3544

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REPORT ON THE RECONNAISSANCE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE CAVONA GRID AND TOP GRID, BABINE LAKE AREA, OMINECA MINING DIVISION, B.C. FOR NITTETSU MINING COMPANY LIMITED

BY

MARION A. GOUDIE, B.Sc.

AND

PHILIP G. HALLOF, Ph.D.

NAME AND LOCATION OF PROPERTY

CAVONA GRID AND TOP GRID, BABINE LAKE AREA, B.C.

OMINECA MINING DIVISION, B.C. 54°N, 126°W - NE

DATE STARTED: AUGUST 8, 1971

DATE FINISHED: AUGUST 22, 1971

TABLE OF CONTENTS

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

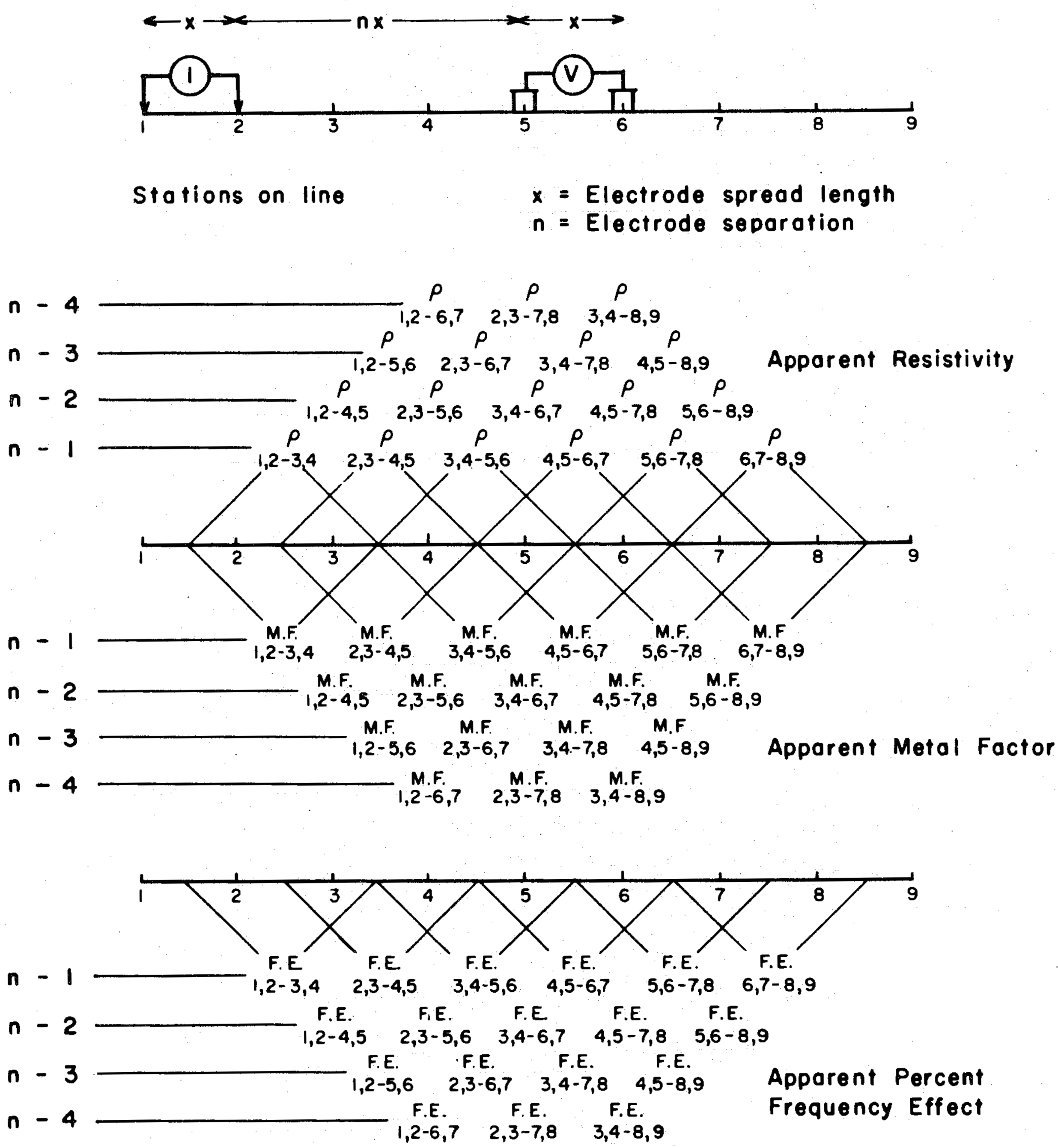

Fig. A

McPHAR GEOPHYSICS LIMITED

REPORT ON THE RECONNAISSANCE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE CAVONA GRID AND TOP GRID BABINE LAKE AREA, OMINECA MINING DIVISION, B.C. FOR NITTETSU MINING COMPANY LIMITED

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1. INTRODUCTION

At the request of the company, a Reconnaissance Induced Polarization and Resistivity survey has been completed on the Cavona Grid and part of the Top Grid, Babine Lake Area in the Omineca Mining Division, British Columbia, for Nittetsu Mining Company Limited. The Cavona and Top claims are situated in the northeast quadrant of the 1° quadrilateral whose southeast corner is at 54°N latitude and 126°W longitude.

There is no outcropping rock in the grid area, but the country rock is believed to be andesite.

The IP survey was carried out to locate any sources of metallic mineralization which might be of economic interest. The work was completed in August, 1971, using a McPhar P660 high power variable frequency IP unit over the following claims :

Cavona	1, 2, 3, 7, 8, 10, 21, 23, 25, 27, 29.
Top	96, 97, 98, 99, 100, 102, 104, 106, 126, 127, 147.

These claims are assumed to be owned or held under option by Nittetsu Mining Company Limited.

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.
Recon. Claim 1	400 feet	IP 5853-1
Recon. Road 1	400 feet	IP 5853-2
Recon. Claim 2	400 feet	IP 5853-3
Recon. Road 2	400 feet	IP 5853-4
Recon. Claim 3	400 feet	IP 5853-5
Recon. Road 3	200 feet	IP 5853-6

Also enclosed with this report is Dwg. I.P.P. 4822, a plan map of the Cavona and Top Grids 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.

3. DISCUSSION OF RESULTS

This reconnaissance IP survey was on the first separation only, except on Reconnaissance Road 3, where n = 1,2,3, were read.

Reconnaissance Claim 1

An anomaly from 22S to 32S is possible.

A probable anomaly extends from 8S to 4N with weaker extensions to 14S and 12N.

Reconnaissance Road 1

An incomplete, probable anomaly extends from south of 45E to 105E.

Reconnaissance Claim 2

No anomalies were present.

Reconnaissance Road 2

The line is anomalous from 6N to 52N and the anomaly is incomplete to both south and north. The resistivities are low as are the frequency effects. The significance of the anomalous effects would be more readily apparent with readings for n = 2, 3 and 4.

Reconnaissance Claim 3

A definite to possible anomaly extends from 60W to 72W. The anomaly probably reflects a mineralised source, resulting from increased frequency effects, with the resistivity decreasing from the west.

Two further anomalies, a probable to definite anomaly from 40W to 48W and a definite anomaly from 4W, where it is incomplete, to 34W, may be resistivity lows. No background frequency effects were obtained for comparison. However, part of the definite anomaly is better defined at 10W where Reconnaissance Road 3 crosses.

Reconnaissance Road 3

The resistivities are very low and a very slight increase in frequency effect produces a large metal factor anomaly. This effect is sometimes found in clays. The line is anomalous from 502NW to 532NW, where the anomaly is incomplete. The definite portion from 514NW to 518NW confirms the definite anomaly at this point on Reconnaissance Claim 3. There is a small increase in frequency effect from 512NW to 518NW; the source of the anomaly appears to be 200' in depth.

4. CONCLUSIONS AND RECOMMENDATIONS

The IP reconnaissance survey has located two areas where a more detailed survey would appear to be warranted and a third area which could be investigated further.

The first area of interest is in the vicinity of Cavona Claim 23, where probable to possible anomalies were located on two lines.

The second area is along Reconnaissance Road 2 and west from this road, north and south of Reconnaissance Claim 3, where this survey indicated the possibility of mineralization.

It would be advantageous to determine the source of the definite anomalies where Reconnaissance Claim 3 crosses Reconnaissance Road 3. This could be done by drilling a hole to cross beneath 515NW on Reconnaissance Road 3 at a depth of 200'.

McPHAR GEOPHYSICS LIMITED

Marion A. Goudie,
Geologist.

Philip G. Hallof,
Geophysicist.

Dated: November 1, 1971

ASSESSMENT DETAILS

PROPERTY: Cavona and Top Grid		MINING DIVISION: Omineca
SPONSOR: Nittetsu Mining Company Limited		PROVINCE: British Columbia
LOCATION: Babine Lake Area		
TYPE OF SURVEY: Induced Polarization		
OPERATING MAN DAYS:	24	DATE STARTED: August 8, 1971
EQUIVALENT 8 HR. MAN DAYS:	36	DATE FINISHED: August 22, 1971
CONSULTING MAN DAYS:	3	NUMBER OF STATIONS: 100
DRAUGHTING MAN DAYS:	5	NUMBER OF READINGS: 333
TOTAL MAN DAYS:	44	MILES OF LINE SURVEYED: 6.4

CONSULTANTS:

Marion A. Goudie, 739 Military Trail West Hill, Ontario
Philip G. Hallof, 11 Barnwood Court, Don Mills, Ontario.

FIELD TECHNICIANS:

M. McDonald, 6135 Bow Crescent, N.W. Calgary, Alberta.
D. Adams 3127 W. 8th Avenue, Vancouver 8, B.C.
Plus 3 Extra Labourers:
M. England, General Delivery, Burns Lake, B.C.
W. Schlogl, 2129 Skeena Street, Vancouver 12, B.C.
T. McDonald, 6135 Bow Crescent, N.W. Calgary, Alberta.

DRAUGHTSMEN:

V. Young, 703 Cortez Avenue, Bay Ridges, Ontario.
B. Marr, 19 Kenewen Court, Toronto 16, Ontario.
N. Lade, 299 Jasper Avenue, Oshawa, Ontario.

McPHAR GEOPHYSICS LIMITED

Marion A. Goudie,
Geologist.

Dated: November 1, 1971

STATEMENT OF COST

Nittetsu Mining Company Limited - Cavona Grid and Top Grid, Babine Lake Area
Omineca Mining Division, B.C. - IP Survey

Crew: 2 men M. McDonald & D. Adams

6 days	Operating	@ $250.00/day	$1,500.00
2-3/4 days	Standby	@ $100.00/day	275.00
			$1,775.00

Expenses - prorated 6/24½

Fares	23.27	
Vehicle Expense	269.12	
Meals & Accommodation	88.24	
Supplies	15.63	
Telephone & Telegraph	6.22	
	402.48	402.48
Extra Labour		695.66
		$ 2,873.14

McPHAR GEOPHYSICS LIMITED

Marion A. Goudie,
Geologist.

Dated: November 1, 1971

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 20 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 Nittetsu Mining Company Limited 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 1st day of November 1971

Marion A. Goudie

Marion A. Goudie, B.Sc.

CERTIFICATE

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

1. I am a geophysicist residing at 11 Barnwood Court, Don Mills, (Toronto) 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 Nittetsu Mining Company Limited 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.

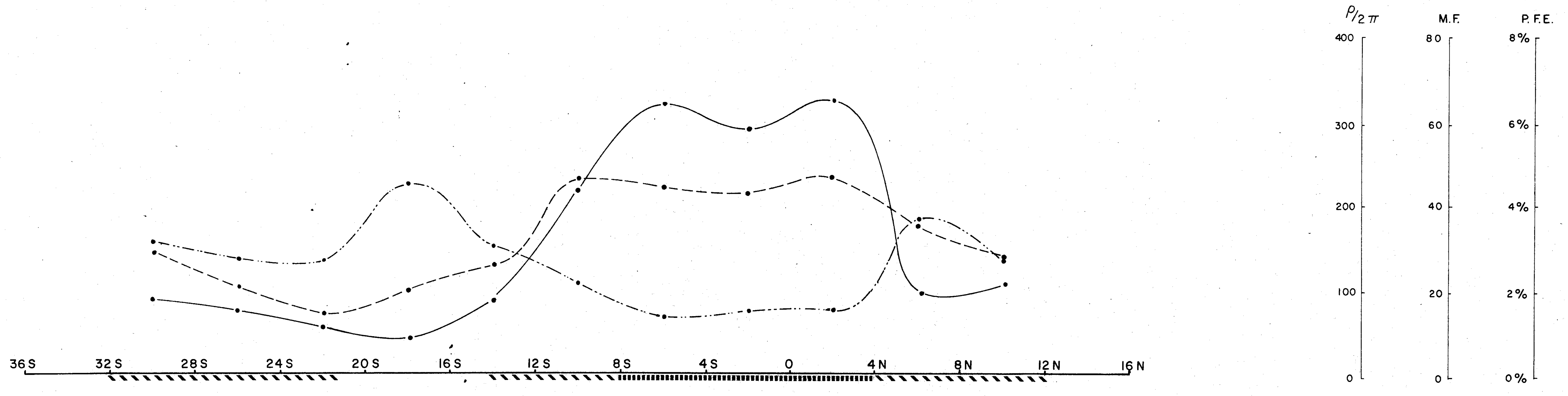
Dated at Toronto

This 1st day of November 1971

Philip G. Hallof, Ph.D.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

Expiry Date: February 28, 1972



DWG. NO. - I.P. - 5853 - 1

NITTETSU MINING CO. LTD.

CAVONA GRID, BABINE LAKE AREA
OMINECA M.D., B.C.

LINE NO. - RECON. CLAIM 1

ELECTRODE CONFIGURATION

PLOTTING POINT
X = 400'

SURFACE PROJECTION OF ANOMALOUS ZONES
- DEFINITE
- PROBABLE
- POSSIBLE

FREQUENCIES: 0.31-5.0HZ

NOTE: I.P. RESULTS SHOWN:
- M.F.
- F.E.
- $\rho_a/2\pi$

DATE SURVEYED: AUG. 1971

APPROVED:

DATE:

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P. G. HALLOF

Expiry Date: February 25, 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

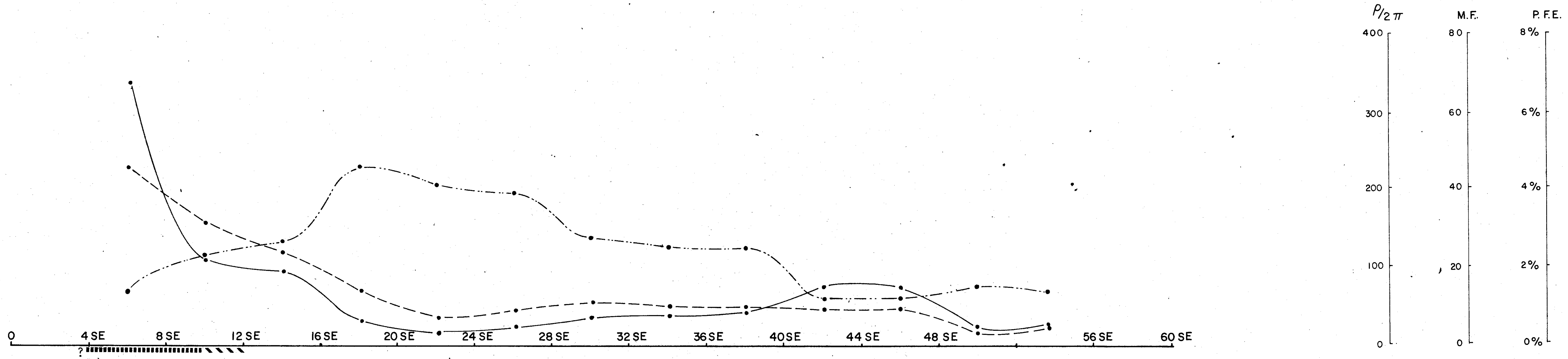
DWG. NO. - I.P. - 5853 - 2

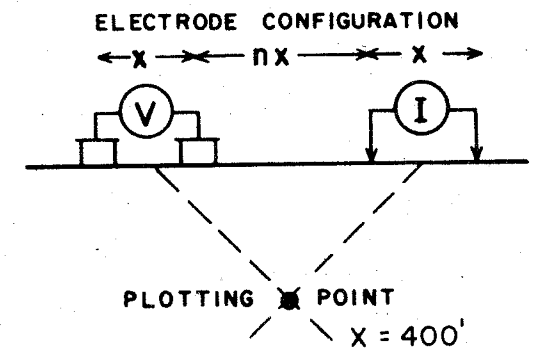
NITTETSU MINING CO. LTD.

CAVONA GRID, BABINE LAKE AREA

OMINECA M.D., B.C.

LINE NO. - RECON. ROAD I





SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0HZ

NOTE: I.P. RESULTS SHOWN:

M. F.

F.E.

$\rho_a/2\pi$

DATE SURVEYED: AUG. 1971

APPROVED:

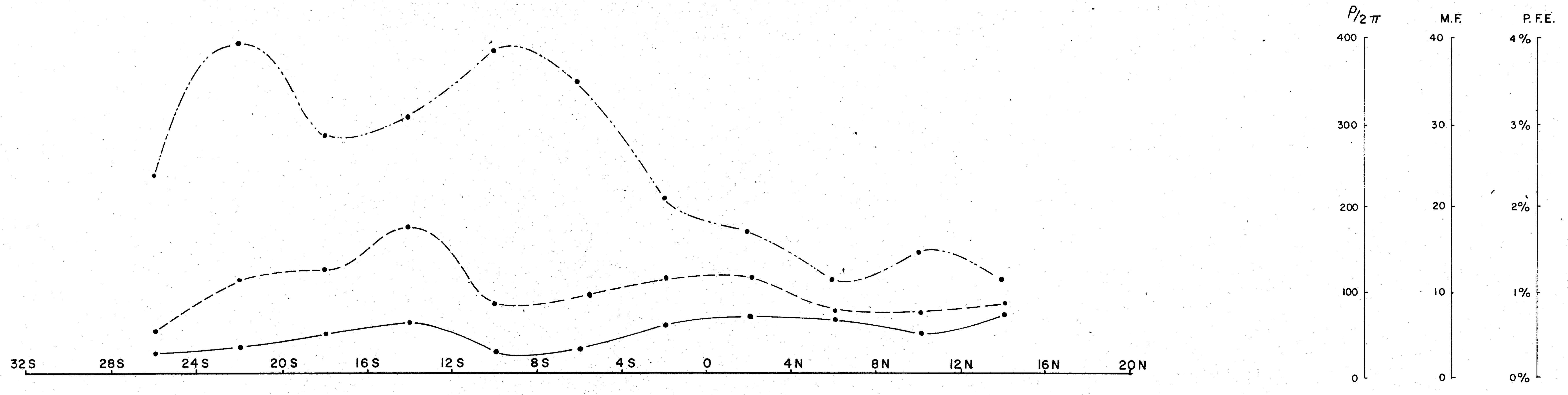
DATE:

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — P. G. HALLOF

Expiry Date: February 25, 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



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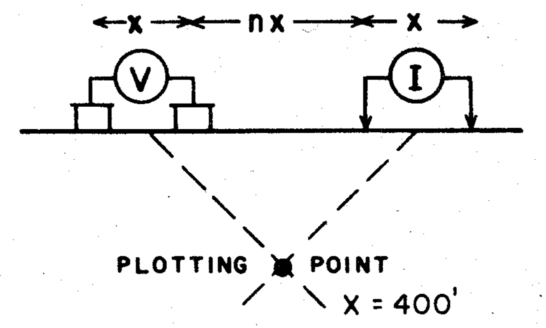
NITTETSU MINING CO. LTD.

CAVONA GRID, BABINE LAKE AREA

OMINECA M.D., B.C.

LINE NO. - RECON. CLAIM 2

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0HZ

DATE SURVEYED: AUG. 1971

APPROVED:

DATE:

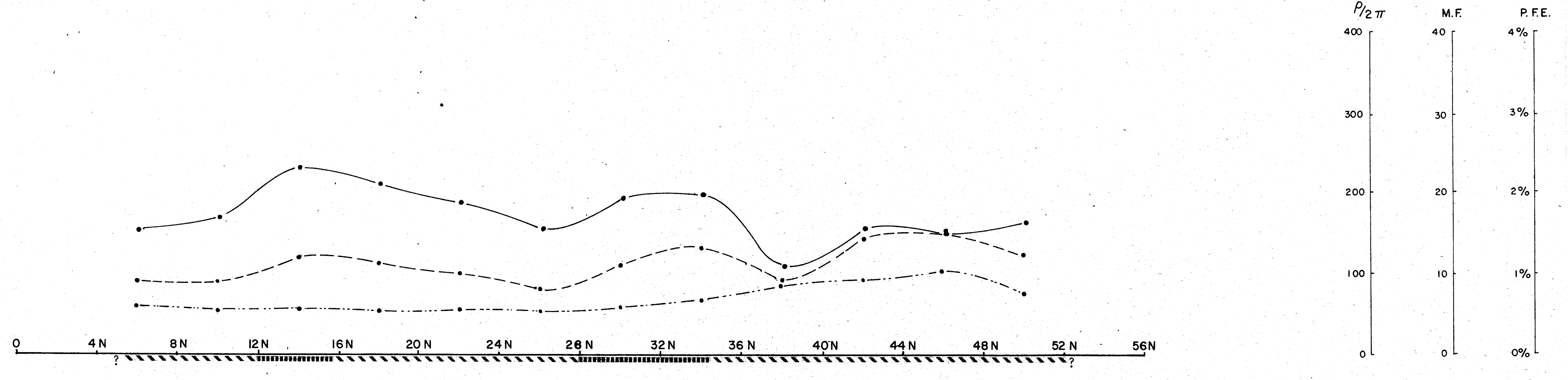
NOTE: I.P. RESULTS SHOWN:

M.F.
F.E.
$\rho_a/2\pi$

February 25, 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

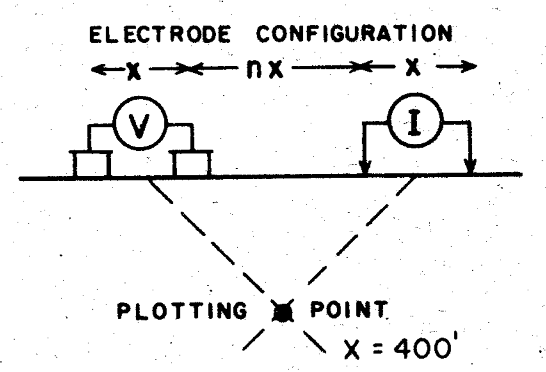


DWG. NO.- I.P.- 5853-4

NITTETSU MINING CO. LTD.

CAVONA GRID, BABINE LAKE AREA
OMINECA M.D., B.C.

LINE NO.- RECON. ROAD 2



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0HZ

DATE SURVEYED: AUG. 1971

APPROVED

DATE

NOTE: I.P. RESULTS SHOWN:
M.F.
F.E.
$\rho_a/2\pi$

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
PHILIP G. HALLOF

Expiry Date: February 25, 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

DWG. NO. - I.P. - 5853 - 5

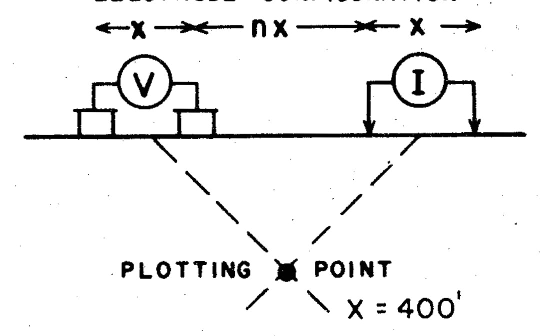
NITTETSU MINING CO. LTD.

TOP GRID, BABINE LAKE AREA

OMINECA M.D., B.C.

LINE NO. - RECON. CLAIM 3

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0HZ

DATE SURVEYED: AUG. 1971

NOTE: I.P. RESULTS SHOWN:

M.F.
F.E.
$\rho_a/2\pi$

APPROVED

DATE: 11/1/71

PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA

Expiry Date: February 25, 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

DWG. NO.- I.P.-5853-6

NITTETSU MINING CO. LTD.

TOP GRID, BABINE LAKE AREA
OMINECA M.D., B.C.

LINE NO.- RECON ROAD 3

ELECTRODE CONFIGURATION

X — NX — X

PLOTTING POINT → X X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE ▬▬▬
PROBABLE ıııııııııı
POSSIBLE / / / / /

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: AUG 1971

APPROVED:

DATE:

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

PROFESSIONAL ENGINEER PHILIP G. HALLOF

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

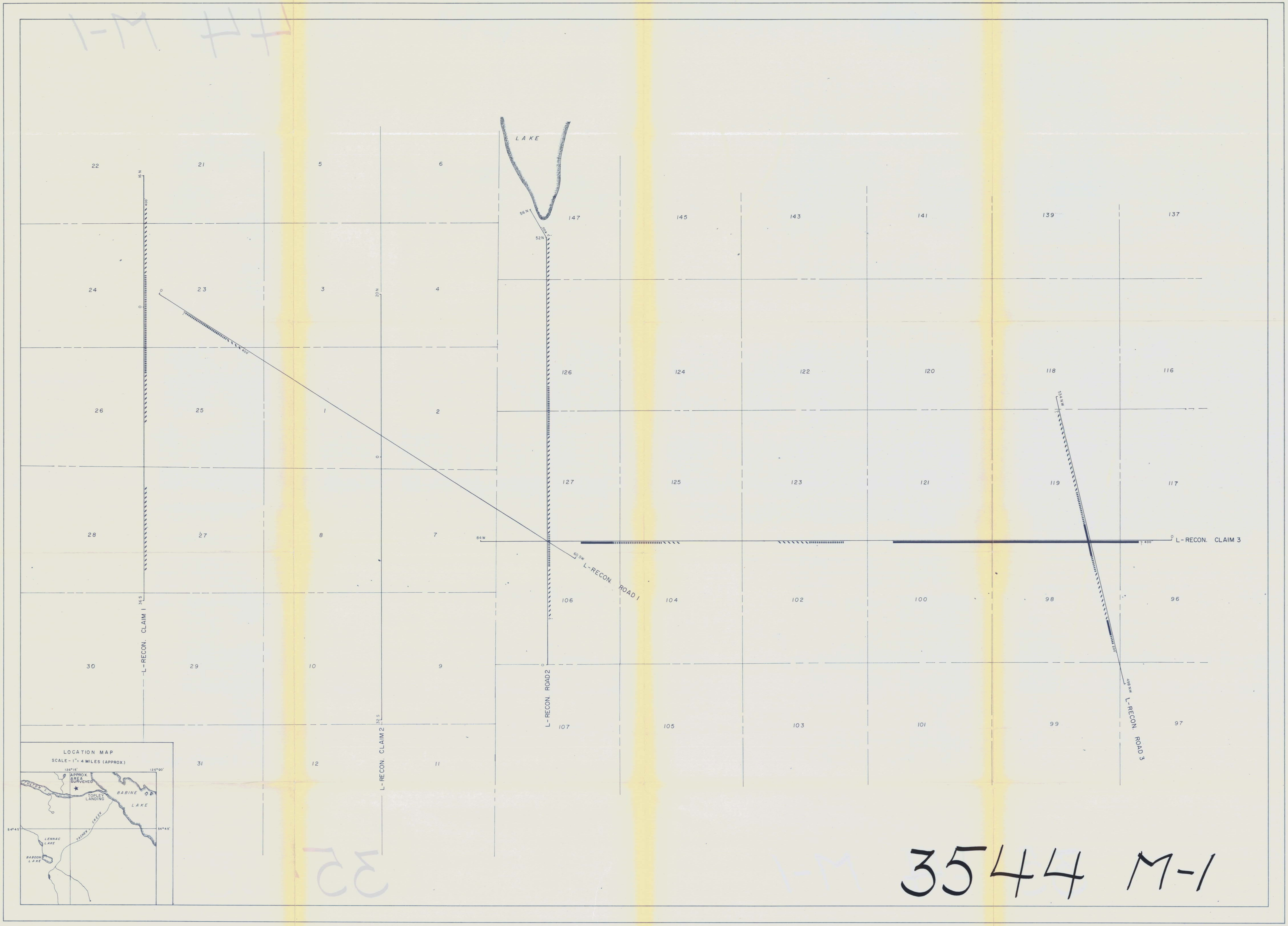
NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/65 COMPUTER AND A CALCOMP PLOTTER

DWG. I.P.P. - 4822

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3544 MAP #1

SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates electrode interval

NITTETSU MINING CO., LTD.

CAVONA & TOP GRIDS, BABINE LAKE AREA

OMINECA M. D., B. C.

SCALE

ONE INCH EQUALS FOUR HUNDRED FEET.

DRAWN: N.T.Y.
DATE: OCT. '71
APPROVED: Philip G. Hallof
DATE: 11/1/71

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
PHILIP G. HALLOF

Expiry Date: February 25, 1972

DWG. I.P.P. - 4822