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REPORT ON THE  
INDUCED POLARIZATION  
AND RESISTIVITY SURVEY  
ON THE <sup>93F/5E</sup>  
TETACHUCK PROPERTY  
TETACHUCK LAKE AREA  
OMINECA MINING DIVISION, B.C.  
FOR  
NORANDA EXPLORATION COMPANY, LIMITED

BY

DAVID K. FOUNTAIN, B.A.Sc., P.Eng.

NAME AND LOCATION OF PROPERTY:

TETACHUCK PROPERTY, TETACHUCK LAKE AREA, B.C.  
OMINECA MINING DIVISION, B.C.  $53^{\circ}24'N - 125^{\circ}40'W$

DATE STARTED: MAY 25, 1972

DATE FINISHED: JUNE 2, 1972

Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP \_\_\_\_\_

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# McPHAR GEOPHYSICS

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

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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 ( $\Delta V$ ) 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 ( $\Delta V$ ) the change in potential will be too small to be measurable. The symbol "TL" on the data plots indicates this situation.

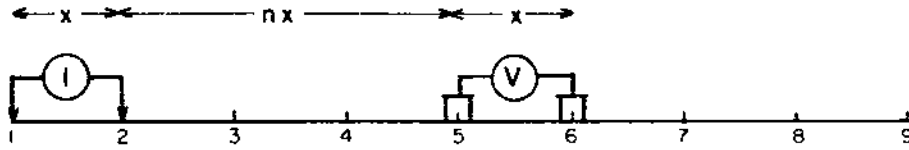
In some situations spurious noise, either man made or natural, will render it impossible to obtain a reading. The symbol "N" on the data plots indicates a station at which it is too noisy to record a reading. If a reading can be obtained, but for reasons of noise there is some doubt as to its accuracy,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



Stations on line

$x$  = Electrode spread length  
 $n$  = Electrode separation

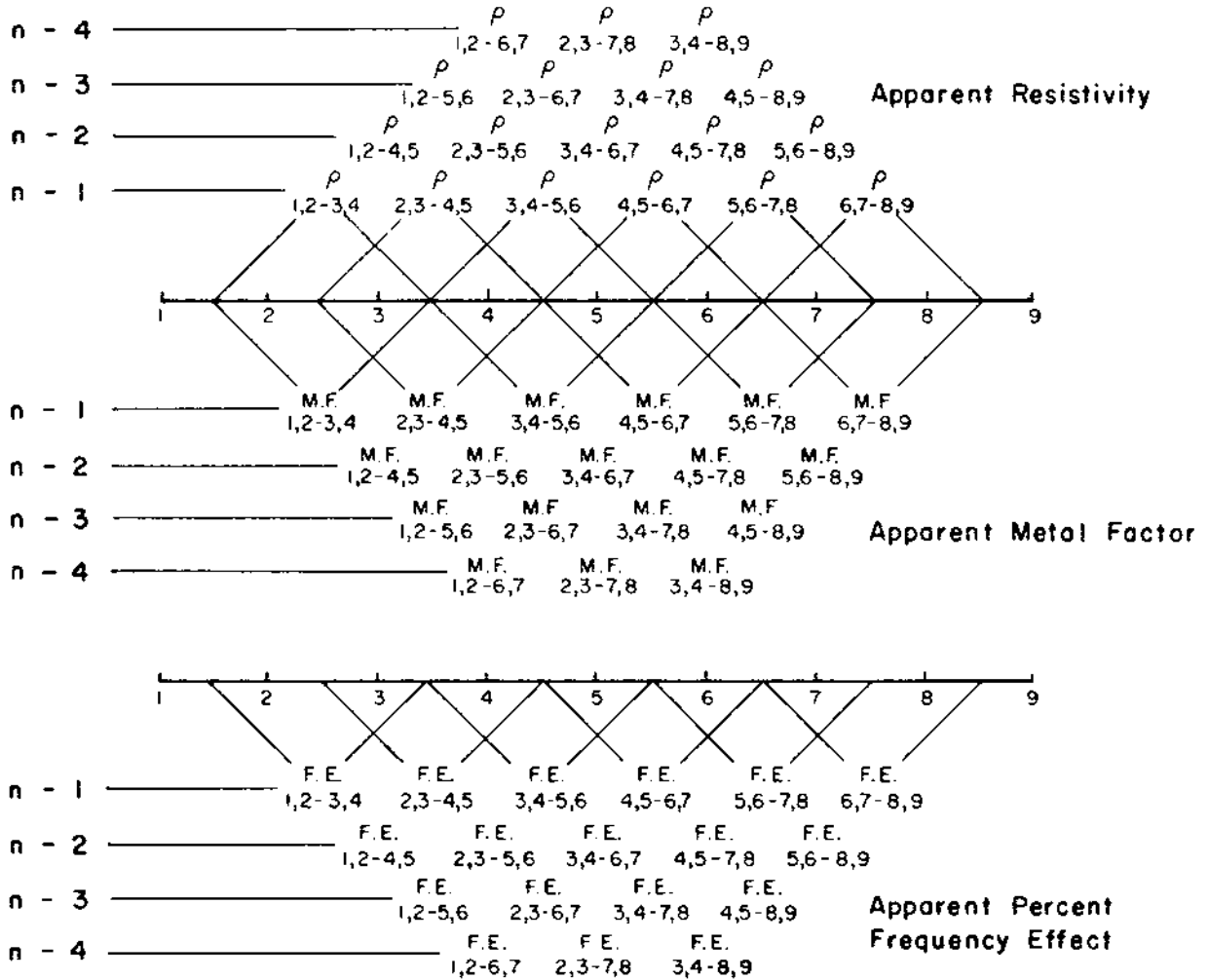


Fig. A

**McPHAR GEOPHYSICS LIMITED**

**REPORT ON THE  
INDUCED POLARIZATION  
AND RESISTIVITY SURVEY  
ON THE  
TETACHUCK PROPERTY  
TETACHUCK LAKE AREA  
OMINECA MINING DIVISION, B.C.  
FOR  
NORANDA EXPLORATION COMPANY, LIMITED**

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**1. INTRODUCTION**

**During May 1972, an Induced Polarization and Resistivity survey was carried out on the Tetachuck Property, of Noranda Exploration Company, Limited in the Tetachuck Lake Area, Omineca Mining Division, British Columbia. The property is located approximately 115 air miles southeast of Smithers, B.C. at approximately  $53^{\circ}24'N$  latitude and  $125^{\circ}40'W$  longitude. Access to the property is by helicopter from helicopter bases at Smithers, Houston, or Burns Lake to a helicopter pad situated within the claim group. Elevations on the property range from 3,200 to 4,379 feet above sea level.**

**The geophysical survey work discussed in this report was carried out on the following claims of the Tetachuck Property.**

<u>Claim</u>	<u>Record Number</u>	<u>Mining Division</u>
Gedot #22	89587	Omineca
Gedot #24	89589	Omineca
Gedot #33	89598	Omineca
Gedot #34	89599	Omineca
Gedot #35	89600	Omineca
Gedot #36	89601	Omineca
Gedot #37	89602	Omineca
Gedot #38	89603	Omineca
Gedot #9 Fr	89614	Omineca
Gedot #10 Fr	89615	Omineca
Gedot #14 Fr	89618	Omineca
Gedot #15 Fr	89619	Omineca
Gedot #16 Fr	89620	Omineca
Gedot #18 Fr	98933	Omineca
Gedot #19 Fr	98934	Omineca
Gedot #43	98927	Omineca
Gedot #45	98929	Omineca
Gedot #47	98931	Omineca
Gedot #21 Fr	200300M (Tag Number)	Omineca

The claims are registered in the name of Noranda Exploration Company, Limited (No Personal Liability).

The southeastern portion of the Tetachuck property is assumed to be underlain by a coarse-grained, relatively unaltered, granodiorite; however, outcrop is limited to the main creek crossing the property in a southeast direction. To the north and west, andesitic and basaltic rocks outcrop along the heights of land. The IP survey was carried out in order to outline zones of metallic mineralization of possible economic significance which may occur on the property. Disseminated pyrite, chalcopyrite and

molybdenite mineralization has been located in the Tetachuck Lake area. This mineralization is usually associated with granodiorite intruding volcanics.

The IP survey was carried out employing a McPhar variable frequency Induced Polarization unit utilizing the dipole-dipole electrode configuration and 400 foot dipoles. Two dipole separations ( $n = 1, 2$ ) were recorded and the frequencies employed were 0.31 Hz and 5.0 Hz.

## 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.

<u>Line</u>	<u>Electrode Intervals</u>	<u>Dwg. No.</u>
12400N	400 feet	IP 5960-1
11600N	400 feet	IP 5960-2
10800N	400 feet	IP 5960-3
10400N	400 feet	IP 5960-4
10000N	400 feet	IP 5960-5
9600N	400 feet	IP 5960-6
9200N	400 feet	IP 5960-7
8400N	400 feet	IP 5960-8

Also enclosed with this report is Dwg. I.P.P. 3534, a plan map of the area surveyed 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 location of survey lines relative to claim boundaries, the name and relative positions of the claims and the geologic data indicated on the maps and discussed in the report, are based upon information supplied by Noranda Exploration Company, Limited.

### 3. DISCUSSION OF RESULTS

Eight lines were surveyed with the IP method on a reconnaissance basis reading only two dipole separations ( $n = 1, 2$ ).

The IP survey results are characterized by relatively high background

apparent resistivity response and moderate to low background IP response. No significantly large zones of anomalous IP response were indicated although areas of above background response do occur.

Values of apparent resistivity are generally lower at the western extent of the lines suggesting either an increase in depth of surficial cover or a change in rock type. Areas of above background IP response have been located in the western portion of the grid.

#### 4. SUMMARY AND CONCLUSIONS

No significantly large zone of anomalous IP response was located by the IP survey results. Above background response is indicated in the western portion of the grid. Of interest is the response on Line 10800N from station 86E to the east. Extension of the survey coverage on this line to the west would be required to properly evaluate this response.

Further work in the form of diamond drilling or trenching in the areas of above background IP response would only be warranted if there were supporting geological and/or geochemical information and if weakly disseminated metallic mineralization could be of economic significance.

McPHAR GEOPHYSICS LIMITED

*David K. Fountain*  
David K. Fountain, P. Eng.  
Geophysicist



Dated: August 2, 1972

Expiry Date: April 25, 1973





INTERIM\* STATEMENT OF COST

Tetachuck Property.  
Tetachuck Lake Area

Crew: John Parker - Ed Novotny

4 days Operating	@ \$240.00/day	\$ 960.00
1 day Preparation )		
2 3/4 days Travel ) 4 1/2 days	@ \$100.00/day	450.00
3/4 day Standby )		
1/2 day Standby ) N.C.		
		<hr/> 1,410.00

Expenses received to date

Vehicle expense	292.00	
Meals	92.50	
Supplies	5.80	
	+ 10%	
	<hr/> 390.30	
	39.03	
		429.33
		<hr/> \$1,839.33

\* Note: This statement reflects at least 90% of the total cost; there may be a few minor charges not yet received by us and hence not included in the foregoing.

McPHAR GEOPHYSICS LIMITED

*David K. Fountain*  
 David K. Fountain, P. Eng.  
 Geophysicist D. K. FOUNTAIN  
 BRITISH COLUMBIA  
 ENGINEER

Dated: August 2, 1972

Expiry Date: April 25, 1973

CERTIFICATE

1. David Kirkman Fountain, of the City of Toronto, Province of Ontario, do certify that:

1. I am a geophysicist residing at 62 Patina Drive, Willowdale 428, Ontario.

2. I am a graduate of the University of Toronto with a Bachelor of Applied Science Degree in Engineering Physics (Geophysics).

3. I am a member of the Society of Exploration Geophysicists, the European Association of Exploration Geophysicists and the Canadian Institute of Mining and Metallurgy.

4. I am a Registered Professional Engineer in the Provinces of British Columbia, Manitoba and Ontario, a Registered Professional Geophysicist in the Province of Alberta and a Registered Professional Geologist in the State of California, and have been practising my profession for eleven years.

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

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

Dated at Toronto

This 2nd day of August, 1972

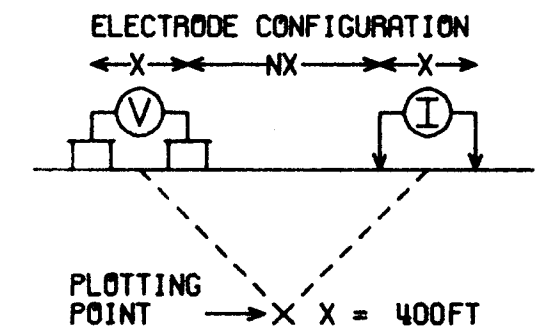
  
David Kirkman Fountain, P. Eng.

Expiry Date: April 25, 1973

**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
OMINECA M.D., B.C.

LINE NO.- 12400N



FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972

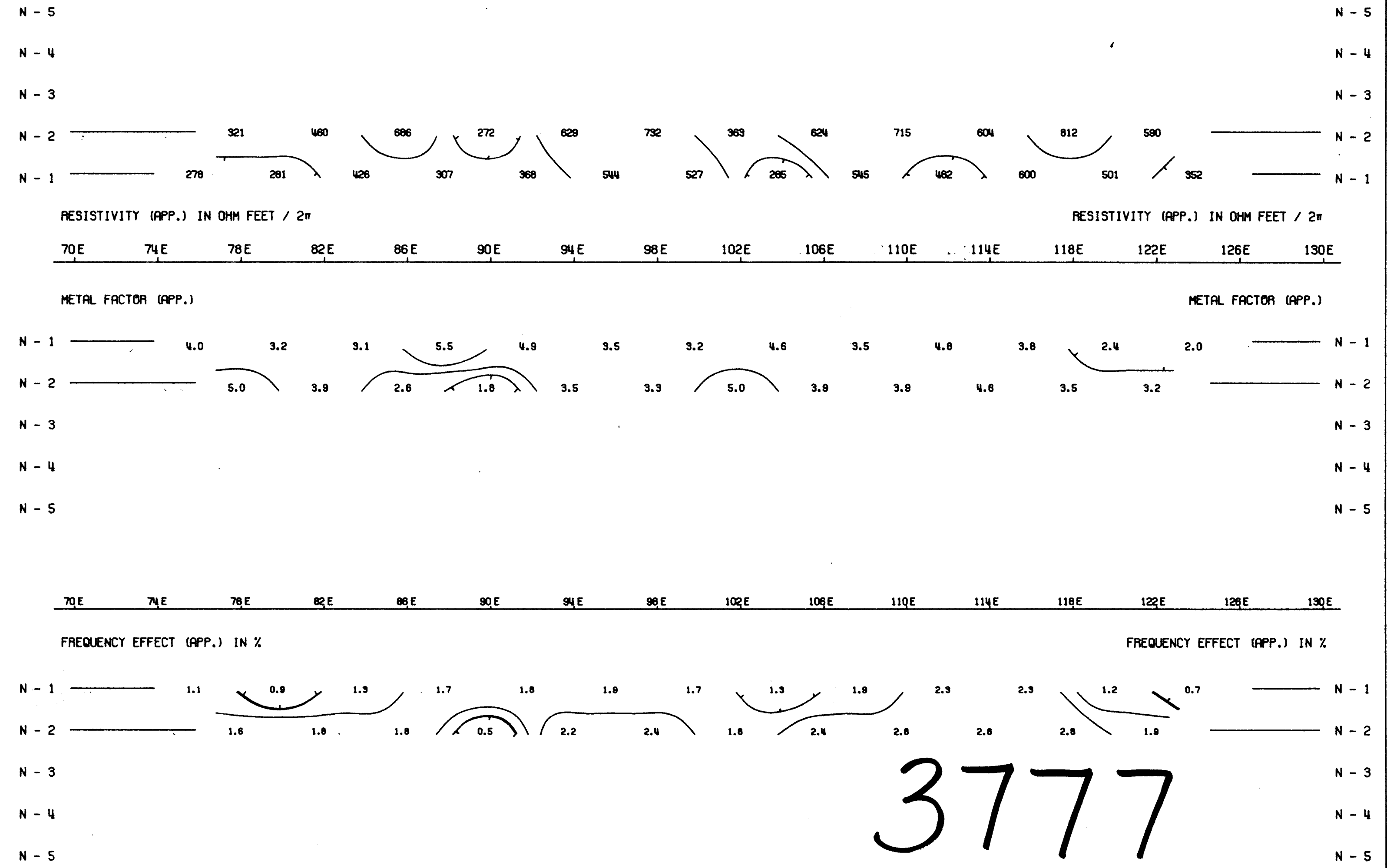
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PROFESSIONAL ENGINEER  
DATE: *[Signature]*  
Exp. Date: April 25, 1973

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

**McPHAR GEOPHYSICS**

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



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Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #2

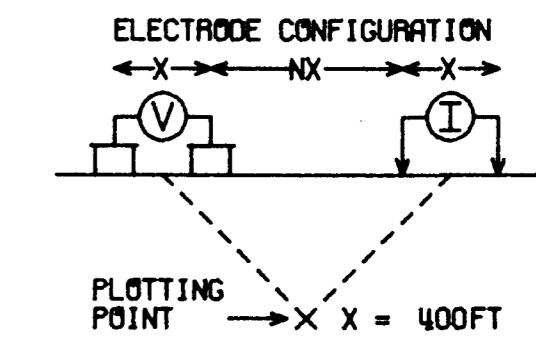




**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
QMINOCA M.D., B.C.

LINE NO. - 10400N

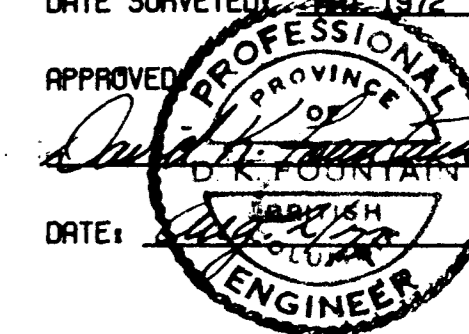


SURFACE PROJECTION  
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DEFINITE   
PROBABLE   
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972

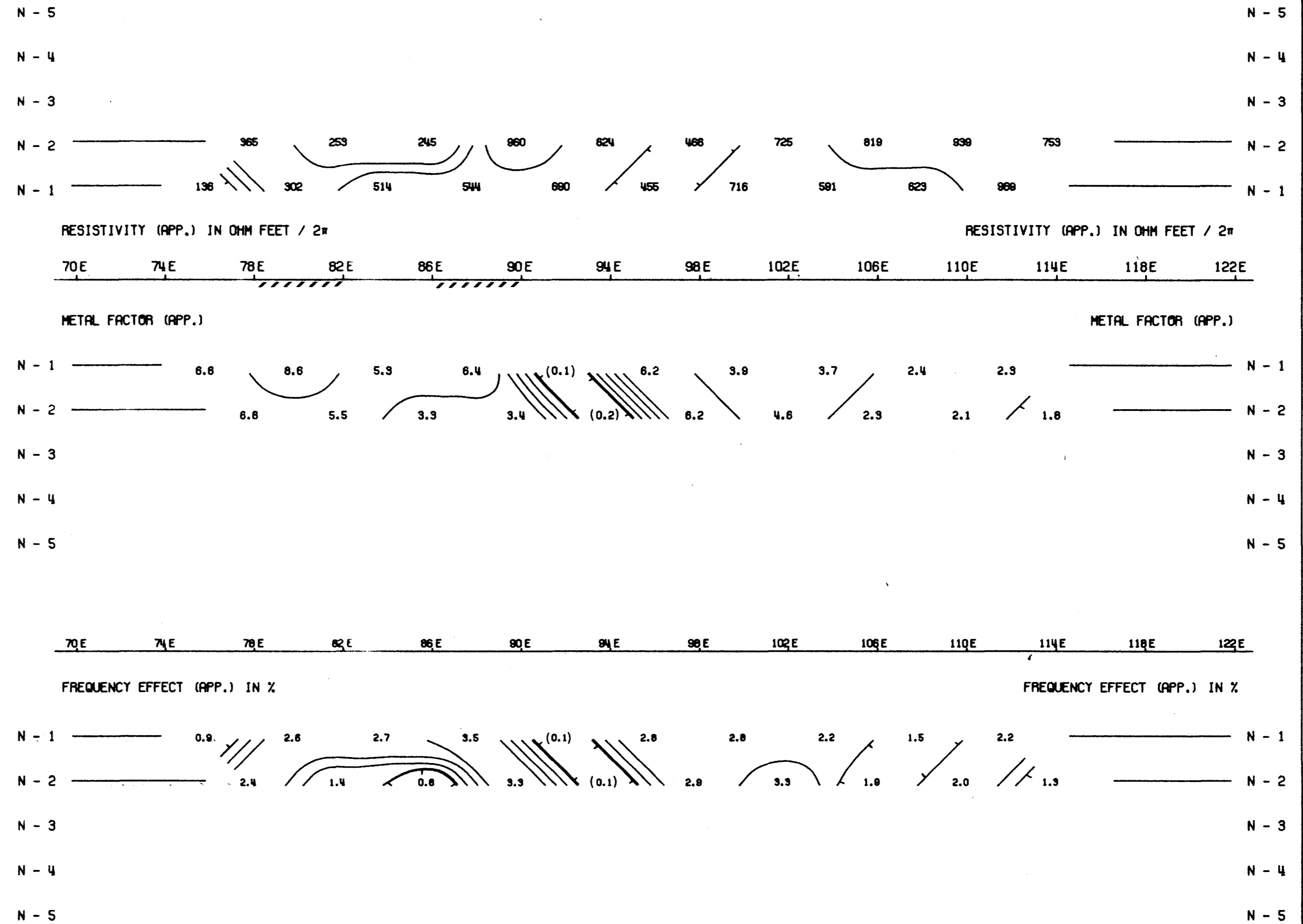
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**McPHAR GEOPHYSICS**

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION

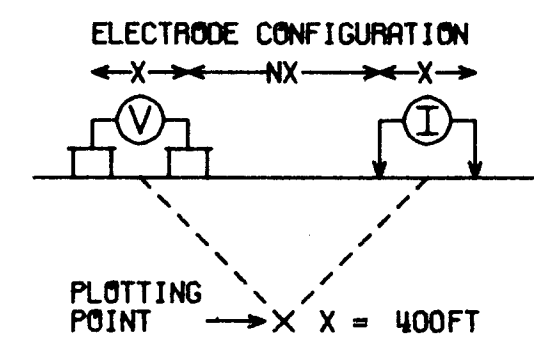


Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
No. 3777 MAP #5

**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
OMINECA M.D., B.C.

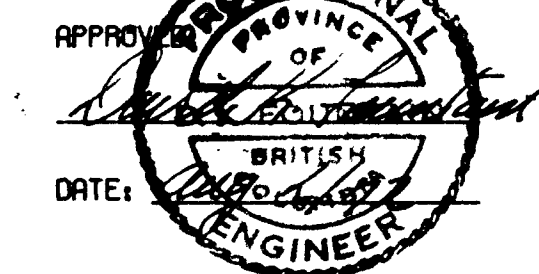
LINE NO. - 10000N



SURFACE PROJECTION  
OF ANOMALOUS ZONES  
DEFINITE —————  
PROBABLE |||  
POSSIBLE / / / /

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972



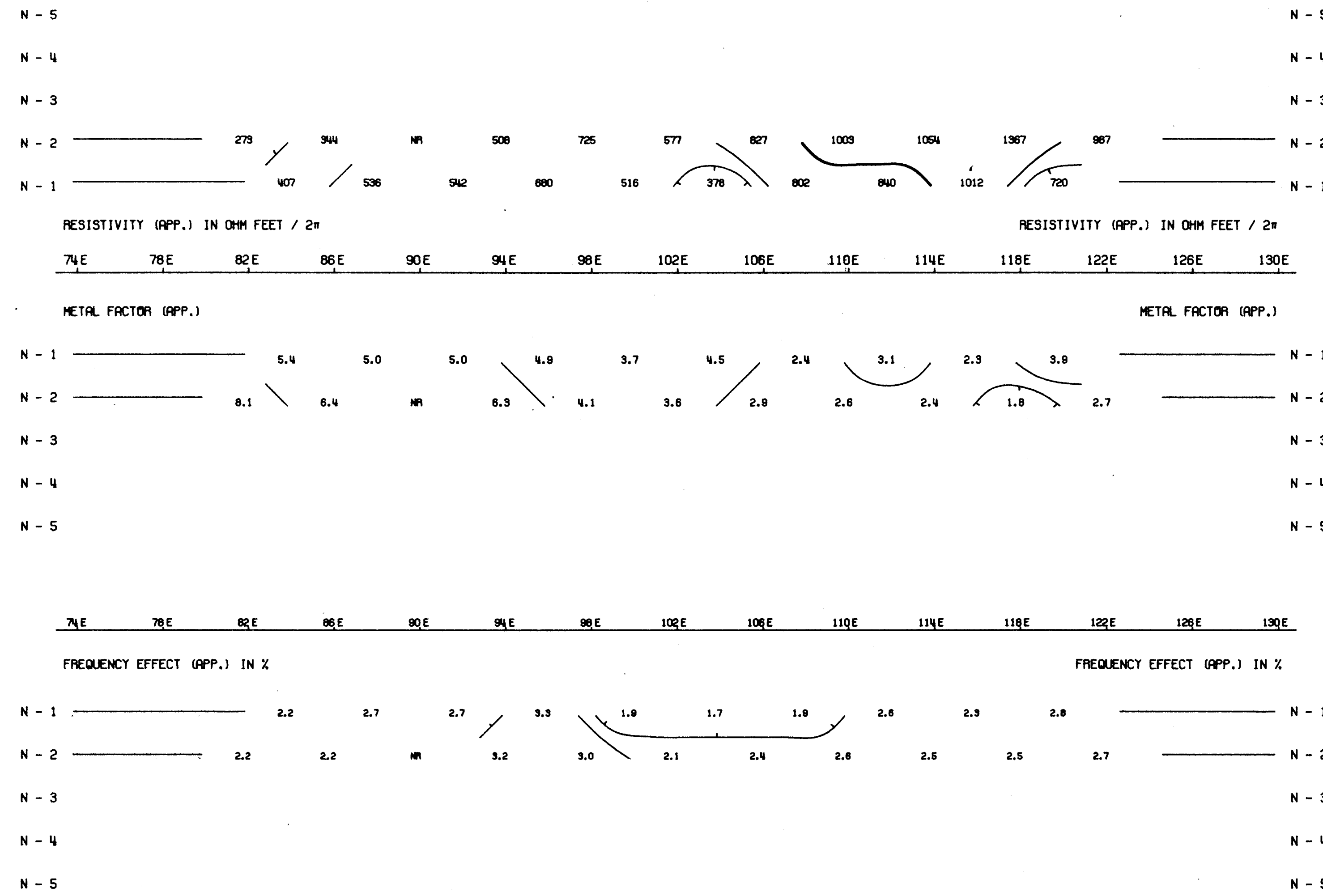
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Expiry Date: April 25, 1973

**McPHAR GEOPHYSICS**

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



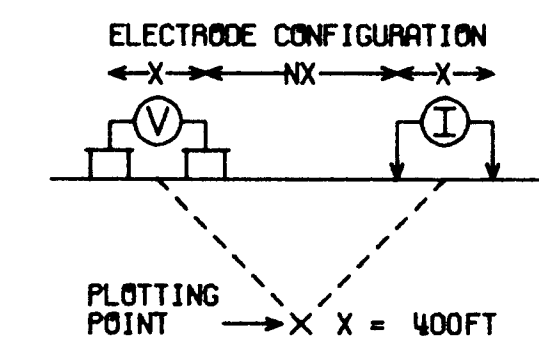
Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #6



**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
OMINECA M.D., B.C.

LINE NO. - 9600N

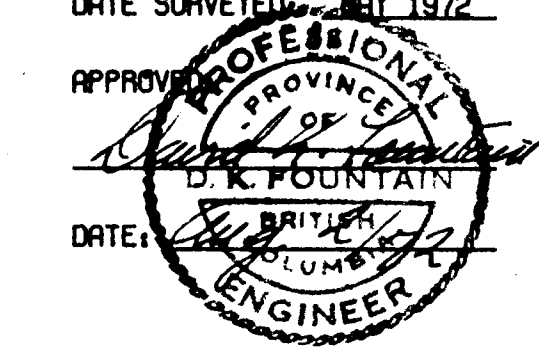


SURFACE PROJECTION  
OF ANOMALOUS ZONES  
DEFINITE —————  
PROBABLE |||  
POSSIBLE / / / / /

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972

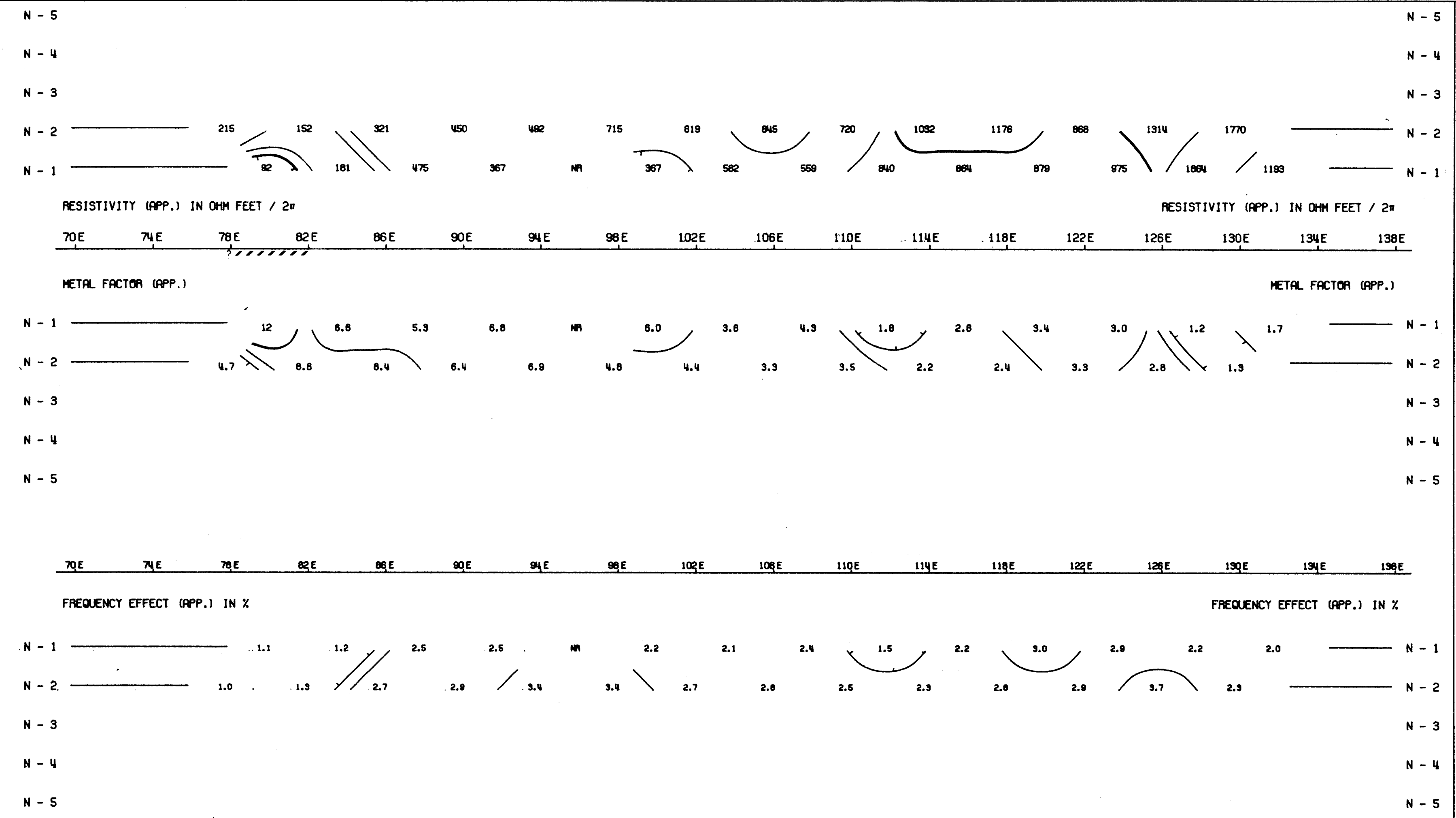
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**McPHAR GEOPHYSICS**

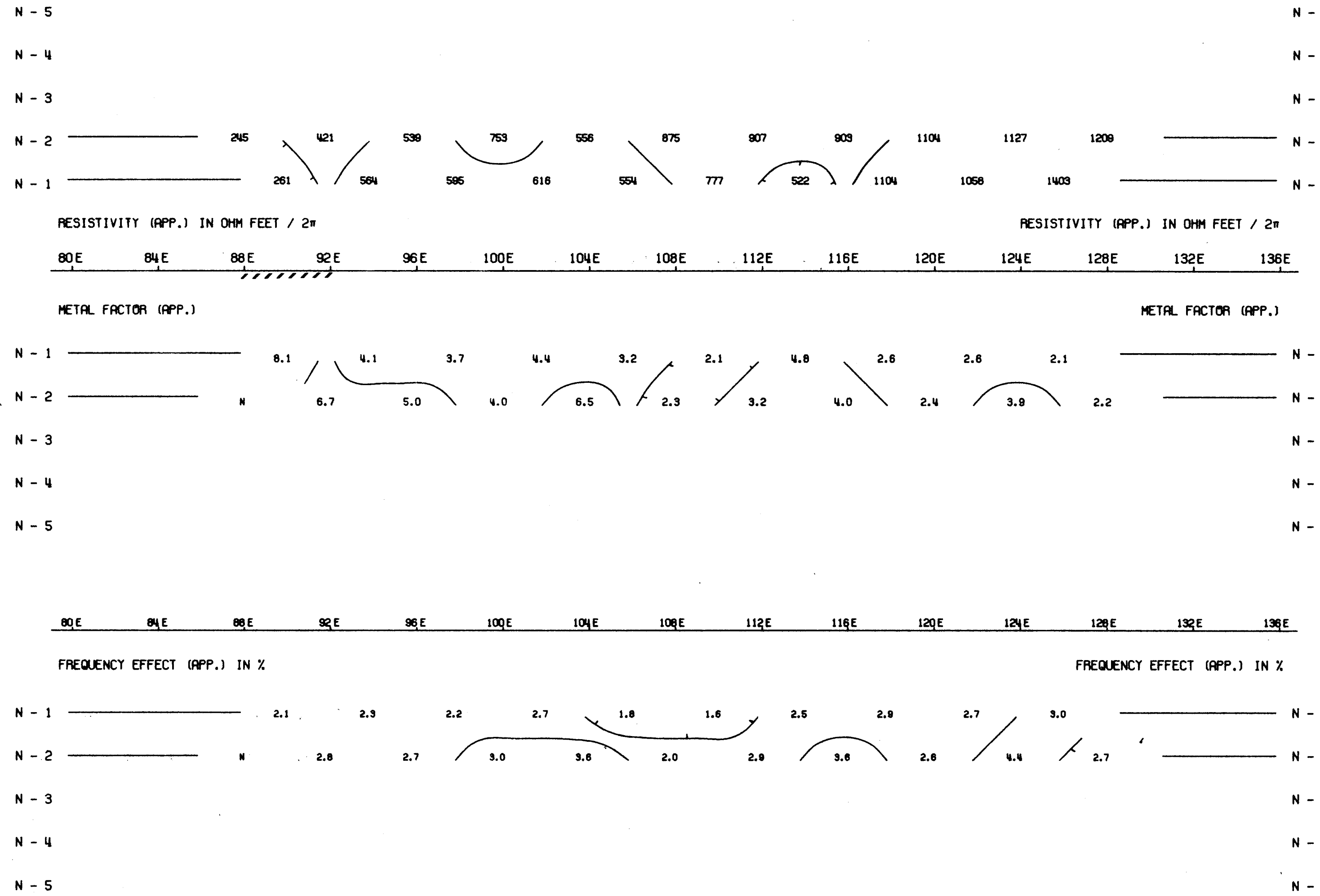
INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



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Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #7

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Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #8

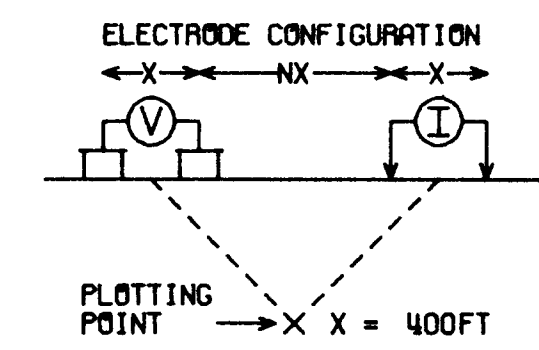


DWG. NO. - I.P. - 5960-7

**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
OMINECA M.D., B.C.

LINE NO. - 9200N



SURFACE PROJECTION  
OF ANOMALOUS ZONES  
DEFINITE —————  
PROBABLE |||||  
POSSIBLE / / / /

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972

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

APPROVED: *[Signature]*  
DATE: *[Signature]*  
PROFESSIONAL  
ENGINEER  
COLUMBIA

Survey Date: April 25, 1973

**McPHAR GEOPHYSICS**

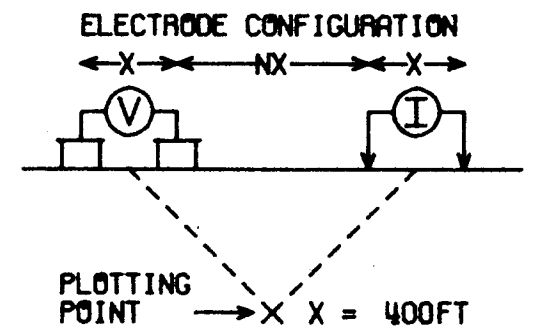
INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION

**NORANDA EXPLORATION  
COMPANY LIMITED**

TETACHUCK PROPERTY, TETACHUCK LAKE AREA,  
OMINECA M.D., B.C.

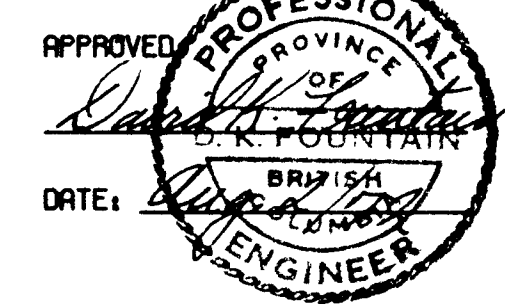
LINE NO. - 8400N



SURFACE PROJECTION  
OF ANOMALOUS ZONES  
DEFINITE **————**  
PROBABLE **|||||**  
POSSIBLE **////**

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAY 1972

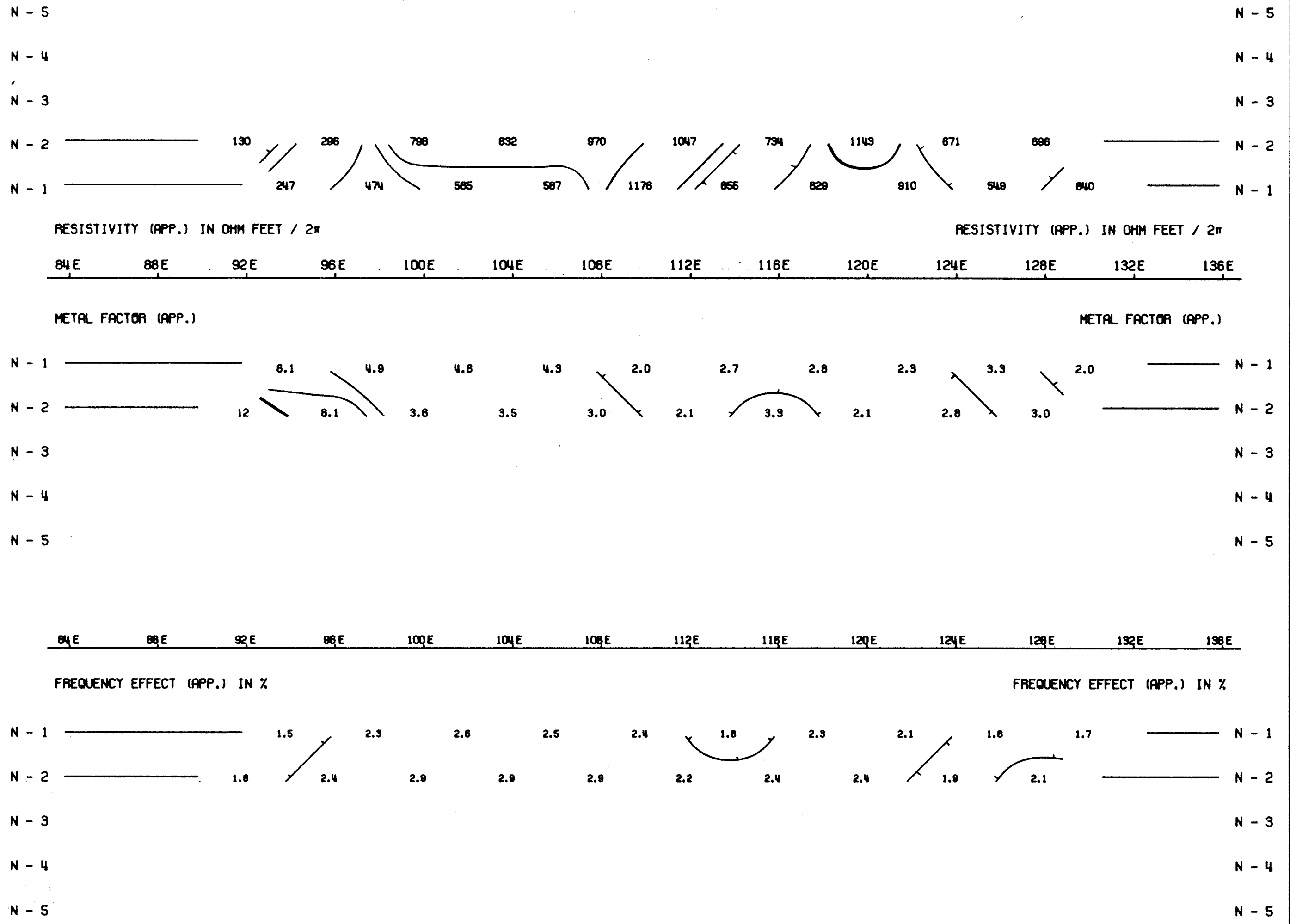


NOTE: CONTOURS AT  
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**McPHAR GEOPHYSICS**

INDUCED POLARIZATION AND RESISTIVITY SURVEY

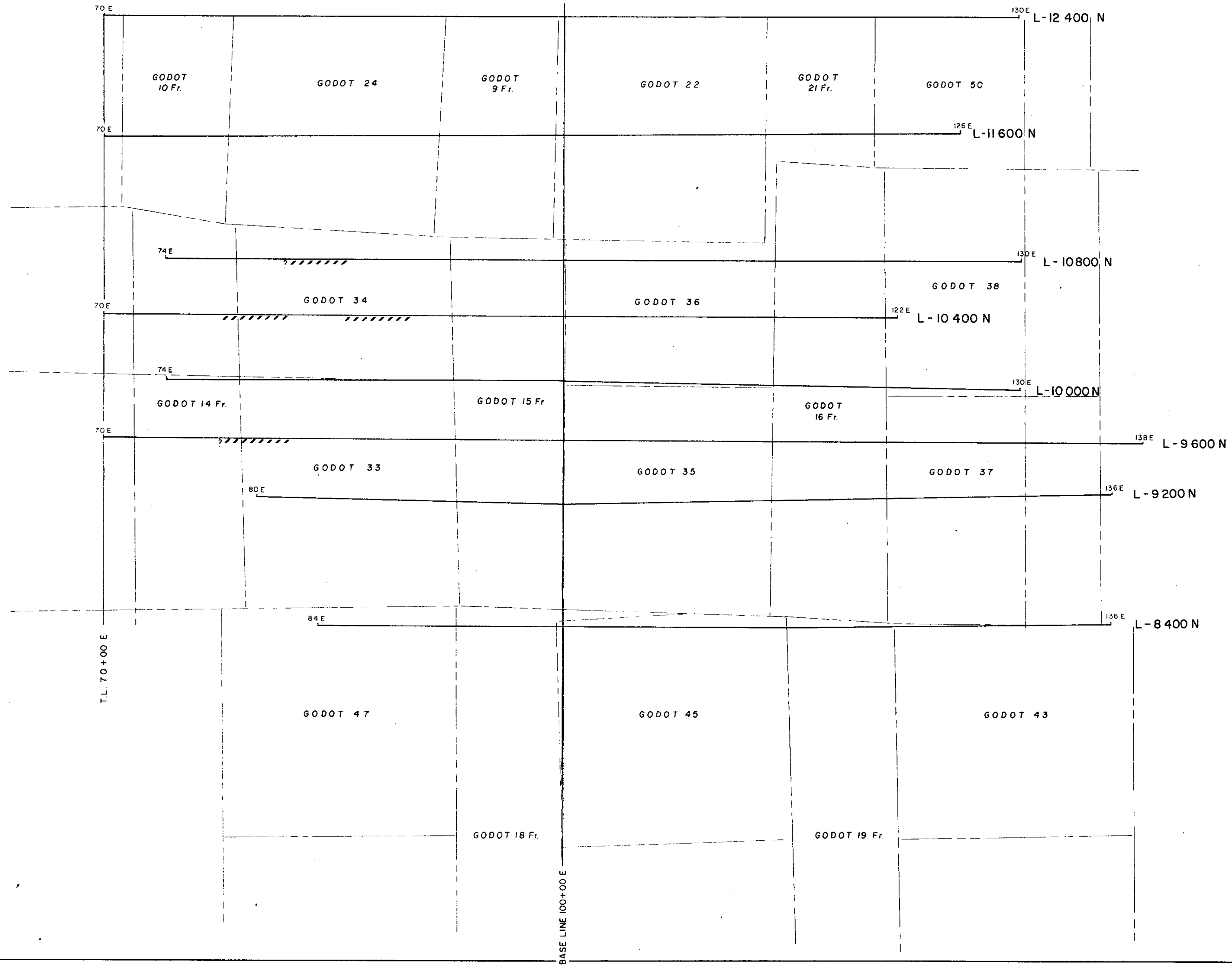
NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



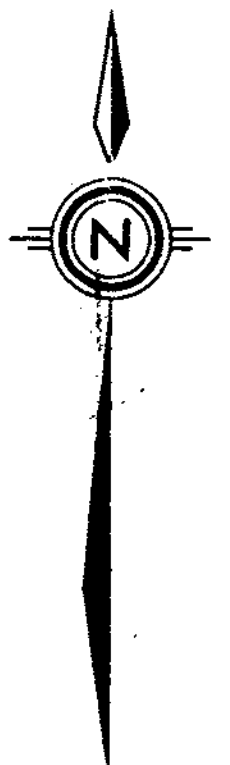
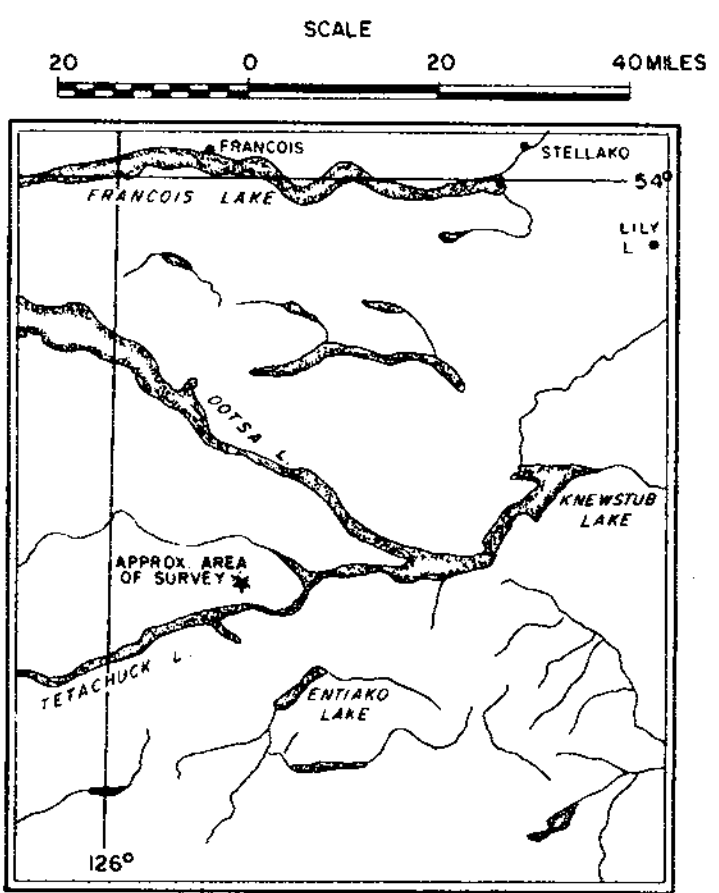
Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #9

# McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY  
PLAN MAP



NOTE: TO ACCOMPANY GEOPHYSICAL REPORT FOR NORANDA EXPLORATION COMPANY LIMITED TETACHUCK PROPERTY, TETACHUCK LAKE AREA, OMINECA M.D., BRITISH COLUMBIA, BY DAVID K. FOUNTAIN, P. ENG.  
DATED: AUGUST 2, 1972



SURFACE PROJECTION OF ANOMALOUS ZONES  
DEFINITE —————  
PROBABLE - - - - -  
POSSIBLE / / / / /  
Number at the end of anomaly indicates electrode interval

NORANDA EXPLORATION COMPANY LIMITED

TETACHUCK PROPERTY, TETACHUCK LAKE AREA  
OMINECA M.D., B.C.

SCALE  
ONE INCH EQUALS FOUR HUNDRED FEET

Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 3777 MAP #1

3777 M-1

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DATE  
APPROVED BY  
PROFESSIONAL  
OF  
BRITISH  
COLUMBIA  
DATE  
DAVID K. FOUNTAIN, P. ENG.