194 PART1 OFZ

REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY TEST SURVEY ON THE 103P/3E¢3W VALLEY-RIDGE-SNAFU CLAIM GROUPS NASS RIVER AREA, BRITISH COLUMBIA 2 parts FOR NASS RIVER MINES LTD.

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PHILIP G. HALLOF, Ph.D.

NAME AND LOCATION OF PROPERTY: VALLEY-RIDGE-SNAFU CLAIM GROUPS, NASS RIVER AREA, BRITISH COLUMBIA SKEENA MINING DIVISION, B.C. 55°/129° S.E.

DATE STARTED: JUNE 24, 1966

DATE COMPLETED: JULY 16, 1966

TABLE OF CONTENTS

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Part A:	Notes on theory and field procedure	6 pages	
Part B:	Report	11 pages	Page
1	Introduction		1
2.	Presentation of Results		2
3.	Discussion of Results		3
4.	Conclusions	,	7
5.	Assessment Details		9
6.	Summary of Costs		10
7.	Certificate		11

Part C: 7 pieces Illustrations Howg. Misc. 2474 3 Dwg. Misc. 3183 Plan Maps (in pockets) , 5, 6 Dwgs. IP 2472-1 to -3 Dwgs. IP 2473-1 to -2 **IP Data Plots** 2, # 1 INDUCED POLARIZATION 4

RESISTIVITY SURVEY

MCPHAR GEOPHYSICS LIMITED

REPORT ON THE

INDUCED POLARIZATION AND RESISTIVITY TEST SURVEY ON THE VALLEY-RIDGE-SNAFU CLAIM GROUPS NASS RIVER AREA, BRITISH COLUMBIA FOR

NASS RIVER MINES LTD.

1. INTRODUCTION

At the request of Nass River Mines Ltd., an induced polarization and resistivity test survey has been carried out on portions of the Valley-Ridge-Snafu Claim Groups in the Nass River Area of British Columbia. The property is in the Skeena Mining Division, in the southeast quadrant of the one degree quadrilateral whose southeast corner is at 55°N - 129°W.

The oldest rocks in the area are granites which are unmineralized, and part of a larger intrusive. Younger granites intrude the old granites and the surrounding sediments, which have been largely altered to hornfels. There are surface evidences of mineralisation in some of the hornfels, and in portions of the younger granites. Many fractures, and at least one major fault, are known in the area.

Some molybdenum mineralization is present at the surface; some pyrite is present, but there is only minor pyrite with most of the important molybdenum mineralization. Our experience elsewhere on the west coast of British Columbia indicates that the induced polarization method can be used to locate, and outline, sones of molybdenum mineralisation similar to that which the geologists hope to locate in the Nass River Area.

However, it has been found in other areas that the mineralization of most economic interest may not be associated with the largest magnitude IP anomalies. Zoning can exist, and the molybdenite concentrations can be either within the most concentrated pyrite mineralization, or to the side. It is necessary to test all of the anomalous zones that are located.

The test survey on the Valley-Ridge-Snafu Claim Groups, in the Nass River area, was planned in an attempt to determine the type of anomalies to be expected from the mineralization that has been located.

2. PRESENTATION OF RESULTS

The induced polarization and drilling results are shown on the following enclosed data plots. The results are plotted in the manner described in the notes preceding this report.

Valley-Ridge Zone

Line 19	300' electrode intervals	Dwg. IP 2472-1
Line 5S	300' electrode intervals	Dwg. IP 2472-2
Line 95	300 ⁺ electrode intervals	Dwg. IP 2472-3
Snafu Zone		
Line 11N	300' electrode intervals	Dwg. IP 2473-1
Line 8N	300' electrode intervals	Dwg. IP 2473-2

The location of the claims and the general topographic features are shown on Dwg. Misc. 2474 at a scale of $1^{11} = 1$ mile. The position of the lines surveyed on the Valley-Ridge Zone, and the location of the drill holes are shown on Dwg. Misc. 3183 at a scale of $1^{11} = 200^{1}$. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as the data plots. These bars represent the surface projection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured.

Since the induced polarization measurement is essentially an averaging process, as are all potential methods, it is frequently difficult to exactly pinpoint the source of an anomaly. Certainly, no anomaly can be located with more accuracy than the spread length; i. e. when using 300' spreads the position of a narrow sulphide body can only be determined to lie between two stations 300' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the center of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

3. DISCUSSION OF RESULTS

The induced polarization method has been found to be of definite use in the exploration search for disseminated molybdenum deposits on

- 3 -

the west coast of British Columbia. The zones of disseminated mineralization (pyrite-chalcopyrite-molybdenite) usually contain 3% to 10% metallic mineralization, and they can be located and outlined easily with IP.

Most of the areas of geologic interest are areas of acid to intermediate intrusives; in this type of rock the resistivities are high and the background IP effects are very low. With ideal conditions it is possible to outline sones of very small concentrations of metallic minerals. Enclosed with this report is Figure 1. This data plot shows the IP results from a mineralized zone recently located in B. C. The total amount of metallic mineralization present is only 1.25%; however, because the minerals are molybdenite and bornite, and because there is a very large volume of mineralized rock, the zone may be an orebody. The IP anomaly is low in magnitude but quite definite.

Until drilling has been completed, and the minerals present have been determined, it is necessary to consider even weak IP anomalies of potential interest. In a given area the more definite IP anomalies may be due to pyrite, with somes of most economic value containing less metallic mineralization and giving weaker IP anomalies.

The geologic examinations and the short holes already drilled in the Nass River Area have shown the widespread presence of molybdenum mineralization. Most of the mineralization present occurs in narrow, relatively high-grade sones. The induced polarization measurements were made using 300' electrode intervals; they were not designed to detect the individual, narrow sources. The test survey was planned in

- 4 -



an attempt to locate those volumes of rock that contained enough veinlets and stringers to give an appreciable IP effect for the entire volume of the rock.

a) Valley-Ridge Zone

The background resistivities and IP effects on these three lines are fairly typical for what we have come to expect in areas of relatively fresh, unaltered, non-porous intrusives. These are some remnants of hornfels known in the area, but they are not evident in the resistivity results.

The IP results on Line IS are typical. The background effects are low, with three moderate magnitude anomalies indicated. The anomalies at the eastern and western ends of the line are not completely outlined by the available data. There is some known mineralization in the vicinity of 12W, but stream sediments cover the surface at the eastern end of the line. The measurements should be extended so that these anomalies can be completed and evaluated.

The moderate magnitude anomaly centered at the base line is quite definite. The anomaly occurs within the favourable granite at a place where mineralization is known. There is a correlating resistivity low that may be due to increased alteration. The source is indicated to have a limited width (perhaps 200' to 400') and there is a definite increase with depth (larger apparent IP effects for n =2, 3.) This zone should be traced by surveying closely spaced parallel lines.

On Line 55 there are two weak anomalies that may represent

small concentrations of metallic mineralization. Since the sources are shallow (measured for n=1), the anomalies can be better evaluated using shorter electrode intervals.

There is a very definite, moderate magnitude IF anomaly located at depth at 8E. The anomalous pattern suggests a relatively narrow, tabular source with a depth to the top of perhaps as much as 300' (one electrode interval.) The IP anomaly correlates with a distinct resistivity low in a region of very high resistivities.

The rocks in the area are the older, unfavourable granite, which would be expected to have a high resistivity. There is a major fault mapped to the southeast, and it may pass to the west of its extrapolated position. This definite IP anomaly could be due to metallic mineralization associated with the fault. The anomaly is quite definite, and the source is not known; detail is warranted. The measurements with 300' electrode intervals should be repeated; with the electrode sites shifted 150 feet. If the anomaly is confirmed, lines 100' to the north and south should be surveyed.

Only two, very weak IP anomalies were located on Line 95. They probably do not warrant further interest at this time, except to mention that the weak anomaly centered at 16E to 19E correlates exactly with the anomalies located at 0+00 on Line 1S and 8E on Line 55. If the three anomalies do correlate in this way, the strike direction is exactly parallel to that of the known fault.

b) Snafu Zone

The IP results at this zone of mineralization are quite different

- 6 -

from those to the west. On each line there is a very sharp resistivity contact with high resistivity rocks to the east and lower resistivity rocks to the west. The high resistivity rocks to the east probably represent a fresh granite.

The low resistivity rocks to the west are either a highly altered, porous intrusive or a more porous meta-sediment (slate or hornfel ?) There are large magnitude, variable IP effects in the low resistivity rocks. The IP effects suggest concentrations of metallic mineralization in the range 1% to 20%; the anomalous effects obviously extend westward, beyond the portion of the lines we have surveyed.

4. CONCLUSIONS

The induced polarization and resistivity test survey on the Valley-Ridge-Snafu Claim Groups has shown the presence of metallic mineralization at several locations. Some of the anomalies indicate very weakly disseminated mineralization, while others suggest zones of more concentrated mineralization. Further IP work is warranted to better evaluate the anomalies and determine if drilling is warranted.

The anomaly located at 0+00 on Line 15 at the Valley-Ridge Zone is definite, and it occurs in an area of known molybdenum mineralization. The IP effects show an increase in concentration of metallic mineralization with depth, so that any further drilling in this area should extend to depths of 300 to 400 feet.

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Philip G. Hallof, Geophysicist.

A. W. Mullan, Geologist.

Dated: July 26, 1966

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ASSESSMENT DETAILS

PROPERTY: Valley-Ridge-Snafu Group		MINING DIVISION: Skeena	
SPONSOR: Nass River Mines Ltd.		PROVINCE: British Columbia	
LOCATION: Nass River Area			
TYPE OF SURVEY: Induced Polaria	sation		
operating man days:	70	DATE STARTED: June 24, 1966	
EQUIVALENT 8 HOUR MAN DAYS:	105	DATE FINISHED: July 16, 1966	
Consulting Man Days:	3	NUMBER OF STATIONS: 91	
DRAUGHTING MAN DAYS:	3	NUMBER OF READINGS: 576	
TOTAL MAN DAYS:	111	MILES OF LINE SURVEYED: 4.69	

CONSULTANTS:

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P. G. Hallof, _____ Geophysicist. _-

A. W. Mullan, Geologist.

SUMMARY OF COSTS

Valley-Ridge-Snafu Claim Groups

Crew

14	days	Operating	@ \$215.00/day	\$3, 010.00
3	days	Travel	@ \$ 75.00/day	225.00
1	day	Bad Weather	@ \$ 75.00/day	75.00
2	davs	Standby	@ \$ 75.00/day	150.00
1	dav	Electrode Preparation	@ \$ 75,00/day	75.00
-			- 1	3, 535, 00

Expenses

Vehicle Expenses	\$ 43.77
Gas and Oil	73.29
Meals and Accommodation	175.15
Groceries	182.08
Telephone and Telegraph	5.10
Supplies	9.93

489.32

\$4, 024. 32

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Philip G. Wallof, Geophysicist.

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A. W. Mullan, Geologist.

Dated: July 26, 1966

CERTIFICATE

I, Philip George Hallof, of the City of Toronto, Province of Ontario, do hereby certify that:

I am a geophysicist residing at 5 Minorca Place, Don Mills,
(Toronto), Ontario.

2. I am a graduate of the Massachusetts Institute of Technology with a B.S. Degree (1952) in Geology and Geophysics, and a Ph.D. Degree (1957) in Geophysics.

3. I am a member of the Society of Exploration Geophysicists and the European Association of the Exploration Geophysicists.

4. I have been practising my profession for ten years.

5. I have no direct or indirect interest, nor do I expect to receive any interest, direct or indirect, in the property or securities of Nass River Mines Limited.

6. The statements made in this report are based on a study of published literature and unpublished private reports and geophysical data.

Dated at Toronto This 26th day of July, 1966.

- 11 -

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NOTES ON THE THEORY OF INDUCED POLARIZATION AND THE METHOD OF FIELD OPERATION

Induced Polarization as a geophysical measurement refers to the blocking action or polarization of metallic or electronic conductors in a medium of ionic solution conduction.

This electro-chemical phenomenon occurs wherever electrical current is passed through an area which contains metallic minerals such as base metal sulphides. Normally, when current is passed through the ground, as in resistivity measurements, all of the conduction takes place through ions present in the water content of the rock, or soil, i.e. by ionic conduction. This is because almost all minerals have a much higher specific resistivity than ground water. The group of minerals commonly described as "metallic", however, have specific resistivities much lower than ground waters. The induced polarization effect takes place at those interfaces where the mode of conduction changes from ionic in the solutions filling the interstices of the rock to electronic in the metallic minerals present in the rock.

The blocking action or induced polarization mentioned above, which depends upon the chemical energies necessary to allow the ions to give up or receive electrons from the metallic surface, increases with the time that a d.c. current is allowed to flow through the rock; i. e. as ions pile up against the metallic interface the resistance to current flow increases. Eventually, there is enough polarization in the form of excess ions at the interfaces to effectively stop all current flow through the metallic particle. This polarization takes place at each of the infinite number of solution-metal interfaces in a mineralized rock.

When the d.c. voltage used to create this d.c. current flow is cut off, the Coulomb forces between the charged ions forming the polarization cause them to return to their normal position. This movement of charge creates a small current flow which can be measured on the surface of the ground as a decaying potential difference.

From an alternate viewpoint it can be seen that if the direction of the current through the system is reversed repeatedly before the polarization occurs, the effective resistivity of the system as a whole will change as the frequency of the switching is changed. This is a consequence of the fact that the amount of current flowing through each metallic interface depends upon the length of time that current has been passing through it in one direction.

The values of the "metal factor" or "M.F." are a measure of the amount of polarization present in the rock mass being surveyed. This parameter has been found to be very successful in mapping areas of sulphide mineralization, even those in which all other geophysical methods have been unsuccessful. The induced polarization measurement is more sensitive to sulphide content than other electrical measurements

- 2 -

because it is much more dependent upon the sulphide content. As the sulphide content of a rock is increased, the "metal factor" of the rock increases much more rapidly than the resistivity decreases.

Because of this increased sensitivity, it is possible to locate and outline zones of less than 10% sulphides that can't be located by E. M. Methods. The method has been successful in locating the disseminated "porphyry copper" type mineralization in the Southwestern United States.

Measurements and experiments also indicate that it should be possible to locate most massive sulphide bodies at a greater depth with induced polarization than with E.M.

Since there is no I. P. effect from any conductor unless it is metallic, the method is useful in checking E. M. anomalies that are suspected of being due to water filled shear zones or other ionic conductors. There is also no effect from conductive overburden, which frequently confuses E. M. results. It would appear from scale model experiments and calculations that the apparent metal factors measured over a mineralized zone are larger if the material overlying the zone is of low resistivity.

Apropos of this, it should be stated that the induced polarization measurements indicate the total amount of metallic constituents in the rock. Thus all of the metallic minerals in the rock, such as pyrite, as well as the ore minerals chalcopyrite, chalcocite, galena, etc. are responsible for the induced polarization effect. Some

- 3 -

oxides such as magnetite, pyrolusite, chromite, and some forms of hematite also conduct by electrons and are metallic. All of the metallic minerals in the rock will contribute to the induced polarization effect measured on the surface.

In the field procedure, measurements on the surface are made in a way that allows the effects of lateral changes in the properties of the ground to be separated from the effects of vertical changes in the properties. Current is applied to the ground at two points a distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes. The distance between the nearest current and potential electrodes is an integer number (N) times the basic distance (X).

The measurements are made along a surveyed line, with a constant distance (NX) between the nearest current and potential electrodes. In most surveys, several traverses are made with various values of (N); i. e. (N) = 1, 2, 3, 4, etc. The kind of survey required (detailed or reconnaissance) decides the number of values of (N) used.

In plotting the results, the values of the apparent resistivity and the apparent metal factor measured for each set of electrode positions are plotted at the intersection of grid lines, one from the center point of the current electrodes and the other from the center point of the potential electrodes. The resistivity values are plotted above the line and the metal factor values below. The lateral displacement of a given value is determined by the location along the survey

- 4 -

line of the center point between the current and potential electrodes. The distance of the value from the line is determined by the distance (NX) between the current and potential electrodes when the measurement was made.

The separation between sender and receiver electrodes is only one factor which determines the depth to which the ground is being sampled in any particular measurement. These plots then, when contoured, are not section maps of the electrical properties of the ground under the survey line. The interpretation of the results from any given survey must be carried out using the combined experience gained from field, model and theoretical investigations. The position of the electrodes when anomalous values are measured must be used in the interpretation.

In the field procedure, the interval over which the potential differences are measured is the same as the interval over which the electrodes are moved after a series of potential readings has been made. One of the advantages of the induced polarization method is that the same equipment can be used for both detailed and reconnaissance surveys merely by changing the distance (X) over which the electrodes are moved each time. In the past, intervals have been used ranging from 100 feet to 1000 feet for (X). In each case, the decision as to the distance (X) and the values of (N) is largely determined by the expected size of the mineral deposit being sought, the size of the expected anomaly and the speed with which it is desired to progress.

- 5 -

The diagram in Figure 1 below demonstrates the method used in plotting the results. Each value of the apparent resistivity and the apparent "Metal factor" is plotted and identified by the position of the four electrodes when the measurement was made. It can be seen that the values measured for the larger values of (n) are plotted farther from the line indicating that the thickness of the layer of the earth that is being tested is greater than for the smaller values of (n); i. e. the depth of the measurement is increased.

METHOD USED IN PLOTTING DIPOLE-DIPOLE INDUCED POLARIZATION AND RESISTIVITY RESULTS



- 6 -



LINE

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ONE INCH EQUALS TWO HUNDRED FEET

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INDUCED POLARIZATION AND RESISTIVITY SURVEY

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