REPORT ON INDUCED POLARIZATION SURVEY MORICE MOUNTAIN PROSPECT BARRETT AREA, BRITISH COLUMBIA FOR

AMAX EXPLORATION INCORPORATED

ΒY

P.G. HALLOF, PH.D.

NAME AND LOCATION OF PROPERTY:

#### MORICE MOUNTAIN PROSPECT

BARRETT AREA, BRITISH COLUMBIA 54°N, 126°W

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DATE STARTED - JUNE 15, 1966

DATE COMPLETED - JUNE 30, 1966

Rpr. 197

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#### McPHAR GEOPHYSICS LIMITED

# REPORT ON INDUCED POLARIZATION SURVEY MORICE MOUNTAIN PROSPECT BARRETT AREA, BRITISH COLUMBIA FOR AMAX EXPLORATION INCORPORATED

#### 1. INTRODUCTION

At the request of Mr. W. W. Shaw, Geophysicist for the Company, an induced polarization survey has been carried out on the Morice Mountain Prospect in the Barrett Area of British Columbia for Amax Exploration Incorporated. The property lies in the Omineca Mining Division, in the SW quadrant of the 1° quadrilateral whose SE corner is at 54°N, 126°W.

Molybdenite mineralization occurs in the base line in a fine grained quartz-porphyry intrusive that is located in the central portion of the claim group. The claim group lies on the western flank of Morice Mountain. Disseminated pyrite is associated with the exposed molybdenite and the purpose of the induced polarization survey was to outline areas of increased metallic content that may be of economic importance.

The field surveying was carried out during June 1966.

#### 2. PRESENTATION OF RESULTS

The IP and resistivity results are shown on the following data plots in the manner described in the notes preceding this report.

Line	Electrode Interval	Dwg. No.
12E	200 feet	IP 2470-1
20E north part	100 feet	IP 2470-2
20E south part	100 feet	IP 2470-3
24E	100 feet	IP 2470-4
28E	100 feet	IP 2470-5
31E	100 feet	IP 2470-6
34E	100 feet	IP 2470-7
34E	200 feet	IP 2470-8
38E	100 feet	IP 2470-9
42E	100 feet	IP 2470-10
46E	100 feet	IP 2470-11
50E	100 feet	IP 2470-12
Base Line	200 feet	IP 2470-13

Enclosed with this report is Dwg. Misc. 3182, a plan map of the grid at a scale of 1" = 200". 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 200'

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spreads the position of a narrow sulphide body can only be determined to lie between two stations 200' 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

#### Line 12E

There are no anomalous IP effects on this line.

#### Line 20E

This line was run in two parts. The possible anomalies centered at 4S and 11S, indicate shallow sources of low metallic content that are considered to be of minor importance at present.

#### Line 24E

The IP results show a broad, shallow source that extends from 2N to 2S. Much stronger metal factor values occur between 0 and 1S suggesting that this portion has a higher metallic content.

The south edge of the anomaly is quite sharp, while the north edge is poorly defined. Weakly anomalous effects extend from 2N to 5N but these are thought to be of secondary importance.

#### Line 28E

On this traverse, the source is shallow, uniform and more

concentrated than on Line 24E. Both the north and south edge of the anomalous pattern are well-defined.

#### Line 31E

The contour pattern suggests a narrow, steeply dipping source of concentrated material, centered near the base line. This is flanked on either side by less concentrated material.

#### Line 34E

This line was initially surveyed with 200 foot spreads which indicated a moderate, shallow source between 0 and 2N.

The detail results show that there are two stronger portions which are centered near 25 and 1N. Both of these appear to have some depth to their top and the highest concentration of metallic material appears to lie at a depth of about 100 feet.

#### Line 38E

Two concentrated portions are also indicated on this line. These are centered near the base line and 4S. Both represent sources of moderate metallic content with 50 to 100 feet to the top of their strongest portions. Weaker metal factor values indicate disseminated material lying between and on either side of these features and the entire anomalous zone has a width of between 600 and 700 feet.

There is also a weak indication of a source between 6N and 8N.

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#### Line 42E

The anomalous zone extends from 2N at least as far south as 5S. The contours on the south part of the data plot suggest that the zone may continue at depth in this direction.

The strongest IP effects occur between 1S and 1N, with the shallowest portion lying just south of the base line.

#### Line 46E

On this line, the source is shallow, but much weaker and narrower.

#### Line 50E

Two probable anomalies are shown on the data plot. Near 1S, the source is shallow but quite weak. At 1N, the source appears to be narrow and between 50 and 100 feet deep.

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#### Base Line

This traverse was run along the strike of the anomalous zone encountered by the north-south traverses. It is continuously anomalous from 24E at least as far as 48E. Variations in the apparent metal factor values along the line may be due to the lateral separation of the line from the more concentrated portions. Consequently, the magnitude of the IP effects is not as significant as on the north-south traverses which are perpendicular to the zone.

#### 4. SUMMARY AND RECOMMENDATIONS

The IP survey appears to have outlined a continuous zone

of metallic material that extends along the base line. Parts of this zone coincides with outcrops of molybdenite mineralization associated with disseminated pyrite and the anomalous area definitely warrants an intensive drill test.

The IP zone extends from 24E at least as far east as 48E. Its western limit is quite sharp, but there is some weak response on Line 50E and the zone may continue farther to the east, at depth. This possibility could be checked by additional surveying with a wider electrode spacing if encouragement is obtained in the initial drilling.

There is considerable variation in the strength and character of the source along its length and it varies in width from 350 to 700 feet. The strongest metal factor values and presumably the heaviest concentrations of metallic material occur on Lines 31E and 42E, and test drill hole locations have been suggested on these lines. There appear to be two concentrated portions in the widest part of the zone on Lines 34E and 38E; drilling has also been suggested on Line 38E to test both of the concentrated portions. The locations and details of the above drill program are shown on the accompanying plan map.

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D. B. Sutherland, Geophysicist.

Philip G. Hallof, Geophysicist.

Dated: July 20, 1966

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#### ASSESSMENT DETAILS

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PROPERTY: Morice Mountain Prospect MINING DIVISION: Omineca SPONSOR: Amax Exploration Inc. **PROVINCE:** British Columbia LOCATION: Barrett Area **TYPE OF SURVEY:** Induced Polarization 51.25 **OPERATING MAN DAYS:** DATE STARTED: June 15, 1966 EQUIVALENT 8 HR. MAN DAYS: 77.25 DATE FINISHED: June 30, 1966 CONSULTING MAN DAYS: NUMBER OF STATIONS: 245 3 7 NUMBER OF READINGS: 1264 DRAUGHTING MAN DAYS: **MILES OF LINE SURVEYED: 5.17** 87.25 TOTAL MAN DAYS:

#### CONSULTANTS:

D. B. Sutherland, Apt. 604, 412 Eglinton Avenue E., Toronto 12, Ontario. P. G. Hallof, 5 Minorca Place, Don Mills, Ontario.

#### FIELD TECHNICIANS:

J. Parker, Box 340, Choiceland, Saskatchewan. D. Malouf, 23 Enden Bridge Drive, Islington, Ontario. 3 helpers supplied by client

#### DRAUGHTSMEN:

F.R. Peer, 38 Torrens Avenue, Toronto 6, Ontario. R. Woods, Apt. 401, 1222 York Mills Road, Don Mills, Ontario. N. Lade, Apt. 7, 1209 Don Mills Road, Don Mills, Ontario.

MCEHAR GEOPHYSICS LIMITED D.B. Sutherland

Geophysicist. P. G. Hallof.

Geophysicist.

### SUMMARY OF COST

### Morice Mountain Prospect

Crew - 2 men

10-1/4 days	Operating	@ \$195.00		\$1,998.75
2 davs	Travel	@\$ 75.00		150.00
3 days	Standby	@\$ 75.00	•	225.00

#### Expenses

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Airfare - Toronto-Vancouver- Toronto -	
D. Malouf	\$267.00
Airfare - Vancouver - Penticton -	50.00
J. Parker	
Taxis	18. 32
Excess Baggage	22.20
Meals and Accommodation	89.60
Freight and Brokerage	111.53
Telephone and Telegraph	3.00
Supplies	65.21

\$ 626.86

\$3,000.61

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D. B. Sutherland,

D. B. Sutherland, Geophysicist.

Philip G. Hallof, Geophysicist.

Dated: July 20, 1966

#### CERTIFICATE

I, Don Benjamin Sutherland of the City of Toronto, Province of Ontario, do hereby certify that:

I am a geophysicist residing at 412 Eglinton Avenue, East,
Toronto 12, Ontario.

2. I am a graduate of the University of Toronto in Physics and Geology with the degree of Bachelor of Arts (1954); and a graduate of the University of Toronto in Physics with the degree of Master of Arts (1955.)

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

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

5. I have no direct or indirect interest, nor do I expect to receive any interest directly or indirectly, in the property or securities of Amax Exploration Incorporated.

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

Don B. Sutherland, M.A.

Dated at Toronto

This 20th day of July 1966

# MCPHAR GEOPHYSICS LIMITED 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 Goulomb 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

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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

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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

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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.

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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



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## DWG. NO.-1.P.-2470-1







DWG. NO.-I.P.-2470-4











DWG. NO.- I.P.- 2470-8 NOTE: CONTOURS AT LOGARITHMIC MULTIPLES OF 10-15-20-30-50-75-100 • Department of Mines and Petroleum Resources ASSESSMENT REPORT 797 NO Мар 样 9  $\rho_{a/2\pi}$ (OHM FEET) 3550 LINE NO.-34 E 12N 14N 1.5 (M.F.) a FREQUE DATE SURVEYED JUN APERO DATE



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