 per ton. This will permit a fair profit on probable average grade ore. It is possible that the cost of power, and so the total cost, may be greatly reduced.

It is essential to secure a more reasonable lease from Richmond Eureka Mining Company before starting the program outlined above. When this is done, the preliminary development will be an exceedingly good speculation. If, as expected, it finds large orebodies on or above the 1700 Level, a total expenditure of less than $1,450,000 plus the cost of a treatment plant, seems likely to result in one of the greatest mining districts in the country.

If no ore is found above the 1700 Level, the venture will be less attractive. Extensions of the deep ore already indicated by drilling may total several million tons. However, there is a remote chance that the flow of water may be so great that the cost of mining and development will be prohibitive. It is far more likely that large scale production from the deep

orebodies can be started at a total cost of $2,650,000, plus the cost of a treatment plant. A possible profit of many times this amount fully justifies an attempt to unwater the 2230 Level even if no higher ore is found.

Ira B Joralemon

San Francisco, California
August 20, 1949.

REPORT ON

EUREKA CORPORATION, LTD.

By Ira B. Joralemon

August 20, 1949.

The following report covers the theory of faulting and of probable ore occurrence in the property of Eureka Corporation, Ltd., at Eureka, Nevada; the results of operations to date; and suggestions as to the proper future policy.

THE PROBLEM AT EUREKA.

From 1869 to 1882 Eureka, Nevada was one of the greatest silver-lead districts in the West. Production to the end of 1882 was reported by J. S. Curtis, in U.S.G.S. Monograph VII, to have totalled about $40,000,000 in silver, $20,000,000 in gold, and 225,000 tons of lead. The high grade oxidized ore was for the most part smelted in several small furnaces in Eureka. After 1882, the great orebodies were exhausted, and there was limited production, chiefly by lessees.

The ore at Eureka occurred in irregular bodies in limestone and dolomite. The sedimentary series, from the top down, is as follows:

Nevada Limestone	(Devonian)	
Eureka Quartzite	(Ordovician)	
Pogonip Limestone	(Ord. & Camb.)	over 1,000 ft.
Dunderberg Shale	(Cambrian)	340 "
Hamburg Dolomite	(")	900 "
Secret Canyon Shale	(")	1,035 "
Geddes Limestone	(")	335 "
Eldorado Dolomite	(")	2,000 "
Prospect Mountain Quartzite	(Camb.)	1,660 "

Thrust faults have in many places greatly reduced the above thicknesses.

Irregular, generally small intrusions of monzonite porphyry cut the sediments.

By far the greater part of the output came from a fault-block of Eldorado Dolomite, under Ruby Hill. The Ruby Hill block was limited on the southwest by the irregular northeast-dipping Footwall Fault zone, below which was crushed Prospect Mountain quartzite. Due to faulting, only the top half of the normal thickness of the dolomite remains in this area. On the northeast the dolomite and the productive fault block were cut off by the large Ruby Hill Fault, that strikes northwest and dips about 70 degrees northeast. To the northwest the Albion cross fault cut off the orebearing dolomite, and to the southeast dolomite played out in a narrow band as the Ruby Hill Fault and the Footwall Fault gradually came together. As the dip of the Ruby Hill Fault is steeper than that of the Footwall Fault that brings in the quartzite, the Eldorado Dolomite under Ruby Hill wedges out about 900 feet below the surface.

The Prospect Mountain Quartzite that underlies the orebearing formation in Ruby Hill is cut off in depth by a large thrust fault, that dips northeasterly. Below this thrust is a block of the Hamburg Dolomite that normally lies 3,300 feet above the Quartzite. Due to later cross faults and to curves in the thrust fault, the thickness of Prospect Mountain Quartzite between the orebearing Eldorado Dolomite and the underlying, very slightly explored Hamburg Dolomite varies from a few feet of drag material up to several hundred feet. The thinnest part of the quartzite extends for about 200 feet northwest and 200 feet southeast of the Richmond Shaft.

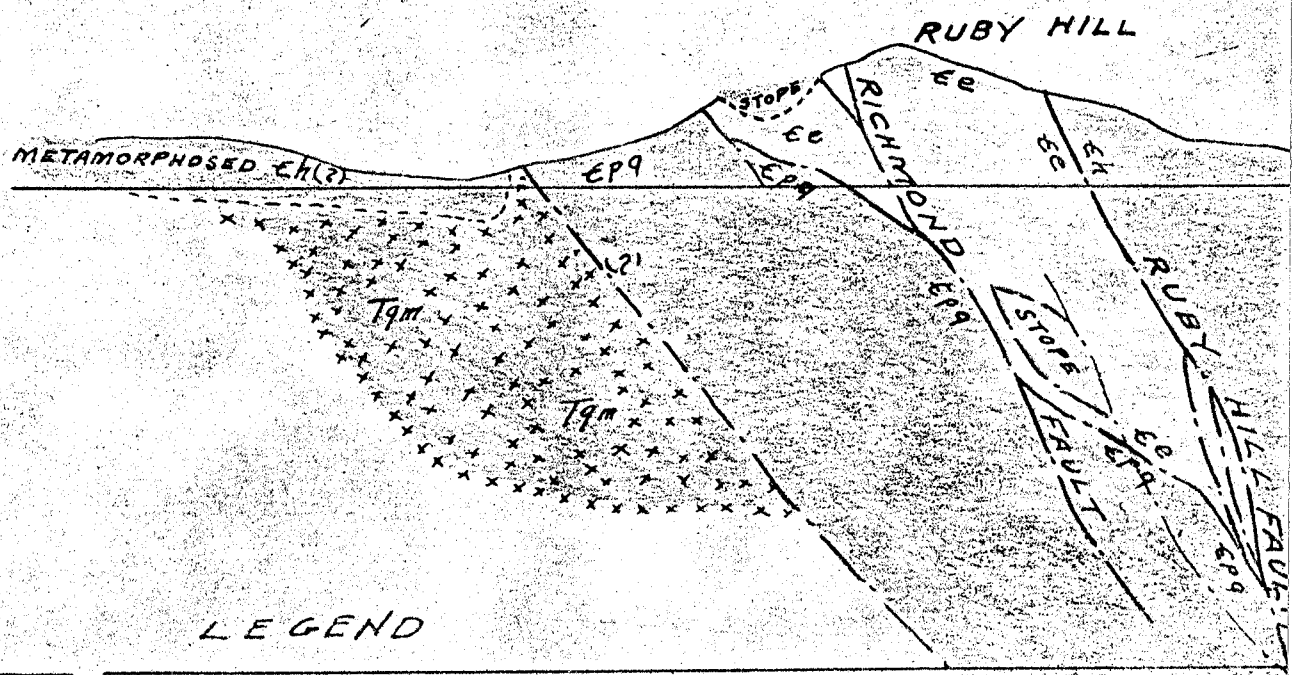
The accompanying map and cross sections show the structure.

It was known at the time of the Curtis U.S.G.S. report, published in 1884, that the rocks on the northeast side of the Ruby Hill Fault had been dropped many hundred feet. The diamond drilling carried on by Eureka Corporation, Ltd., and the United States Bureau of Mines between 1940 and 1944 proved that the maximum vertical displacement on the Fault is about 1,300 feet. The beds northeast of the Ruby Hill Fault, like those southwest of it, dip to the northeast at varying angles, averaging about 20 degrees. Many other faults, the most important of which are shown on the accompanying horizontal projection and on the vertical sections, cut the area northeast of the Ruby Hill Fault up into large fault blocks. In addition to the steeper faults, there are flat thrust faults that often greatly reduce the thickness of the formations.

An excellent geological map and sections that are now being made by Mr. Thomas B. Nolan for the United States Geological Survey, were most useful in the study of the Eureka geology. Discussions with Mr. Nolan were exceedingly helpful.

The age relation between the deposition of ore and the Ruby Hill Fault has been the subject of much disagreement. Regardless of this relation, it was early recognized that the downfaulted block of Eldorado Dolomite northeast of the Fault might contain large orebodies. The drilling by Eureka Corporation, Ltd., and later by the Bureau of Mines was based on this assumption. It was spectacularly successful. Hole A, far to the northwest, failed to find ore. The next five holes, opposite the most productive part of the Ruby Hill area, all cut ore of fair to excellent grade. These holes are more or less evenly spaced in an area extending 550 feet northeast from the projected position of the Ruby Hill Fault at the ore horizon, by 425 feet from northwest to southeast, parallel with the fault. Ore in all five holes is apparently at the same horizon, near the bottom of the Eldorado dolomite. Detailed results of drilling are given later in this report.

The essential problem at Eureka is first, the possible location and size of orebodies in fault blocks adjacent to the productive Ruby Hill Block; and second, how these orebodies can best be opened up for mining.

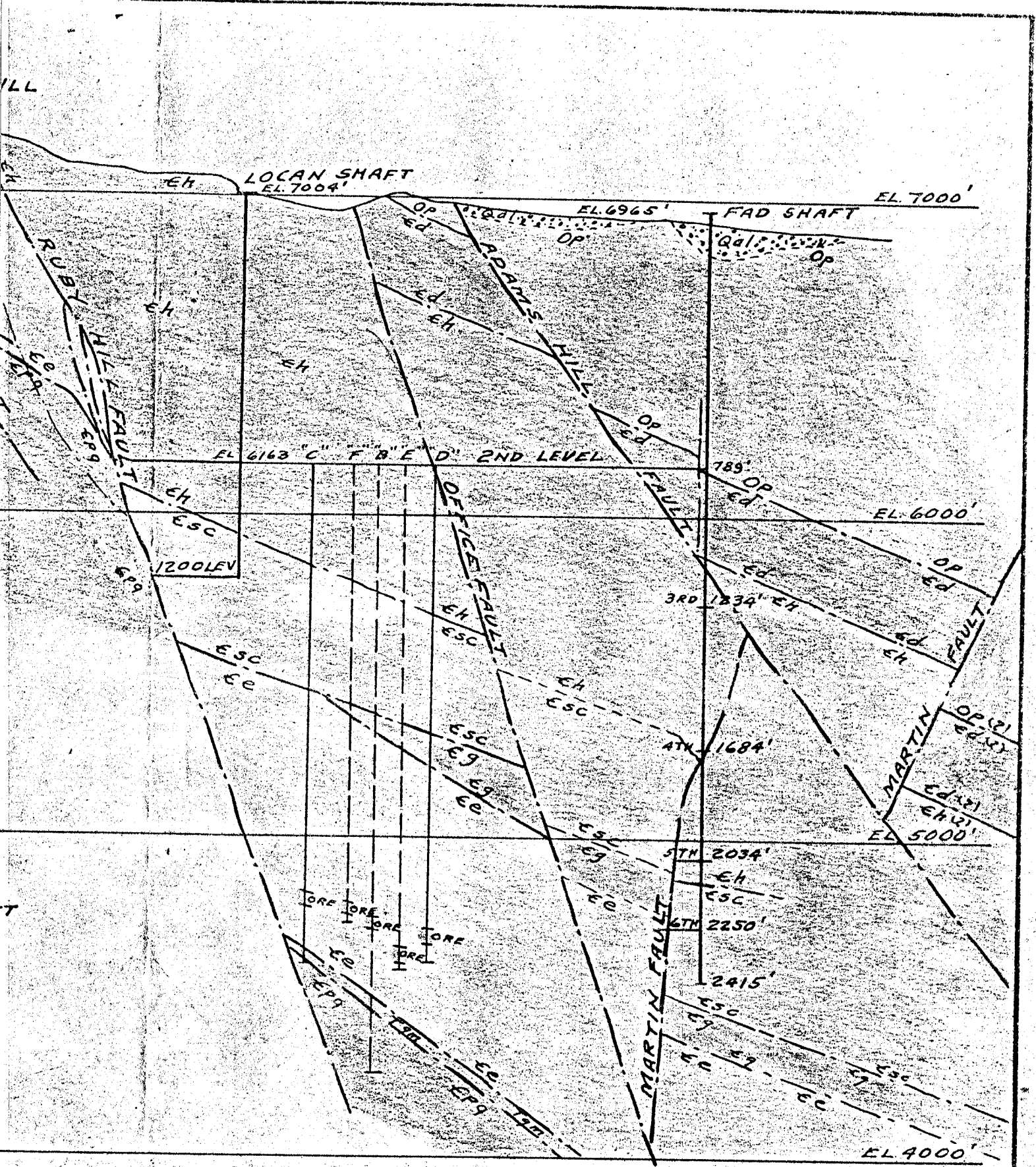


LEGEND

Tqm	QUARTZ MONZONITE
Op	POGONIP LIMESTONE
Ed	DUNDERBERG SHALE
Eh	HAMBURG DOLOMITE
Esc	SECRET CANYON SHALE
Eg	GEDDES LIMESTONE
Ee	ELDORADO DOLOMITE
Ep9	PROSPECT MTN. QUARTZITE

SECTION THROUGH DRILL HOLES "C" AND "D" AND FAD SHAFT

BY WM SHARP SCALE 400' = 1"



Drawing No Gs-3

OREBODIES SOUTHWEST OF RUBY HILL FAULT, AND RELATION TO FAULTS

The best index of the possible size of orebodies in the dropped block northeast of the Ruby Hill Fault is the size of the worked out bodies southwest of the Fault.

As shown in the horizontal projection and sections, the principal Ruby Hill orebodies occurred within an area 2,200 feet long from northwest to southeast, parallel with the Fault, by a maximum of 700 feet in horizontal width, at right angles to the strike of the Fault. Due to the northeast dip of the Fault, the area of greatest mineralization shown on the horizontal projection is 1,200 feet wide, instead of the 700 foot maximum horizontal width. In depth the width of orebearing formation rapidly decreases until 1,100 feet below the top of Ruby Hill, or 800 feet below the collar of the Logan Shaft, there is only a narrow drag-block of Eldorado Dolomite, with very small ore showings.

As all of the workings except those on the 900 Level of the Logan Shaft and the corresponding 800 Level, Richmond Shaft, are inaccessible, information about the size and form of the Ruby Hill orebodies must be obtained from old maps and reports. The horizontal projection indicates that within the area 2,200 feet long from northwest to southeast by 1,200 feet wide, approximately 25% is underlain by ore. Maps and sections in the mine office at Eureka show that the vertical thickness of ore varies from a few feet to 300 or 400 feet. No exact tonnage records are available, but it seems likely that 1,300,000 tons of ore were mined from under Ruby Hill, with recovered gold, silver, and lead totalling at least $40,000,000.

There were two principal types of orebodies in Ruby Hill. The largest ones replaced certain beds of the Eldorado Dolomite, dipping 20 to 30 degrees northeast. The most continuous bedded ore was in the bottom 100 to 200 feet of dolomite, a short distance above the Footwall Fault. Large orebodies at this horizon came to the surface on the southwest slope of Ruby Hill, and were mined partly by open cut. A second favorable horizon, with somewhat smaller bedded orebodies, was 400 to 500 feet above the Footwall Fault. While most of the top of the Eldorado dolomite is eroded away in Ruby Hill, a small bedded orebody was mined in the Phoenix Mine, 1,000 feet southwest of the main productive area, just under the overlying Geddes Limestone. It seems likely that the entire thickness of Eldorado Dolomite is favorable for replacement by ore.

A second type of orebodies consists of steep, irregular chimneys and tabular deposits along steep faults, with bedded branches leading away from the steep ore. Most of the steep ore occurred on three faults; the Richmond Hill, which branches away south from the Ruby Hill fault, with a steeper easterly dip; the nearly north-south Lawton Fault; and one or more parallel fractures of the Ruby Hill Fault, in the footwall of the heavy gouge on which the principal displacement took place. The steep ore was found from high up in the dolomite, at 7,000 or 7,100 feet elevation, to the bottom of the Ruby Hill Fault block, at about 6,180 ft. elevation, just below the 900 Level of the Logan shaft.

Reports by Waldemar Lindgren, for the U. S. Geological Survey, and others state that a little ore was found down to the bottom or 1,200 level of the Logan shaft, but that this ore was apparently dragged in along the Fault. It was too bunchy to mine at a profit.

It has not been possible to correlate faults northeast of the Ruby Hill Fault with the mineralized Lawton and Richmond Faults southwest of the Ruby Hill. Drillhole A, about 1,000 feet northeast of the Ruby Hill, was sunk to test the theory that the Bowman Fault is a continuation of the Lawton, with a lateral displacement by the Ruby Hill of 900 feet to the northwest. No mineralization was found in Hole A to substantiate this theory. It seems more likely that faults on both sides of the Ruby Hill formed blocks with the Ruby Hill, and were not offset by it.

The ore in the old mine was largely oxidized, with residual kernels of silver-bearing galena. The ore mined before 1882 was almost all from the high grade central portions of the orebodies. Leaner surrounding material was mined in later years, chiefly by lessees, and was shipped to smelters in the Salt Lake valley for flux.

It is reasonably certain that most of the displacement on the Ruby Hill Fault is on the hanging wall strand, and that this part of the movement on the Fault is later than the ore formation. This indicates that the ore zone as well as the beds were displaced by the Fault. However, the ore in drillholes northeast of the Fault is practically all sulphide, while that in the old mine was oxidized. Therefore, it seems likely that the principal faulting took place between the time of ore deposition and that of oxidation by circulating surface waters.

POSSIBLE ORE-BEARING AREAS NORTHEAST OF RUBY HILL FAULT

If the above fault theory is correct, there is an excellent chance that orebodies northeast of the Ruby Hill Fault may compare in size and in area with the orebodies that were mined southwest of the Fault. Ore may therefore be found through a length from northwest to southeast of about 2,200 feet. The deeper, most continuous orebodies southwest of the Ruby Hill Fault were mined to or close to the fault for a length of 800 feet, southwest of the Richmond Fault. This length is particularly promising for prospecting in the downthrown block. For the rest of the 2,200 ft. length of strongest mineralization in the old mine, most of the orebodies either played out before they reached the Ruby Hill Fault, or were cut off by that Fault in the upper portion of the Eldorado Dolomite. It seems likely that similar scattered orebodies may be found northeast of the Ruby Hill Fault, both northwest and southeast of the most productive 800 foot central section.

The distance northeast from the Ruby Hill Fault through which ore may extend in the downthrown blocks is uncertain. In the old mine, the large stopes extend at most for 700 feet horizontally southwest of the Fault. They come to the surface at that point, and may have continued much further southwest before they were truncated by erosion. There is at least a fair chance

that ore may be found for 1,000 feet or more northeast of the Ruby Hill Fault, or for double the distance indicated by drilling thus far.

It seems possible, therefore, that important orebodies may be found through an area 2,200 feet long from northwest to southeast, extending 1,000 feet northeast of the Ruby Hill Fault. As in the old mine, a quarter of this area may be underlain by ore.

The promising area northeast of the Ruby Hill Fault is in two fault blocks. The limiting faults, projected to the probable orebearing horizons, are shown on the 100 scale map and the vertical sections. The block marked I-A on the map, in which ore has already been found by drilling, is bounded on the southwest by the Ruby Hill Fault. The northeast limit is the Martin Fault, nearly parallel with the Ruby Hill Fault in strike but with a steep southwest dip which drops the orebearing dolomite about 400 feet. The southeast border of the block is the large Jackson Fault, which strikes east of north and dips 70 degrees southeast. Beyond the Jackson Fault the beds are dropped many hundred feet. The Bowman Fault, nearly parallel with the Jackson in strike but steeper, limits Block I-A on the northwest. The North 10 degree West Office Fault, dipping 60 to 70 degrees northeast, cuts the northeast corner of the rhombic block. At the horizon of the lower part of the Eldorado Dolomite Block I-A is about 1,600 feet long from northwest to southeast by 1,400 feet wide.

The ore found by Drillholes B, C, D, E, and F is in the west corner of Block I-A, close to both the Ruby Hill and the Bowman Faults. This ore is at 4,610 to 4,800 feet elevation, with the 2,250 Level, Pad Shaft, at about the middle of the ore horizon. In addition to this main ore bed, Holes B, C, and E cut notable mineralization from 200 to 350 feet above this bed. While the higher mineralization is not of commercial grade, it encourages the hope that lenses of ore may be found, as in Ruby Hill, in about the middle of the Eldorado Dolomite. The intersection of this horizon with the Ruby Hill Fault, at about the 1,700 Level, Pad Shaft, seems particularly favorable. Drillhole G was started to prospect for such higher ore, but was not completed.

As both the Bowman and the Jackson Faults are normal faults with southeast dips, any post-ore motion on them has carried the portion of the orebearing area southeast of the Bowman Fault several hundred feet southeast of its original position. It seems likely that this block was originally opposite the southeast half or two-thirds of the old stoped area, and of the central 600 feet of strongest mineralization in this area.

The possible faulted extension of the northwest third or half of the 2,200 feet in length through which the old orebodies occurred will be in Block I-B, northeast of the Ruby Hill Fault and northwest of the Bowman Fault. As the southeast side of the Bowman Fault dropped many hundred feet, the Eldorado Dolomite northwest of this fault will be at a higher elevation than that southeast of the Fault. The accompanying vertical sections indicate that the bottom of the orebearing Eldorado Dolomite in Block I-B should be at about 5,300

feet elevation next to the Ruby Hill Fault, dipping down to the northeast away from the Fault. This is 500 or 600 feet higher than the same horizon in Block I-A. This displacement agrees with the surface geology. The only evidence that conflicts with this interpretation is the fact that Drillhole A, which starts from surface 1,800 feet northeast of the Ruby Hill Fault, was reported to have cut Eldorado Dolomite from 5,660 to 3,600 feet elevation. This is more than double the thickness of this formation developed in adjoining blocks. It seems likely that, as shown in the vertical sections, the Prospect Mountain Quartzite has wedged out between thrust faults, and that the portion of Hole A below a crushed zone at 4,670 feet elevation is in Hamburg Dolomite. This agrees with the structure southwest of the Ruby Hill Fault.

Based on this interpretation of the geological structure, the most likely places in which additional ore may be found northeast of the Ruby Hill Fault are first, in the part of Block I-A extending 1,000 or 1,200 feet southeast of the Bowman Fault, and an unknown distance northeast of the Ruby Hill Fault, with the ore developed by Drillholes B to F near the west corner of this area; and second, in the part of Block I-B extending 800 to 1,200 feet northwest of the Bowman Fault and an unknown distance northeast of the Ruby Hill Fault. Ore in this latter area should be at about the 4th or 1,700 foot level of the Fad Shaft. There may be higher ore in both blocks.

POSSIBLE DEEPER ORE UNDER RUBY HILL BLOCK

There is a fair chance that ore may be found in the fault block of Hamburg Dolomite that underlies the Prospect Mountain Quartzite in the Ruby Hill Block, southwest of the Ruby Hill Fault. As shown in the northeast sections, the quartzite is thin in the vicinity of the Richmond Shaft. The Hamburg Dolomite below it is practically indistinguishable in character from the orebearing Eldorado Dolomite. The Richmond Fault and the footwall strands of the Ruby Hill Fault, which seem to have been the most important mineralizing channels, cut through the flatter thrust faults into the Hamburg Dolomite. Inclined diamond drillholes from the 800 Level, Fad Shaft, would cut the intersection of the mineralizing faults with the Hamburg Dolomite, at a depth of 200 to 400 feet below this level. They will be excellent prospecting.

RESULTS OF DRILLING

The five vertical diamond drillholes from the 900 Level of the Logan Shaft all found ore of commercial grade and thickness. The holes and the ore horizon are shown on the accompanying 100 scale map and on vertical sections.

The better ore is in a fairly regular bed 150 to 200 feet above a monzonite sill at the bottom of the Eldorado Dolomite. In Holes B and C the ore is divided into two bands separated by barren dolomite. In addition to the commercial ore, Holes B, C, and E cut notable mineralization at a horizon 200 to 350 feet higher.

The ore, consisting of galena, sphalerite, pyrite, and arsenopyrite in a gangue that is chiefly dolomite, was very friable. Only a few small bits of core were recovered. Every attempt was made to get reliable sludge samples, both from Holes B and C, run by Eureka Corporation, Ltd., and from Holes D, E, and F, run by the United States Bureau of Mines. The weight of sludge is said to have agreed closely with the theoretical weight, indicating that there was probably no very serious salting or dilution. However, no drillhole in friable material cuts an absolutely even cylinder. Sludge samples are therefore not accurate. It is likely that a little of the richer material from the upper part of the ore section spalled off and enriched the leaner material a few feet lower down. The average ore figured from the sludge samples may therefore be a little thicker than the actual ore. The grade of ore should be about as indicated by the samples.

Following is a summary of the results of drilling, as reported by Company engineers, with much of the data taken from U. S. Bureau of Mines reports:

Hole A from surface 1400 ft. west of north from the orebody found by the later drilling. Reported to have cut Eldorado Dolomite from 1191 to 3223 ft., and the underlying monzonite sill from 3223 to 3243 ft. Showed very little lead, zinc and iron sulphides at 2613 to 2633 ft., and in spots from 2997 to 3223 ft. As noted earlier in this report, it seems likely that the material from 2153 to 3223 ft. depth was a fault block of Hamburg Dolomite instead of Eldorado.

Hole B from 900 Level, Locan (Elev. 6163 ft.), near center of indicated ore area. Cut Eldorado Dolomite from 832 to 1678 ft. depth.

	Thick	Oz.Au	Oz.Ag	% Pb	% Zn
Av. Values 1153-1172 ft.	13'	0.094	3.09	.14	5.55
1409-1449 ft.	40'	0.164	3.39	2.46	12.95
1494-1509 ft.	15'	0.123	2.35	2.90	4.74

Hole C from 900 Level, Locan. SW corner of indicated ore area, nearest Ruby Hill Fault. Cut Eldorado Dolomite 725 to 1537 ft.

	Thick	Oz. Au	Oz. Ag	% Pb	%Zn
Av. Values 1100-1325 ft.	225'	.005 to .04	Tr. to .25	.02	.70
1350-1390 ft.	40'	0.139	6.75	4.51	10.05
1425-1443 ft.	18'	0.104	6.29	3.14	3.82
1443-1554 ft.	111'	0.02 to .03	0.14 to 0.69	0.1 to 0.3	0.13 to 2.1

Hole D from 900 Level, Locan, in NE corner of indicated ore area. Cut Eldorado Dolomite from 928 to 1562 ft.

	Depth	Oz. Au	Oz. Ag	% Pb	% Zn
AV. Values 1454-1507 ft.	53'	0.084	2.32	1.48	7.24

Hole E from 900 Level, Locan, in SE corner of indicated ore area. Cut Eldorado Dolomite from 1000 to 1582 ft.

		Thick.	Oz. Au	Oz. Ag	% Pb	%Zn
Av. Values	1258-1262 ft.	4'	0.05	6.9	8.4	1.3
	1262-1487 ft.	205'	Tr. to .09	.10 to 1.3	.10 to .97	0.34 to 6.9
(Scattered assays)	1487-1497 ft.	30'	Tr. to .063	.05 to 2.98	.2 to .71	0.7 to 6.25
	1497-1562 ft.	65'	0.388	11.52	6.89	10.93

Hole F from 900 Level, Locan, in NW corner of indicated ore area, cut Eldorado Dolomite from 790 to 1433 ft.

	Thick.	Oz. Au	Oz. Ag	% Pb	% Zn
Av. Values 1375.6-1403 ft.	27.4'	0.153	3.49	2.22	6.35

Weighted Average of commercial ore cut in all five holes, including both bands in Holes B and C, but omitting low grade and spotty higher mineralization in Holes B, C, and E:

Thick.	Oz. Au	Oz. Ag	% Pb	% Zn
51.7'	0.192	5.92	3.74	9.0

Gross content per ton, @ $35 Au, $0.91 Ag, 15¢ Pb, 10¢ Zn	$6.73	$5.40	$11.23	$18.00
Total Gross Content				$ 41.35 per ton of ore

Metallurgical losses and the cost of transporting and smelting concentrates will greatly reduce the amount received for metals at the mine, particularly for lead and zinc. The gross content is given simply to show the distribution of values between the metals.

An estimate of ore indicated by the five drillholes is hardly more than a guess. While all five holes cut ore at practically the same horizon, the horizontal projection of orebodies in the old mine shows that there may be barren areas within the orebody. Neglecting any barren areas and assuming that ore will extend 50 feet from the outer four drillholes along the diagonals of the rhombic area, the possible orebody would cover 124,000 square feet. With an average thickness of 51.7 feet and a specific gravity factor of 8 cubic feet per ton for the heavy sulphide ore, the possible or indicated ore totals 800,000 tons.

While the above estimate is a very rough one, there is no question but that the drilling has indicated a great orebody.

Much additional ore will certainly be found. The partly developed area in Block I-A includes less than a tenth of this block. Hole E, which is

the furthest east of any of the holes, has the richest and thickest ore found by any of the drillholes. Development further east and south in Block I-A should add greatly to the tonnage. It seems likely that at least spotty ore will be found in this block 200 to 300 feet above the developed ore bed. Block I-B should contain orebodies comparable with those in Block I-A. The Hamburg Dolomite that underlies the footwall quartzite under Ruby Hill also has attractive possibilities.

While no estimate can be made of additional possible ore, it seems likely that several million tons of workable sulphide ore may be found in the area tributary to the Fad Shaft.

METALLURGICAL RECOVERY

Mill tests were made by the U. S. Bureau of Mines and by Nepheline Products, Ltd., on samples of sludge from the diamond drillholes. The samples were too small to permit conclusive tests. The tests suggest, however, that approximately the following recoveries and grades of concentrates can be made by selective flotation:

	Grade of Concentrates				% Metals Recov. in various concs.			
	Au Oz.	Ag Oz.	Pb %	Zn %	Au	Ag	Pb	Zn
Heads	0.19	5.9	3.75	9.0	100	100	100	100
Pb Conc.	.15	65.0	60.0	2.5	7.0	70	82	2.5
Zn "	.01	4.0	0.7	54.0	1.0	6.0	1.5	67.0
Pyr."	.20	1.5	1.0	6.0	20.0	5.0	2.5	12.0
Arsenopyr. Conc.	.25	1.5	1.0	1.5	64.0	10.0	5.0	5.0

The above figures are approximate, being based on interpolation between the Bureau of Mines tests on ore of below average grade and the Nepheline Products tests on ore richer than the average. Data are not sufficient to permit computing a metallurgical balance.

Returns from smelters in the Salt Lake Valley and at Amarillo, Texas, for lead and zinc concentrates respectively, are equally uncertain, as metal prices and costs are changing rapidly. Based on the open contract schedule, net payments for the lead concentrate, FOB Eureka, would total about 73% of the gross value of the Au, Ag, and Pb contained. Net payments for zinc concentrate, after credit for cadmium, FOB Eureka, would total about 49% of the gross value of the Au, Ag, and Zn contained. Recovery from the pyrite and arseno-pyrite concentrates, by roasting and cyaniding, is indicated by preliminary tests made by Nephelene Products, Ltd., to be 70% of the gold and silver contained.

Based on these assumptions, the net recovered, FOB Eureka, from ore of the estimated grade would be approximately as follows:

From Pb Conc.	Au	73% of 7% of .15 oz. @	$35.00	or	$0.27	p/t of ore
	Ag	73% of 70% of 5.9 " @	.91	"	2.84	" " "
	Pb	73% of 82% of 3.75% @	.15	"	6.73	" " "
		Total Net from Pb Conc.			$9.84	" " "
From Zn Conc.	Au	49% of 1% of .15 oz. @	$35.00	"	$0.03	" " "
	Ag	49% of 6% of 5.9 " @	.91	"	.16	" " "
	Zn	49% of 67% " 9.0% @	.10	"	2.94	" " "
		Total net from Zn Conc.			$3.13	" " "
From Pyrite & Arsenopyrite Conc.						
	Au	70% of 84% of 0.19 oz. @	$35.00	"	$3.92	" " "
	Ag	70% " 15% " 5.9 " @	.91	"	0.56	" " "
		Total recovery from Py and Arsenopy			$4.48	" " "
		Less approx. cost of roasting and cyaniding, $4.00 per ton concs.		"	$2.70	" " "
		Net from Py and Arsenopy. Conc.			$1.78	" " "

With 13% Pb and 10% Zn, the total net, FOB Eureka, after deducting cost of roasting and cyaniding gold concentrates, would therefore be approximately $14.75 per ton, compared with gross values of $41.35 per ton.

Improved metallurgy and more favorable smelter contracts on large and regular shipments may increase the net return materially. Selective mining of the richer ore should greatly increase the return per ton. For example, the returns from ore of the grade of that cut by Hole E would be more than double the returns from ore of average grade. The actual grade of ore mined will depend on economic conditions.

Although there were many uncertainties, the large tonnage of ore of good grade indicated by drilling, and the still greater additional possibilities, justified the decision to sink the new Fad Shaft in order to open up the downthrown fault block for mining.

WATER PROBLEM

The possibility that a large flow of water might be encountered in the dropped block northeast of the Ruby Hill Fault has long been recognized. Only a limited flow, estimated at 600 to 1,000 gallons per minute, was pumped from the 1200 Level of the Locan Shaft. This level was only about 240 feet below the water level in the Locan Shaft, and 200 feet below the water level in wells in the large Diamond Valley, 3 to 5 miles northwest of the mine. Several engineers have thought that as workings became deeper, and the effective head increased, the flow might become prohibitive.

The shattered and faulted dolomite beds are sure to contain large watercourses. The reported presence of fair sized caverns in the Eldorado Dolomite under Ruby Hill makes the migration of underground water on a large scale much more likely. The fractured Prospect Mountain Quartzite is also a

good water carrier. The shale beds are relatively impervious, except perhaps where traversed by large fault zones. Where faults are great enough so that one limestone or dolomite formation is brought against a similar formation, there would be a relatively free circulation of surface water down the dip of the beds. As shown in the accompanying vertical sections, the Ruby Hill Fault and probably the Adams Hill and Martin Faults present opportunities for water to go from the surface to a depth of 3000 feet in the area northeast of the Ruby Hill Fault without passing through any horizon where both walls of the faults are shale.

A more favorable condition is the fact that in the area northeast of the Ruby Hill Fault there is no great mass of leached and porous material like that in the oxidized zone at Bisbee, Globe, and other copper districts that have encountered heavy flows of water. The migrating water in Eureka must be largely in water courses and other cavities, which occupy a comparatively small portion of the entire rock mass.

The mine at Eureka is in fairly steep hills, where most of the precipitation should run off, often under the surface talus, into the large Diamond Valley and its southerly feeder, Spring Valley. Mr. Aiken, of the Water Resources division of the U. S. Geological Survey at Ely, Nevada, estimates that with an annual rainfall of 12 to 15 inches, as in the Eureka hills, not more than 7% of the total precipitation gets into the ground water table. The greater part even of this limited amount probably runs into the larger valleys rather than down watercourses into the directly underlying rock. The flow of surface water from the portion of the area that is in the hills should not be excessive.

The great danger lay in the possibility that water in the deep gravel in Spring Valley, one mile west of the mine, might run down a hypothetical fault under Spring Valley and then along the intersecting Ruby Hill, Albion and other faults into the deep block northeast of the Ruby Hill Fault. This danger delayed the development of the downthrown block for many years.

Recent study of surface geology by Mr. Thomas B. Nolan, of the U. S. Geological Survey, has shown that the Spring Valley Fault outcrops along the base of the hills, on the east slope of the valley, and that it dips west, under the valley. The west side of the Fault has dropped, possibly 1000 or 2000 feet. If, as seems likely, there is a heavy gouge on this fault, it would divert any seepage from Spring Valley to the west, away from the possible orebearing area.

On the whole, it seemed likely to engineers of Eureka Corporation, Limited, that while the water problem would be serious, it would not involve prohibitive expense.

UNDERGROUND DEVELOPMENT - Water Record

The flow of water encountered in the Fad Shaft and in short crosscuts from it proved to be exceedingly great. The attached chart shows the gallons of water pumped per minute and the level of water in the Fad Shaft