4667

REPORT ON THE 4667
INDUCED POLARIZATION
AND RESISTIVITY SURVEY
ON THE 92I/7W
KRISTIAN ROSS PROPERTY, MERRITT AREA,
NICOLA MINING DIVISION, B.C.
FOR Fin, Luck
RIO PLATA SILVER MINES LTD.

BY

ASHTON W. MULLAN, P.Eng.

AND

MARION A. GOUDIE, B.Sc.

NAME AND LOCATION OF PROPERTY:
KRISTIAN ROSS PROPERTY, MERRITT AREA, B.C.
NICOLA MINING DIVISION, B.C. 50°17'N - 120°51'W
DATE STARTED: JUNE 24, 1973
DATE FINISHED: JUNE 30, 1973

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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

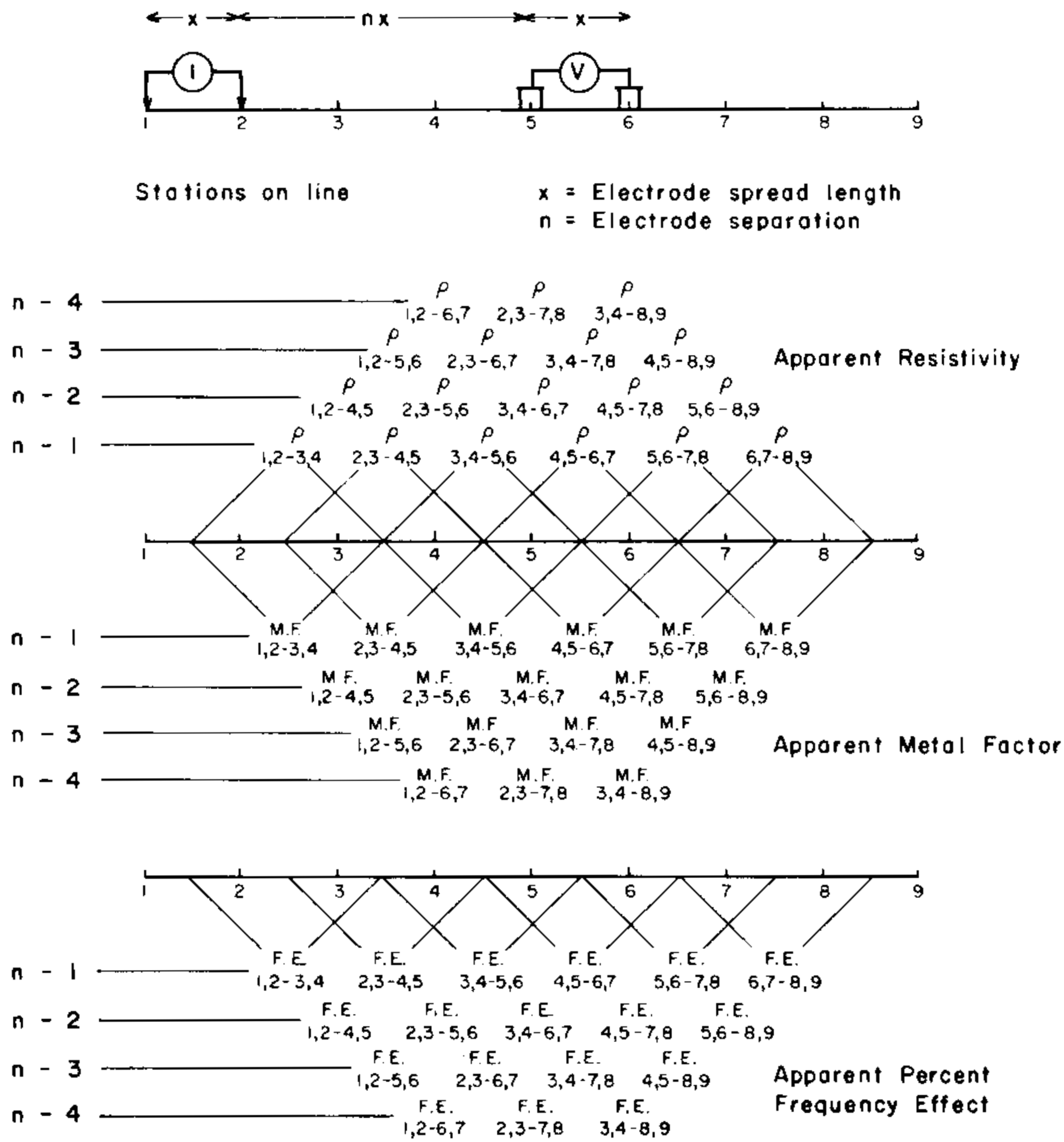

Fig. A

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REPORT ON THE
INDUCED POLARIZATION
AND RESISTIVITY SURVEY
ON THE
LUCK AND FIN CLAIM GROUP
KRISTIAN ROSS PROPERTY, MERRITT AREA,
NICOLA MINING DIVISION, B.C.
FOR
RIO PLATA SILVER MINES LTD.

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1. INTRODUCTION

We have recently completed an Induced Polarization and Resistivity survey on the Luck and Fin Claim Group, Kristian Ross Property, Merritt area, Nicola Mining Division, B.C., for Rio Plata Silver Mines Ltd. The centre of the survey grid is situated at 50°17'N latitude and 120°51'W longitude, 16 miles northeast of Merritt, B.C.

The country rocks underlying the grid belong to the Guichon Creek batholith, with basic intrusives of the Chataway variety of the Highland Valley phase. The expected mineralization is disseminated copper with associated molybdenite.

The survey grid adjoins to the southeast a previous survey over claims belonging to the Luck and Fin claim group which was reported upon in May, 1973.

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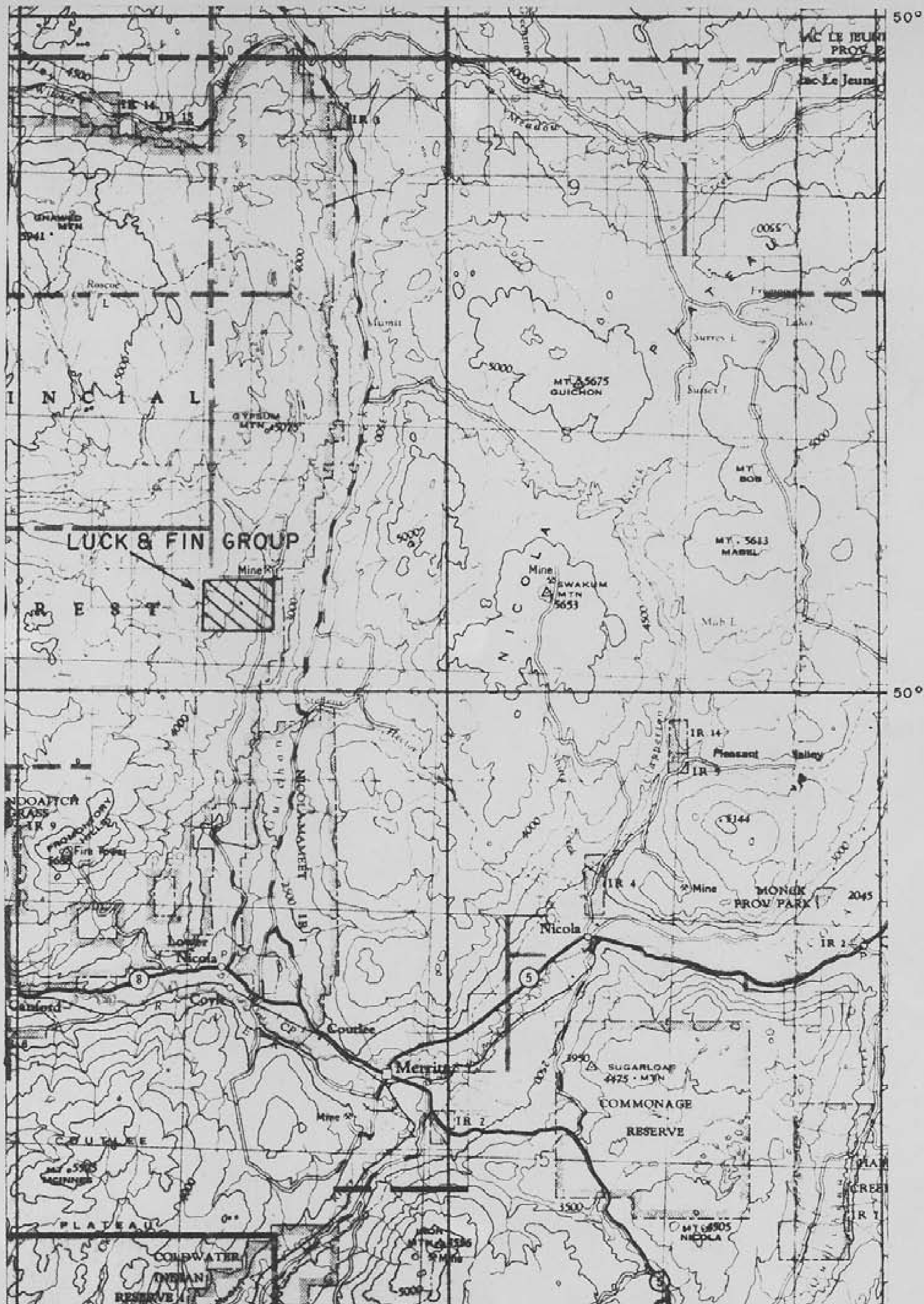
LOCATION MAP
1:250000



NOTE TO ACCOMPANY GEOPHYSICAL REPORT FOR RIO PLATA SILVER MINES LIMITED ON KRISTIAN ROSS PROPERTY, NICOLA M.D., MERRITT AREA, B.C. BY A.W. MULLAN (P.ENG.) AND M.A. GOUDIE (GEOLOGIST) DATED JULY 25, 1973.

4667

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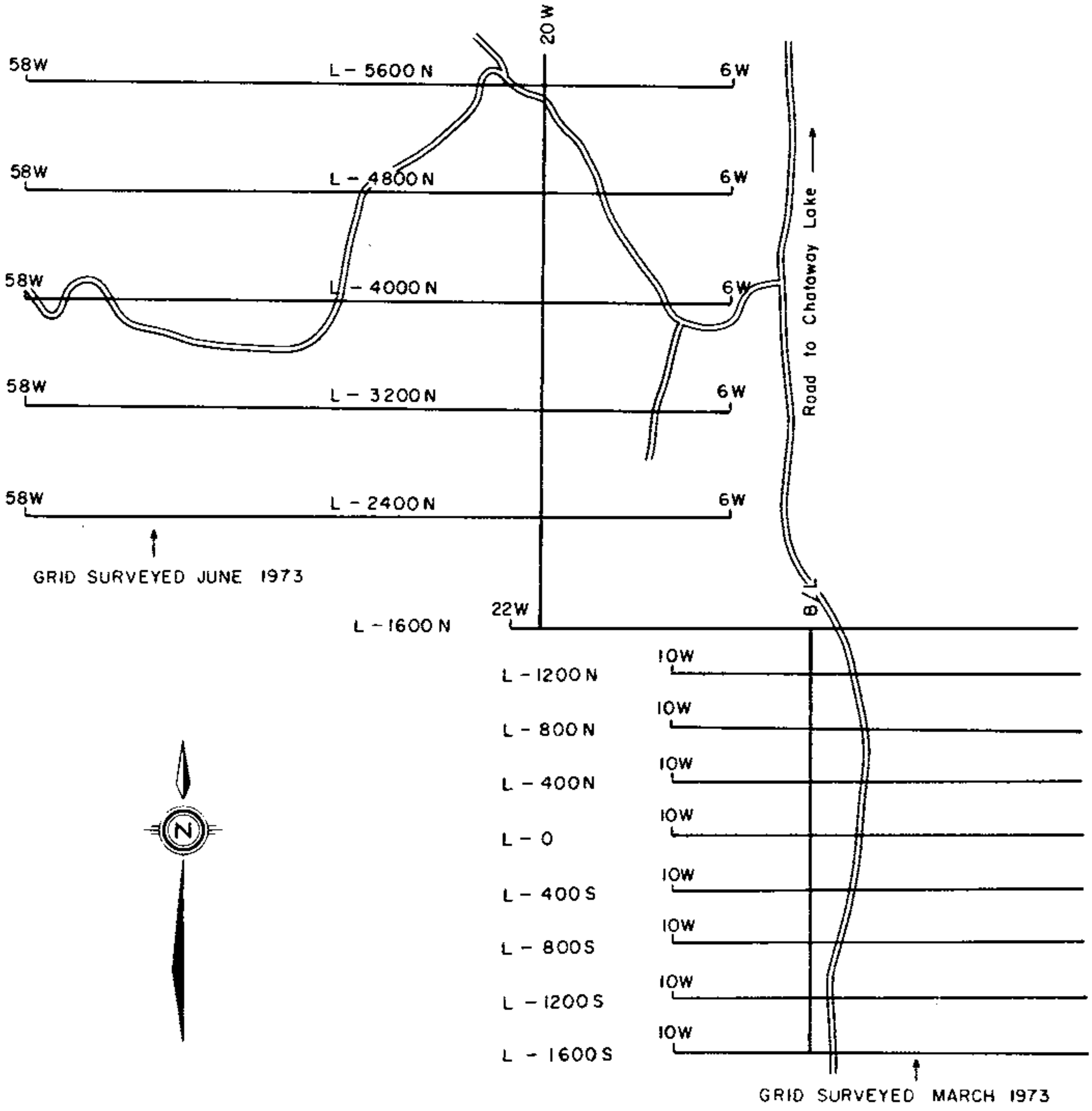
GRID REFERENCE MAP



NOTE TO ACCOMPANY GEOPHYSICAL REPORT FOR RIO PLATA SILVER MINES LIMITED ON KRISTIAN ROSS PROPERTY, NICOLA M. D., MERRITT AREA, B.C. BY A.W. MULLAN (P.ENG.) AND M.A. GOUDIE (GEOLOGIST) DATED JULY 25, 1973.

In addition to this new grid, detail was surveyed on two lines of the previous survey.

The work was completed in June, 1973, using a McPhar P660 high power variable frequency IP unit operating at 0.3 Hz and 5.0 Hz over the following claims:

Fin :	13 to 24 inclusive
Luck :	1, 2, 16.

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.
5600N	400 feet	IP 6075-1
4800N	400 feet	IP 6075-2
4000N	400 feet	IP 6075-3
3200N	400 feet	IP 6075-4
2400N	400 feet	IP 6075-5
800S	200 feet	IP 6075-6
1600S	200 feet	IP 6075-7

Also enclosed with this report is Dwg. I.P.P. 3587 a plan map of the Fin Grid and Dwg. I.P.P. 3575 a plan map of the Luck and Fin 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.

3. DISCUSSION OF RESULTS

A fairly broad anomalous IP zone, open to the north, south and south-east, was located by the IP survey. This interpretation of the anomalous zone suggests a mineralised source which is relatively shallow at the western end of the lines (e.g. at a depth of less than 200' to 200'), then becomes more deeply buried to the east. It is possible that the same source again rises at the eastern end of the line, although this would have to be determined by further exploration. A detailed description of the lines follows.

Line 5600N

The line is anomalous from 46W to 18W, with the complex anomaly varying in magnitude from possible to definite. The top of the source lies at a depth between -200' to 200' at 40W. The pattern of the anomaly suggests that very lightly mineralized rocks may overlie the main anomaly source from 34W to 30W and from 26W to 22W. From 30W to 26W a shallow source is indicated. From 26W to 22W, the magnitude of the anomaly increases on n = 3, with weaker anomalous effects on n = 2 and n = 1 to 18W. A better interpretation of the anomaly could be obtained by detailing the anomaly from 46W to 22W with shorter electrode spacing. The line could be detailed with longer electrode spacing from 34W to 14W to allow a better interpretation at depth.

The pattern of this anomaly suggests a source of disseminated mineralization of variable concentration (see Appendix I).

Line 4800N

The line is anomalous from 54W to 18W. The anomaly is incomplete at the western end of the line, otherwise the pattern of the anomaly is very similar to that on Line 5600N.

Line 4000N - Line 3200N

The anomalies on these lines are similar to the anomalies on Line 5600N and Line 4800N, although the barren capping appears to be slightly more extensive and the eastern portions of the anomalies have decreased in magnitude. The probable portion of the anomaly from 34W to 30W on Line 4000N reflects a one-station anomalous reading on n = 3.

Line 2400N

The probable anomaly from 46W to 42W may represent a shallow, narrow, tabular source (see Appendix II). There is no similar anomaly on lines to the north.

The anomaly from 38W to the east is similar to the anomalies in the zone to the north, except that the definite and probable portions of the anomaly are less extensive.

Detail survey on Survey I

Included with this report are the original 400' survey data for Line 800S and Line 1600S to facilitate comparison of the results.

Line 800S

The 200' detail has confirmed the anomalies located by the first survey. That portion of the anomaly from 10E to 14E has been somewhat enhanced, but in general the survey does not see deeply enough to add much information.

Line 1600S

The 200' detail has confirmed and enhanced the anomaly from 2E to 18E on the original survey. The top of the source of the anomaly lies at a depth of less than 100' from 4E to 8E. East of this station (8E) the top of the source appears to be near 200' in depth. A hole to test the source should be located to test a vertical depth of 100' below 7E.

4. CONCLUSIONS AND RECOMMENDATIONS

A fairly broad anomalous IP zone was located by the survey. The zone is open to the north, south and southeast. The anomalies are fairly complex - this interpretation suggests that there may be one continuous source which is in part overlain, or capped, by barren rocks.

The pattern of the anomalies indicate that the source may be a porphyry copper type of mineralisation. If the source minerals were copper and molybdenum, the results would warrant further exploration. It would, however, be advisable to detail the shallower portions of the anomalies to be tested with shorter electrode intervals, to better locate and define the source of the anomalies. Detail work has been suggested for Line 5600N.

Detail using 200' electrode intervals confirmed and in one case enhanced the anomalies located on two lines of the previous survey.

McPHAR GEOPHYSICS LIMITED

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. W. MULLAN

Ashton W. Mullan, P.Eng.
Geophysicist

Marion A. Goudie,
Geologist

Dated: July 25, 1973

ASSESSMENT DETAILS

PROPERTY: Kristian Ross Property
Luck & Fin Grid

MINING DIVISION: Nicola

SPONSOR: Rio Plata Silver Mines Ltd.

PROVINCE: British Columbia

LOCATION: Merritt Area

TYPE OF SURVEY: Induced Polarization

OPERATING MAN DAYS:	16	DATE STARTED:	June 24, 1973
EQUIVALENT 8 HR. MAN DAYS:	27	DATE FINISHED:	June 30, 1973
CONSULTING MAN DAYS:	2	NUMBER OF STATIONS:	106
DRAUGHTING MAN DAYS:	3	NUMBER OF READINGS:	675
TOTAL MAN DAYS	32	MILES OF LINE SURVEYED:	6.97

CONSULTANTS:

Ashton W. Mullan, 1440 Sandhurst Place, West Vancouver, B.C.
Marion A. Goudie, 739 Military Trail, West Hill, Ontario.

FIELD TECHNICIANS:

J. Parker, Box 340, Choiceland, Saskatchewan.
M. Faust, 841 Selkirk Ave. Kamloops, B.C.
Plus Extra Labourers:
J. Shippit, 1411 Shubert Drive, Kamloops, B.C.
D. Couture, Box 2034, Merritt, B.C.

DRAUGHTSMEN:

B. Boden, 103 Petworth Crescent, Agincourt, Ontario.
F.R. Peer, 38 Torrens Ave. Toronto 6, Ontario.
V. Young, 703 Cortez Avenue, Bay Ridges, Ontario.

McPHAR GEOPHYSICS LIMITED

Ashton W. Mullan

Ashton W. Mullan, P. Eng.

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — A. W. MULLAN

Dated: July 25th, 1973

STATEMENT OF COST

Rio Plata Silver Mines,
Kristian Ross Property,
Merritt Area, B.C.

Crew:- J. Parker - M. Faust

6.97 line miles surveyed

5 miles	@ $440.00/line mile	$2,200.00
.88 mile	@ $400.00/line mile	352.00
1 day detail (1.09 miles)	@ $420.00/day	420.00
		$2,972.00

Breakdown of above

4½ days Operating		@ $310.00/day	$1,395.00
2 days Travel 1 day Preparation 1 day Standby	4 days	@ $100.00/day	400.00
Charge re less than 10 operating days			200.00
Crew Expenses			
Transportation		219.91	
Meals and Accommodation		378.80	
		598.71	
+ 10%		59.87	
			658.58
Extra Labour:	262.50		
+ 20%	52.50		
			315.00
			$2,968.58

McPHAR GEOPHYSICS LIMITED

Ashton W. Mullan

Ashton W. Mullan, P. Eng.

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — A. W. MULLAN

Declared before me at the City of Vancouver, in the Province of British Columbia, this 25 day of October 1973, A.D.

A D Ross

Joan Turner

A Commissioner for taking Affidavits within British Columbia or Sub - mining Recorder
A Notary Public in and for the Province of British Columbia

AMEX EXPLORATION SERVICES LTD.

A. A. (AB) ABLETT

Confidential Work

BUS. 374-1123
RES. 376-7490

204, 635 VICTORIA STREET

BOX 286
KAMLOOPS, B.C.

June 19, 1973

Rio Plata Silver Mines Ltd.
420 - 475 Howe St.
Vancouver, B.C.

RECEIVED JUN 21 1973

Attention : Mr. A.D. Ross

Statement of Account

Completion of 5.68 Miles of Grid extension on part of your Luck and Fin Claims, Guichon Creek Area, north of Craigmont Mines, Nicola Mining Division.

5.68 miles @ $135.00	= $ 766.80
Total Requested	$ 766.80

Yours truly,

A.A. Ablett, President
Amex Exploration Services Ltd.

73-24

Encl. Grid Layout sketch

AAA/pp

Declared before me at the City
of Vancouver, in the
Province of British Columbia, this 25
day of October 1973

A.D. Ross

A Commissioner for taking Affidavits within British Columbia.
A Notary Public in and for the Province of British Columbia. Sub-mining Recorder

CERTIFICATE

I, Ashton W. Mullan, of the City of Vancouver, in the Province of British Columbia, hereby certify:

1. That I am a geologist and a fellow of the Geological Association of Canada with a business address at Suite 811, 837 West Hastings Street, Vancouver, B.C.

2. That I am registered as a member of the Association of Professional Engineers of the Provinces of Ontario and British Columbia.

3. That I hold a B.Sc. degree from McGill University.

4. That I have been practising my profession as a geologist for about twenty 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 Rio Plata Silver Mines 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 Vancouver

This 25th day of July, 1973

PROFESSIONAL ENGINEER
PROVINCE OF
A. W. MULLAN
BRITISH COLUMBIA

A. W. Mullan, B.Sc., P.Eng.

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 Rio Plata Silver Mines 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 25th day of July 1973

Marion A. Goudie

Marion A. Goudie, B.Sc.

APPENDIX I

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.

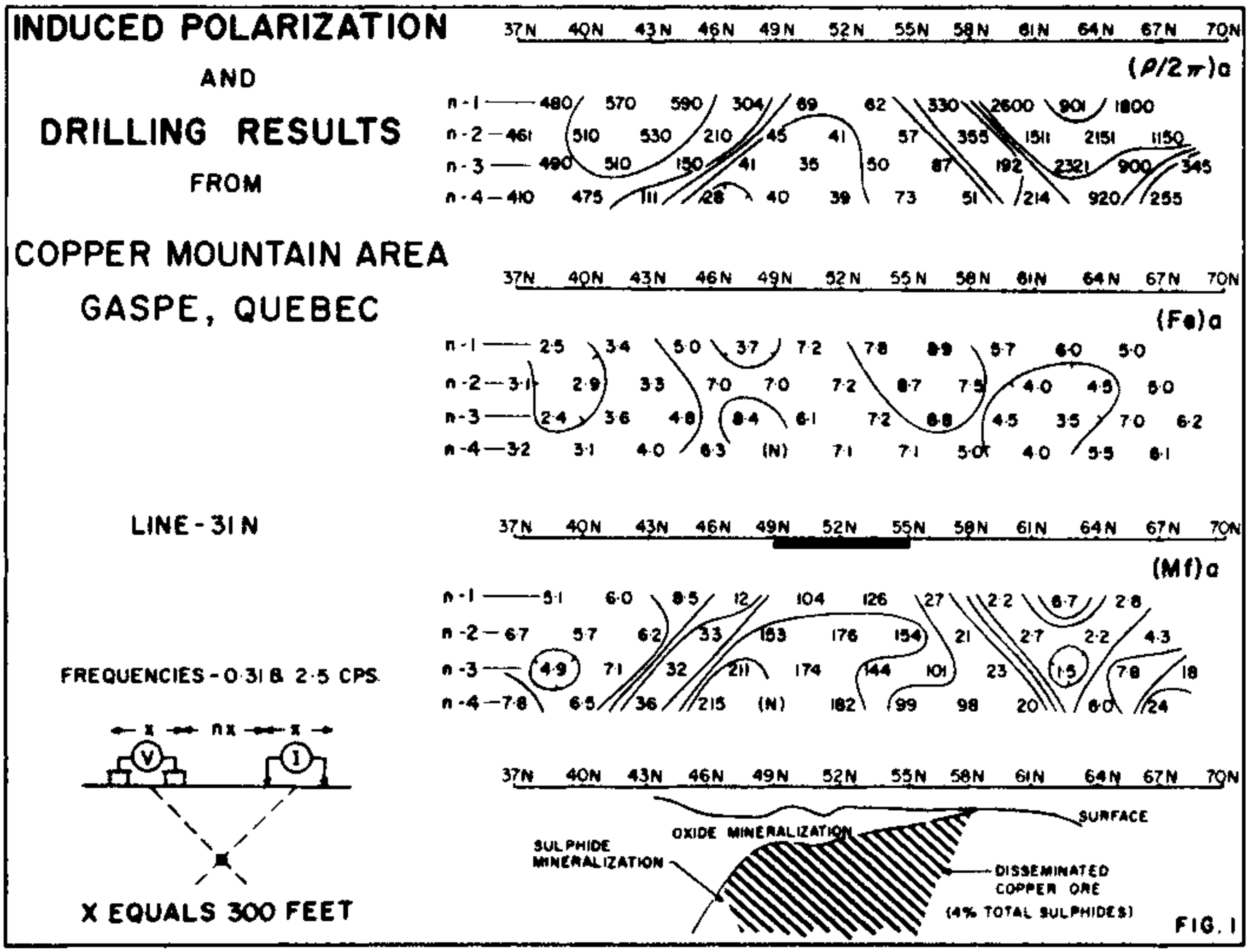


FIG. 1

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.

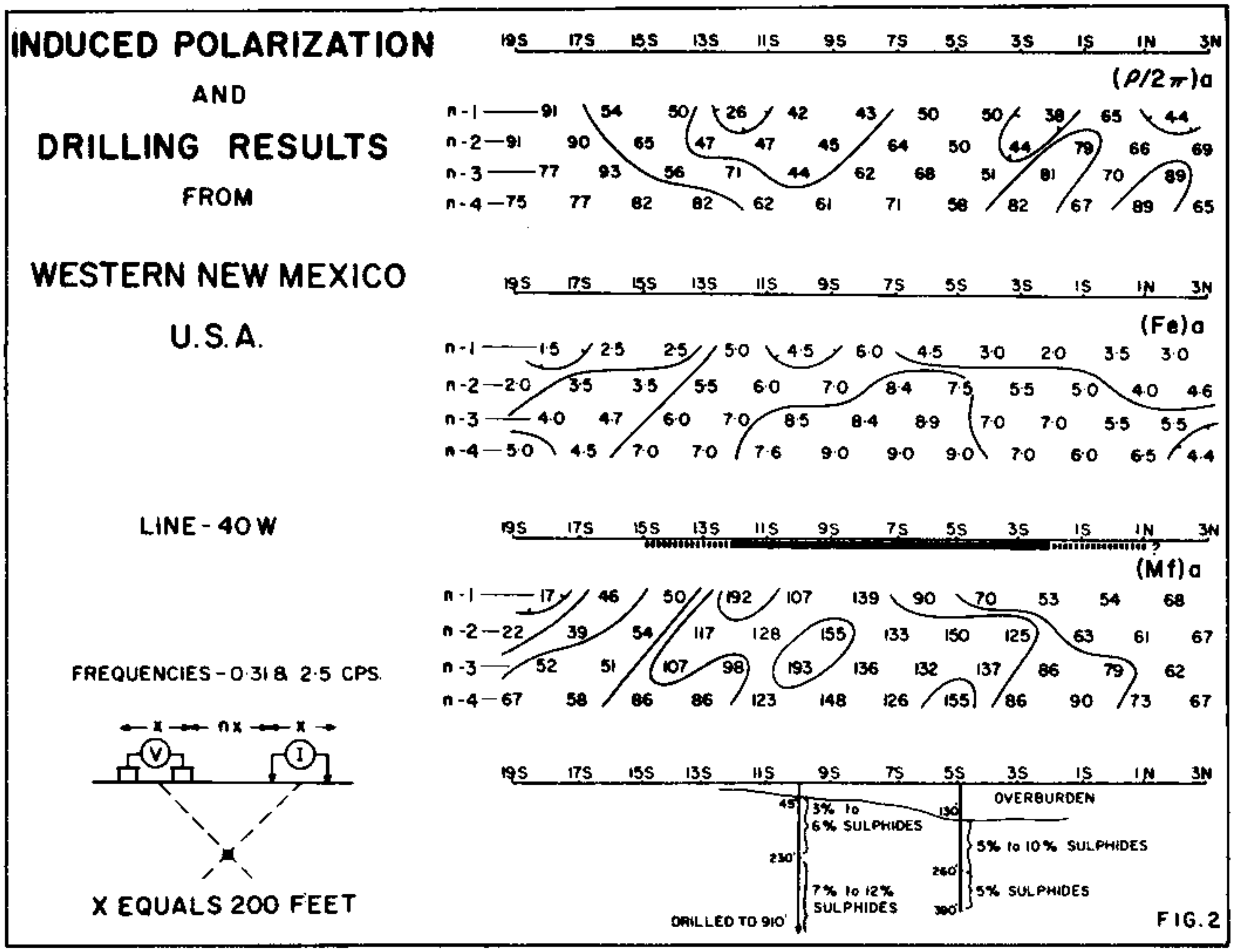


FIG. 2

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.

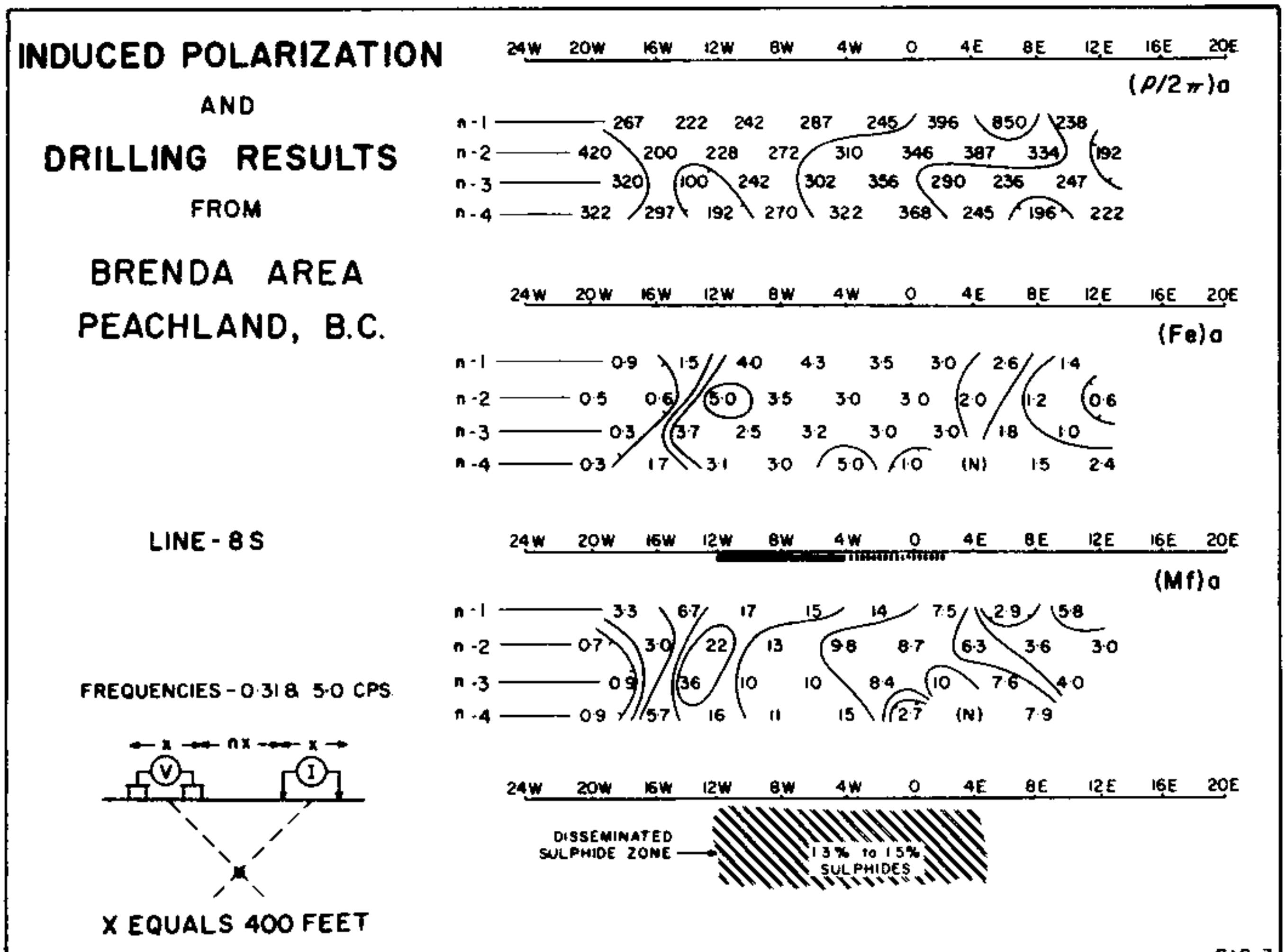


FIG.3

APPENDIX II

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.

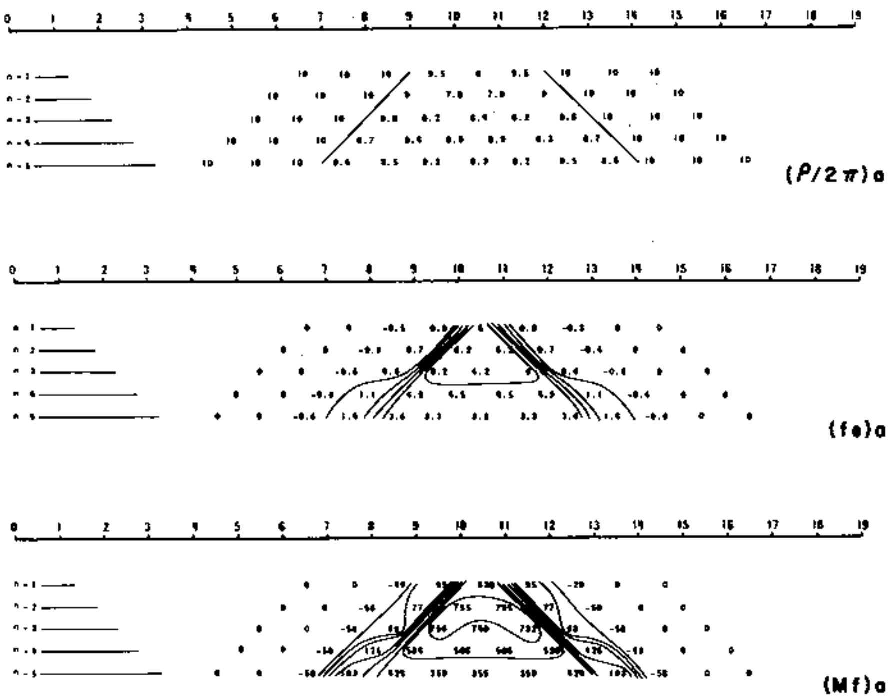
The very weak, shallow anomaly shown in Figure 5 is typical of those located by the X = 200' reconnaissance survey. Several anomalies of this type were detailed using shorter electrode intervals. In most cases the detail measurements suggested broad zones of very weak mineralization. However, in the 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.

McPHAR GEOPHYSICS LIMITED

Theoretical Induced Polarization and Resistivity Studies

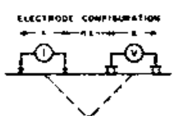
Scale Model Cases



$(\rho/2\pi)_1 = 10$ $(\rho/2\pi)_2 = 2.51$

$(Mf)_1 = 0$ $(Mf)_2 = 10000$

$(fe)_2 = 25\%$



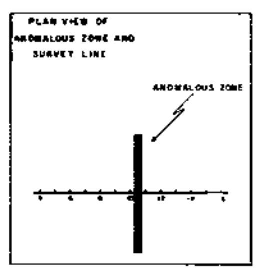


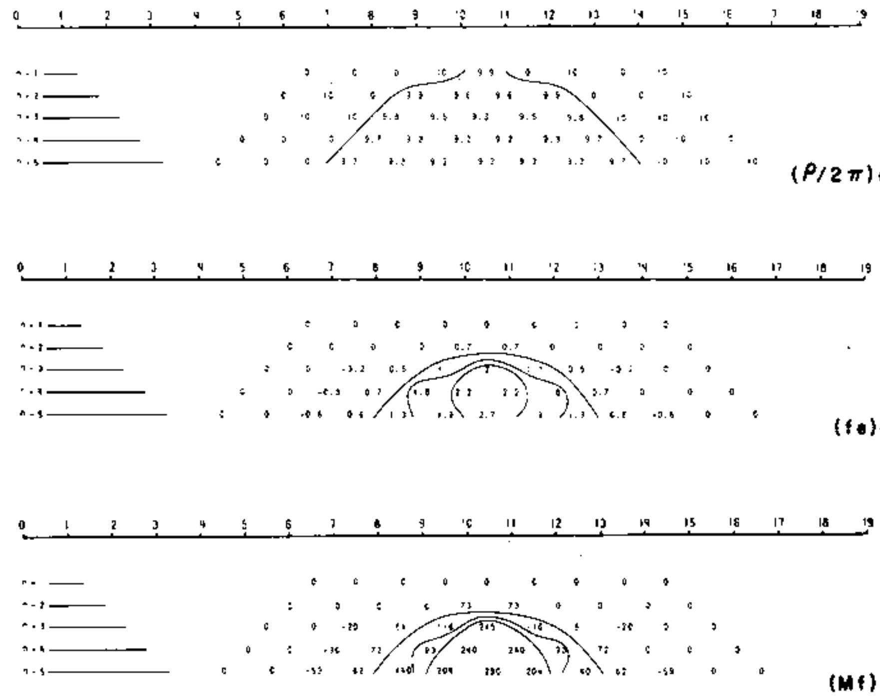
FIG 1

CASE II-0.5-BU-10-a

McPHAR GEOPHYSICS LIMITED

Theoretical Induced Polarization and Resistivity Studies

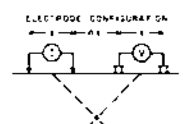
Scale Model Cases



$(\rho/2\pi)_1 = 10$ $(\rho/2\pi)_2 = 2.6$

$(Mf)_1 = 0$ $(Mf)_2 = 9250$

$(fe)_2 = 24\%$



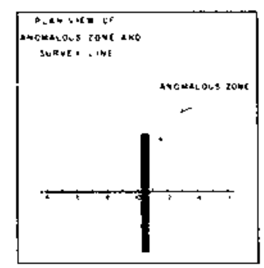
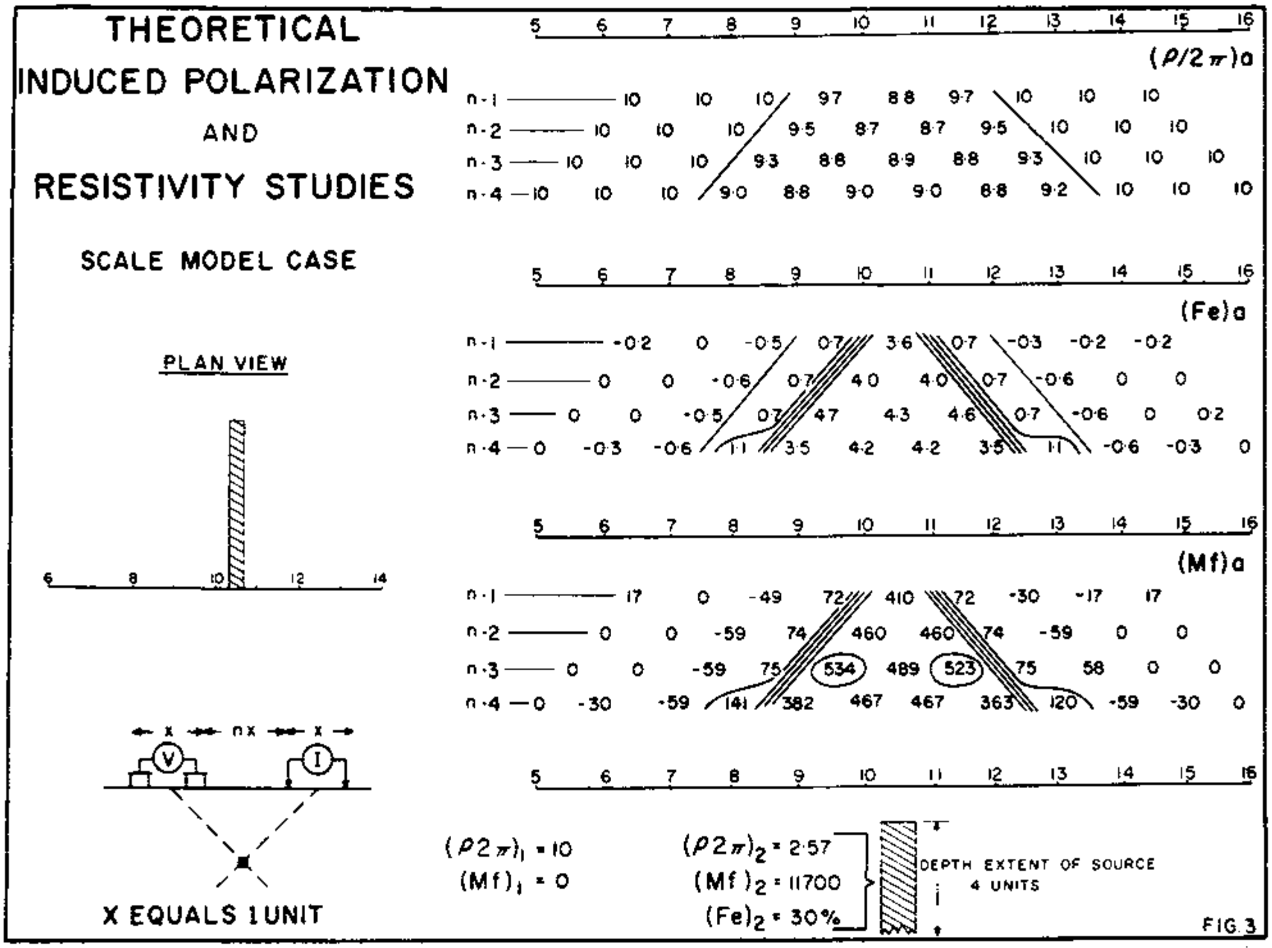
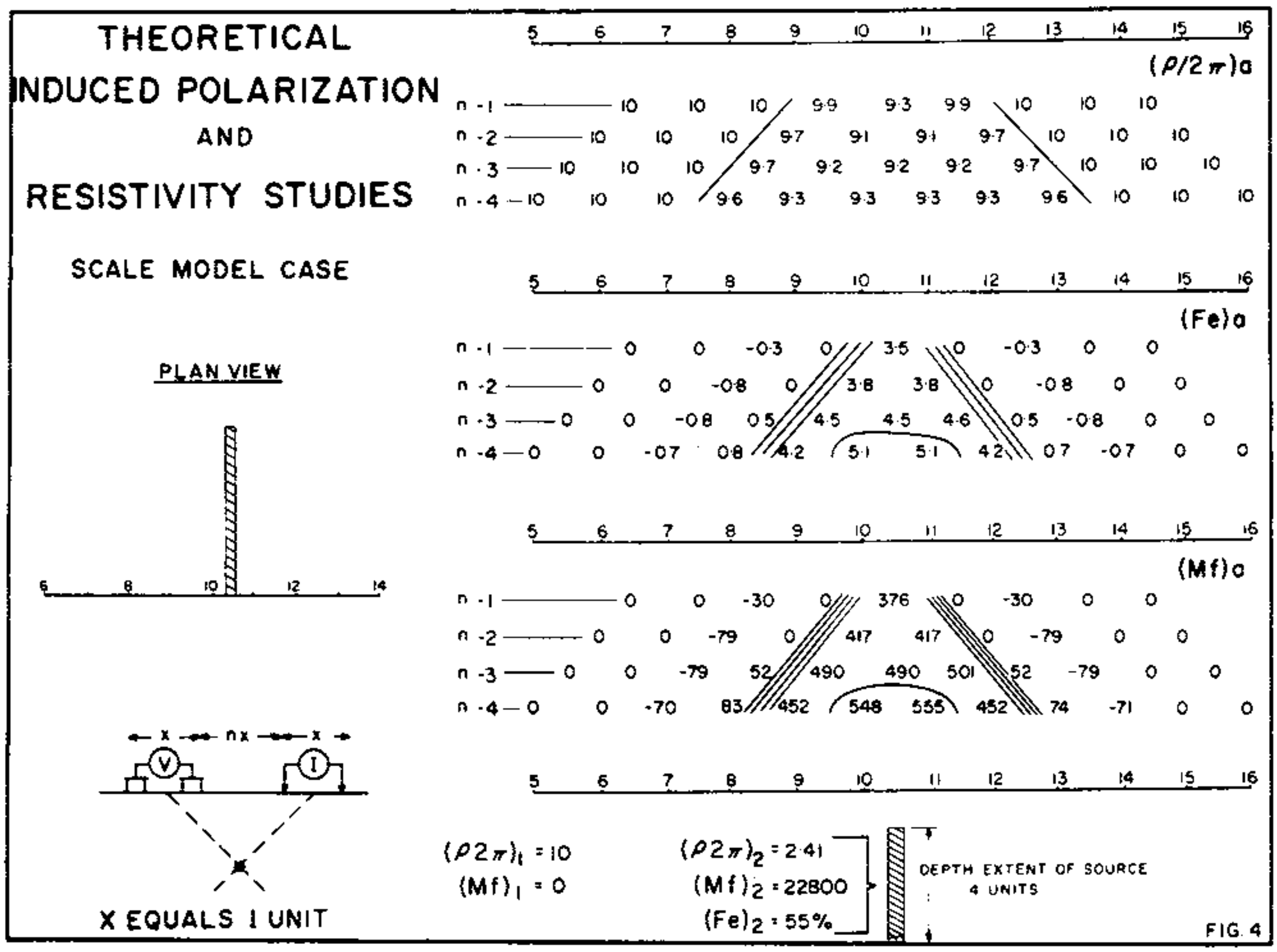


FIG 2

CASE II-1.5-BU-10-a


THEORETICAL
INDUCED POLARIZATION
AND
RESISTIVITY STUDIES
SCALE MODEL CASE
PLAN VIEW
(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
X EQUALS 1 UNIT
FIG. 3


THEORETICAL
INDUCED POLARIZATION
AND
RESISTIVITY STUDIES
SCALE MODEL CASE
PLAN VIEW
(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
X EQUALS 1 UNIT
FIG. 4

INDUCED POLARIZATION AND RESISTIVITY RESULTS

BATCHELOR LAKE AREA, QUEBEC.

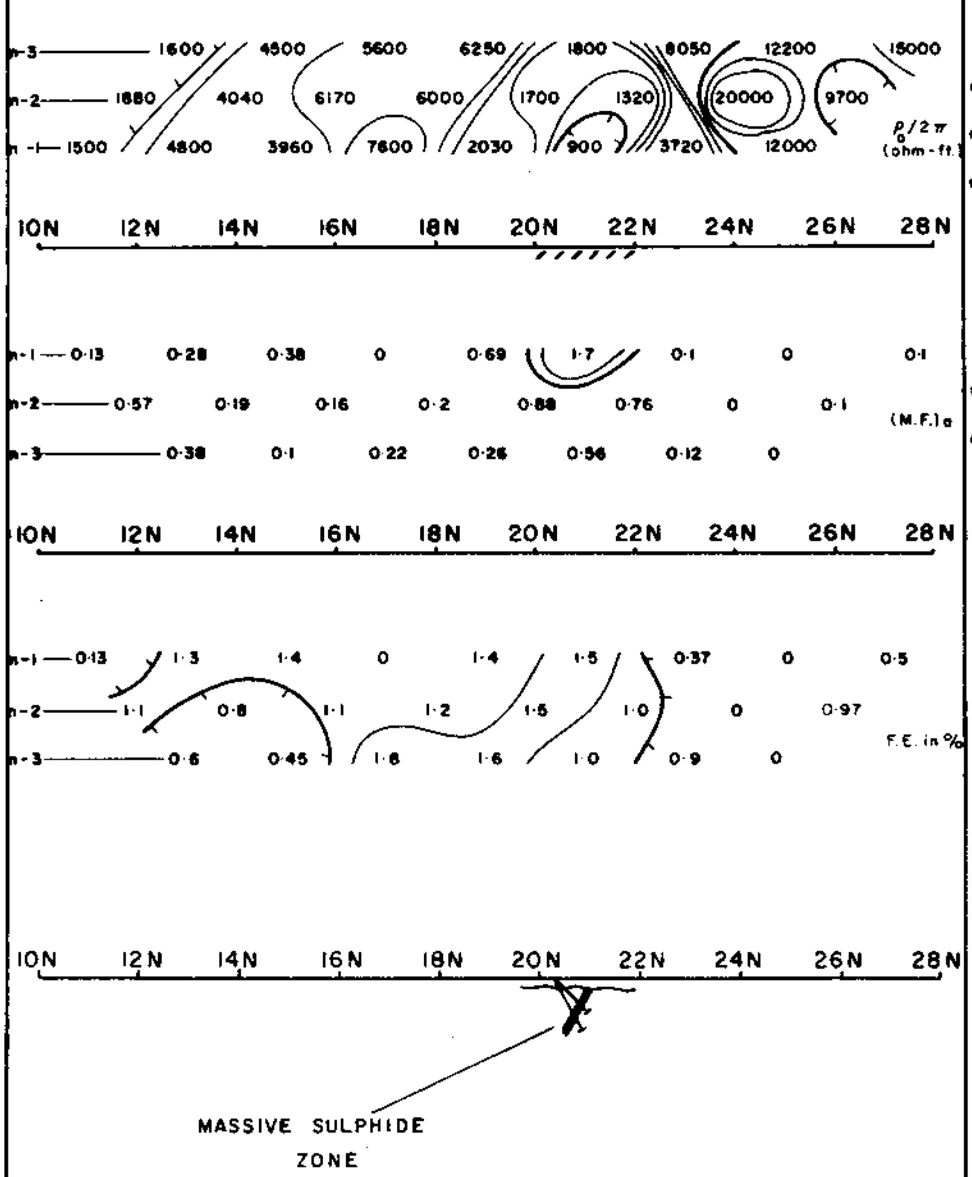


FIG. 5

INDUCED POLARIZATION AND RESISTIVITY RESULTS

BATCHELOR LAKE AREA, QUEBEC.

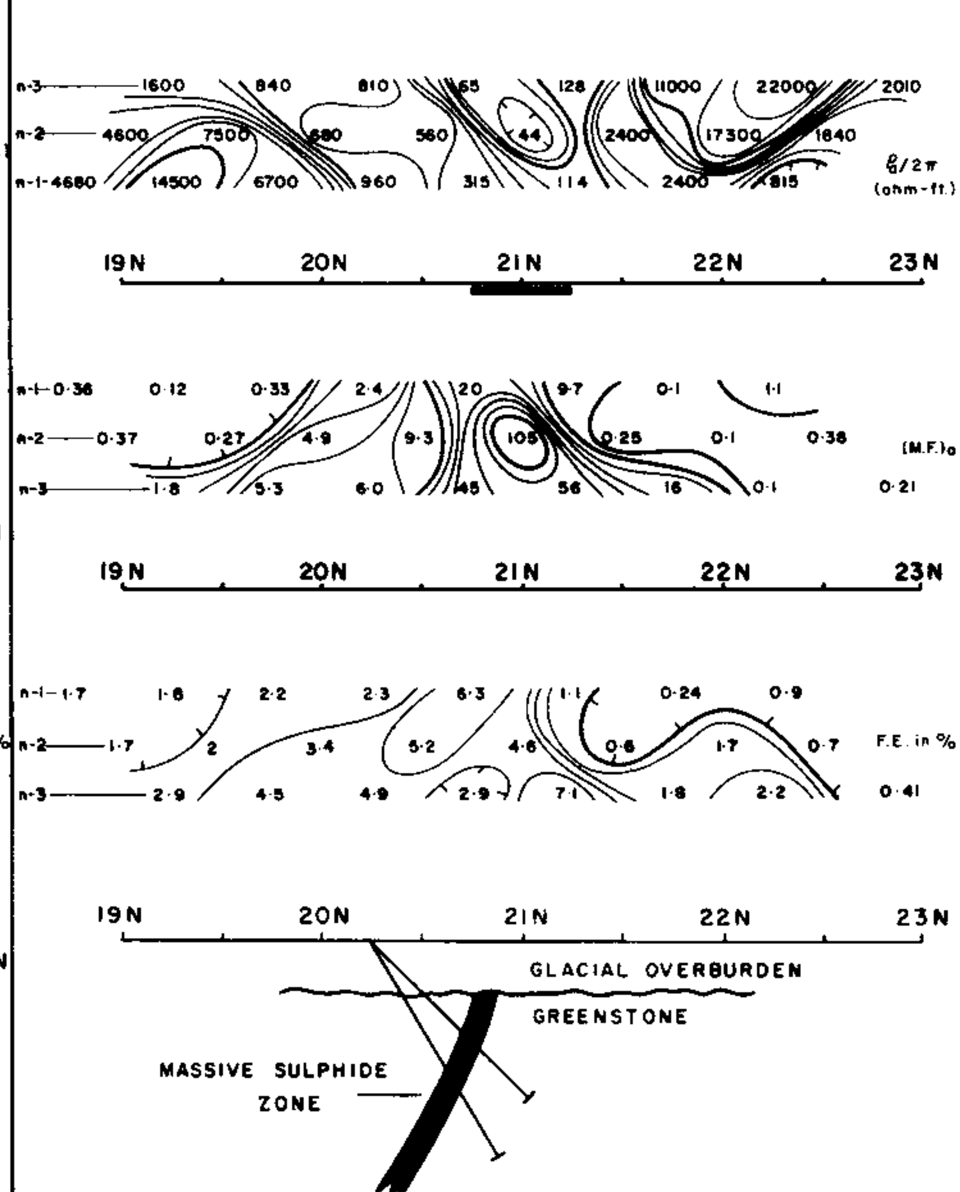
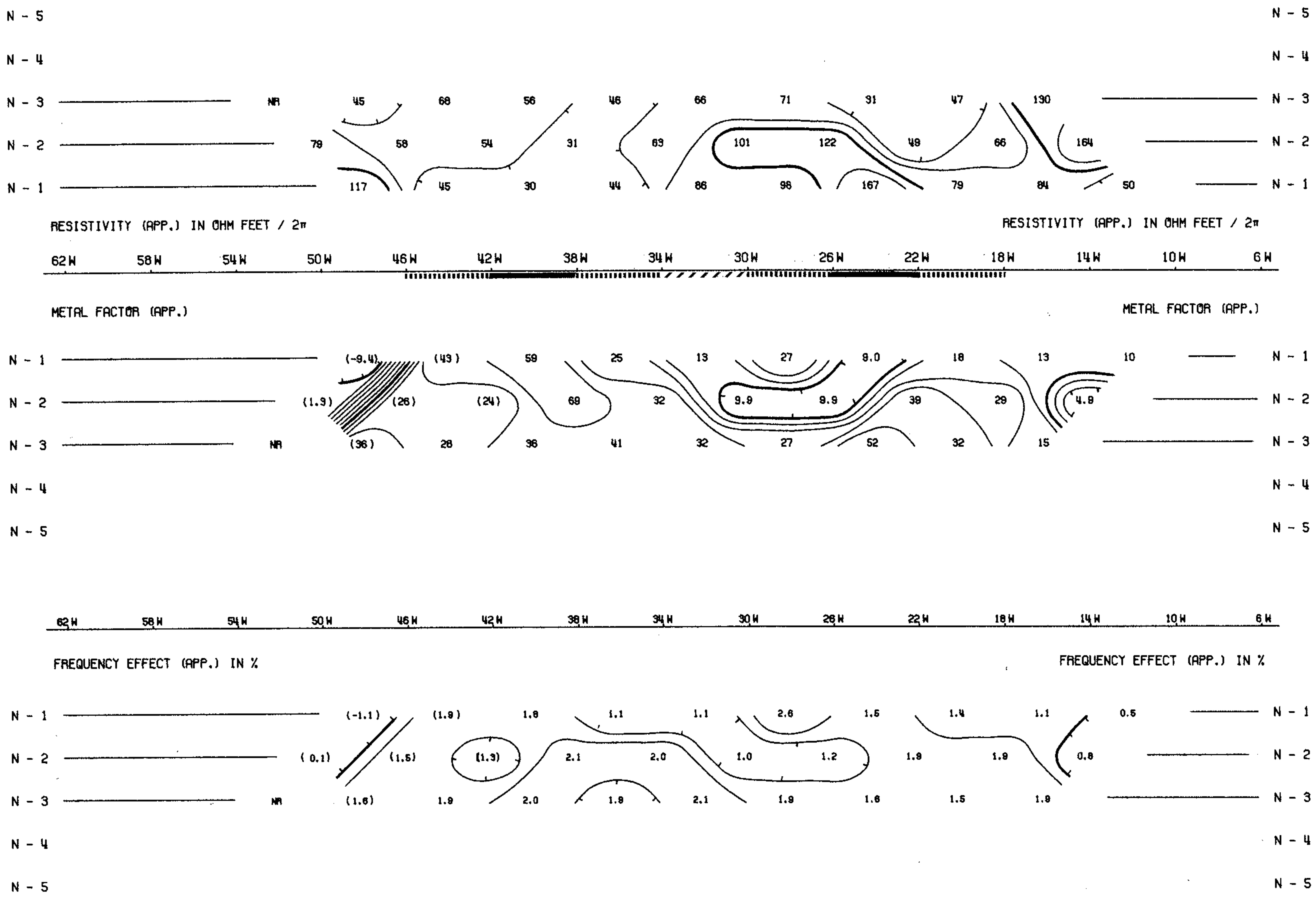


FIG. 6



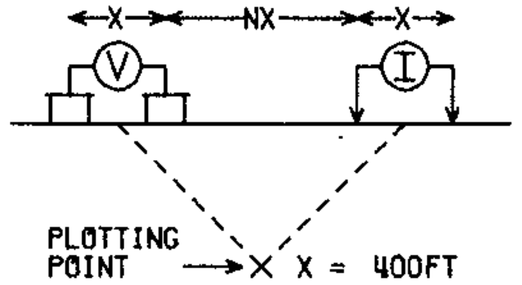
DWG. NO.- I.P.- 6075-1

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA
NICOLA M.D., B.C.

LINE NO.- 5600N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ
DATE SURVEYED: JUN 1973

APPROVED:

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

PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, A. W. MULLAN

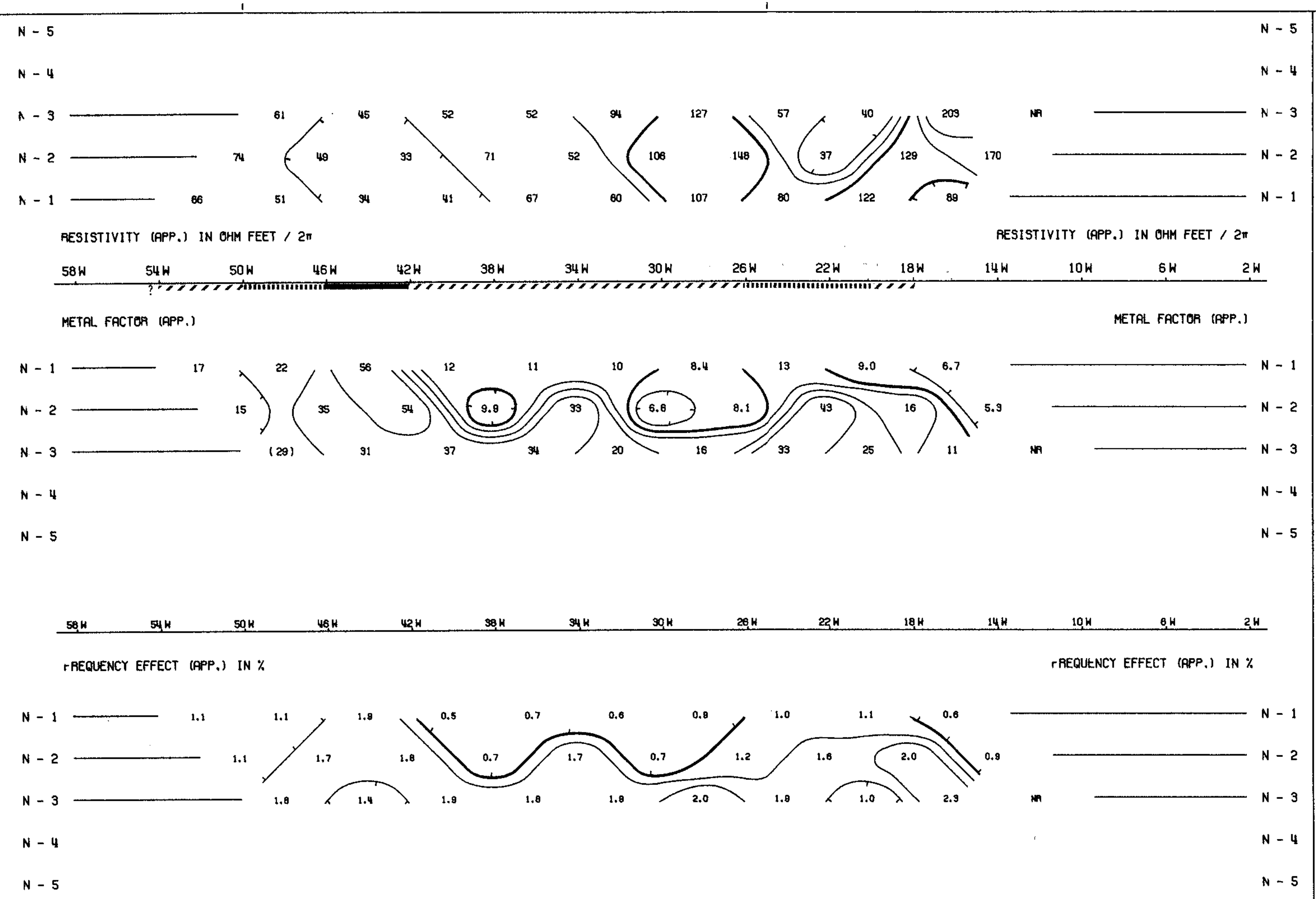
DATE: Aug 3, 1973

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.- 6075-2

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO.- 4800N

ELECTRODE CONFIGURATION

PLOTTING POINT X = 400FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

DATE: Aug. 3, 1973

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

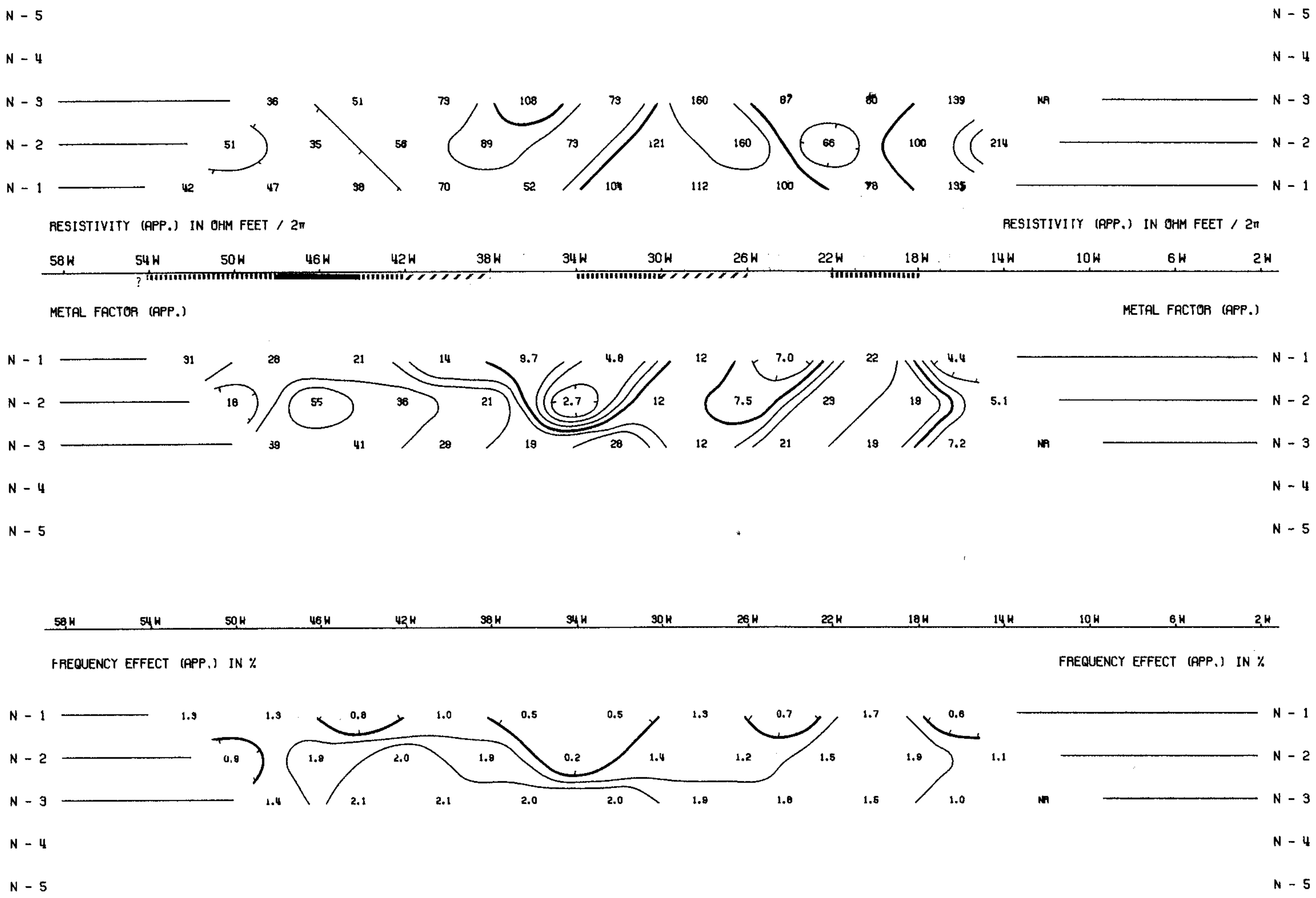
PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — A. W. MULLAN

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



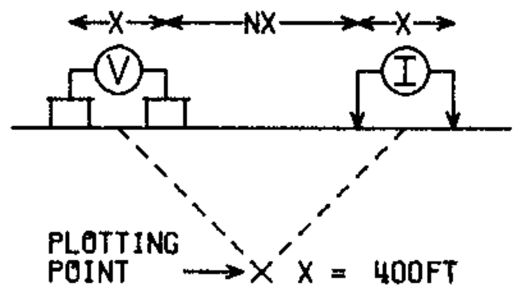
DWG. NO.- I.P.- 6075-3

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA
NICOLA M.D., B.C.

LINE NO.- 4000N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

DATE: Aug 3, 1973

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

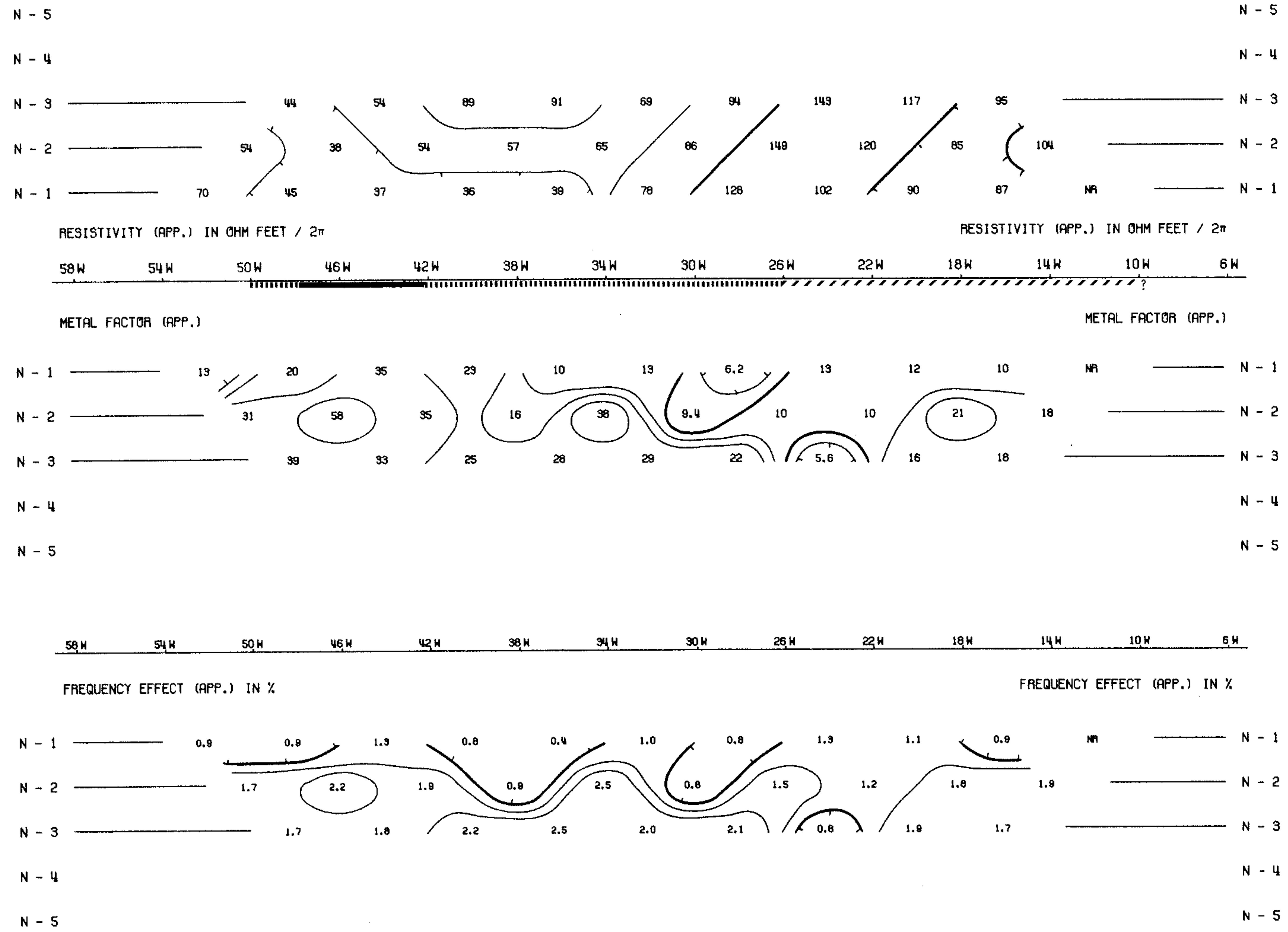
PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — A. W. MULLAN

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.-6075-4

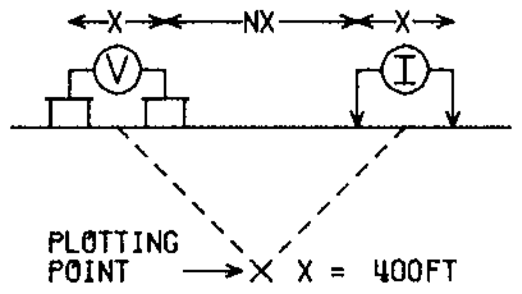
RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO.- 3200N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

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

DATE: Aug 3, 1973

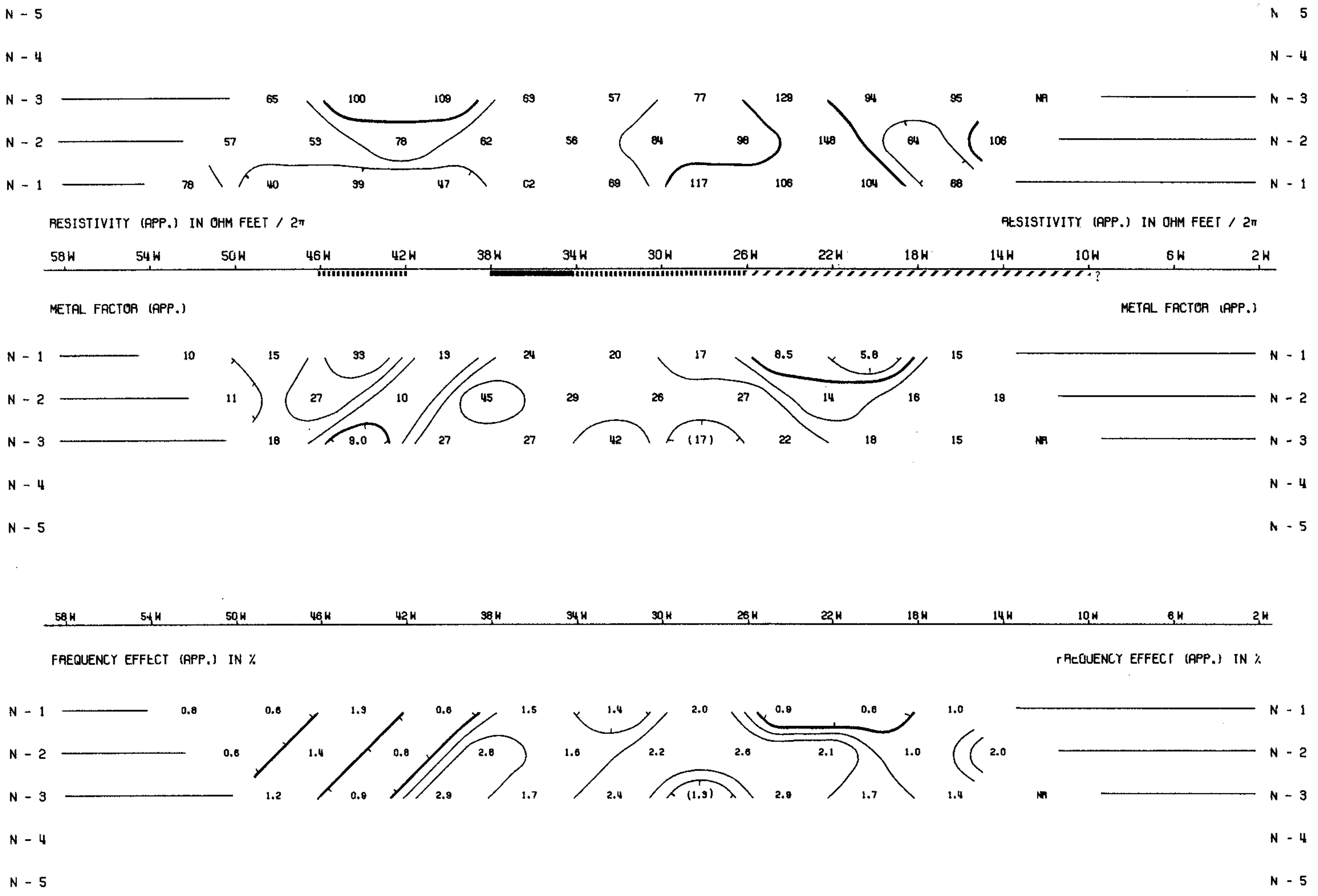
PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — A. W. MULLAN

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.- 6075-5

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO.- 2400N

ELECTRODE CONFIGURATION

PLOTTING POINT X = 400FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

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

DATE: Aug. 3, 1973

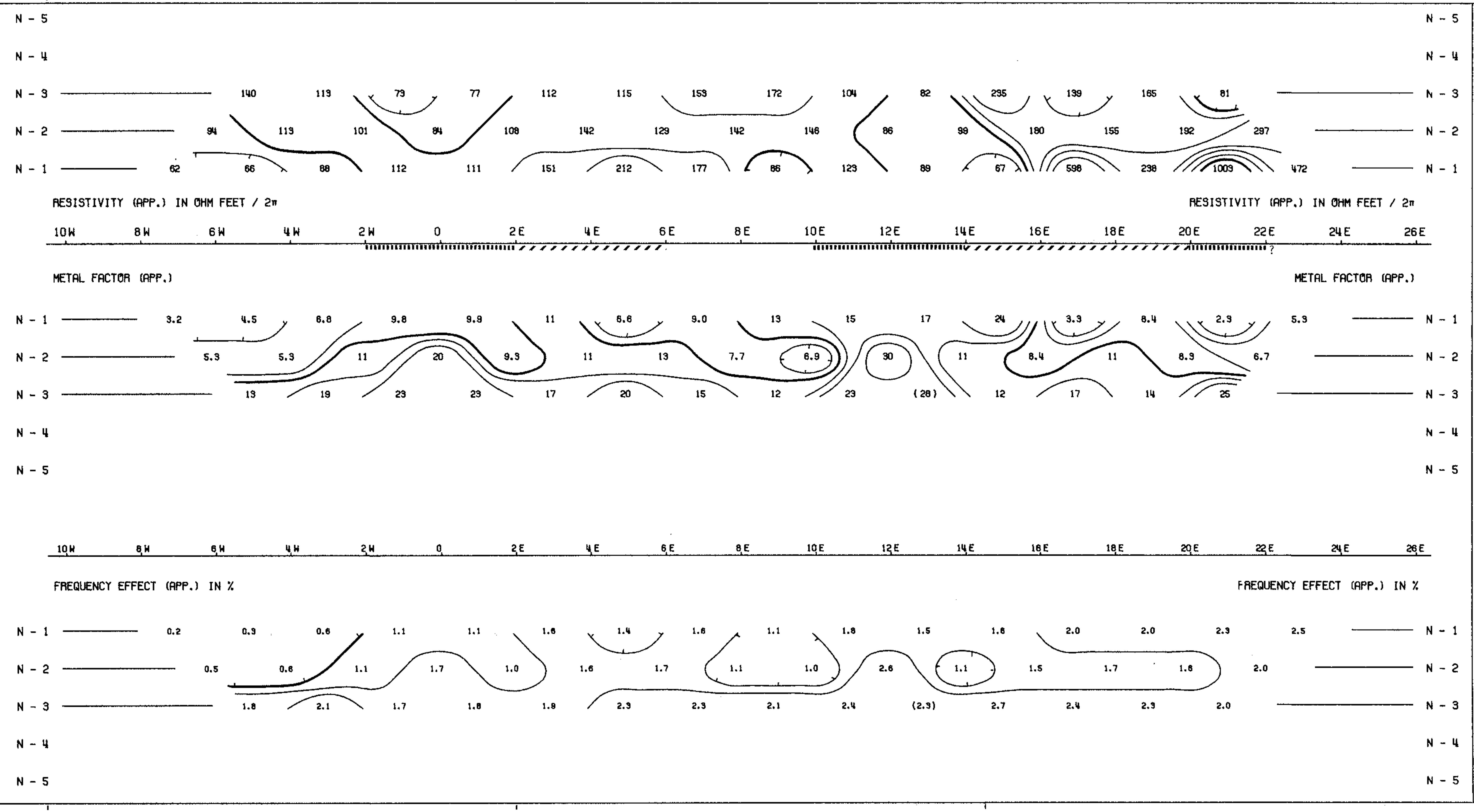
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA A. W. MU...

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.-6075-6

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO.- 800S

ELECTRODE CONFIGURATION

PLOTTING POINT — X = 200FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

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

DATE: Aug. 3, 1973

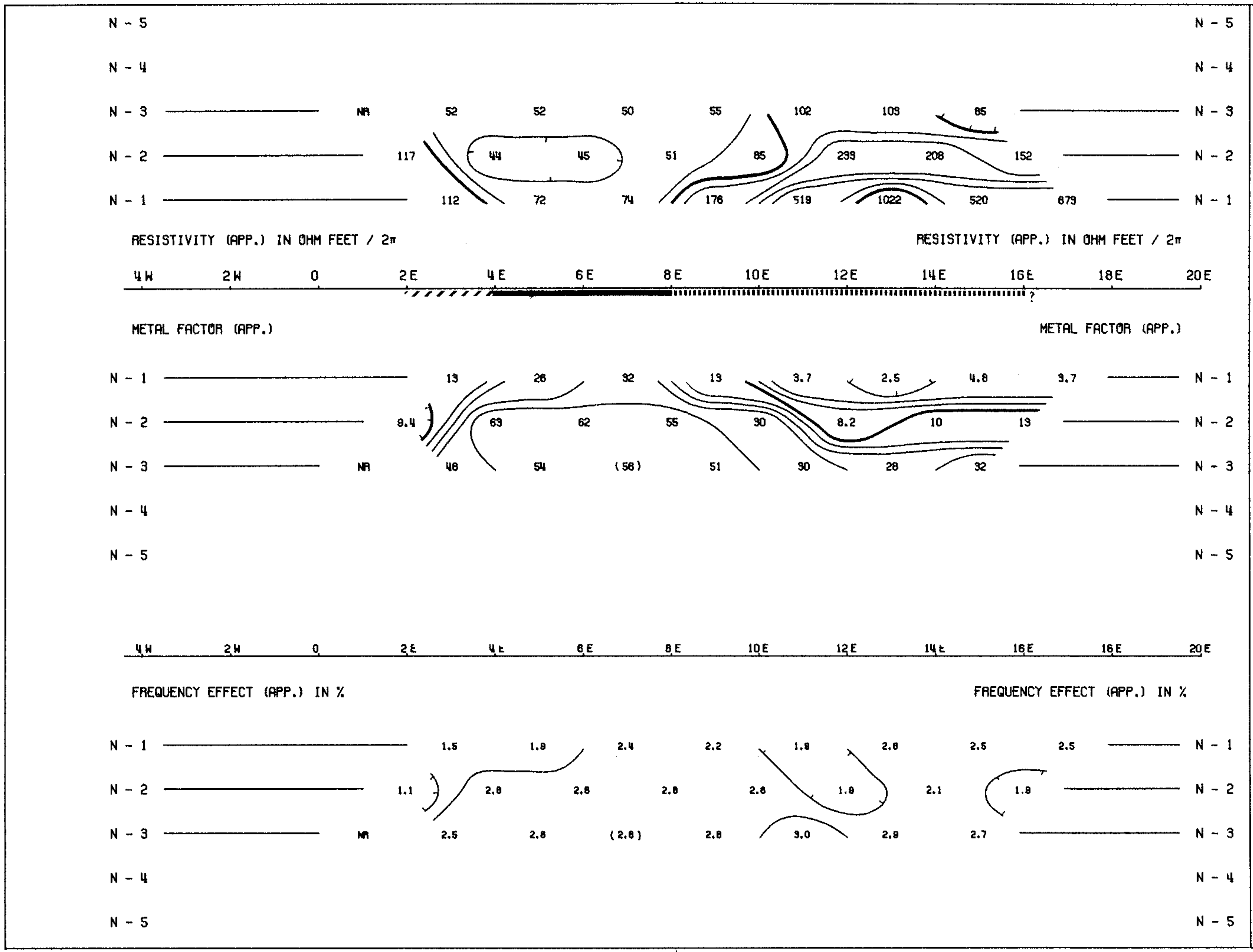
PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, W. MU...

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY McPHAR COMPUTER DIVISION



DWG. NO.- I.P.- 6075 - 7

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA
NICOLA M.D., B.C.

LINE NO.- 1600S

ELECTRODE CONFIGURATION

X NX X

PLOTTING POINT X = 200FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: JUN 1973

APPROVED:

DATE: Aug. 3, 1973

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

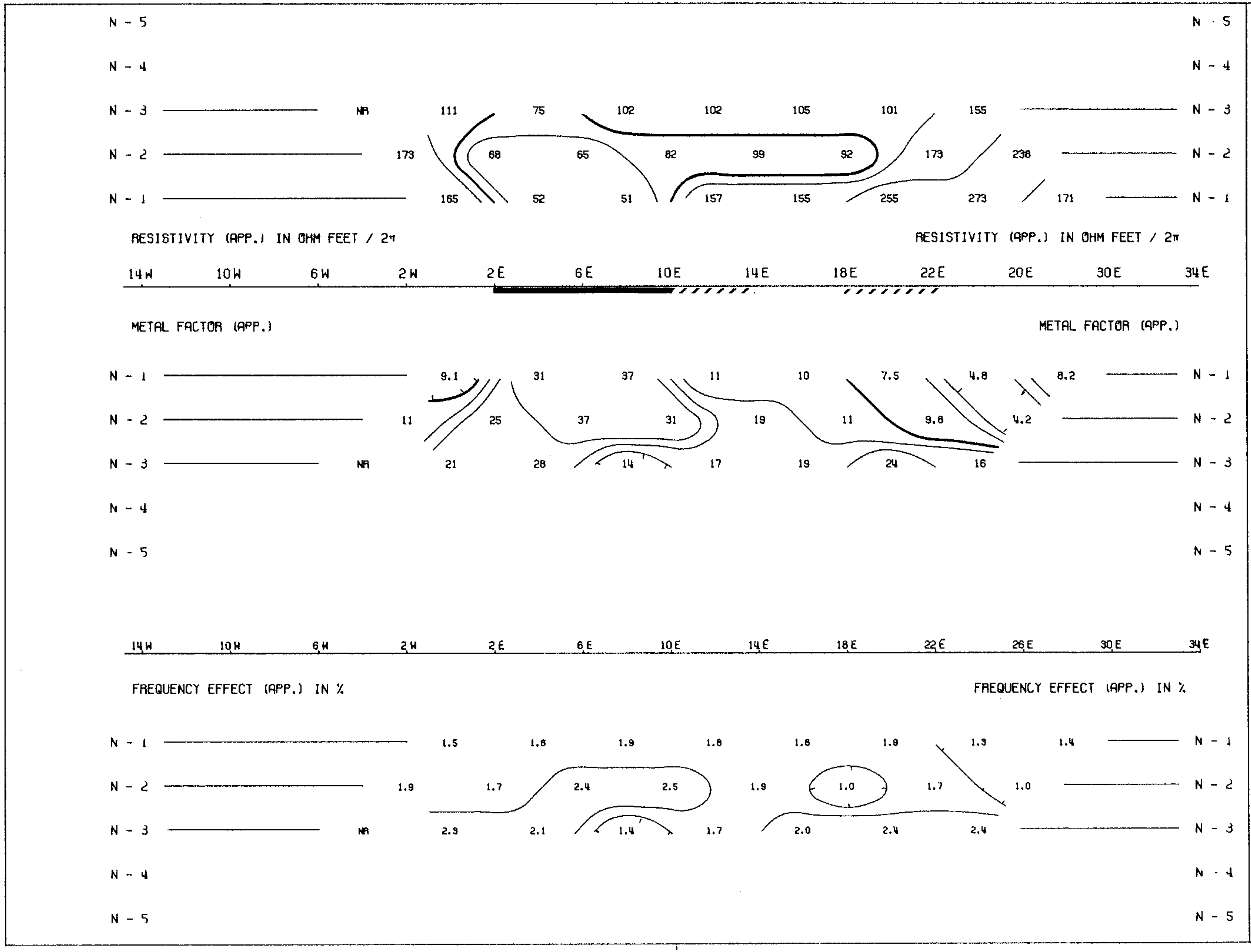
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R. W. M...

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO. - I.P. -

I ST. SURVEY

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO. - 1600S

ELECTRODE CONFIGURATION

PLOTTING POINT → X X = 400FT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAR 1973

APPROVED:

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

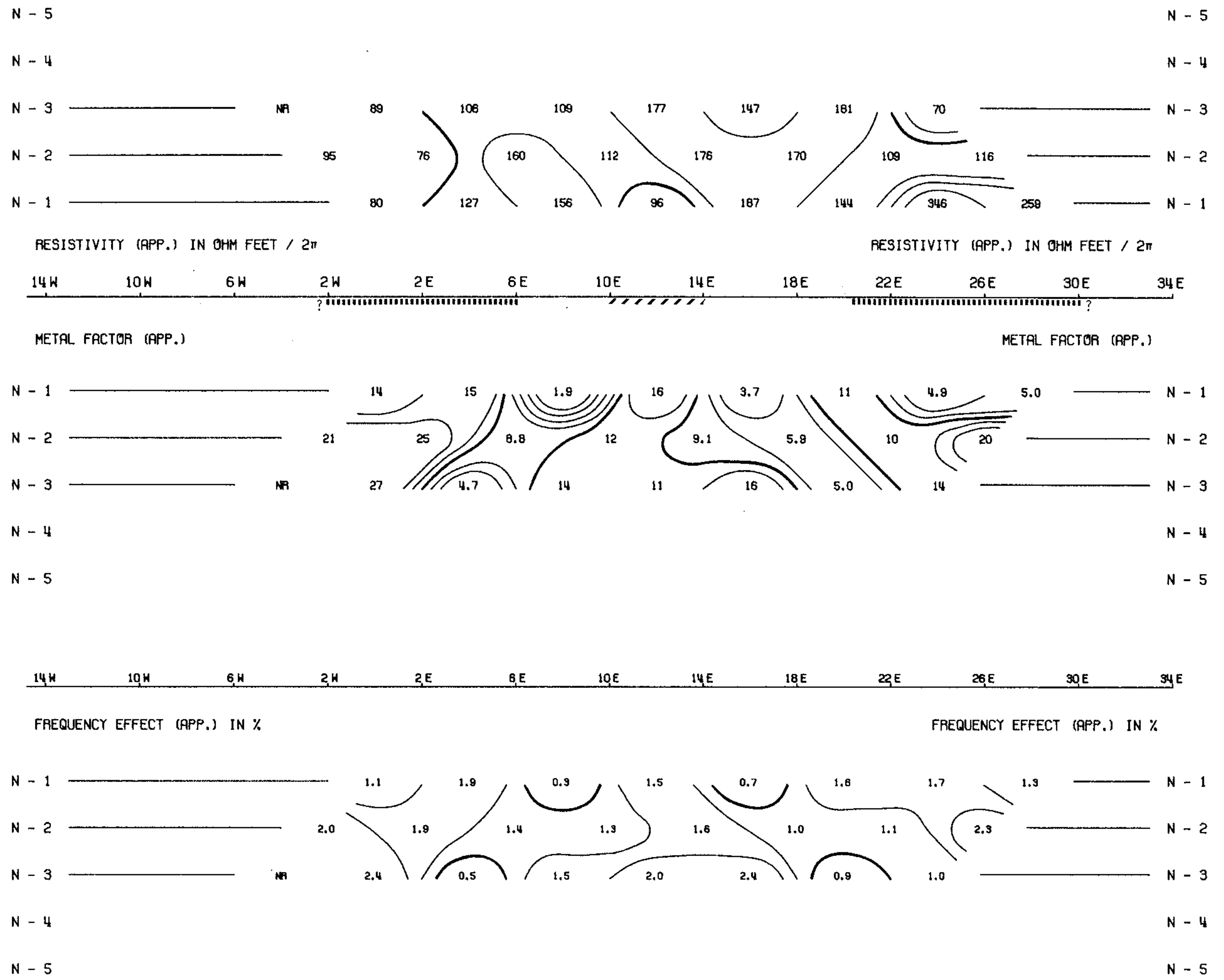
DATE: Aug 3, 1973

4667

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION



DWG. NO.- I.P.-

I ST. SURVEY

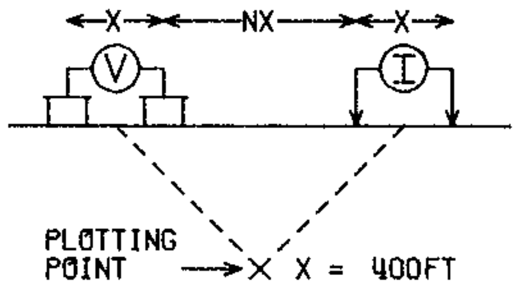
RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, MERRITT AREA

NICOLA M.D., B.C.

LINE NO.- 800S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-5.0 HZ

DATE SURVEYED: MAR 1973

APPROVED:

DATE: Aug 1973

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

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA W. MULLAN

4667

McPHAR GEOPHYSICS

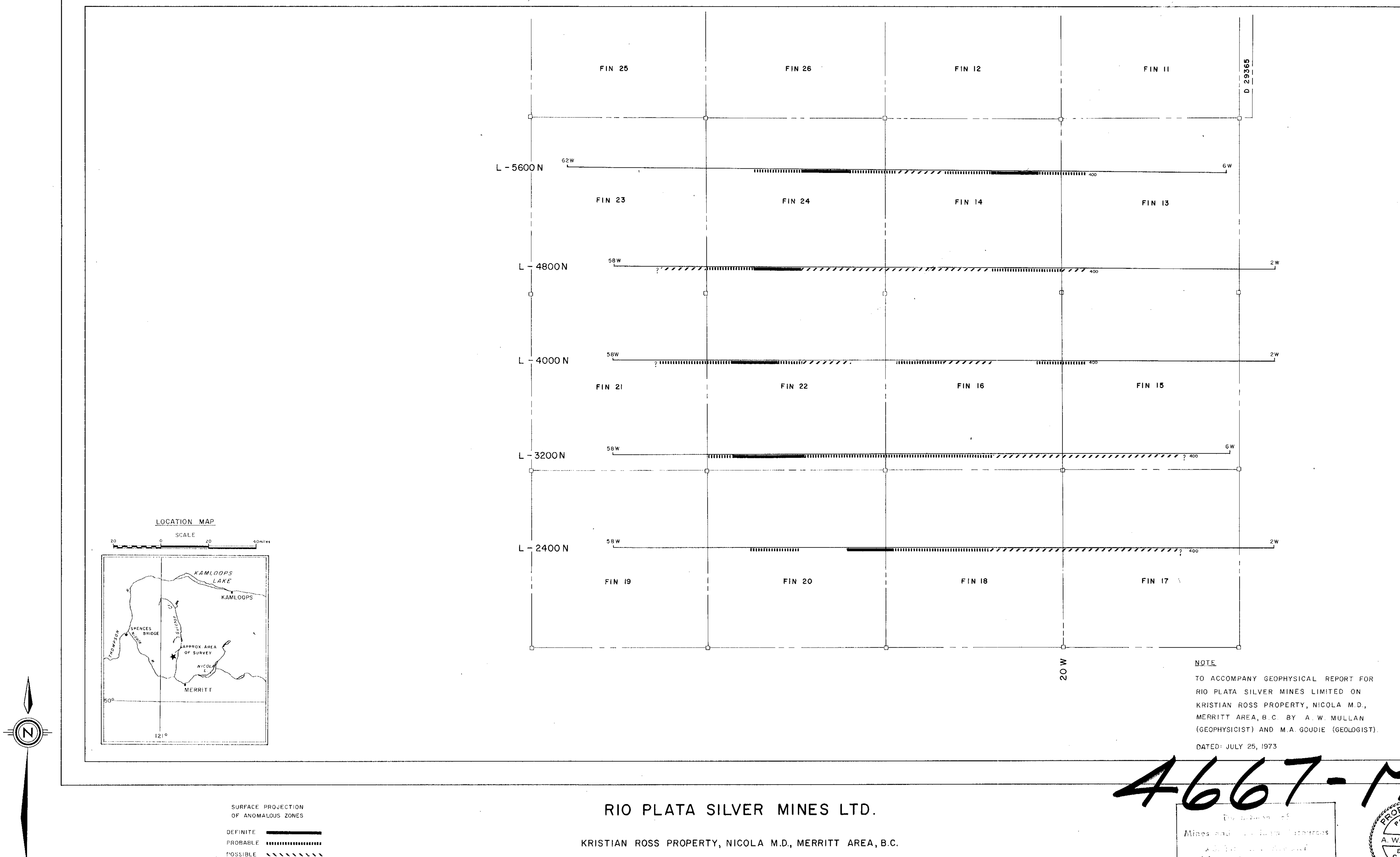
INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED BY MCPHAR COMPUTER DIVISION

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



NOTE

TO ACCOMPANY GEOPHYSICAL REPORT FOR RIO PLATA SILVER MINES LIMITED ON KRISTIAN ROSS PROPERTY, NICOLA M.D., MERRITT AREA, B.C. BY A. W. MULLAN (GEOPHYSICIST) AND M.A. GOUDIE (GEOLOGIST).

DATED: JULY 25, 1973

4667-M1

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates spread used.

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, NICOLA M.D., MERRITT AREA, B.C.

SCALE

ONE INCH EQUALS FOUR HUNDRED FEET

Mines and Petroleum Resources

NO. 4667 #1

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA A. W. MULLAN

DRAWN: FRP

DATE: JULY 1973

APPROVED:

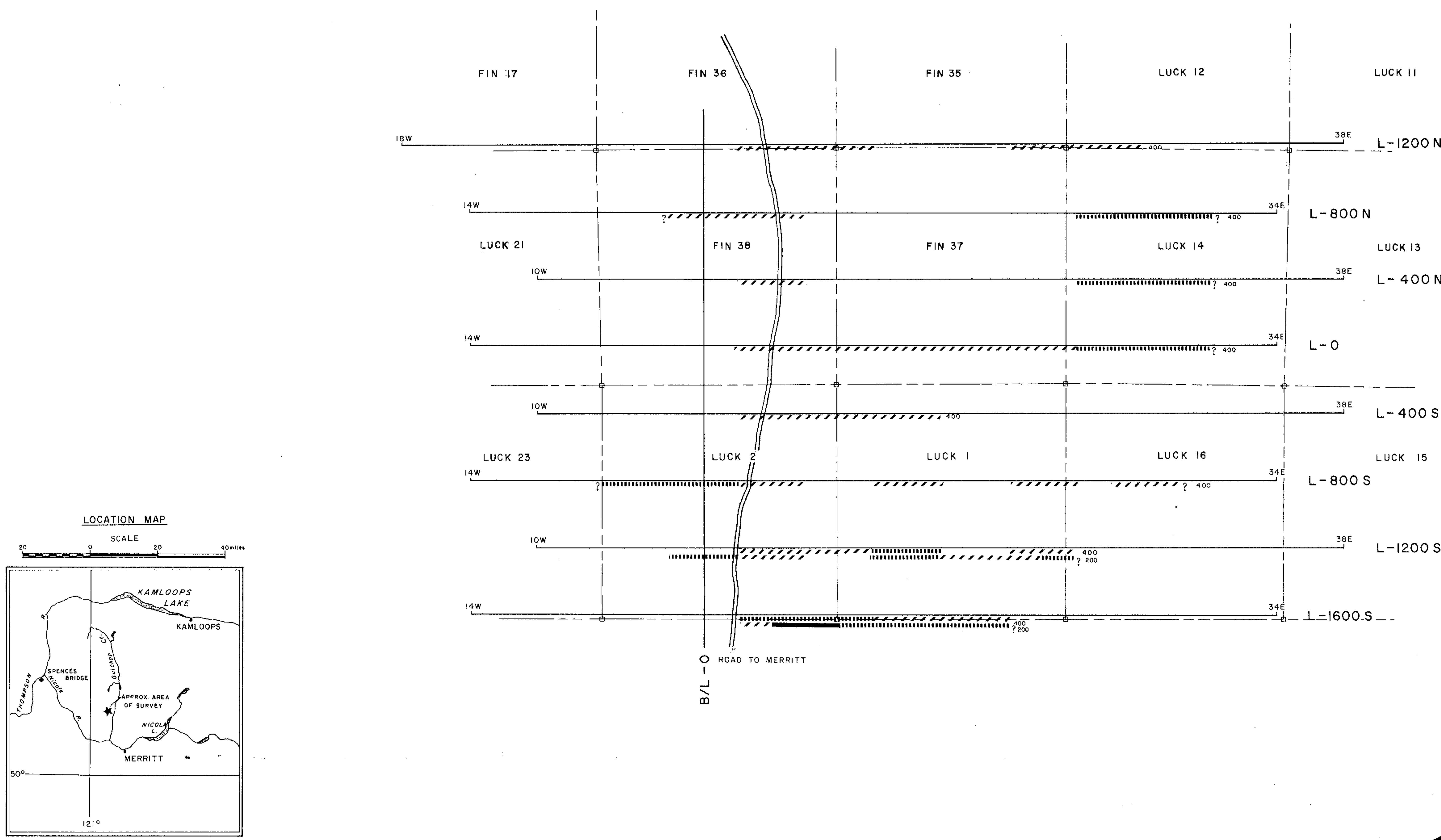
DATE: Aug 3, 1973

DWG. IPP - 3587

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



NOTE

TO ACCOMPANY GEOPHYSICAL REPORT FOR RIO PLATA SILVER MINES LIMITED ON KRISTIAN ROSS PROPERTY, NICOLA M.D., MERRITT AREA, B.C. BY P.G. HALLOF (P.ENG.) AND M.A. GOUDIE (GEOLOGIST)

DATED: MAY 2, 1973

4667-M2

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used.

RIO PLATA SILVER MINES LTD.

KRISTIAN ROSS PROPERTY, NICOLA M.D., MERRITT AREA, B.C.

SCALE

ONE INCH EQUALS FOUR HUNDRED FEET

Department of Mines and Petroleum Resources ASSESSMENT REPORT NO. 4667 MAP #2

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA A. W. MULL... 1973

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA PHILIP G. HALLOF May 2/73 Expiry Date: February 25, 1974

DWG. IPP-3575