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HEAD OFFICE
HOPE, B. C.

009235 TELEPHONE
PA. 5832
PA. 7857

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VANCOUVER 2, B.C.

FINAL REPORT ON GEOLOGICAL AND GEOPHYSICAL WORK PACIFIC NICKEL MINES LTD.

The final reports of the geological and geophysical investigations for Pacific Nickel Mines are now completed and have been received. The resident geologist was Aaro Aho to whom I granted permission to use his study of Pacific Nickel Mines geology for a Doctor's dissertation at Berkeley University. There he has been working under the direction of two of the world's outstanding petrologists, Doctors Turner and Voorhagen. Two winters' work have been done in the Berkeley laboratories on several hundred rock and ore specimens prepared in the laboratories of the University of B.C. A study was made of the available literature on all nickel ore deposits of the world. The surface and underground has been carefully mapped and studied. Aho has done a remarkably good piece of work at the property and in his microscopic work. The results are a very detailed and accurate map and as nearly a complete knowledge of the property as can be had with present exposures. Aho's laboratory work has been done at minor cost to the Company for time or for equipment.

SUMMARY OF THE GEOLOGY

The ore bodies are found in an area of ultrabasic rocks. These rocks are differentiates from a larger complex of hypersthene quartz diorite, norites, gabbros, and other related rocks. We have not found the outer contact of the latter, and they may occupy a large area. If that is the case, it is possible that other bodies of ultra basic rocks with nickel copper deposits may be found in them in the same district.

The ultra basic rocks on the Western Nickel property are quite varied in character even though similar in appearance. They are closely related in origin, sometimes grade one into the other, sometimes are found with sharp contacts, sometimes with inclusions of one in the other and overlap in age. In general, the age relationship from older to younger is norite, pyroxenites, peridotites, dunites, hypersthenites, hornblendites, and ore. However, there are gradations from one type into another and other exceptions to the above generality.

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The ultrabasic rocks and ores represent a differentiate from a diorite-gabbroic magma of which the norites and hypersthene diorites were first intruded. The basic differentiate came in a plug-like form in a series of injections resulting in pipe shaped masses of the various rock types with the heavier types generally last and the sulphides or mixed sulphides and rock minerals last of all. This has resulted in the ore bodies having a plunging cigar like shape but not necessarily all have the same plunge direction.

The hornblendites are found as intrusive masses, as aureoles to the ultrabasics or as dikes, and are the result of the presence of water either in the final magma fraction or from the earlier rocks into which they were injected. A hornblendite aureole is found on the margins of the ultrabasic plugs in Alaska.

The ore bodies grade into the ultrabasic rocks and give every evidence of having been emplaced by the same forces as formed the various rock types into which they grade. There are two main types of ore occurrence, also with gradations:

1. A zoned type with a halo of disseminated sulphides.

2. The unzoned type with sharp contacts between rock and ore.

The ore bodies are most commonly associated with dunite, peridotite, and the minerals enstatite and hypersthene. There are several ore bodies or near ore bodies with characteristics as follows:

Trail Ore Body - zoned, in hypersthenite, probably continues down plunge.

512 - zoned, in hornblende pyroxenite with a crescentic shell of norite. Probable plunge west.

1400 1370 - zoned, in hornblendic pyroxenite and peridotite in a norite embayment.

1600 - zoned, along the edge of a body of peridotite and partly along the edge of a norite body. Probably has southwestward plunge.

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1500 1600E - Known by drilling only. Zoned

1900 - zoned. In hypersthenite with a hornblendic peridotite core. Probable plunge southwest.

Pride of Emory - Both zoned and with sharp contacts. At a contact between peridotite and pyroxenite. Plunges northward and northwestward.

Brunswick No. 1 - zoned. Rock is dunite and enstatite. Plunges N. 30° E.

Brunswick No. 2 - Massive with sharp contacts. In peridotite and in olivine enstatite rich rock. Plunges N 20°E.

Brunswick No. 5, 6, and 7.- Form a related group which are enclosed in a body of enstatite rich pyroxenite.

No. 5 has a dunite core grading outward into peridotite and then barren enstatite. Pipelike with steep northward plunge.

No. 6 - A series of mineralized dunite with massive ore streaks. The western end of the ore body is pyroxenite with disseminated and scattered masses of coarse sulphide. Lies below the 2550 level and has a probable northwest plunge.

Other bodies may exist down the plunge of the enstatite pipe.

Brunswick 8 and 9 - Massive types with sharp contacts. The ore is enstatite in a ground mass of sulphides. Possible plunge 60° northeast.

Other ore possibilities - Other ore possibilities exist at 3605, at 4200 as indicated by drilling, and at 3720 as suggested by the electromagnetic survey. Locations in the surface having possibilities of being ore localities are described in Aho's report. One such location found in 1951 gave interesting pulse anomalies.

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CONCLUSIONS

The evidence gathered indicates that the ore found to date was part of a continuing process of emplacement of the ultra basic rock mass. There is every reason to suppose therefore that it should be continuous to depth. There is nothing to suggest dimunition or increase in size downward. The present study of the general environment of the ore bodies should be of assistance in locating others at deeper horizons. This is an important consideration in view of the small size of the targets if ore bodies alone are to be aimed for. Aho's report summarizes the general environs of ore bodies.

No evidence has been found so far for the resson of the concentration of the ore bodies in the south western part of the stock, and situated in a broad linear zone. That part may have been the locale of final igneous activity and hence of ore bodies.

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SUMMARY OF THE GEOPHYSICAL WORK

MAGNETIC

The first geophysical work of any extent on the Pacific Nickel property was a magnetometer survey carried out about 1934 by E.E. Bergman. There is no record of the grid used or of the readings secured. Most of his lines appeared to be 100 feet apart only and some as close as 25 feet apart. This involved a huge amount of line cutting and surveying. Colonel C. North told me that they had spent some $30,000.00 on these items alone.

Bergman found a number of anomalies, some of which he says represented two of the Brunswick ore bodies. I located Bergman in the Spring of 1951 and communicated with him, but he had none of the records of his work on the propêrty.

McPhar Geophysics Ltd. of Toronto was employed to do electromagnetic work, supplemented by a magnetometer, in the summer of 1952. At the commencement of work, we took the magnetometer to the Pride of Emory and Brunswick surface exposure and ran traverses across each.

A north to south line was run over the Pride of Emory. A strong reaction took place on the approach from the north, but there was no difference in leaving the ore body southward. There was no detectable reaction whatever on either of the Brunswick ore bodies. We even took a piece of massive ore and raised it directly under the instrument. It was completely non-magnetic. It appears therefore that most pyrrhotite on the property is non-magnetic. There is a possibility that there may be an excess of magnetite near the ore bodies which caused the attraction in the north side of the Pride of Emory ore body. We did not ascertain how Bergman located the Brunswick ore bodies and without his actual readings it cannot be done. He may have seen some small differences by a very detailed magnetometer survey.

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The Pride of Emory ore body is very little over 100 feet in diameter at the surface. The others are smaller. This small size together with the low magnetic qualities are factors considerably limiting the value of the magnetometer as an ore finder on the Western Nickel property. It is apparent that lines more than 100 feet apart could miss an ore body.

A great variation in readings was found on the McPhar plans submitted. If these were surveyed more closely a great number of small anomalies would show up, but most of them would be due to the varying amount of magnetite present in the rocks.

A small anomaly was found in the XYZ area where the pulse method found its first strong anomalous area. The magnetometer found an interesting anomaly on B-n and C-n at about 12W. This corresponds with an anomaly found by the electromagnetic and the pulse methods. This area should be investigated and may be important.

The general value of the magnetometer depends largely on the closeness of the lines. In view of the cost of line cutting and surveying in this area, and the lack of magnetic qualities in the pyrrhotite, the use of the magnetometer should be carefully considered before its employment.

ELECTROMAGNETIC

SURFACE WORK

The lack of response of the rocks of Western Nickel to electro-magnetic methods was remarkable. This equipment detects massive sulphide bodies rather than disseminated sulphides. The few small anomalies secured indicate that there are no large bodies of massive sulphides within three hundred feet of the surface in the area surveyed. As with the magnetometer, the small bodies characteristic of the property could easily be missed without very close spacing of line. One area of significance was found, namely that found by the magnetometer and pulse on line B-n at about 12W. BLUEBIRD CLAIM

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UNDERGROUND WORK

The underground survey showed more response than the surface. It located all the known ore bodies and found a new area at 4500' in the No. 1 tunnel. This zone could be tested by drilling from the west portal of the tunnel or from the surface on the creek to the south of the tunnel.

The Drill hole electromagnetic survey located two areas that hold promise, one at 1600 feet and the other at 3720 feet.

THE PULSE SURVEY

The Pulse Survey was carried out by a method recently developed by Newmont Mining Company for locating disseminated sulphides. In view of the fact that the ore bodies of the Western Nickel property generally have a halo of disseminated sulphides, they present a larger target to the pulse than to the electromagnetic methods. The pulse method can penetrate more deeply and, particularly because of its ability to locate disseminated sulphides, can cover a greater area laterally. Further, the pulse method was supplemented by a resistivity and self potential survey which can be carried out with the same equipment from the same set-ups.

I have not been supplied with a copy of the report, but I have seen the plans and the report. A series of anomalies were found in a broad zone about on line with and overlapping the No. 1 tunnel area. Strong anomalies were found in the XYZ area to the south where we found disseminated sulphides in 1951.

UNDERGROUND PULSE SURVEY

The Pulse Survey underground had considerable difficulty at first in making satisfactory contacts with the rock surfaces. This difficulty was finally surmounted and the survey was carried out satisfactorily. Unfortunately, it was not possible to work the 512 crosscut where the drilling had found one rather promising zone of disseminated sulphides.

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Following the survey, an attempt was made to carry out a survey from the drill holes. A good deal of time was spent and work done but it proved impossible to make contacts with the rock walls through which to send out impulse or currents. That work had to be discontinued.

CONCLUSIONS

Until follow up diamond drilling or underground work has been done, it will not be possible to evaluate properly the work of the pulse method. It has the great advantage of deep penetration and capacity of making a much larger target for itself than the electromagnetic method. Further, it has the resistivity and self potential supplements.

It would seem well worth while in some cases to follow it up with the electromagnetic. Certainly, they and the magnetometer agreed on the B-n C-n locality. Even if disseminated areas only are found, they would provide targets for a follow up drill program, and thus a great deal of dead area would be eliminated.

C. Riley

C. Riley,

CR/d

December 29th, 1952.