REPORT ON THE
INDUCED POLARIZATION
AND RESISTIVITY SURVEY
ON THE
MOSQUITO CLAIM GROUP
MT. MILLIGAN AREA, OMINECA M.D., B.C.
FOR
PECHINEY DEVELOPMENT LTD.

BY

PHILIP G. HALLOF, Ph.D.

AND

MARION A. GOUDIE, B.Sc.

NAME AND LOCATION OF PROPERTY:

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA, B.C.

OMINECA MINING DIVISION, B.C. - 55°07'N - 124°03'W

DATE STARTED: JULY 30, 1973

DATE FINISHED: AUGUST 8, 1973

4742

4742

93N/1E

Geophysical report on the ZAP # 1 mineral claim and on the ZAP-A group of claims, situated 4½ miles south of Mt. Milligan, Omineca Mining Division, British Columbia, N.T.S. 93 NW, Longitude 124°03', latitude 55°07', owned by and on behalf of Pechiney Development Ltd.

Field work between July 30 and August 8, 1973, and between June 10 and June 15, 1973

Report by:

J.P. Guelpa,
Geologist

Ph. G. Hallof, Ph.D.

M.A. Goudie, B.Sc.

November 29, 1973

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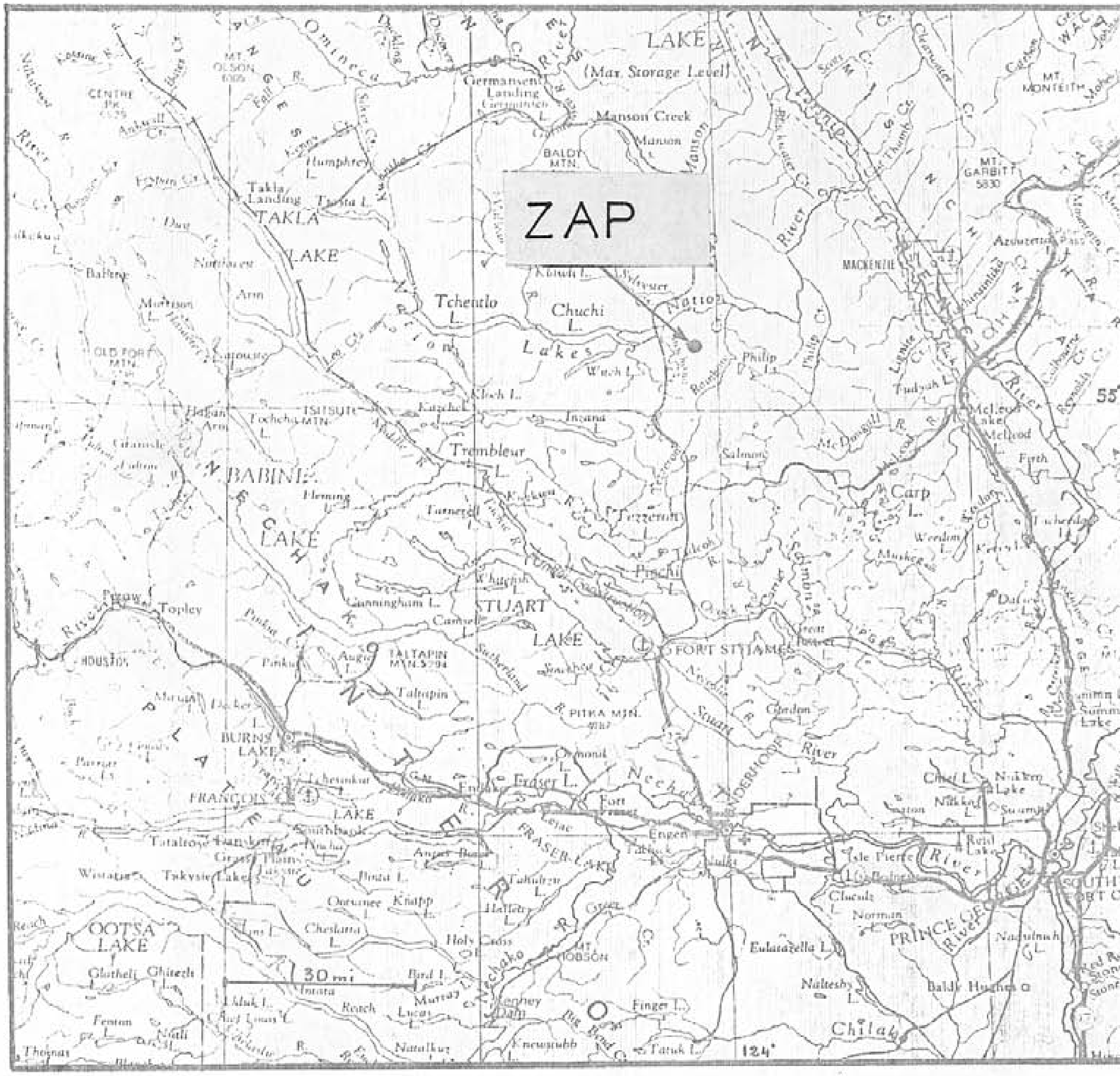

General Location of the ZAP Claims

MAP 1

I CLAIMS - LOCATION - ACCESS

The ZAP claims are adjoining the MOSQUITO group of claims, 4½ miles south of Mt. Milligan.

The ZAP # 1 mineral claim is adjoining MOSQUITO # 8 to the north and MOSQUITO # 9 to the east. This claim is recorded under number 126 064.

The ZAP-A group of claims consists of 3 contiguous claims which are

ZAP # 2	Record Number 126 065
ZAP # 3	126 066
ZAP # 4	126 067

The ZAP # 1 mineral claim and the ZAP-A group of claims were recorded on June 14, 1973; they were staked on June 9, 1973.

These claims are located some 50 miles north of Fort St. James and can only be reached by helicopter.

II WORK DONE

Between July 30 and August 8, 1973, an induced polarization and resistivity survey was carried out on the ZAP # 1, ZAP # 2, ZAP # 3 and ZAP # 4 mineral claims as a part of a program comprising the adjoining MOSQUITO claims. The enclosed report by P.G. Hallof and M.A. Goudie describes the work done and its results.

Lines necessary for the IP survey had been cut previously on the ZAP # 1 claim and on ZAP # 2, # 3 and # 4 by Manex Mining Ltd. between June 10 and June 15, 1973.

McPHAR GEOPHYSICS

NOTES ON THE THEORY, METHOD OF FIELD OPERATION AND PRESENTATION OF DATA FOR THE INDUCED POLARIZATION METHOD

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 appreciably reduce the amount of 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 per cent frequency effect or F. E. are a measurement of the polarization in the rock mass. However, since the measurement of the degree of polarization is related to the apparent resistivity of the rock mass it is found that the metal factor values or M. F. are the most useful values in determining the amount of polarization present in the rock mass. The MF values are obtained by normalizing the F. E. values for varying resistivities.

The induced polarization measurement is perhaps the most powerful geophysical method for the direct detection of metallic sulphide mineralization, even when this mineralization is of very low concentration. The lower limit of volume per cent sulphide necessary to produce a recognizable IP anomaly will vary with the geometry and geologic environment of the source, and the method of executing the survey. However, sulphide mineralization of less than one per cent by volume has been detected by the IP method under proper geological conditions.

The greatest application of the IP method has been in the search for disseminated metallic sulphides of less than 20% by volume. However, it has also been used successfully in the search for massive sulphides in situations where, due to source geometry, depth of source, or low resistivity of surface layer, the EM method can not be successfully applied. The ability to differentiate ionic conductors, such as water filled shear zones, makes the IP method a useful tool in checking EM anomalies which are suspected of being due to these causes.

In normal field applications the IP method does not differentiate between the economically important metallic minerals such as chalcopyrite, chalcocite, molybdenite, galena, etc., and the other metallic minerals such as pyrite. The induced polarization effect is due to the total of all electronic conducting minerals in the rock mass. Other electronic conducting materials which can produce an IP response are magnetite, pyrolusite, graphite, and some forms of hematite.

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 in distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current 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, apparent per cent frequency effect, 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. (See Figure A.) The resistivity values are plotted above the line as a mirror image of the metal factor values below. On a second line, below the metal factor values, are plotted the values of the per cent frequency effect. In some cases the values of per cent frequency effect are plotted as superscripts of the metal factor value. In this second case the frequency effect values are not contoured. The lateral displacement of a given value is determined by the location along the survey 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. The 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 results, model study results and theoretical investigations. The position of the electrodes when anomalous values are measured is important 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 25 feet to 2000 feet for (X). In each case, the decision as to the distance (X) and the values of (n) to be used 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.

The diagram in Figure A demonstrates the method used in plotting the results. Each value of the apparent resistivity, apparent metal factor, and apparent per cent frequency effect 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. When the F. E. values are plotted as superscripts to the MF values the third section of data values is not presented and the F. E. values are not contoured.

The actual data plots included with the report are prepared utilizing an IBM 360/75 Computer and a Calcomp 770/763 Incremental Plotting System. The data values are calculated, plotted, and contoured according to a programme developed by McPhar Geophysics. Certain symbols have been incorporated into the programme to explain various situations in recording the data in the field.

The IP measurement is basically obtained by measuring the difference in potential or voltage (ΔV) obtained at two operating frequencies. The voltage is the product of the current through the ground and the apparent resistivity of the ground. Therefore in field situations where the current is very low due to poor electrode contact, or the apparent resistivity is very low, or a combination of the two effects; the value of (ΔV) the change in potential will be too small to be measurable. The symbol "TL" on the data plots indicates this situation.

In some situations spurious noise, either man made or natural, will render it impossible to obtain a reading. The symbol "N" on the data plots indicates a station at which it is too noisey to record a reading. If a reading can be obtained, but for reasons of noise there is some doubt as to its accuracy, the reading is bracketed in the data plot ( ).

In certain situations negative values of Apparent Frequency Effect are recorded. This may be due to the geologic environment or spurious electrical effects. The actual negative frequency effect value recorded is indicated on the data plot, however the symbol "NEG" is indicated for the corresponding value of Apparent Metal Factor. In contouring negative values the contour lines are indicated to the nearest positive value in the immediate vicinity of the negative value.

The symbol "NR" indicates that for some reason the operator did not attempt to record a reading although normal survey procedures would suggest that one was required. This may be due to inaccessible topography or other similar reasons. Any symbol other than those discussed above is unique to a particular situation and is described within the body of the report.

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

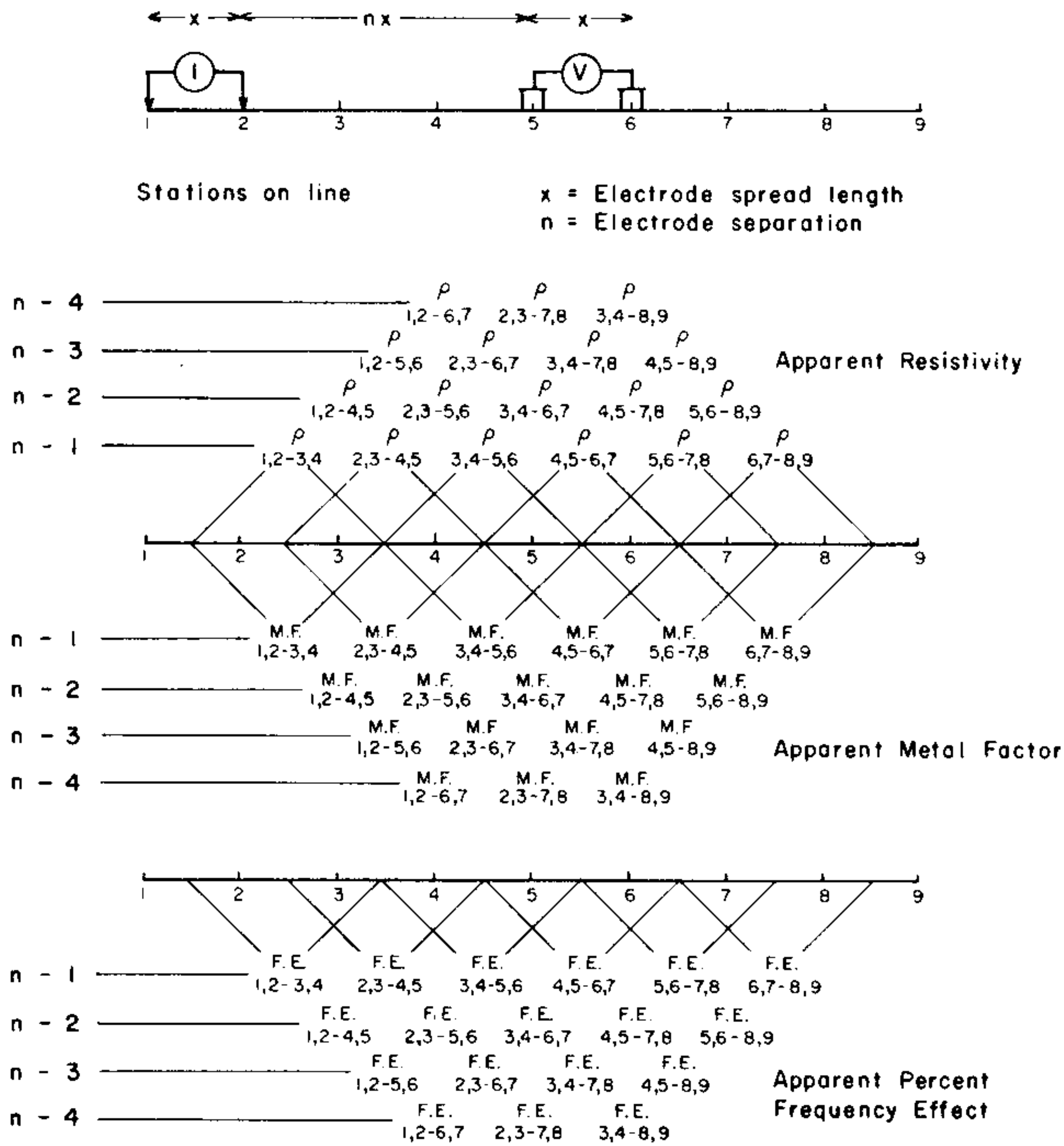

Fig. A

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REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE MOSQUITO CLAIM GROUP MT. MILLIGAN AREA, OMINECA M.D., B.C. FOR PECHINEY DEVELOPMENT LTD.

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1. INTRODUCTION

We have recently completed an Induced Polarization and Resistivity survey on the Mosquito Claim Group, Mt. Milligan area, Omineca Mining Division, B.C. for Pechiney Development Ltd. The survey grid is situated at 55°07' N latitude and 124°03' W longitude, six miles southeast of Mt. Milligan. Access is by helicopter.

The country rocks are volcanics of the Takla Group. A detailed geochemical survey located a good geochemical anomaly for copper; a geological survey was also carried out.

The IP survey was carried out to check the geochemical anomaly and to determine whether the possible source continued beneath the talus cover. The work was done in early August, 1973, using a McPhar P660 high power variable frequency IP unit operating at 0.3 Hz and 5.0 Hz over the following claims:

Mos: 2, 4, 6, 8, 9, 10

Zap: 1, 2, 3, 4

These claims are assumed to be owned or held under option by Pechiney Development Ltd.

2. PRESENTATION OF RESULTS

The Induced Polarization and Resistivity results are shown on the following data plots in the manner described in the notes preceding this report.

Line	Electrode Intervals	Dwg. No.
1000N	400 feet	IP 6085-1
500N	400 feet	IP 6085-2
0	400 feet	IP 6085-3
500S	400 feet	IP 6085-4
1000S	400 feet	IP 6085-5
1500S	400 feet	IP 6085-6

Also enclosed with this report is Dwg. I. P. P. 3594, a plan map of the Mosquito Claim Grid at a scale of 1" = 400'. The definite, probable and possible Induced Polarization anomalies are indicated by bars, in the manner shown on the legend, on this plan map as well as on 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 electrode interval length; i.e. when using 400' electrode intervals the position of a narrow sulphide body can only be determined to lie between two stations 400' apart. In order to definitely locate, and fully evaluate, a narrow, shallow source it is necessary to use shorter electrode intervals. In order to locate sources at some depth, larger electrode intervals must be used, with a corresponding increase in the uncertainties of location. Therefore, while the centre 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.

The topographic and geological information shown on Dwg.I.P.P.3594 has been taken from maps made available by the staff of Pechiney Development Ltd.

3. DISCUSSION OF RESULTS

The IP survey results indicate that the lines surveyed are continuously anomalous from west to east with three minor exceptions. Two of these exceptions occur on Line 1000N from 18W to 10W and on Line 500N from 18W to 14W, where a relatively barren source appears on n = 1 and n = 2, where it may overlie a continuation of the source which is reflected by possible anomalies on either flank. The same pattern is repeated on Line 1000N from 2W to 2E, the third exception.

The anomalous zone is open in all directions. The anomalies are variable in magnitude and there appears to be little consistency in these variations generally. One zone has been correlated (see Dwg. I. P. P. 3594) where the metal factor values are over 100 and the frequency effects are over 10. However, the IP results do not differentiate between economic and uneconomic mineralization, as is shown in the illustration of IP results over the Bell Orebody in British Columbia. Thus it is possible that this correlation may be of little significance - it will be necessary to define the source by drilling.

The source of the anomalies is shallow with respect to the electrode interval, with erratic concentrations of mineralization reflected at varying depths. Some depth extent is indicated. As an illustration, Line 500N will be described in detail.

Line 500N

The anomaly is incomplete at 26W, indicating that the mineralization probably extends westward. The anomaly is probable from 26W to 22W, reflecting the moderate metal factor values on n = 2 and n = 3. The anomaly is possible from 22W to 18W and from 14W to 10W, interrupted by a relatively barren source rock which may be a cap rock. From 10W to 2W the anomaly is definite with the metal factor values improving with depth. A possible section of the anomaly from 2W to 6E is followed by a definite to probable section to the eastern end of the line, where the anomaly is incomplete. In this definite portion of the anomaly, the metal factor values of greatest magnitude occur on n = 2 and n = 3, e.g. from about 200' to 400' in depth.

INDUCED POLARIZATION

AND

GEOLOGIC SECTION

FROM

BRITISH COLUMBIA
DISSEMINATED SULPHIDES

BELL OREBODY
LINE-22N

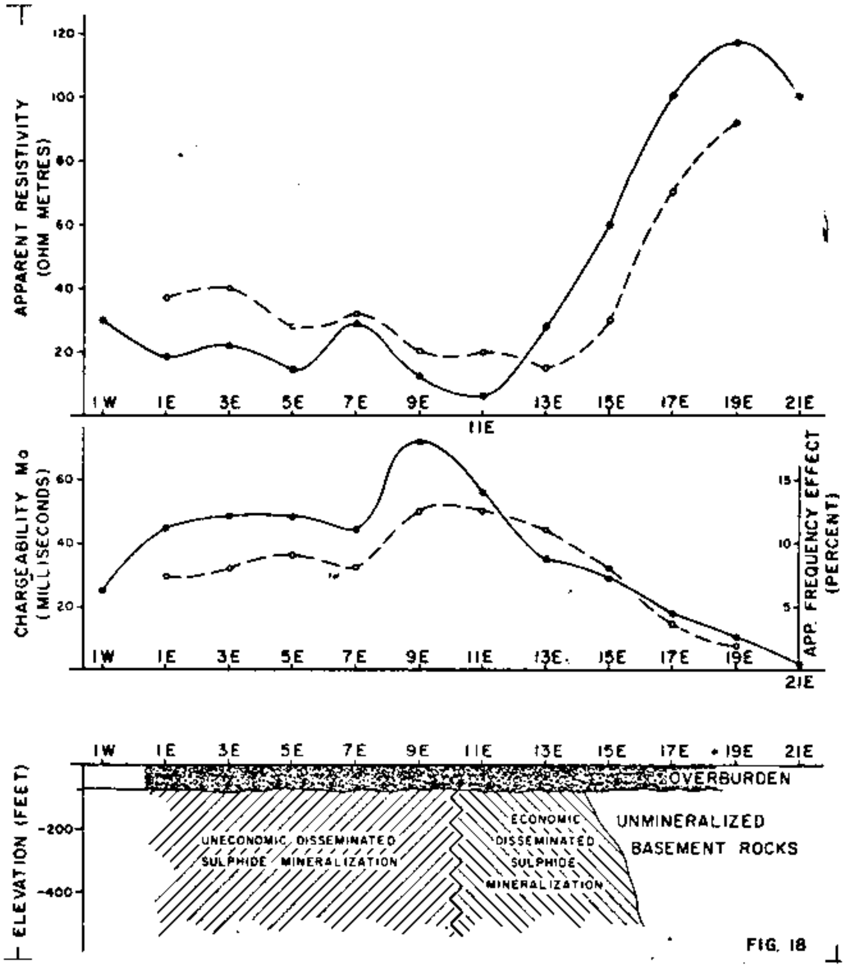


FIG. 18

INDUCED POLARIZATION

AND

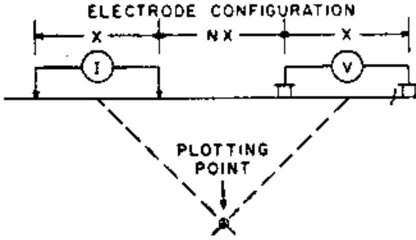
GEOLOGIC SECTION

FROM

BRITISH COLUMBIA
DISSEMINATED SULPHIDES

BELL OREBODY
LINE-22N

FREQUENCIES- 0·31/5HZ



X = 200 FEET

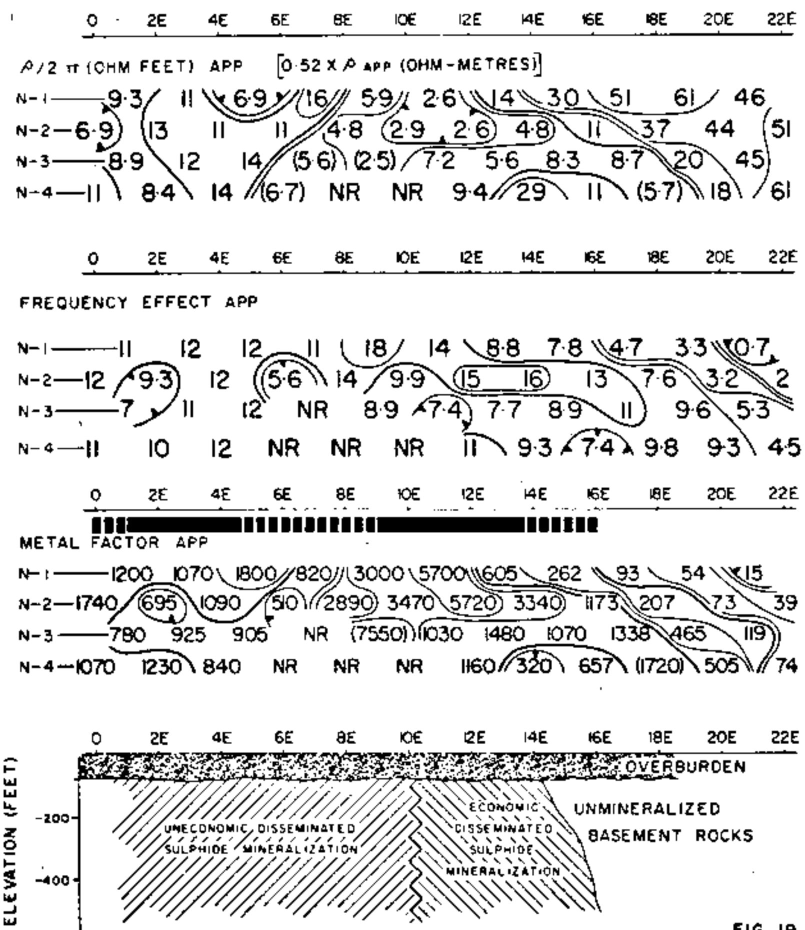


FIG. 19

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The pattern of the anomalies suggests disseminated mineralization of varying concentration as the source (see Appendix II).

Since the IP values are an average reading over the electrode interval, it is usually desirable to better locate and define an anomaly before selecting drilling targets by detailing the anomaly with the appropriate electrode interval. Appendix I describes the theory for narrow sources, but the theory also applies to wider sources (see Page 2, paragraphs 2 and 3). Before drilling the source on this grid, it is recommended that detail using 200' electrode intervals be carried out on Line 1000N, Line 500N and Line 0, from 2W to the eastern end of the line. This detail should provide drilling targets. Possible, probable and definite portions of the anomalies should all be tested.

4. CONCLUSIONS

The IP survey has located a large anomalous zone which is open in all directions. The pattern of the anomalies suggests disseminated metallic mineralization as the source of the anomalies. The survey was carried out to check a geochemical high for copper, and if copper is a significant constituent of the mineralization, the area could be of major interest. The anomalous source has been shown to extend beneath the talus slope. It has been recommended that IP detail with shorter electrode intervals be carried out before choosing drilling locations, in order to achieve optimum results from the drilling. Some detail has been recommended in the foregoing discussion.

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof,
Geophysicist

Marion A. Goudie,
Geologist

Dated: September 10, 1973

ASSESSMENT DETAILS

PROPERTY: Mosquito Project		MINING DIVISION: Omineca
SPONSOR: Pechiney Development Ltd.		PROVINCE: British Columbia
LOCATION: Mt. Milligan Area		
TYPE OF SURVEY: Induced Polarization		
OPERATING MAN DAYS:	26	DATE STARTED: July 30, 1973
EQUIVALENT 8 HR. MAN DAYS:	39	DATE FINISHED: August 8, 1973
CONSULTING MAN DAYS:	3	NUMBER OF STATIONS: 109
DRAUGHTING MAN DAYS:	6	NUMBER OF READINGS: 693
TOTAL MAN DAYS:	48	MILES OF LINE SURVEYED: 7.80

CONSULTANTS:
Philip G. Hallof, 15 Barnwood Court, Don Mills, Ontario.
Marion A. Goudie, 739 Military Trail, West Hill, Ontario.

FIELD TECHNICIANS:
J. Parker, Box 340, Choiceland, Saskatchewan
J. Shippit, 1411 Schubert Drive, Kamloops, B.C.
Plus 2 Helpers:
M. Faust, 841 Selkirk Ave. Kamloops, B.C.
J. Whittier, General Delivery, Prince Rupert. B.C.

DRAUGHTSMEN:
B. Boden, 103 Petworth Crescent, Agincourt, Ontario.
F.R. Peer, 38 Torrens Ave., Toronto 6, Ontario.

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof,
Geophysicist

Dated: September 10, 1973

STATEMENT OF COST

Pechiney Development Ltd.
Mosquito Project,
Mt. Milligan Area, B.C.

Crew: J. Parker - J. Shippit

7.80 line miles surveyed - prorata portion		$3,545.46
6½ days Operating	@ $382.00/day	$2,483.00
½ day Travel) 1½ days Preparation) 3 days 1 day Standby)	@ $100.00/day	300.00

Crew expense prorated - operating days @ 6½/16½

Truck rental	75.00	
Vehicle expense	28.94	
Meals and Accommodation	293.78	
Telephone and Telegraph	2.99	
Supplies	7.79	
Chain Saw	37.24	
	445.74	
+ 10%	44.57	
		490.31

Extra Labour prorated

operating days @ 6½/16½	226.52	
+ 20%	45.30	
		271.82
		$3,545.13

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof,
Geophysicist

Dated: September 10, 1973

CERTIFICATE

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

1. I am a geophysicist residing at 15 Barnwood Court, Don Mills, Ontario.

2. I am a graduate of the Massachusetts Institute of Technology with a B.Sc. 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 am a Professional Geophysicist, registered in the Province of Ontario, the Province of British Columbia and the State of Arizona.

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 Pechiney Development Ltd. or any affiliate.

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

7. Permission is granted to use in whole or in part for assessment and qualification requirements but not for advertising purposes.

Dated at Toronto

This 10th day of September 1973

Philip G. Hallof, Ph.D.

CERTIFICATE

I, Marion A. Goudie, of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geologist residing at 739 Military Trail, West Hill, Ontario.

2. I am a graduate of the University of Western Ontario with a B.Sc. Degree (1950) in Honours Geology.

3. I am a member of the Geological Society of America.

4. I have been practising my profession for 23 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 Pechiney Development Ltd. or any affiliate.

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

7. Permission is granted to use in whole or in part for assessment and qualification requirements but not for advertising purposes.

Dated at Toronto

This 10th day of September 1973

Marion A. Goudie

Marion A. Goudie, B.Sc.

APPENDIX I

THE INTERPRETATION OF INDUCED POLARIZATION ANOMALIES FROM RELATIVELY SMALL SOURCES

The induced polarization method was originally developed to detect disseminated sulphides and has proven to be very successful in the search for "porphyry copper" deposits. In recent years we have found that the IP method can also be very useful in exploring for more concentrated deposits of limited size. This type of source gives sharp IP anomalies that are often difficult to interpret.

The anomalous patterns that develop on the contoured data plots will depend on the size, depth and position of the source and the relative size of the electrode interval. The data plots are not sections showing the electrical parameters of the ground. When the electrode interval (X) is appreciably greater than the width of the source, a large volume of unmineralized rock is averaged into each measurement. This is particularly true for the large values of the electrode separation (n).

The theoretical scale model results shown in Figure 1 and Figure 2 indicate the effect of depth. If the depth to the top of the source is small compared to the electrode interval (i.e. d X) the measurement for n = 1 will be anomalous. In Figure 1 the depth is 0.5 units (X = 1.0 units) and the n = 1 value is definitely anomalous; the pattern on the contoured data plot is typical for a relatively shallow, narrow, near-vertical tabular source. The results in Figure 2 are for the same source with the depth increased to 1.5 units. Here the n = 1 value is not anomalous; the larger values of (n) are anomalous but the magnitudes are much lower than for the source at less depth.

When the electrode interval is greater than the width of the source, it is not possible to determine its width or exact position between the electrodes. The true IP effect within the source is also indeterminate; the anomaly from a very narrow source with a very large true IP effect will be much the same as that from a zone with twice the width and 1/2 the true IP effect. The theoretical scale model data shown in Figure 3 and Figure 4 demonstrate this problem. The depth and position of the source are unchanged but the width and true IP effect are varied. The anomalous patterns and magnitudes are essentially the same, hence the data are insufficient to evaluate the source completely.

The normal practise is to indicate the IP anomalies by solid, broken, or dashed bars, depending upon their degree of distinctiveness. 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. As illustrated in Figure 1, Figure 2, Figure 3 and Figure 4, no anomaly can be located with more accuracy than the spread length. While the centre of the solid bar indicating the anomaly corresponds fairly well with the source, the length of the bar should not be taken to represent the exact edges of the anomalous material.

If the source is shallow, the anomaly can be better evaluated using a shorter electrode interval. When the electrode interval used approaches the width of the source, the apparent effects measured will be nearly equal to the true effects within the source. When there is some depth to the top of the source, it is not possible to use electrode intervals that are much less than the depth to the source. In this situation, one must realize that a definite ambiguity exists regarding the width of the source and the IP effect within the source.

Our experience has confirmed the desirability of doing detail. When a reconnaissance IP survey using a relatively large electrode interval indicates the presence of a narrow, shallow source, detail with shorter electrode intervals is necessary in order to better locate, and evaluate, the source. The data of most usefulness is obtained when the maximum apparent IP effect is measured for n = 2 or n = 3. For instance, an anomaly originally located using X = 300' may be checked with X = 200' and then X = 100'. The data with X = 100' will be quite different from the original reconnaissance results with X = 300'.

The data shown in Figure 5 and Figure 6 are field results from a greenstone area in Quebec. The expected sources were narrow (less than 30' in width) zones of massive, high-grade, zinc-silver ore. An electrode interval of 200' was used for the reconnaissance survey in order to keep the rate of progress at an acceptable level. The anomalies located were low in magnitude.

The very weak, shallow anomaly shown in Figure 5 is typical of those located by the X = 200' reconnaissance survey. Several anomalies of this type were detailed using shorter electrode intervals. In most cases the detail measurements suggested broad zones of very weak mineralization. However, in the case of the source at 20N to 22N, the measurements with shorter electrode intervals confirmed the presence of a strong, narrow source. The X = 50' results are shown in Figure 6. Subsequent drilling has shown the source to be 12.5' of massive sulphide mineralization containing significant zinc and silver values.

The change in the anomaly that results when the electrode interval is reduced is not unusual. The X = 50' data more accurately locates the narrow source, and permits the geophysicist to make a better evaluation of its importance. The completion of this type of detail is very important, in order to get the maximum usefulness from a reconnaissance IP survey.

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Theoretical Induced Polarization and Resistivity Studies

Scale Model Cases

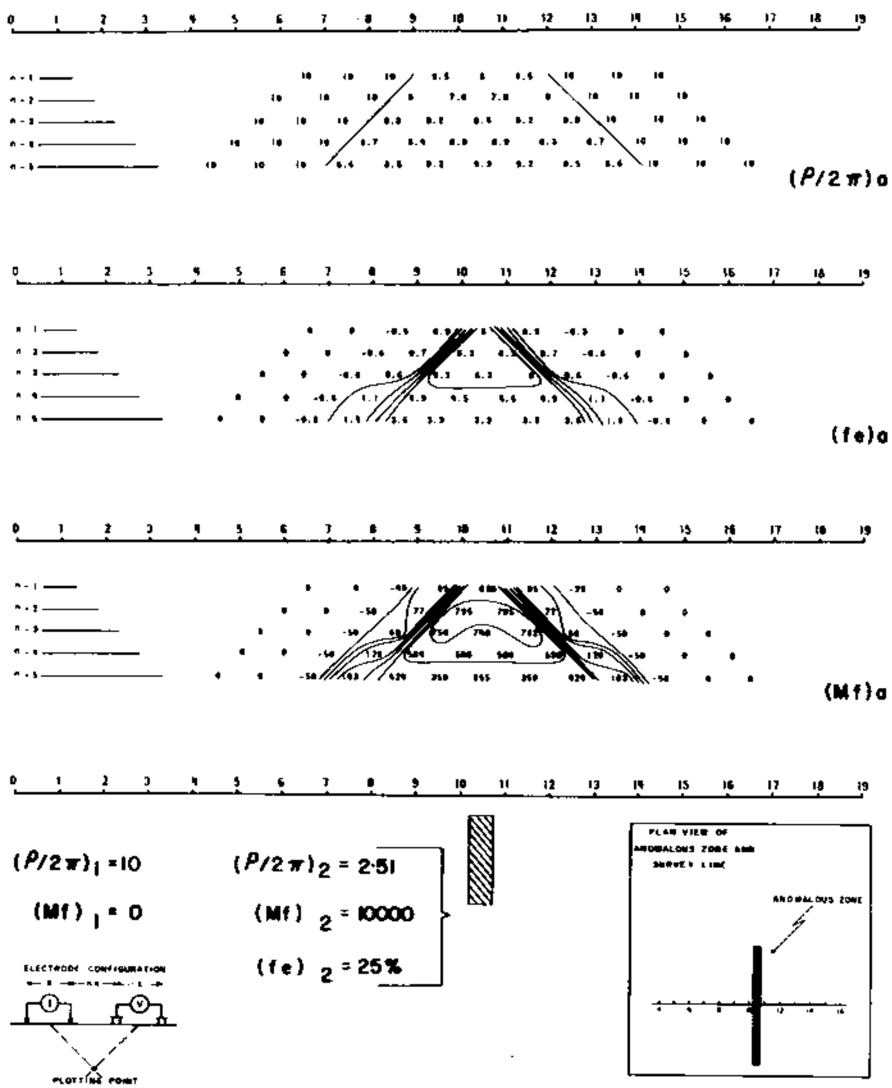

FIG 1

CASE II-0.5-BU-10-a

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Theoretical Induced Polarization and Resistivity Studies

Scale Model Cases

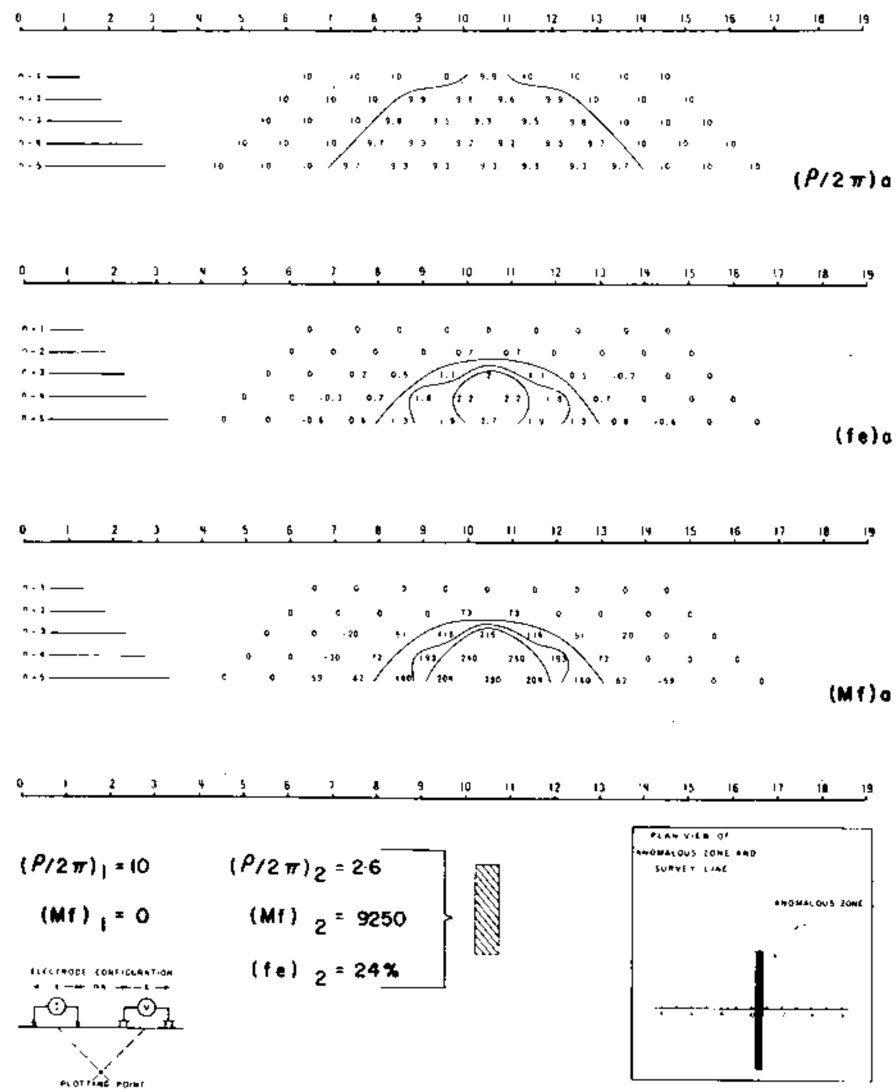


FIG 2

CASE II-1.5-BU-10-a

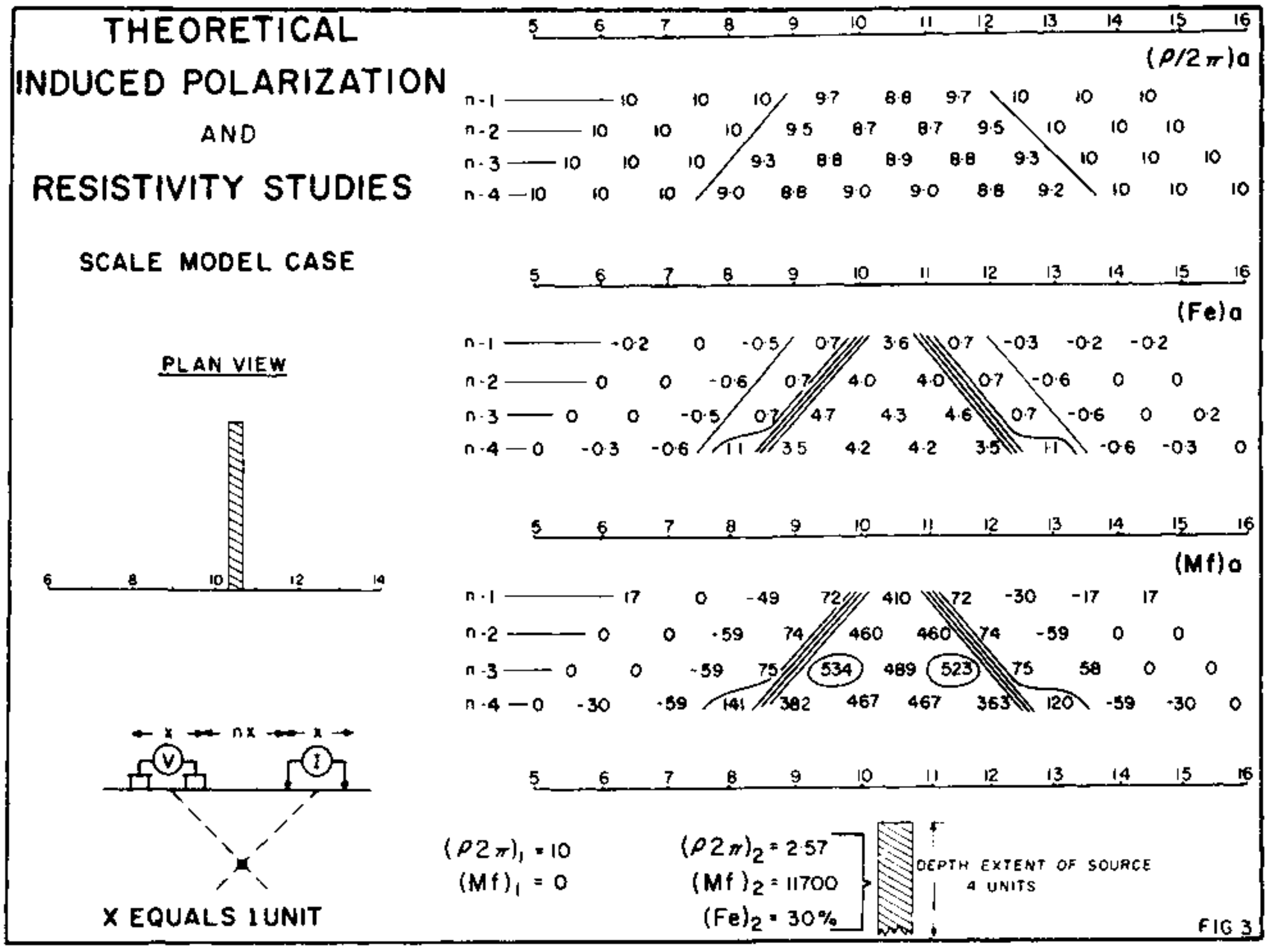

THEORETICAL
INDUCED POLARIZATION
AND
RESISTIVITY STUDIES
SCALE MODEL CASE
PLAN VIEW
6 8 10 12 14
X EQUALS 1 UNIT
5 6 7 8 9 10 11 12 13 14 15 16
(ρ/2π)a
n-1 10 10 10 9.7 8.8 9.7 10 10 10
n-2 10 10 10 9.5 8.7 8.7 9.5 10 10 10
n-3 10 10 10 9.3 8.8 8.9 8.8 9.3 10 10 10
n-4 10 10 10 9.0 8.8 9.0 9.0 8.8 9.2 10 10 10
(Fe)a
n-1 -0.2 0 -0.5 0.7 3.6 0.7 -0.3 -0.2 -0.2
n-2 0 0 -0.6 0.7 4.0 4.0 0.7 -0.6 0 0
n-3 0 0 -0.5 0.7 4.7 4.3 4.6 0.7 -0.6 0 0.2
n-4 0 -0.3 -0.6 1.1 3.5 4.2 4.2 3.5 1.1 -0.6 -0.3 0
(Mf)a
n-1 17 0 -49 72 410 72 -30 -17 17
n-2 0 0 -59 74 460 460 74 -59 0 0
n-3 0 0 -59 75 534 489 523 75 58 0 0
n-4 0 -30 -59 141 382 467 467 363 120 -59 -30 0
(ρ2π)₁ = 10
(Mf)₁ = 0
(ρ2π)₂ = 2.57
(Mf)₂ = 11700
(Fe)₂ = 30%
DEPTH EXTENT OF SOURCE
4 UNITS

FIG 3

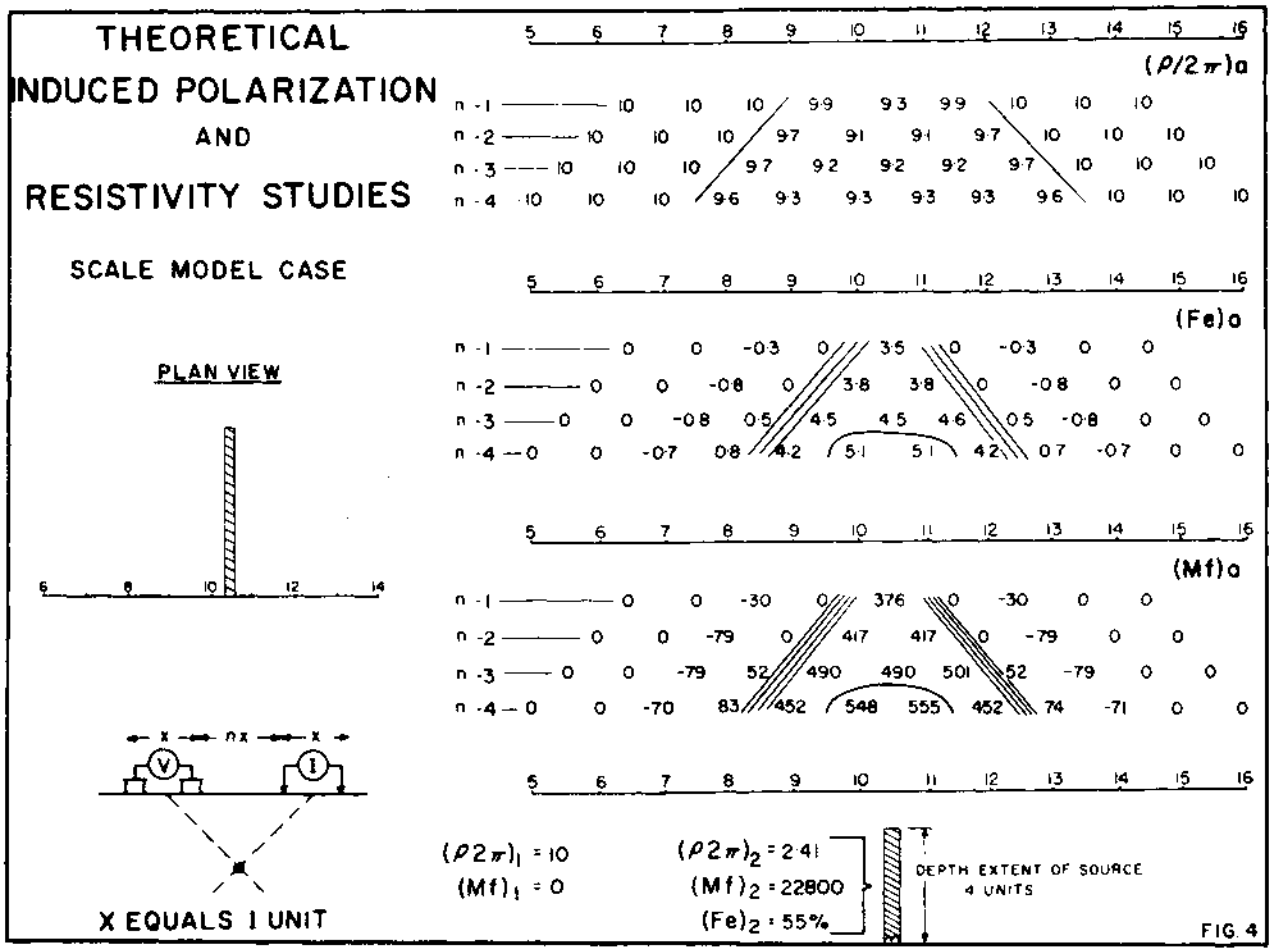

THEORETICAL
INDUCED POLARIZATION
AND
RESISTIVITY STUDIES
SCALE MODEL CASE
PLAN VIEW
6 8 10 12 14
X EQUALS 1 UNIT
5 6 7 8 9 10 11 12 13 14 15 16
(ρ/2π)a
n-1 10 10 10 9.9 9.3 9.9 10 10 10
n-2 10 10 10 9.7 9.1 9.1 9.7 10 10 10
n-3 10 10 10 9.7 9.2 9.2 9.2 9.7 10 10 10
n-4 10 10 10 9.6 9.3 9.3 9.3 9.3 9.6 10 10 10
(Fe)a
n-1 0 0 -0.3 0 3.5 0 -0.3 0 0
n-2 0 0 -0.8 0 3.8 3.8 0 -0.8 0 0
n-3 0 0 -0.8 0.5 4.5 4.5 4.6 0.5 -0.8 0 0
n-4 0 0 -0.7 0.8 4.2 5.1 5.1 4.2 0.7 -0.7 0 0
(Mf)a
n-1 0 0 -30 0 376 0 -30 0 0
n-2 0 0 -79 0 417 417 0 -79 0 0
n-3 0 0 -79 52 490 490 501 52 -79 0 0
n-4 0 0 -70 83 452 548 555 452 74 -71 0 0
(ρ2π)₁ = 10
(Mf)₁ = 0
(ρ2π)₂ = 2.41
(Mf)₂ = 22800
(Fe)₂ = 55%
DEPTH EXTENT OF SOURCE
4 UNITS

FIG. 4

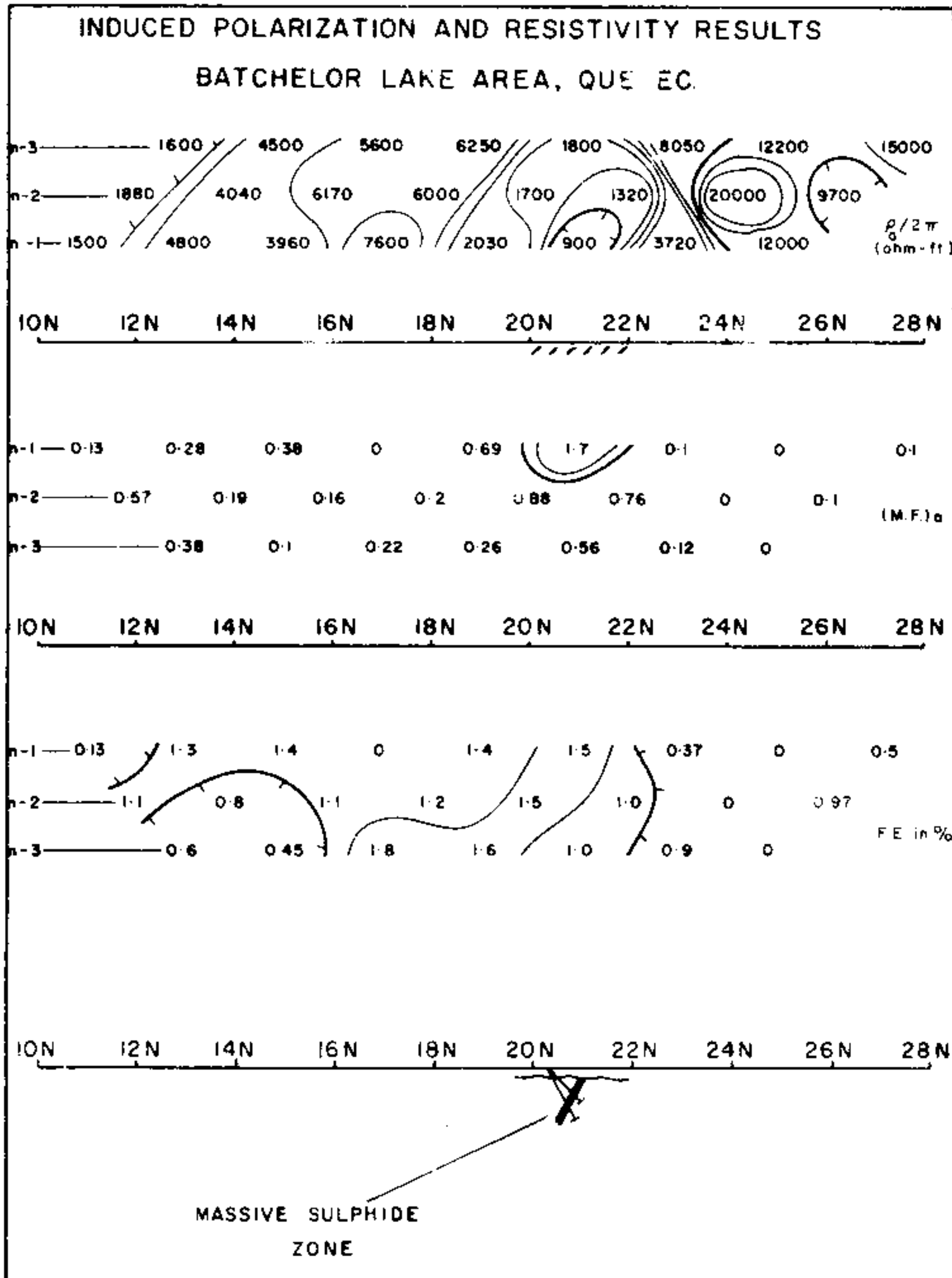

INDUCED POLARIZATION AND RESISTIVITY RESULTS
BATCHELOR LAKE AREA, QUEBEC.
n-3 1600 4500 5600 6250 1800 8050 12200 15000
n-2 1880 4040 6170 6000 1700 1320 20000 9700
n-1 1500 4800 3960 7600 2030 900 3720 12000
ρa/2π (ohm-ft)
10N 12N 14N 16N 18N 20N 22N 24N 26N 28N
n-1 0·13 0·28 0·38 0 0·69 1·7 0·1 0 0·1
n-2 0·57 0·19 0·16 0·2 0·88 0·76 0 0·1
n-3 0·38 0·1 0·22 0·26 0·56 0·12 0
(M.F.)a
10N 12N 14N 16N 18N 20N 22N 24N 26N 28N
n-1 0·13 1·3 1·4 0 1·4 1·5 0·37 0 0·5
n-2 1·1 0·8 1·1 1·2 1·5 1·0 0 0·97
n-3 0·6 0·45 1·8 1·6 1·0 0·9 0
F.E. in %
10N 12N 14N 16N 18N 20N 22N 24N 26N 28N
MASSIVE SULPHIDE
ZONE

FIG. 5

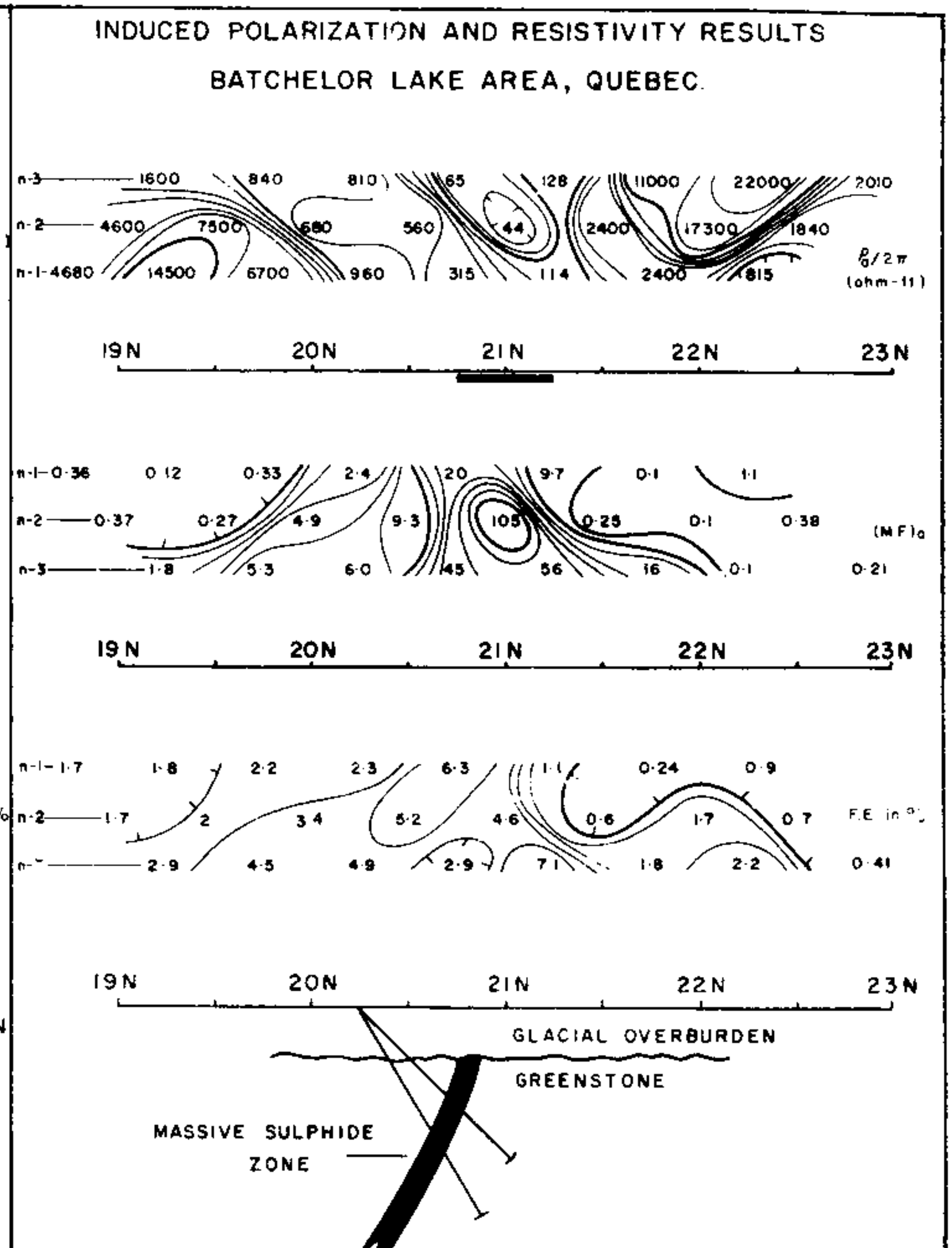

INDUCED POLARIZATION AND RESISTIVITY RESULTS
BATCHELOR LAKE AREA, QUEBEC.
n-3 1600 840 810 65 128 11000 22000 2010
n-2 4600 7500 680 560 44 2400 17300 1840
n-1 4680 14500 6700 960 315 114 2400 815
ρa/2π (ohm-ft)
19N 20N 21N 22N 23N
n-1 0·36 0·12 0·33 2·4 20 9·7 0·1 1·1
n-2 0·37 0·27 4·9 9·3 105 0·25 0·1 0·38
n-3 1·8 5·3 6·0 45 56 16 0·1 0·21
(M.F.)a
19N 20N 21N 22N 23N
n-1 1·7 1·8 2·2 2·3 6·3 1·1 0·24 0·9
n-2 1·7 2 3·4 5·2 4·6 0·6 1·7 0·7
2·9 4·5 4·9 2·9 7·1 1·8 2·2 0·41
F.E. in %
19N 20N 21N 22N 23N
GLACIAL OVERBURDEN
GREENSTONE
MASSIVE SULPHIDE
ZONE

FIG. 6

APPENDIX II

EXPECTED IP ANOMALIES FROM "PORPHYRY COPPER" TYPE ZONES OF DISSEMINATED SULPHIDE MINERALIZATION

Our experience in other areas has shown that the induced polarization method can be successfully used to locate, and outline, zones of disseminated sulphide mineralization of the "porphyry copper" type. In most cases the interpretation of the IP results is simple and straightforward. The results shown in Figure 1 and Figure 2 are typical.

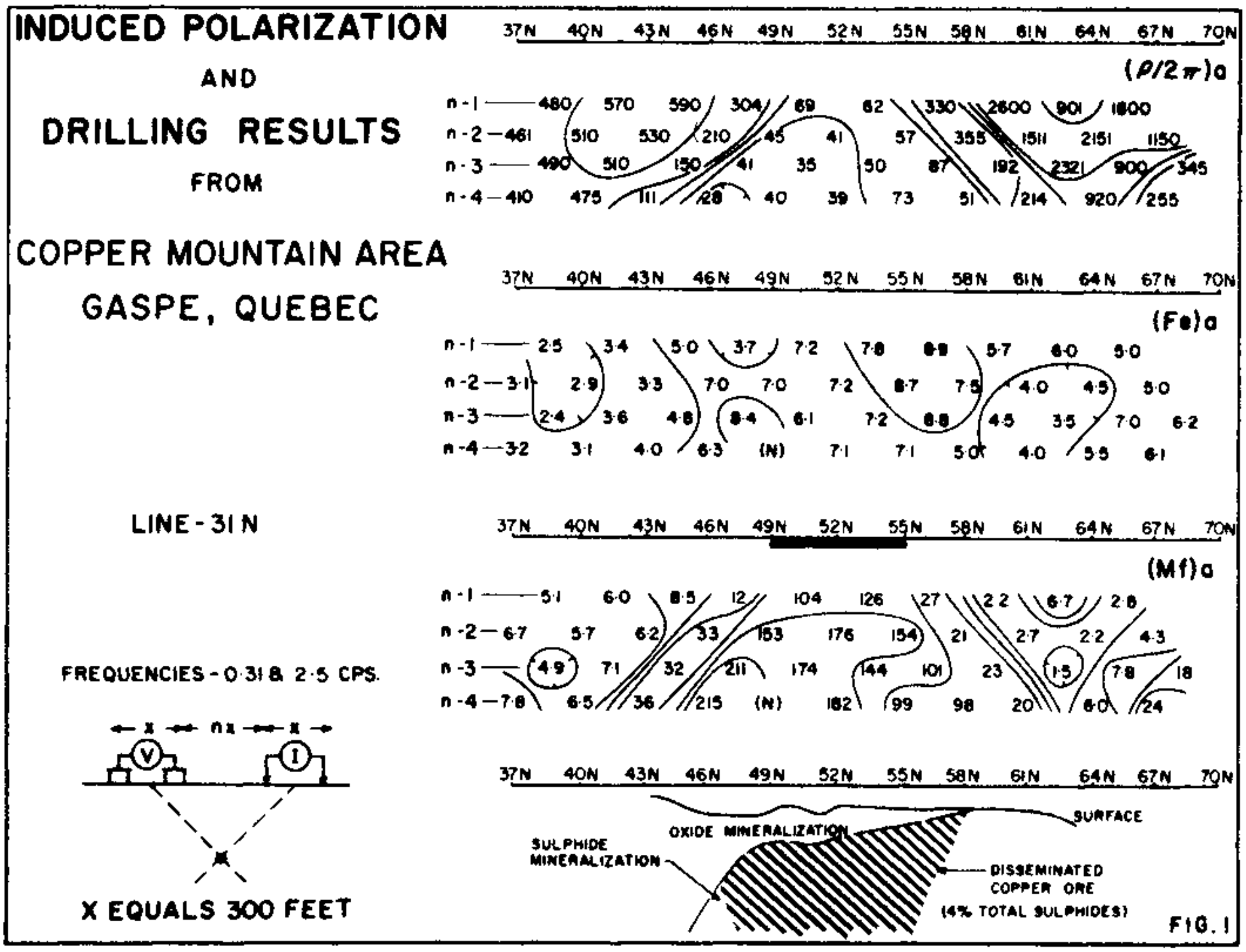


FIG. 1

The source of the moderate magnitude IP anomaly shown in Figure 1 contains approximately 4% metallic mineralization. The zone is of limited lateral extent and enough copper is present to make the mineralization "ore grade". The presence of the surface oxidation can be seen in the fact that the apparent IP effects increase for n = 2.

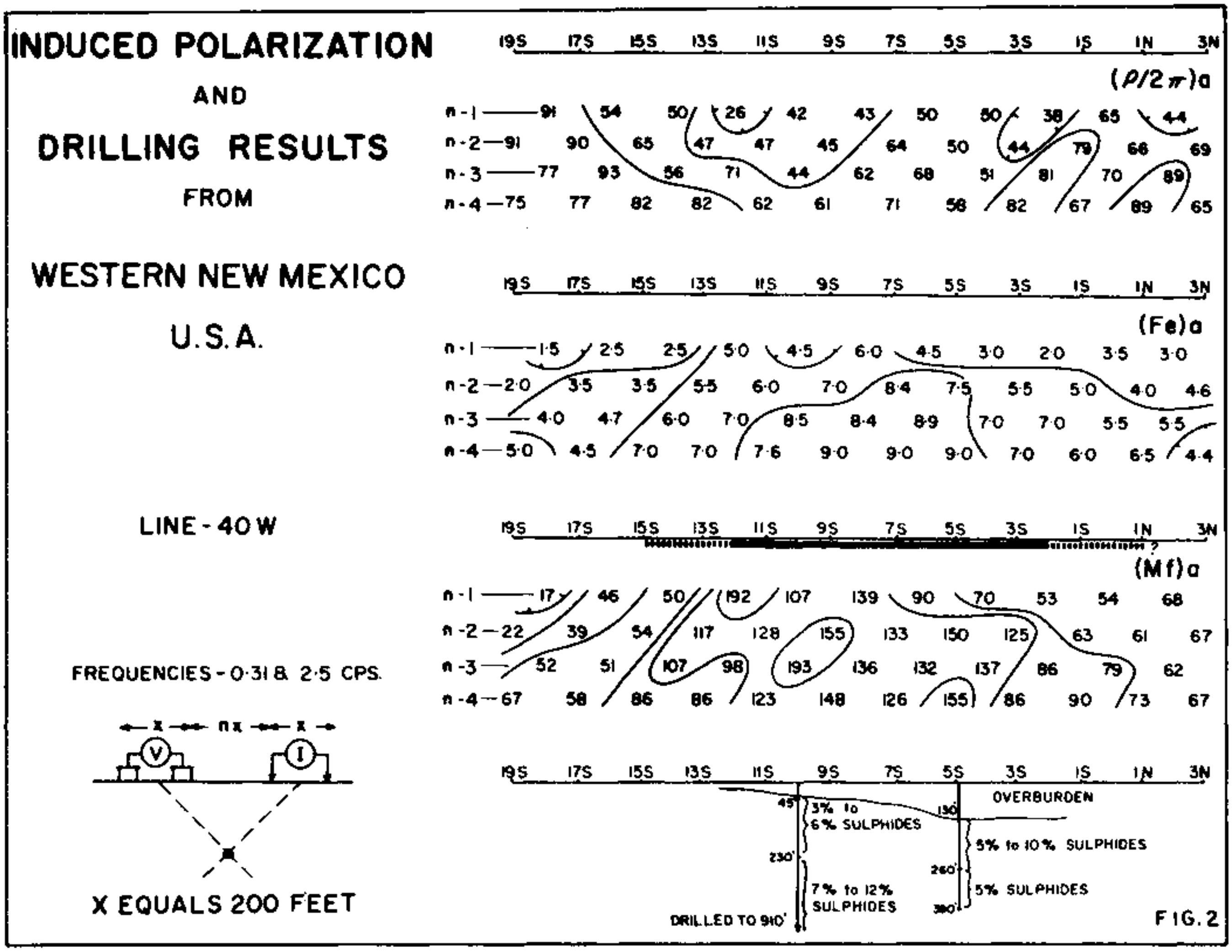


FIG. 2

The IP anomaly shown in Figure 2 has about the same magnitude as that described above. It should be noted that appreciably greater concentrations of metallic mineralization are present; further, there is little or no copper present. These results illustrate the fact that IP results can not be used to determine the exact amount of metallic mineralization present or to determine the economic importance of a mineralized zone. In some geologic situations zoning is present; the zones of mineralization of greatest economic value may contain less total metallic mineralization than other zones in the same general area.

In the proper geologic environment, the method will detect even very low concentrations of metallic mineralization. The IP results shown in Figure 3 located the ore zone at the Brenda Property near Peachland, B. C. The zone contains 1. 0 to 1. 5 per cent metallic mineralization; however, the mineralization is "ore grade" because only molybdenite and chalcopyrite are present.

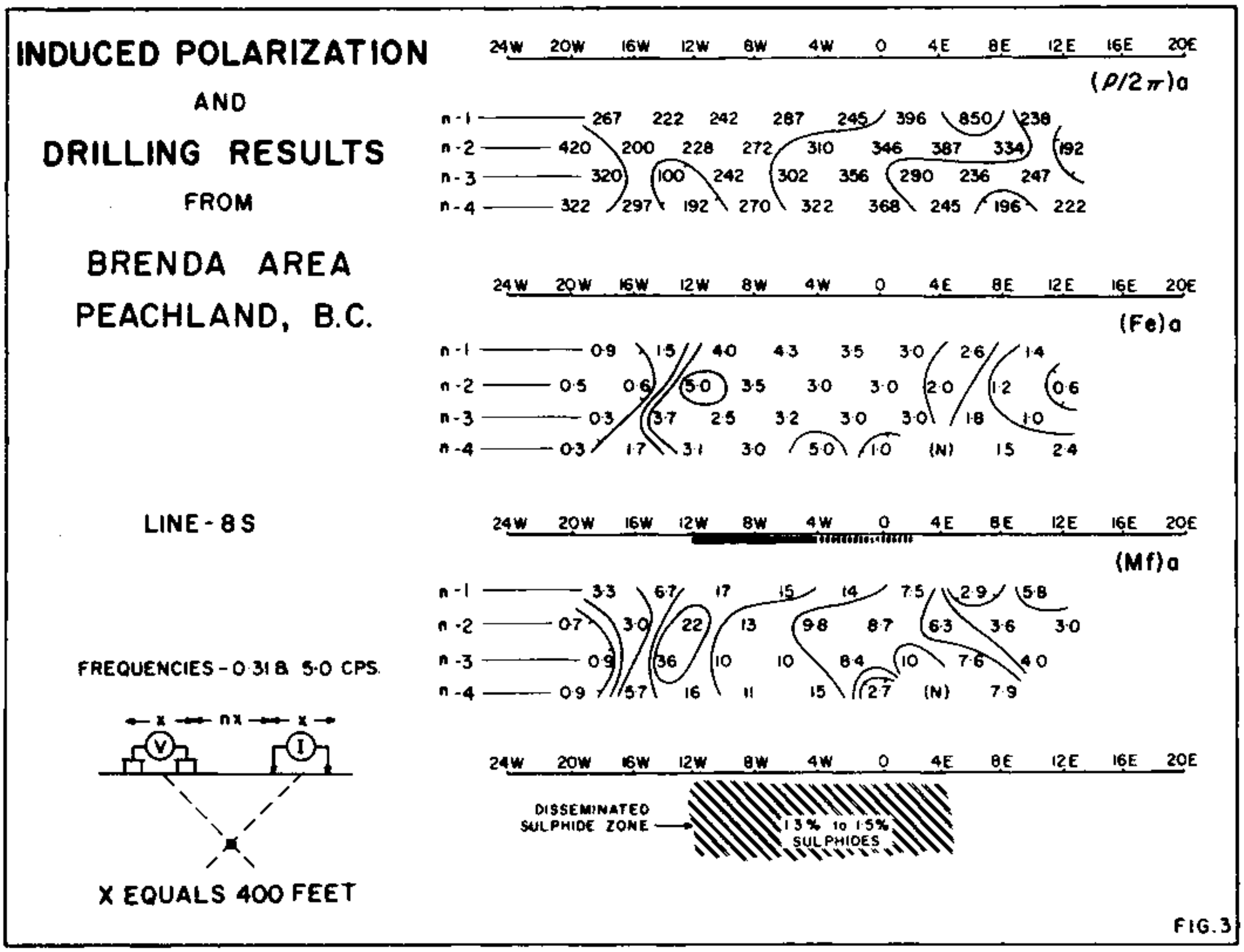
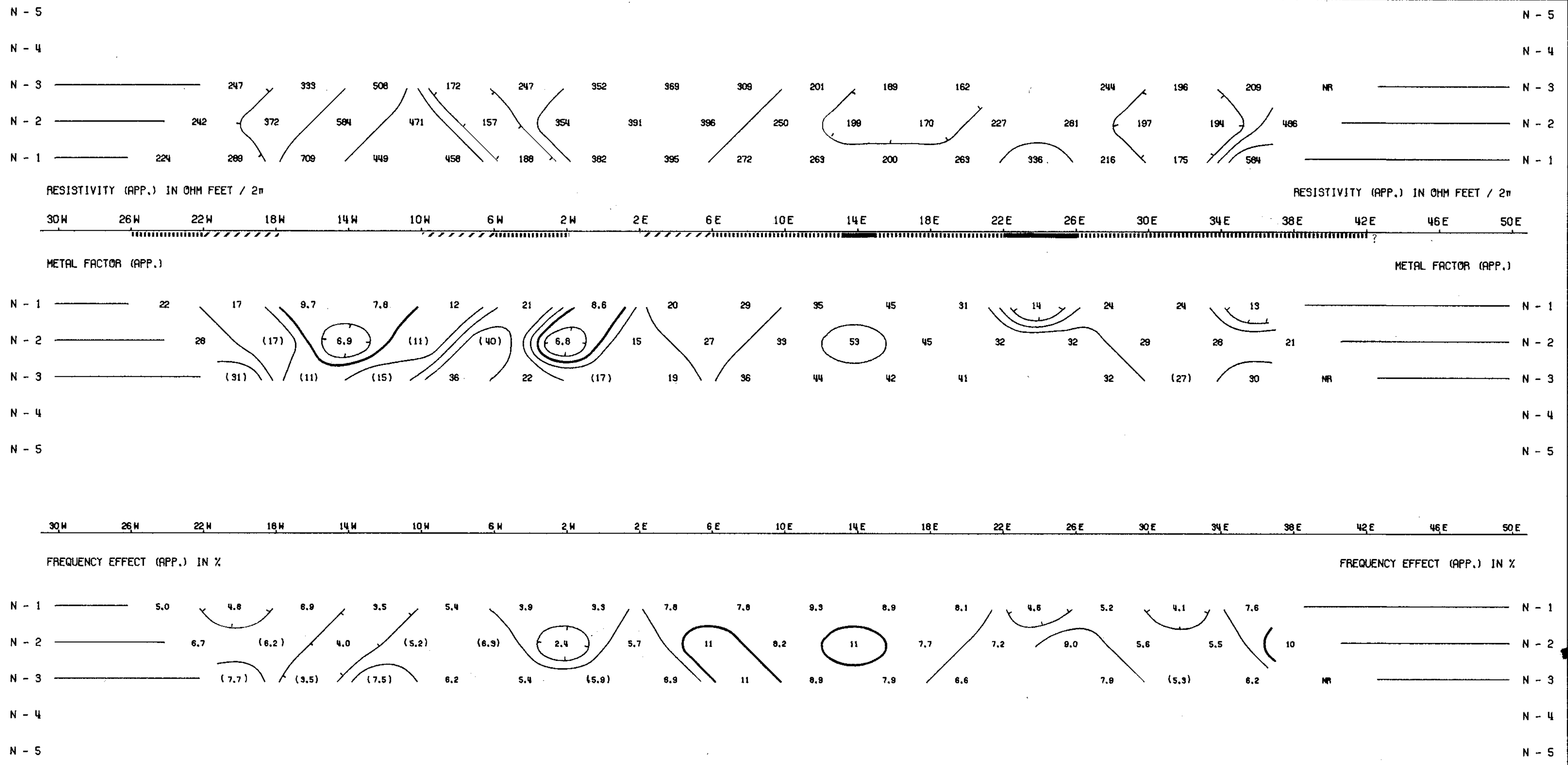


FIG. 3



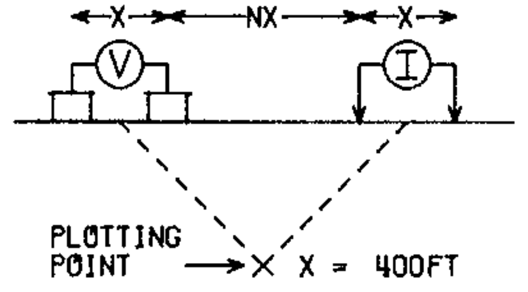
DWG. NO.- I.P.- 6085-1

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA

LINE NO.- 1000N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1973

APPROVED:

DATE: 9/10/73

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

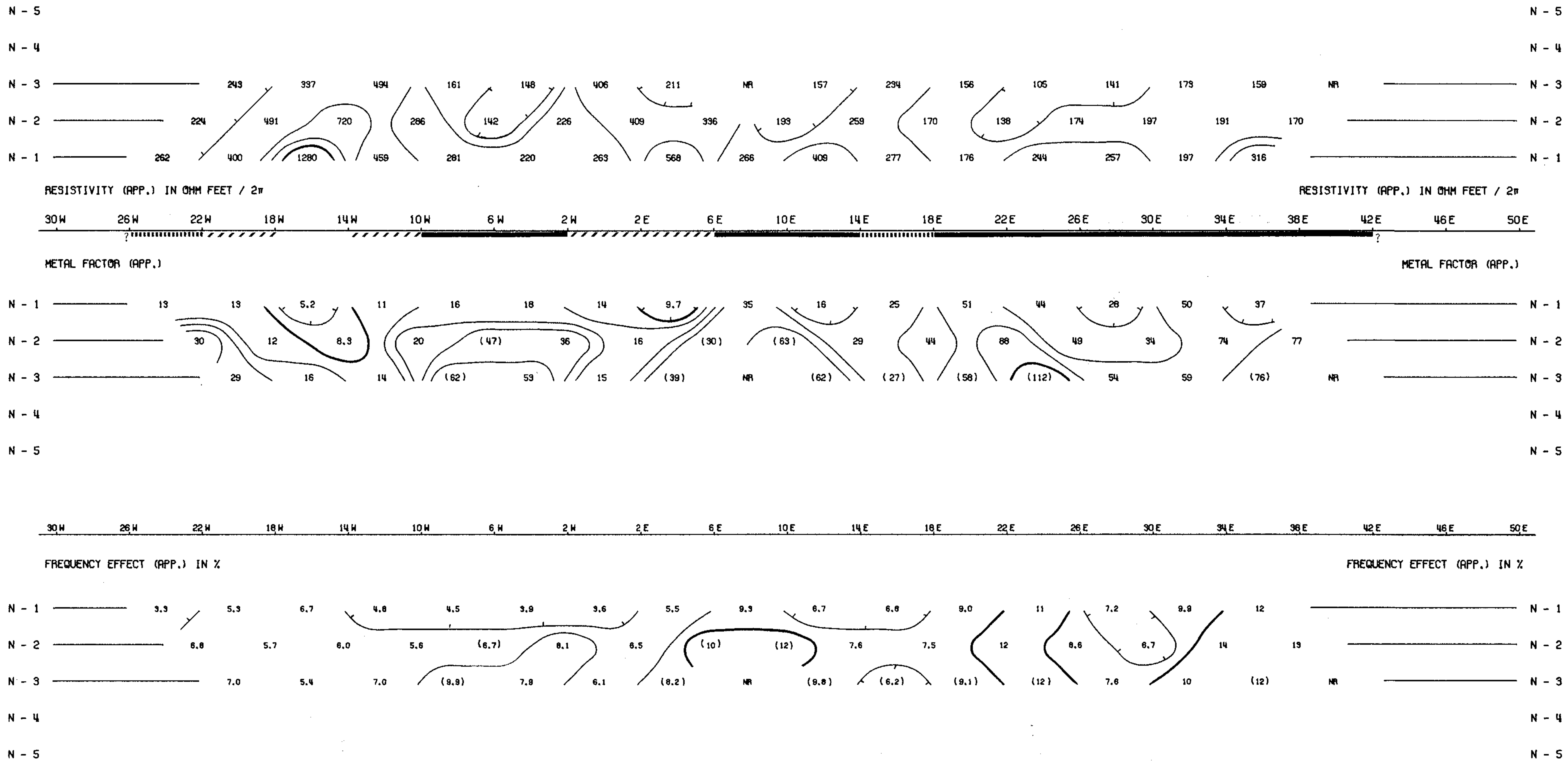
4742

Expiry Date: February 25, 1973

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



DWG. NO.- I.P.- 6085-2

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA

LINE NO.- 500N

ELECTRODE CONFIGURATION

PLOTTING POINT

X = 400FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1973

APPROVED: P. G. Hallof

DATE: 9/10/73

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

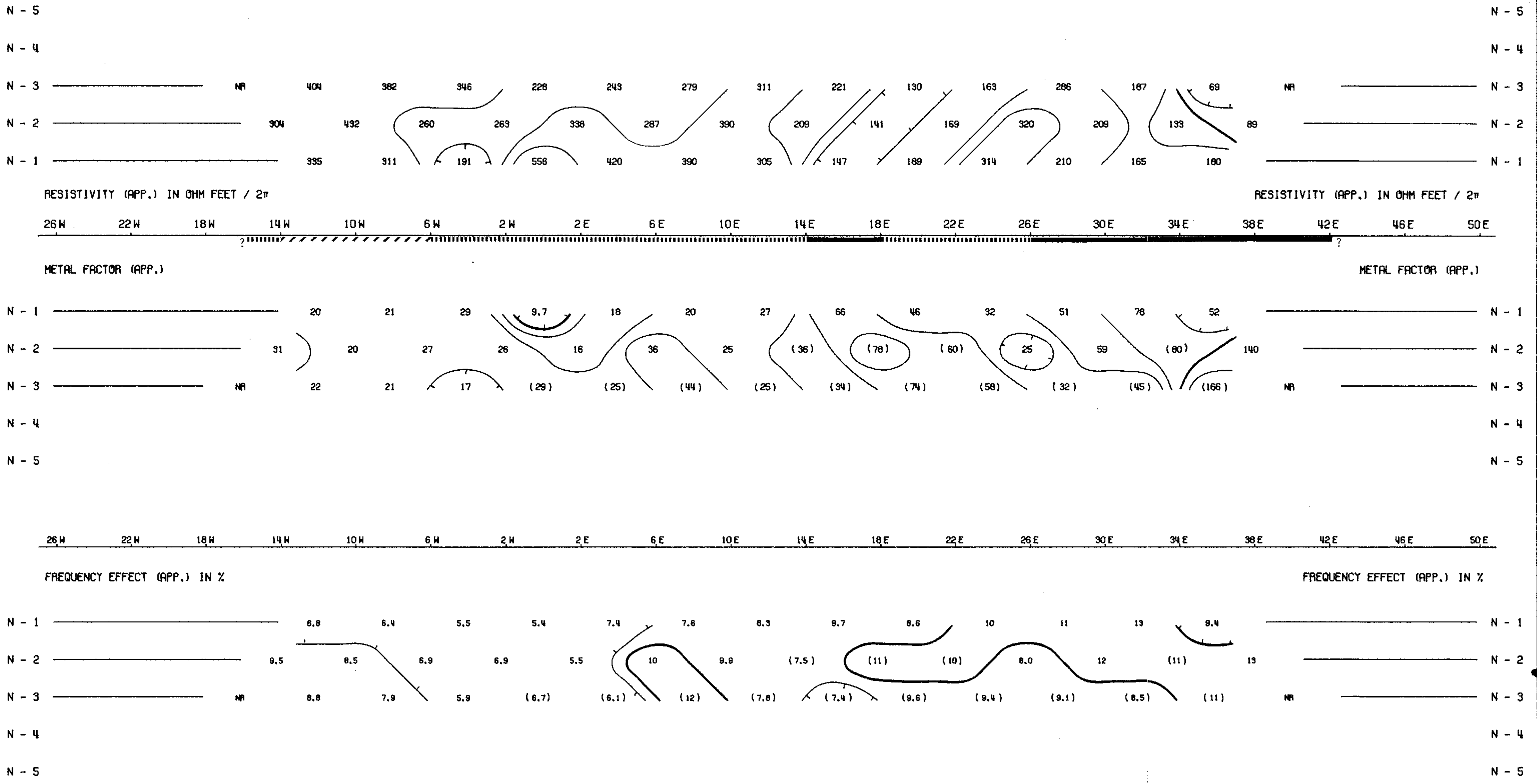
4742

Expiry Date: February 25, 1974

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.-6085-3

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA

LINE NO.- 0

ELECTRODE CONFIGURATION
X — NX — X
V I
PLOTTING POINT → X   X = 400FT

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1973

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

APPROVED: [signature]

DATE: 9/10/73

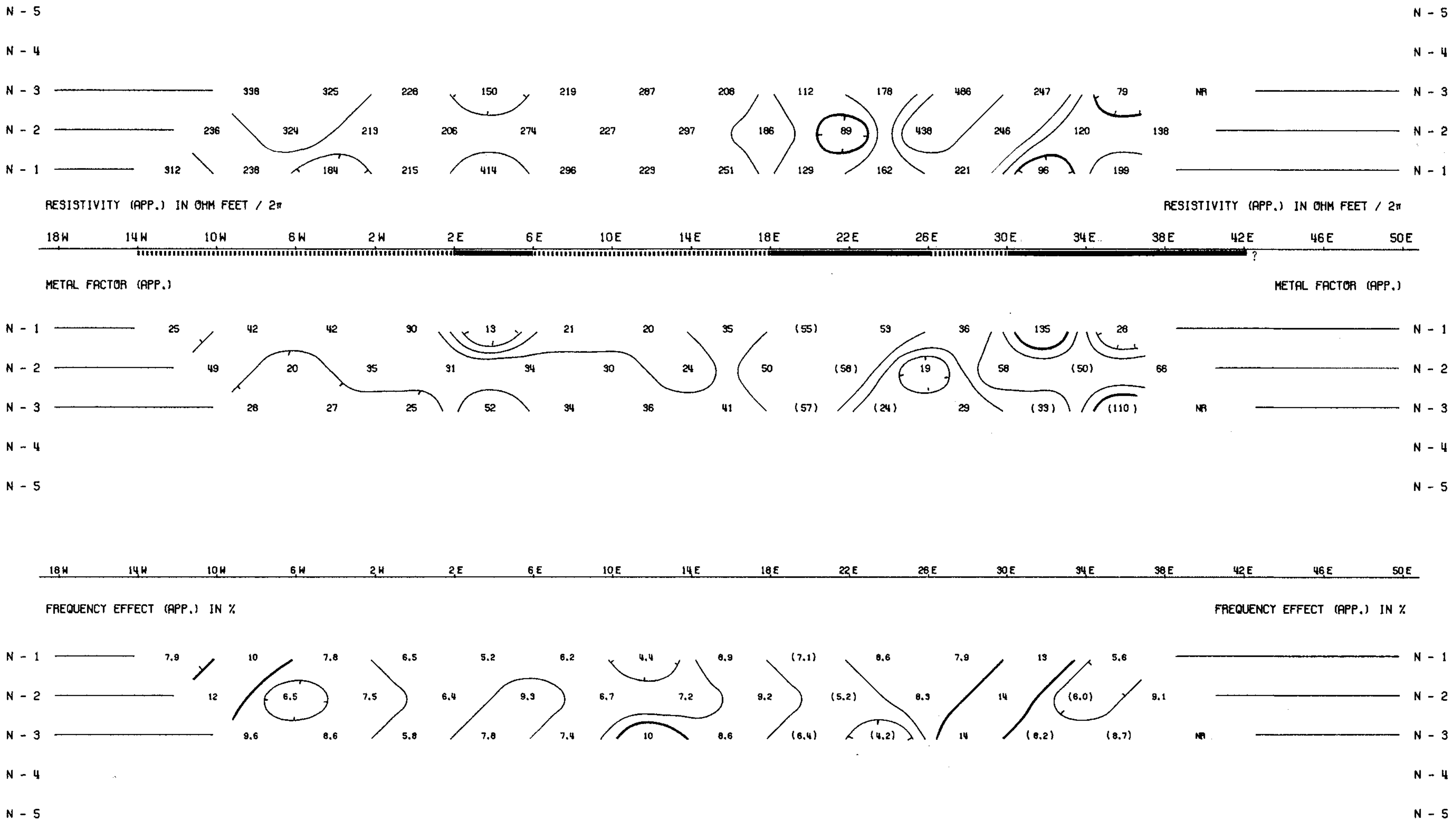
Expiry Date: February 25, 1974

4742

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



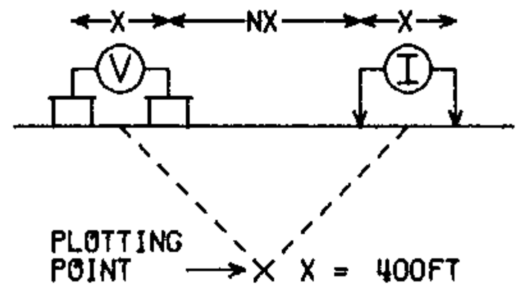
DWG. NO.- I.P.-6085-4

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA

LINE NO.- 500S

ELECTRODE CONFIGURATION



SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1973

APPROVED:

DATE: 9/10/73

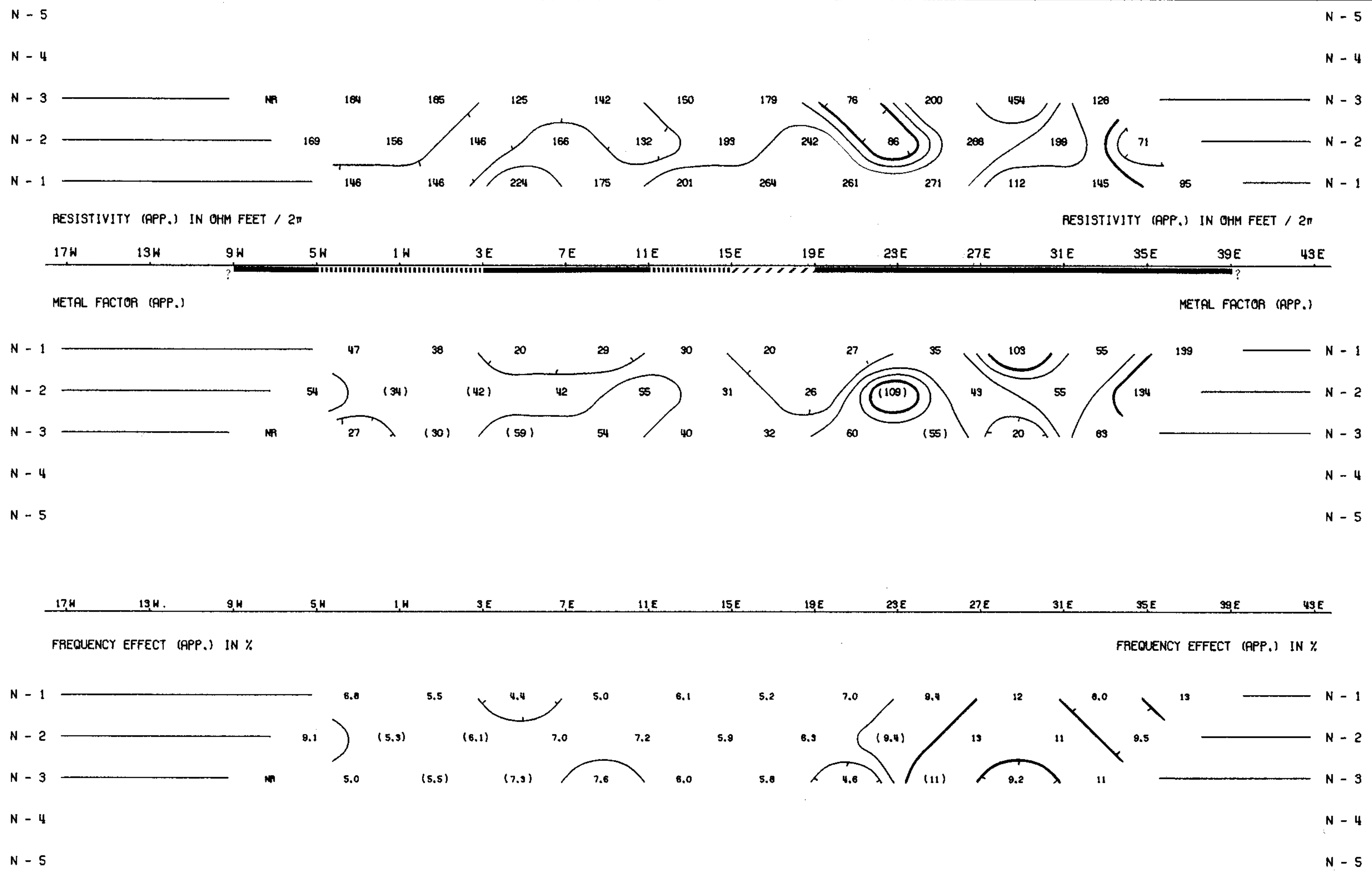
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1,-1.5-2,-3,-5,-7.5-10

4742

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



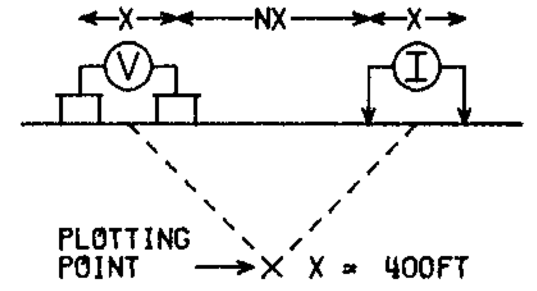
DWG. NO.- I.P.-6085-5

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA

LINE NO.- 1000S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1973

APPROVED: R.G. Hallof

DATE: 9/10/73

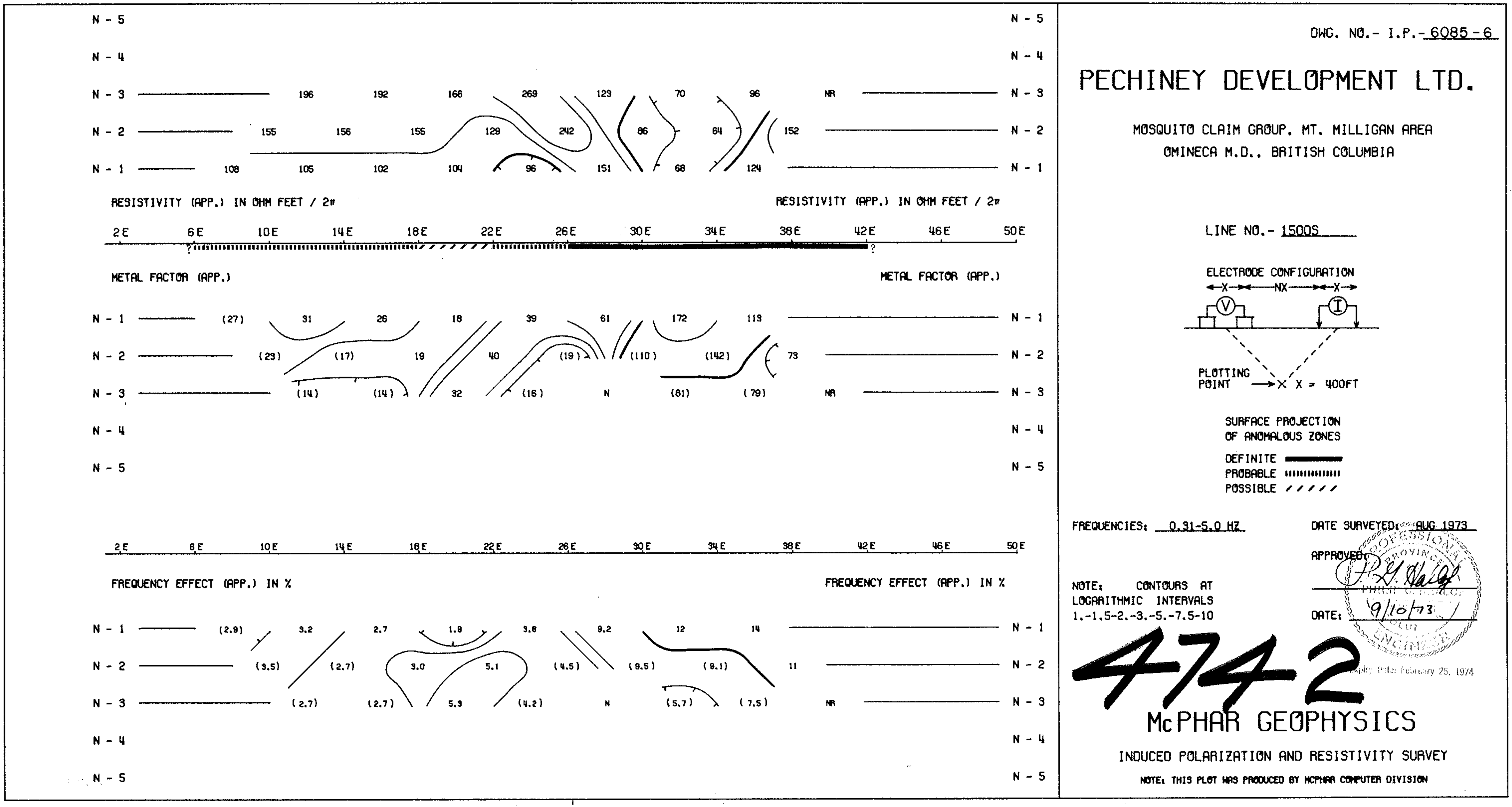
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

4742

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION


DWG. NO.- I.P.-6085-6
PECHINEY DEVELOPMENT LTD.
MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA
OMINECA M.D., BRITISH COLUMBIA
LINE NO.- 1500S
ELECTRODE CONFIGURATION
PLOTTING POINT
X = 400FT
SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE
FREQUENCIES: 0.31-5.0 HZ
DATE SURVEYED: AUG 1973
APPROVED:
DATE: 9/10/73
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1,-1.5-2,-3,-5,-7.5-10
4742
McPHAR GEOPHYSICS
INDUCED POLARIZATION AND RESISTIVITY SURVEY
NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION
RESISTIVITY (APP.) IN OHM FEET / 2π
METAL FACTOR (APP.)
FREQUENCY EFFECT (APP.) IN %
2E 6E 10E 14E 18E 22E 26E 30E 34E 38E 42E 46E 50E
N - 1
N - 2
N - 3
N - 4
N - 5

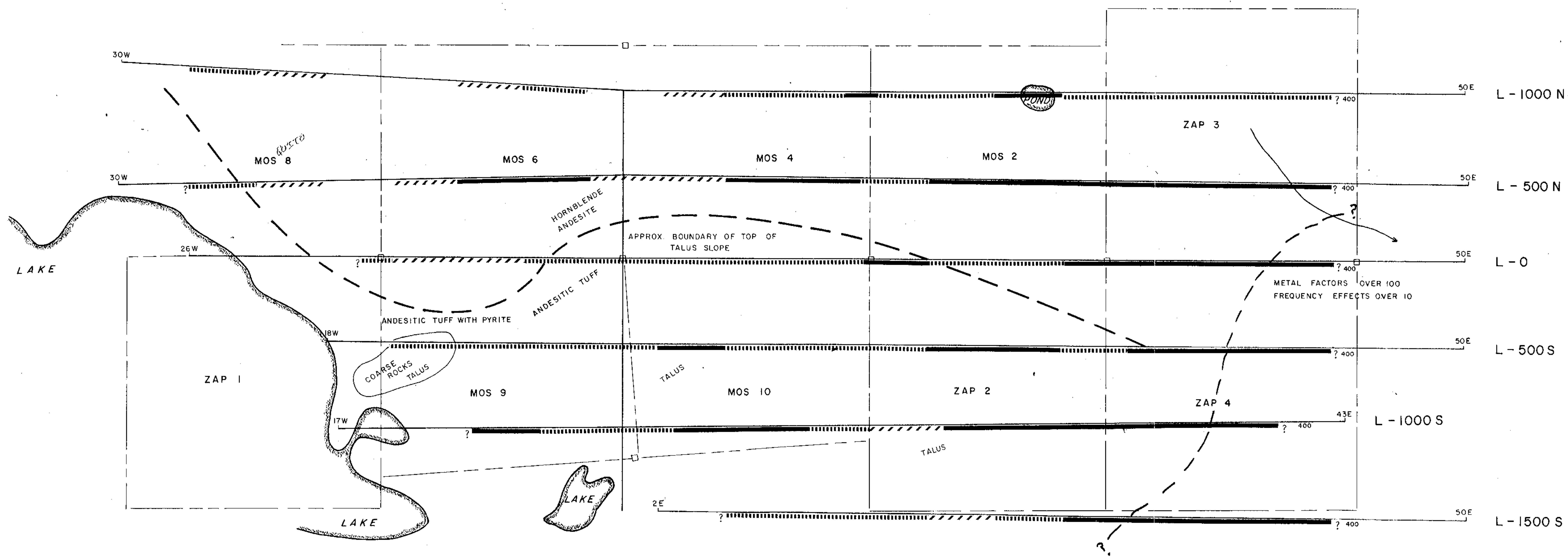
DWG. IPP-3594

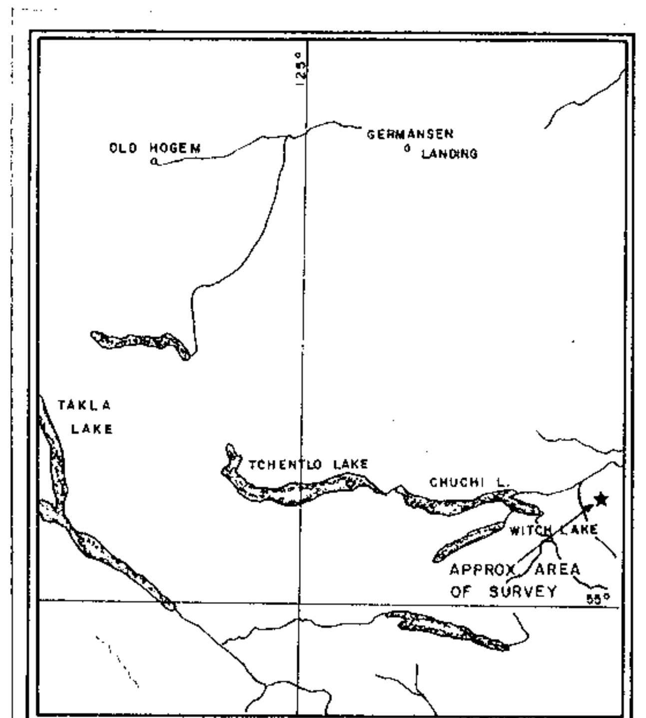
McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4742 M.P. #2





NOTE TO ACCOMPANY GEOPHYSICAL REPORT FOR PECHINEY DEVELOPMENT LTD., MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA, OMINECA M.D., B.C. BY P.G. HALLOF (P. ENG.) AND M.A. GOUDIE GEOLOGIST.

DATED – SEPT. 10, 1973

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used.

PECHINEY DEVELOPMENT LTD.

MOSQUITO CLAIM GROUP, MT. MILLIGAN AREA

OMINECA M.D., BRITISH COLUMBIA

SCALE

ONE INCH EQUALS FOUR HUNDRED FEET

4742 M2