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THE LORNEX COPPER DEPOSIT

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ABSTRACT

The Lornex deposit is situated at the centre of the Guichon Batholith in the Highland Valley at an elevation of 5,200 feet.

It is contained in a wide zone of faulting and hydrothermal alteration that is up to 2,000 feet wide and at least 8,000 feet long. Because of its softened nature very little of this zone has natural outcrops. It is bounded on the east by Skeena types of granodiorite and on the west by Bethsaida types.

Widespread mineralization in the form of bornite, chalcopyrite, and molybdenite is present within the zone of alteration both as stringers and disseminations.

So far exploration has been by bulldozing, percussion holes, and diamond drilling. The weakness of the ground has presented recovery problems and the deep over-burden on the west side has been troublesome.

An average grade of about 1/2% copper is being found over a probable length of 3,000 feet and widths from 500 to 1,800 feet.

Large scale underground exploration is being planned in conjunction with a sampling plant and a pilot mill. A much better idea of the geology of the deposit should then be obtained as well.

INTRODUCTION

This can only be a preliminary account of the geology of the Lornex deposit of the Lornex Mining Corporation. Very little of it can be observed in place because of the cover of overburden. During the next twelve months however I expect that the underground exploration will provide us with much new information that should make the interpretation of the diamond drilling much more definitive.

ACKNOWLEDGMENTS

In writing this report I have used the work of the three field geologists who have been at the property in succession during the past 18 months, namely, J. M. Newell, O. Vagt, and H. W. Marsh. They have laid a good foundation on which to build the geology of the deposit.

The field manager, J. W. Scott, has done a tremendous job keeping the exploration in high gear.

Mr. J. A. Sadler, President of Rio Canadian Exploration who now have the management control of the operation, readily agreed that I should present this paper.

I am grateful to the officials of the Bethlehem Copper Corporation for providing much information on their experiences during the exploration of their deposits.

Finally I would like to pay tribute to Egil Lorntzsen, President of Lornex Mining Corporation, who made it possible to write this paper by discovering the deposit.

SITUATION

The deposit is two miles south of the Highland Valley road where it passes along Quiltanton Lake and it is 3 1/2 miles southwest of the Bethlehem Mine that is on the opposite side of Highland Valley.

The highest part of the ore is at 5,200 feet and the lowest point reached by drilling is at 3,625 feet or 300 feet below the elevation of Quiltanton Lake.

GEOLOGY

The Lornex deposit is centrally situated in the Guichon Batholith which has its long axis striking at N 15° W for about 40 miles and the short axis at right angles for 16 miles.

In the general area of the mine John Newell has distinguished two main rock types:

1. The Skeena granodiorite corresponding to Carr's Bethlehem Younger Quartz Diorite that grades to a quartz diorite and occurs in a northwesterly striking belt to the east of the deposit.
2. The Bethsaida porphyritic granodiorite that grades to quartz monzonite in a parallel belt to the west of the deposit.

Both types are further differentiated according to the predominance of biotite or hornblende.

The closest that these two types get together in outcrop is 3,000 feet. In the diamond drill core however numerous sections of a quartz porphyry have been recognized that is probably the dyke equivalent of the Bethsaida but no shapes can be given to these occurrences at present.

It is interesting to note that the Bethlehem deposits are on the opposite side of the mass of Skeena granodiorite where it is contact with the Guichon Quartz Diorite.

Going west from the fresh Skeena rocks there is an irregular belt of alteration up to 700 feet wide in which there is an increasing amount of argillic alteration with the development of chlorite, sericite, kaolin, etc., and quartz eyes until the rock is largely secondary in nature over a further width of at least 2,000 feet. In this latter section there is a large amount of faulting and fracturing. The west side is largely unknown because of the thick cover of overburden and the limited amount of drilling. Presumably the alteration grades out to fresh Bethsaida.

More or less continuous mineralization is present within the zone of alteration for a length of 5,000 feet and a width of up to 2,000 feet. Discontinuous mineralization extends for at least another 2,000 feet to the south.

Within this zone of mineralization a potential orebody is being developed. The main portion is 3,000 feet long and up to 1,800 feet wide with a narrow tail extending for another 2,000 feet to the southeast.

For this whole occurrence there was only one outcrop and it consisted of broken rock containing malachite in an area about 6 by 6 feet. It was discovered by Egil Lorntzsen on 13th June 1964 on the side of an old glacial overflow channel.

It appears that an ice-filled hanging-valley once occupied the west half of the area that is underlain by the ore deposit and subsequently it was filled in by glacial material for a depth of several hundred feet. Award Creek has since cut down into the glacial deposits but as much as 250 feet is still left covering the ore.

Bulldoze cuts have exposed a small portion of the main part of the orebody on the east side. It consists of highly altered iron-stained rock with malachite widely distributed. On close inspection the tell-tale chocolate brown limonite left by the oxidation of chalcopyrite and the black specks of tenorite formed from bornite are found.

Drilling shows that oxidation is usually limited to the first 30 feet below bedrock but it may be present for as much as 100 feet.

MINERALIZATION

A large number of fractures striking northeast and north-northeast with steep dips to the east were exposed by the trenching. They are frequently mineralized especially when filled by quartz stringers. It is believed that these mineralized fractures belong to the group that predominates in the drill cores and extends throughout the orebody.

The primary copper minerals are bornite, chalcopyrite, and chalcocite. Small amounts of native copper and cuprite have been recognized.

As previously noted the oxide minerals are malachite and tenorite with occasional azurite.

Molybdenite is present in economic amounts and appears to be restricted to certain sections of the deposit.

MINERAL ZONING

Although a detailed plot of the percentage variation of bornite, chalcopyrite, pyrite, and molybdenite has still to be assembled a broad zoning is obvious.

There is a large central area in which bornite carries the predominant amount of copper with the balance as chalcopyrite. Going north and south the relative amount of bornite decreases until it is no longer present and the copper is entirely contained in chalcopyrite . Pyrite is then present and increases relative to chalcopyrite further to the north and south until the average copper content of the rock is less than 0.20%.

To the east and west the relative amounts of bornite and chalcopyrite are not so variable but the absolute amounts decrease.

The molybdenite appears to have a distribution largely independent of the copper. So far most of it is concentrated on the east side of the deposit with another area on the west. There is some evidence already that it can be significant at the north end whilst at the far south end there appears to be a separate concentration of molybdenite with only minor copper.

GRADE OF ORE

The average grade of the copper content of a particular section of the deposit is closely related to the amount of bornite present.

It is expected that a substantial tonnage of ore averaging about 0.50% Cu and 0.04% MoS_2 will be developed.

There does not appear to be any significant trend in the variation of the grade to a depth of over 1,000 feet in the sections drilled so far.

The reliability of the results obtained from percussion drilling can be seen in the following comparison with diamond drilling on line 11N:

15 vertical percussion holes of varying depths up to 300 feet and over a section length of 1,500 feet gave an average of 0.51% Cu.

A series of 6 diamond drill holes probed the same section to depths of 600 to 1,200 feet at 55° to 60° and averaged 0.48% Cu for a section length of 1,800 feet.

STRUCTURE

The largest fault intersected by the drilling to date is apparently 50 feet wide but its strike and dip are uncertain. It could well be the same fault that was cut by a drill hole at another 800 feet to the north which would give it a northwest strike and steep dip to the northeast. It would then match with a large fault exposed by the trenching in the discovery area and striking north-northwest.

The drilling results suggest that the limit of mineralization on the west side for the northern portion of the main orebody could be a major fault striking due north.

A plot of the topographic lineations for the general area shows that two major fracture directions are north-northwest and north-northeast. I suspect that the zone of alteration and subsequent mineralization were localized by the junction of a large fault zone striking north-northwest and a series of north-northeast fractures.

Until the deposit has been explored underground we cannot be sure of the fracture pattern and its relationship to ore.

EXPLORATION METHODS

After the initial discovery a bulldoze trench was cut along the rim of the overflow channel which exposed considerable malachite staining for a length of 600 feet in a northwest direction. A similar trench was then made alongside a parallel channel about 500 feet to the south and the malachite staining was again found for a length of 1,000 feet in a west-northwest direction. Further trenching demonstrated that a large area of mineralization was present.

A programme of percussion drilling with the Copco overburden machine was then started. Holes were set out at intervals of 100 feet on E - W lines spaced 200 feet apart.

At first all drilling was dry to a depth of as much as 250 feet and holes were stopped when water was encountered because of the lack of any return. The dust was carefully collected from every 10 feet, weighed and put through a Jone's splitter to obtain a sample for assaying. The two inch holes yield about 36 pounds of material for every 10 feet.

When a number of holes failed to reach bedrock or attain a suitable depth the machine was adapted to drill with water as well. The sludge so obtained was passed through a special electrically run splitter designed by Mr. J. W. Scott that yielded one-eighth of the material. This was dried, weighed, and assayed.

All holes have been drilled vertically although the machine can be used at an angle and should have been at Lornex now that we know that the mineral streaking has a steep attitude. To date over 450 holes have been drilled.

To obtain greater depth other equipment has been tried such as the Mayhew rotary drill, a churn drill, and the interesting Becker drill but with limited success considering the costs.

Ordinary diamond drilling gave poor core recovery and erratic sludge assays. N X wireline equipment gave better recovery but the sludge assayed much higher than the core. It was realized that much of the values were present as loose coatings of sulphides on numerous fractures from which they were washed by the drill water.

Wireline drilling in a special circulating mud has given much the best recovery - usually better than 95% - although it is expensive.

The plan of drilling is for diamond drill holes directed 60° W and collared about 300 feet apart along section lines spaced 400 feet apart. Most of the holes are about 1,400 feet long to give a vertical range of 1,000 feet. Four lines at 800 feet apart have been completed and the lines halfway between are now being drilled at an accelerated rate with four machines.

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GEOPHYSICS

An IP survey by H. Seigel and Associates showed that a strong anomaly was present as an extension north of the discovery zone and this has now proved to be the main part of the ore deposit.

Because of the intense hydrothermal alteration I am not at all certain that the IP response was solely due to the sulphides - it could be mainly due to the large amount of clay minerals present.

By varying the electrode spacing it was possible to define the presence of deep overburden on the west side of the zone.

The zone was also defined by a magnetometer survey as a magnetic low of 200 to 400 gammas below the surrounding area due no doubt to the destruction of the original magnetite of the granodiorite during hydrothermal alteration.

GEOCHEMISTRY

A geochemical silt survey for copper and molybdenum showed that all the drainage channels from the portion of the mineralized zone with shallow overburden were anomalous for at least 4,000 feet away. Numerous samples gave over 3,000 ppm of total copper and some gave over 100 ppm total molybdenum.

Award Creek that flows along the west side of the mineralized zone gave essentially no response. This was a great surprise at first until it was realized that the creek was perched on 250 feet of glacial deposits.

COMPARISON WITH OTHER DEPOSITS

The following discussion is a direct outcome of reading the recently published "Geology of the Porphyry Copper Deposits of Southwest North America."

The original description of a porphyry copper deposit was a large, low grade, flat-lying body of disseminated copper minerals in an igneous rock that was formed by secondary enrichment. Over the years the definition has been continually stretched so that now the term includes any copper deposit of large dimensions that can be mined on a large scale at a profit.

The Lornex deposit certainly falls well within the grouping of the typical porphyry copper deposits of the southwestern North America area yet the combination of the principal characteristics places it in a sub-division of its own. The outstanding attributes that make it distinctive are:

1. High proportion of bornite
2. Total lack of pyrite within the ore
3. Limited zone of leaching
4. No secondary enrichment
5. Relatively high average molybdenite content
6. Great depth
7. Extensive faulting
8. Intimate intrusion of tongues of quartz porphyry which are mineralized along with the intruded rock.

The major characteristics that it shares with other deposits are:

1. Large size
2. Quartz - sericite - clay alteration
3. Quartz porphyry intrusions

The Lornex deposit differs from the Bethlehem orebodies in the apparent absence of breccias and late acid dykes.