

GM 39001

REPORT ON INDUCED POLARIZATION AND RESISTIVITY SURVEYS

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Ministère de l'Énergie et des Ressources
Gouvernement du Québec
Service du Potentiel minéral

DATE: 1 SEP. 1982

No G.M.:

39991

PHOENIX GEOPHYSICS LIMITED

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 cannot 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 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 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 at the top of the data profile, above the metal factor values. On a third line, below the metal factor values, are plotted the values of the percent frequency effect. 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 the 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.

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.

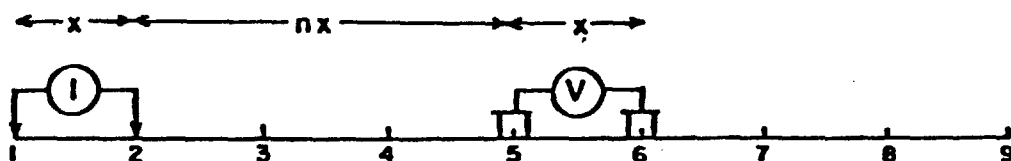
In some situations spurious noise, either man made or natural, will render it impossible to obtain a reading. The symbol "N" on the data plots indicates a station at which it is too noisy to record a reading. If a reading can be obtained, but for reasons of noise there is some doubt as to its accuracy,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

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



Stations on line

x = Electrode spread length

n = Electrode separation

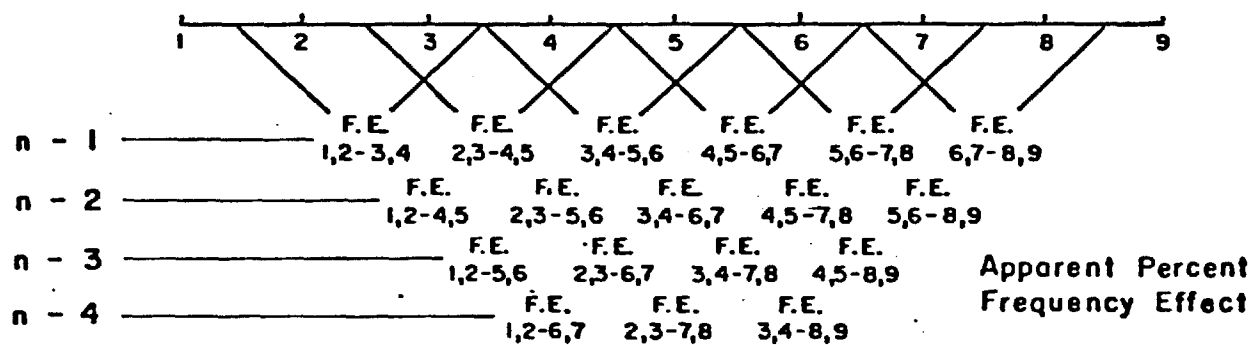
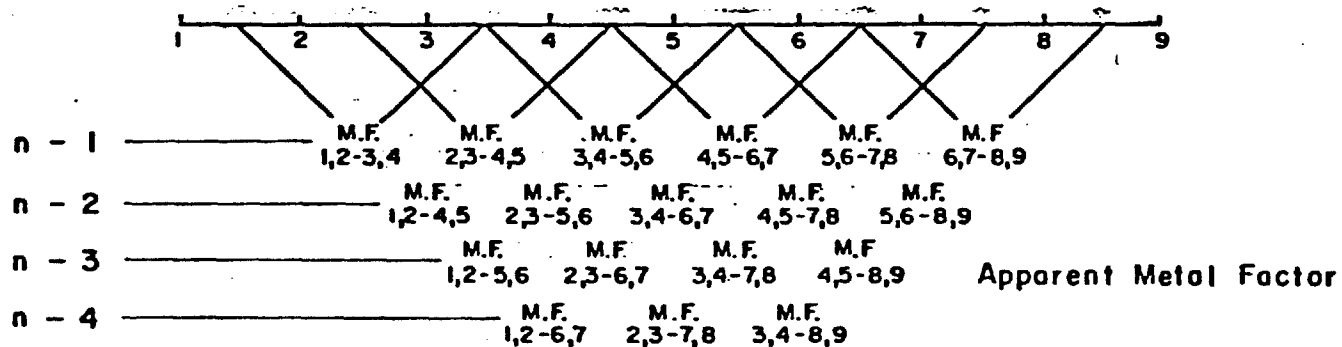
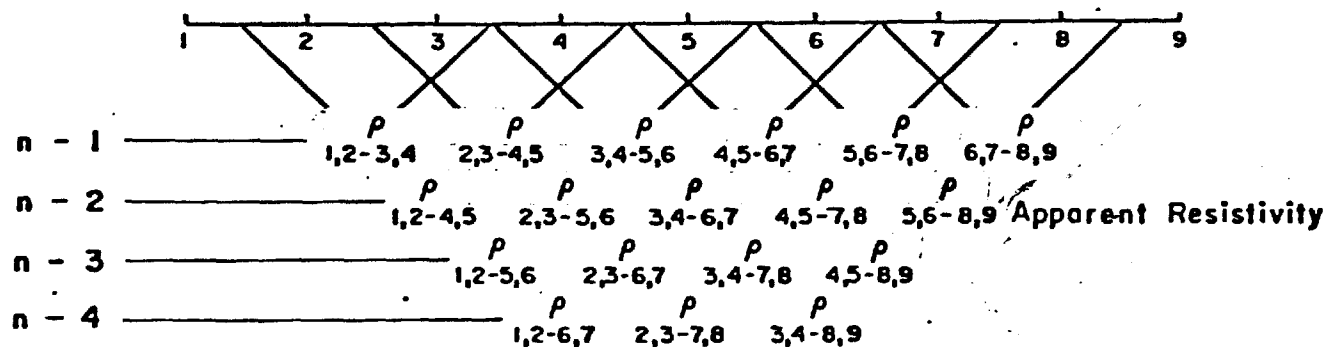


Fig. A

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REPORT ON THE
INDUCED POLARIZATION
AND RESISTIVITY TEST SURVEYS
NEAR CHIBOUGAMAU, QUEBEC
FOR
DERRY, MICHENER AND BOOTH

1. INTRODUCTION

At the request of Derry, Michener and Booth, we have completed brief induced polarization and resistivity surveys on five grids near Chibougamau, Quebec. Some geologic information is available for each of the five test areas. The test measurements were planned to give information concerning the usefulness of the induced polarization and resistivity method in exploration for gold-bearing sulphide mineralization.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results are shown in the

following enclosed data plots. The field results have been plotted using the pseudosection format.

a) Norbeau Mine Area Grid

Line No. 7E	25 meter electrode intervals	Dwg. No. IP 5284-1
	50' electrode intervals	Dwg. No. IP 5284-2
Line No. 6E	50' electrode intervals	Dwg. No. IP 5284-3
Line No. 4E	25 meter electrode intervals	Dwg. No. IP 5284-4

b) McKenzie-Roy Area - Grid #1

Line 5W	25 meter electrode intervals	Dwg. No. IP 5285-1
Line 4W	25 meter electrode intervals	Dwg. No. IP 5285-2
Line 3W	25 meter electrode intervals	Dwg. No. IP 5285-3
Line 2W	25 meter electrode intervals	Dwg. No. IP 5285-4
Line 1W	25 meter electrode intervals	Dwg. No. IP 5285-5

c) McKenzie-Roy Area - Grid #5

Line 7W	25 meter electrode intervals	Dwg. No. IP 5286-1
Line 6W	25 meter electrode intervals	Dwg. No. IP 5286-2
Line 5W	25 meter electrode intervals	Dwg. No. IP 5286-3
Line 4W	25 meter electrode intervals	Dwg. No. IP 5286-4
	12.5 meter electrode intervals	Dwg. No. IP 5286-5
	12.5 meter electrode intervals	Dwg. No. IP 5286-6
Line 3W	25 meter electrode intervals	Dwg. No. IP 5286-7
Line 2E	25 meter electrode intervals	Dwg. No. IP 5286-8
Line 3E	25 meter electrode intervals	Dwg. No. IP 5286-9

d) Dufault Lake Area - Grid #1

Line 96W	12.5 meter electrode intervals	Dwg. No. IP 5287-1
Line 0+00	12.5 meter electrode intervals	Dwg. No. IP 5287-2

Line 0+50W	12.5 meter electrode intervals	Dwg. No. IP 5287-3
Line 0+00	25 meter electrode intervals	Dwg. No. IP 5287-4
Line 3+50W	25 meter electrode intervals	Dwg. No. IP 5287-5
Line 4W	25 meter electrode intervals	Dwg. No. IP 5287-6
Line 5W	25 meter electrode intervals	Dwg. No. IP 5287-7
Line 6W	25 meter electrode intervals	Dwg. No. IP 5287-8

e) Cummings Lake Area ✓

Line 8W	25 meter electrode intervals	Dwg. No. IP 5288-1
Line 9+50W	25 meter electrode intervals	Dwg. No. IP 5288-2
Line 11W	25 meter electrode intervals	Dwg. No. IP 5288-3

Also enclosed with this report are plan maps for each of the Test Survey Areas.

a) Norbeau Mine Area	Dwg. No. IPP 3101
b) McKenzie-Roy Area - Grid #1	Dwg. No. IPP 1102
c) McKenzie-Roy Area - Grid #5	Dwg. No. IPP 3102
d) Dufault Lake Area - Grid #1	Dwg. No. IPP 3103
e) Cummings Lake Area	Dwg. No. IPP 2106

The definite, probable and possible Induced Polarization anomalies are indicated by bars, in the manner shown on the legend, on these plan maps 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 25 meter

electrode intervals the position of a narrow sulphide body can only be determined to lie between two stations 25 meters 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 topographical and geological information shown on the various plan maps has been taken from maps made available by the staff of Derry, Michener and Booth.

3. DISCUSSION OF RESULTS

The use of the induced polarization and resistivity method in exploration for gold-bearing deposits is dependent upon the presence of metallic minerals associated with the zone of interest. These metallic minerals may be a concentrated sulphide zone within volcanic fragmental rocks, a zone of weak pyrite within an altered acid intrusive rock or small concentrations of arsenopyrite and/or pyrite within a structural quartz vein.

If the gold is present in a silicified zone or a quartz vein without associated metallic mineralization, there will be no IP anomaly expected. If this type of source is highly silicified, it will often represent a zone of decreased porosity within the non-silicified country rock. In this situation the gold-bearing source may be detected as an apparent resistivity high.

A second difficulty often encountered is a matter of scale. The gold-bearing zones that are the target of the exploration program can often be

relatively narrow and still be of economic interest. However, in order to make the survey practical, it is necessary to use electrode intervals that are appreciably greater than the width of the targets. As outlined in the Appendix to this report, this situation will give rise to any weakly anomalous apparent effects being measured. In order to accurately locate, and fully evaluate, the source of shallow, narrow, weak apparent anomalies located with large electrode intervals, it is necessary to repeat the field measurements using shorter electrode intervals.

a) Norbeau Mine Area

The effect of scale in the induced polarization and resistivity method can be seen in the data measured on Line 7E, over the Norbeau Mine. The measurements with $x = 25$ meters ($\approx x = 80'$) show a shallow, narrow, weak anomalous pattern. The detailed measurements with $x = 50$ feet, show the same type of anomalous pattern; the magnitude is greater. The apparent effects measured are larger in magnitude and closer to the true magnitude in the source because the scale of the measurement (the electrode interval) is closer to the narrow width of the source.

Since the measurements with $x = 50$ feet show a shallow source (i.e. anomalies for $n = 1$) the source could clearly be better evaluated using $x = 30$ feet measurements.

To the west, the measurements with $x = 50$ feet over the main Norbeau Zone show a decrease in the magnitude of the anomaly. On both Line 7E and Line 6E, the measurements with $x = 50$ feet show a second, weaker source centered to the north (approximately 100' to 150') of the main zone. The anomaly centered at Line 6E, 4+50N to 5+00N should be check using $x = 30'$ in order to better evaluate its importance.

b) McKenzie-Roy Area - Grid #1

On this grid an anomalous zone was located along the southern edge of the grid. For the measurements with $x = 25$ meters, the more definite anomalies were detected on Line 3W, and particularly on Line 1W. The position of the source is located to the south of the thrust fault shown on the geologic map. On both Line 2W and Line 1W, the measurements would have to be extended to the south to complete the anomalous pattern. Without this data, the expected position of the source of the anomaly cannot be accurately interpreted.

Two drill holes have been completed at the south edge of Grid #1. The geology cannot be easily correlated from hole to hole. Only weak pyritic mineralization was intersected in DDH MR-2. In DDH MR-3, a zone of massive pyrrhotite and pyrite was intersected within a tuff bed in the Blondean Formation. This type of mineralization could be the source of the anomaly on Line 1W. However, the geologic section shows that the upper portion of the zone would be centered at approximately 1+25S to 1+50S; the anomaly measured with $x = 25$ meters on Line 1W suggests that the source is centered at about 2+50S.

If the source of this definite anomaly is of possible interest, further detailed measurements would be necessary to make certain that the source has been fully tested by the existing drill holes.

c) McKenzie-Roy Area - Grid #5

The results on this grid are very much the same as those located on Grid #1. On Grid #5, the lines surveyed are longer and more anomalous zones were located. As shown on Dwg. No. IPP 3102, the zones are distributed across the grid.

On Grid #5, there are at least three zones located along the southern edge of the grid. They may correlate with the pyrrhotite-pyrite bed known from the gossans shown on the geologic map and from the two drill holes that apparently intersected the source. On Grid #5 there appears to be some type of structural off-set between Line 5W and Line 4W. The detailed measurements with $x = 12.5$ meters on Line 4W show a strong, shallow anomaly at about 1+25S to 1+00S. To the west, the off-set anomalous zone also shows very strong anomalous effects.

On several lines, there is a narrow, weaker anomaly just to the north of the strong source. On Line 4W this source is centered at 37.5S; on Line 6W this source is centered at 112.5N. This is clearly a different type of source and further investigation is warranted.

There is also a weaker anomalous zone near the center of the grid (about 2+50N to 3+50N). On Line 4W and Line 3W this source appears to be low in magnitude, complex and definite. Detail with 12.5 meters on Line 4W suggests a multiple source. These anomalies are not unlike those measured at the Norbeau Mine Grid. Further work is warranted to evaluate this zone. A small grid should be surveyed to completely outline the anomalous source.

Broad, strong anomalies were detected on all survey lines that crossed the contact at the north edge of the grid. Pyrrhotite, pyrite and graphite have been intersected in multiple zones in this location. At least three drill holes have tested this source. The multiple zones of mineralization have been averaged together by the IP measurement to give a broad anomalous pattern on the pseudosection.

On several lines the IP results show a narrow source to the north, within the Blondeau Formation. A weak definite anomaly is centered at Line 4W,

712.5N to 725N; a stronger, narrow anomaly is centered at Line 2E, 4+50N to 4+75N. The source of this narrow, shallow anomaly may be mineralization of a different type. Further measurements with shorter electrode intervals, and on closely spaced lines, would be necessary to better locate, and evaluate, this source. With detailed data available a test of trenching and/or drilling can be planned.

d) Dufault Lake Area - Grid #1

Several anomalous zones were located on this grid also (see Dwg. No. IPP 3103). However, the IP anomalies are not as strong as in the McKenzie-Roy Area.

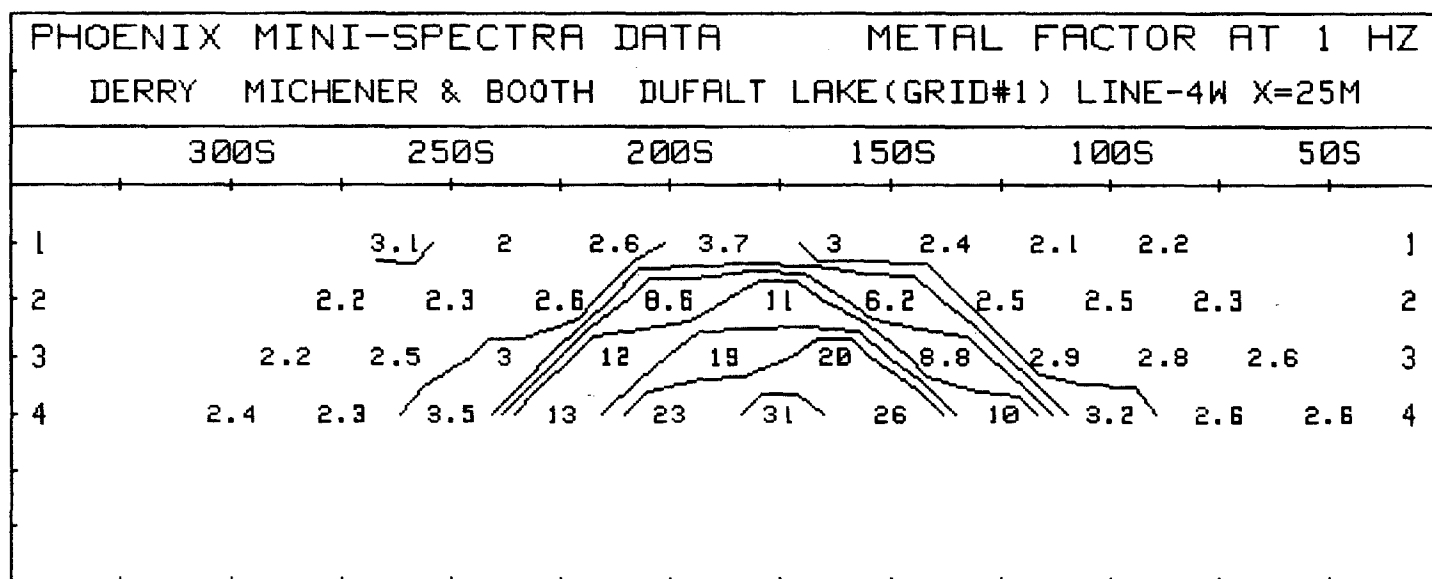
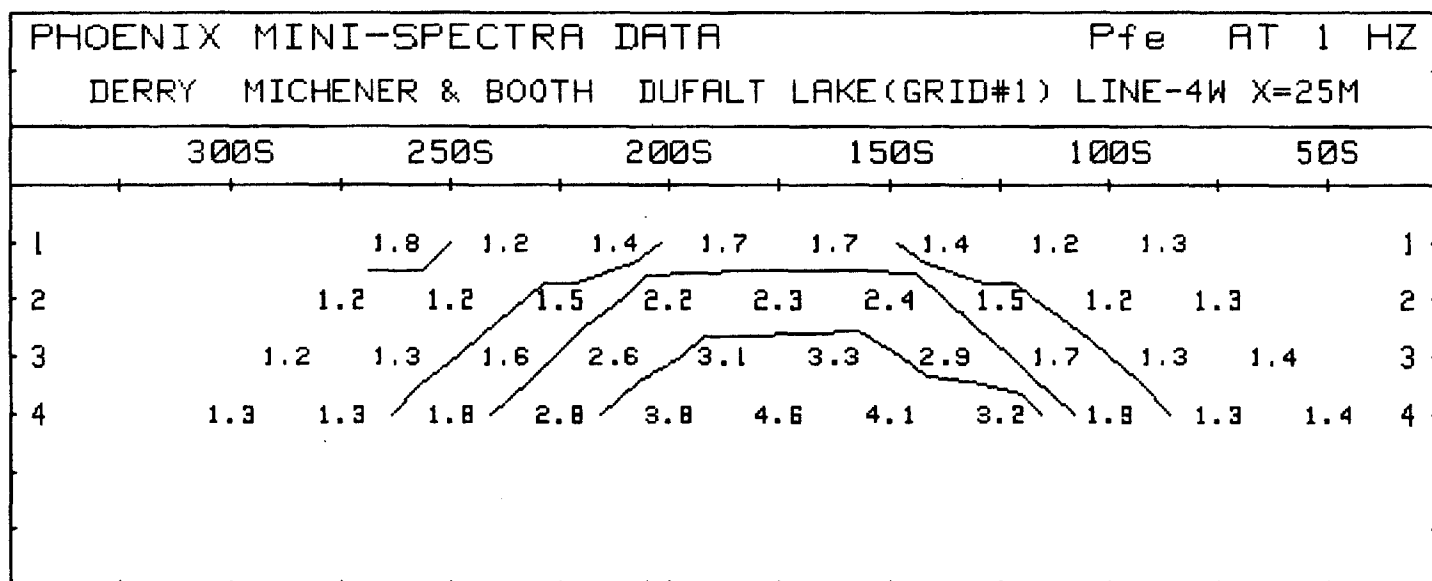
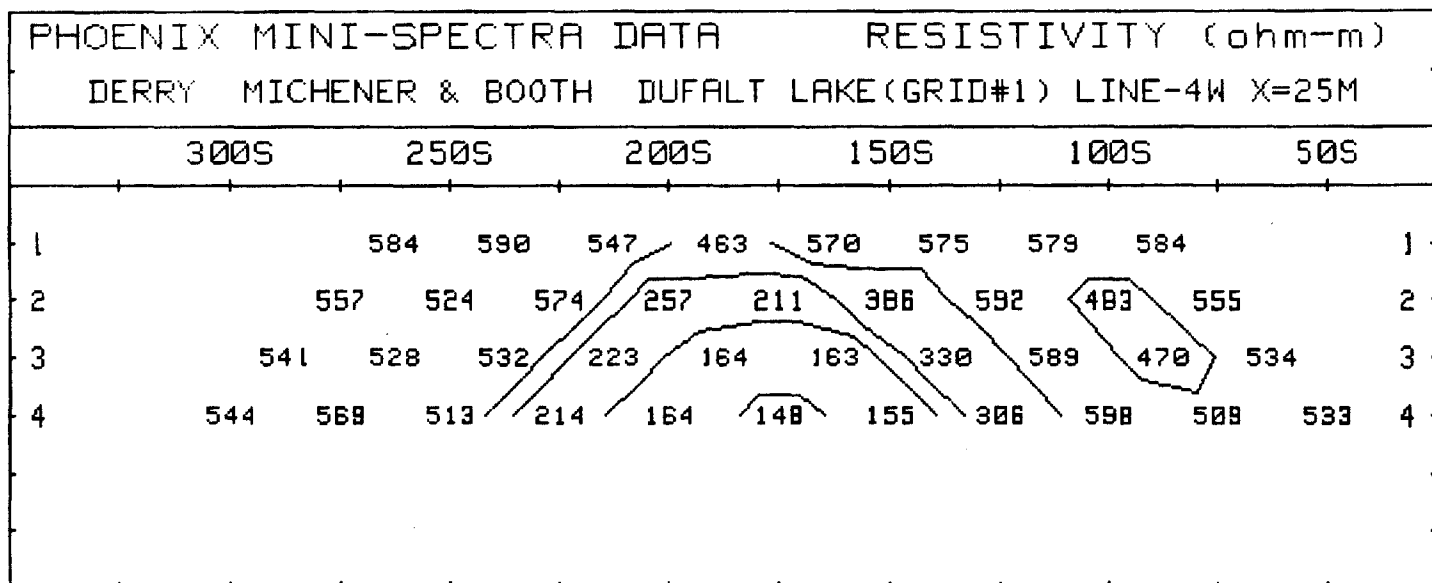
The weak, but definite anomaly centered at Line 0+00, 2+75N to 2+07.5N has been tested by ddh LD-1; a narrow zone of pyrite was intersected in tuffaceous rocks beneath the anomaly. The somewhat more definite anomaly centered at Line 4W, 3+00N to 3+50N has been tested by ddh LD-2. In this location, the source of the IP effects was found to be pyrite and graphite.

The anomaly for this zone is more definite to the west on Line 5W. In addition, there is a narrow anomaly at 3+75N to 4+00N, Line 5W that would warrant further investigation.

Finally, there is an anomalous zone at the southwest corner of the grid that has an unknown source. The most definite anomaly is located at Line 4W, 1+75S. The source of this zone is indicated to be at some depth.

e) Cummings Lake Area

Strongly anomalous effects were measured on all three lines surveyed on this grid. The anomalous patterns suggest narrow, shallow sources (Line 8W, 4+00S to 3+75S) as well as very wide sources (Line 9+50W, 2+75S to 1+50S).



DERRY, MICHENER AND BOOTH

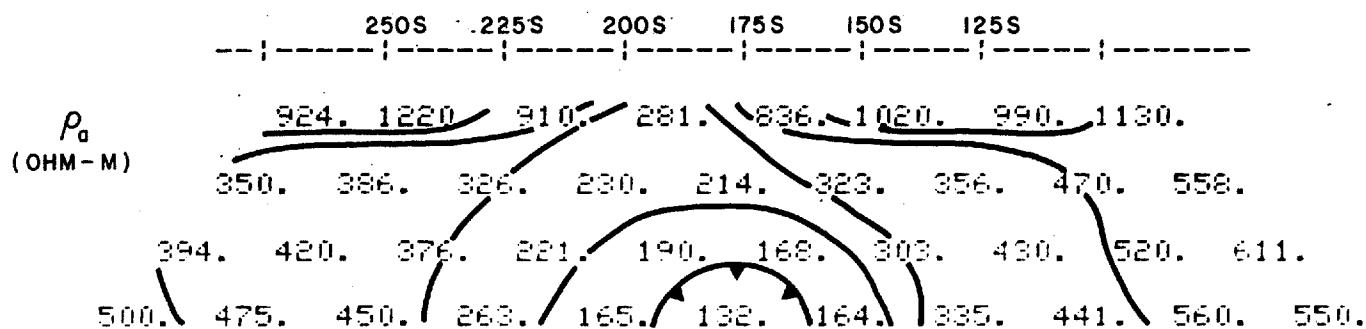
DUFAULT LAKE AREA / GRID #1

LINE - 4W

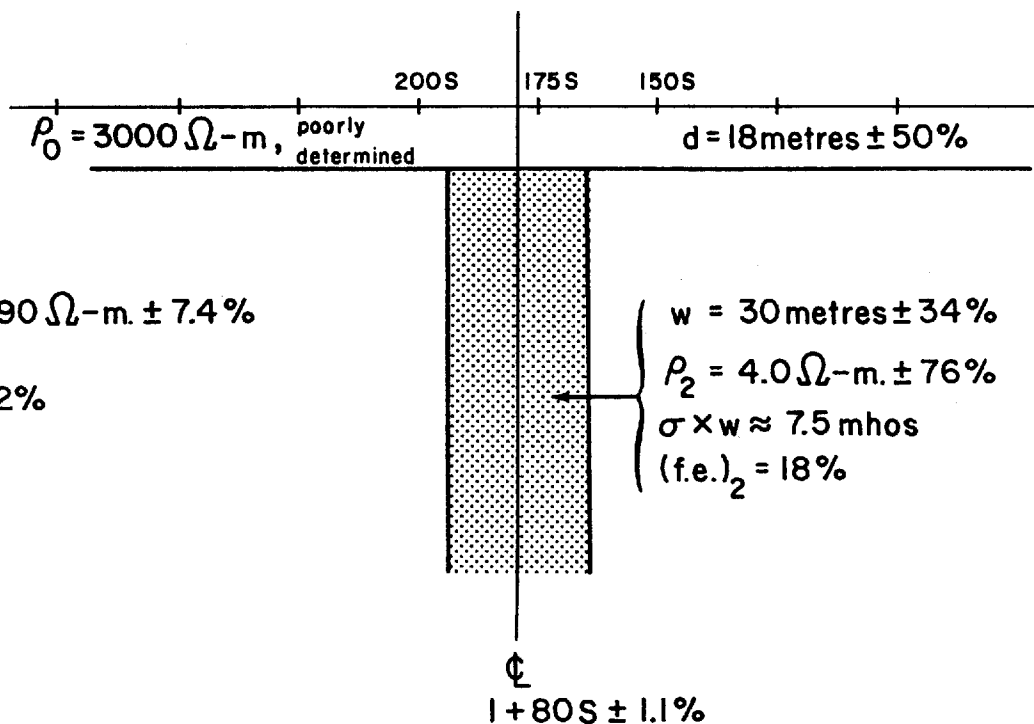
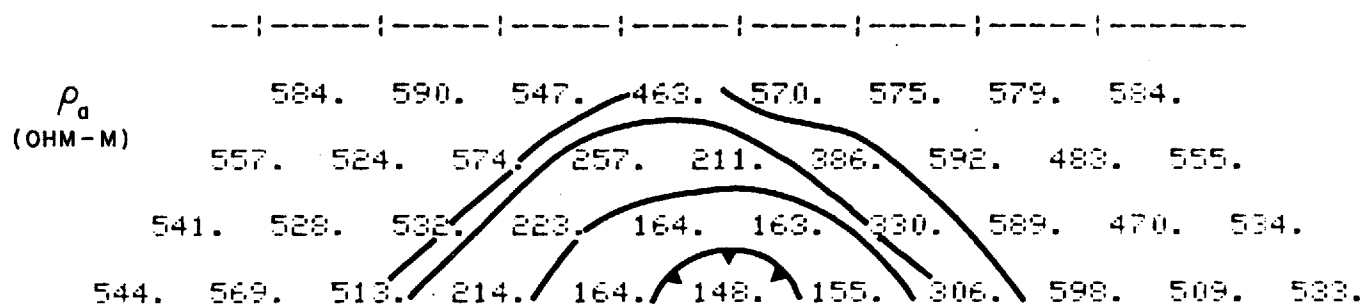
FINAL MODEL FOR DATA SET 1

x = 25metres

OBSERVED DATA



CALCULATED DATA



DERRY, MICHENER AND BOOTH

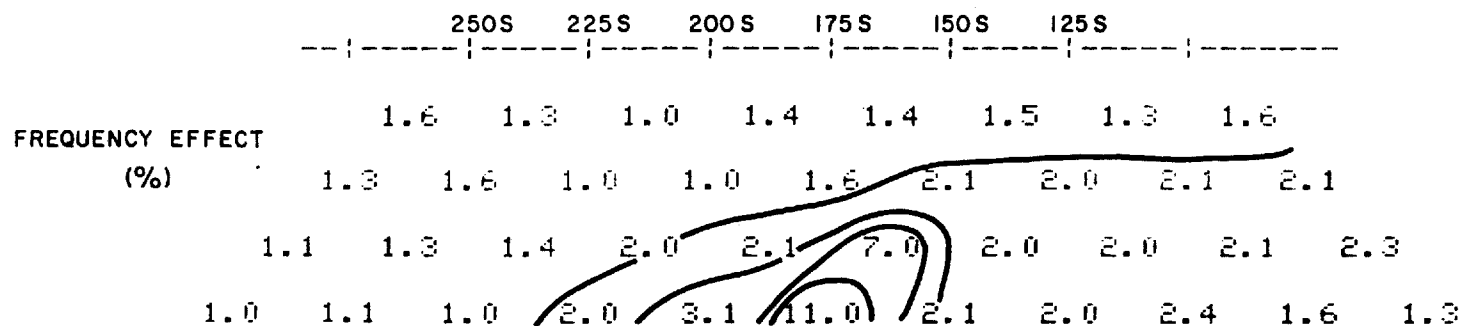
DUFAULT LAKE AREA / GRID #1

LINE - 4W

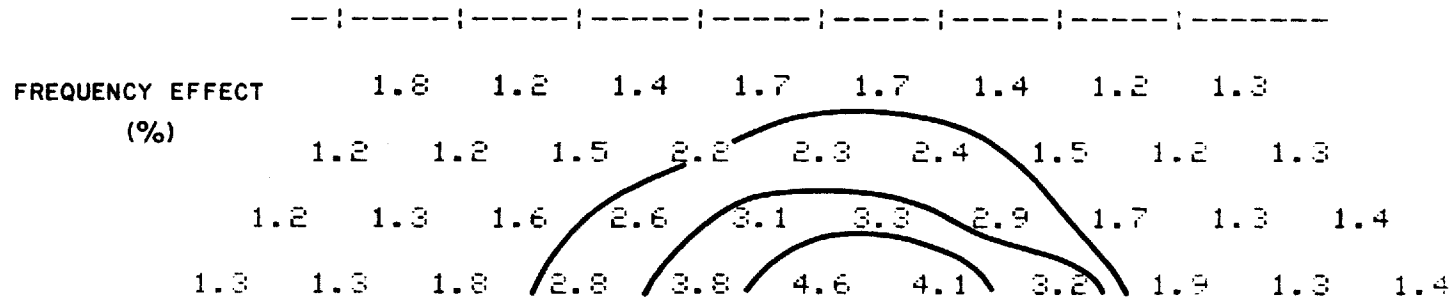
x = 25metres

FINAL MODEL FOR DATA SET 1

OBSERVED DATA



CALCULATED DATA



There are no drill holes on this grid, but some geologic data is available. The anomalies located appear to lie within a felsic volcanic rock unit. If the available geological and/or geochemical information suggests that further investigation is warranted, a detailed grid should be surveyed in this area. When the anomalous zones are completely outlined, investigation by trenching and/or drilling can be planned.

4. CONCLUSIONS

The induced polarization and resistivity test surveys on the five grids in the Chibougamau Area of Quebec have located a variety of anomalies. At the Norbeau Mine, a weak, shallow definite anomaly was located over the sulphide and gold-bearing quartz structure that was the ore zone. The anomaly is not strong, presumably due to the narrow width and low sulphide content of the zone.

On other grids, much stronger IP anomalies were measured from zones of concentrated pyrrhotite and pyrite and also from other zones of pyrite and/or graphite in tuffaceous rocks. There are numerous other anomalies, both weak and strong, that have an unknown source.

The induced polarization and resistivity results should be correlated with the available geological and geochemical data from the Test Survey Areas. In several localities, further detailed IP measurements are warranted so that trenching and/or drilling can be planned. The detailed measurements recommended are necessary in order to better locate, and evaluate the sources of the shallow anomalies (see Appendix)

It is recommended that phase IP measurements be used for any further detail planned. The use of the IPV-2, Phase IP Voltmeter would speed the

completion of the detailed work. Further, the multi-frequency capability of the system would make it possible to make mini-spectra determinations on each anomalous zone, when the detail is completed.

PHOENIX GEOPHYSICS LIMITED

Philip G. Hallof
Philip G. Hallof, Ph.D., M.Eng.
Geophysicist



21

Dated: December 16, 1981

ASSESSMENT DETAILS

PROPERTY: McKenzie Roy Area

SPONSOR: Derry, Michener & Booth

PROVINCE: Quebec

LOCATION: Chibougamau Area

TYPE OF SURVEY: Induced Polarization
& Resistivity

OPERATING MAN DAYS:	13.34	DATE STARTED: July 19, 1981
EQUIVALENT 8 HR. MAN DAYS:	20.0	DATE FINISHED: August 28, 1981
CONSULTING MAN DAYS:	2.0	NUMBER OF STATIONS: 339
DRAFTING MAN DAYS:	11.0	NUMBER OF READINGS: 3,250
TOTAL MAN DAYS	33.0	KM. OF LINE SURVEYED: 7.38 KM

CONSULTANTS:

Philip G. Hallof, 2045 Lakeshore Blvd. W., Toronto, Ontario.

FIELD TECHNICIANS:

M. Parent, 222 St. John Street, St. Leonard, N.B.

CARTOGRAPHERS:

R.C. Norris, 1201 - 45 Sunrise Ave., Toronto, Ontario.
R.J. Pryde, R.R.#1, Sharon, Ontario.
M.W. Reh, 58 Crossbow Cres., Willowdale, Ontario.

PHOENIX GEOPHYSICS LIMITED

Philip G. Hallof
Philip G. Hallof, Ph.D. P.Eng.
Geophysicist



Dated: December 16, 1982

ASSESSMENT DETAILS

PROPERTY: Lac Dufault Grid

SPONSOR: Derry, Michener & Booth

PROVINCE: Quebec

LOCATION: Chibougamau Area

TYPE OF SURVEY: Induced Polarization
& Resistivity

OPERATING MAN DAYS:	5.98	DATE STARTED: July 19, 1981
EQUIVALENT 8 HR. MAN DAYS:	9.0	DATE FINISHED: August 28, 1981
CONSULTING MAN DAYS:	1.0	NUMBER OF STATIONS: 178
DRAFTING MAN DAYS:	5.0	NUMBER OF READINGS: 1,752
TOTAL MAN DAYS	15.0	KM. OF LINE SURVEYED: 3.71 KM

CONSULTANTS:

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FIELD TECHNICIANS:

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CARTOGRAPHERS:

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PHOENIX GEOPHYSICS LIMITED

Philip G. Hallof
Philip G. Hallof, Ph.D. P.Eng.
Geophysicist



Dated: December 16, 1982

ASSESSMENT DETAILS

PROPERTY: Lac Cummings Grid

SPONSOR: Derry, Michener & Booth

PROVINCE: Quebec

LOCATION: Chibougamau Area

TYPE OF SURVEY: Induced Polarization
& Resistivity

OPERATING MAN DAYS:	3.68	DATE STARTED: July 19, 1981
EQUIVALENT 8 HR. MAN DAYS:	5.5	DATE FINISHED: August 28, 1981
CONSULTING MAN DAYS:	1.0	NUMBER OF STATIONS: 93
DRAFTING MAN DAYS:	3.0	NUMBER OF READINGS: 918
TOTAL MAN DAYS	9.5	KM. OF LINE SURVEYED: 2.25 KM

CONSULTANTS:

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PHOENIX GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof, Ph.D. P.Eng.
Geophysicist



Dated: December 16, 1982

STATEMENT OF COST

Derry, Michener & Booth - IP Survey
Chibougamau Area of Quebec

CREW: M. Parent

PERIOD: July 19 - August 28, 1981

23 Operating days	@ 495.00/day	\$11,385.00
3 Travel)		
3½ Organization)	91 days @ \$225.00/day	2,137.50
2 Standby)		
1 Bad Weather)		

EXPENSES:

Freight	\$ 456.99
Telephone	109.90
Fares	501.75
Meals & Accommodation	96.54

	<u>\$1,165.18</u>
+ 15%	<u>174.78</u>

1,339.96

\$14,862.46

EXPENDITURE ON EACH GRID:

McKenzie-Roy Area	58%	\$ 8,620.23
Lac Dufault Grid #1	26%	\$ 3,864.24
Lac Cummings Grid	16%	\$ 2,377.99
	<u>100%</u>	<u>\$14,862.46</u>

PHOENIX GEOPHYSICS LIMITED

Philip G. Hallof
Philip G. Hallof, Ph.D., P.Eng.
Geophysicist



Dated: December 16, 1981

CERTIFICATE

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

1. I am a geophysicist residing at Suite 3505, 2045 Lakeshore Blvd. W., 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 Derry, Michener & Booth 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 nor for advertising purposes.

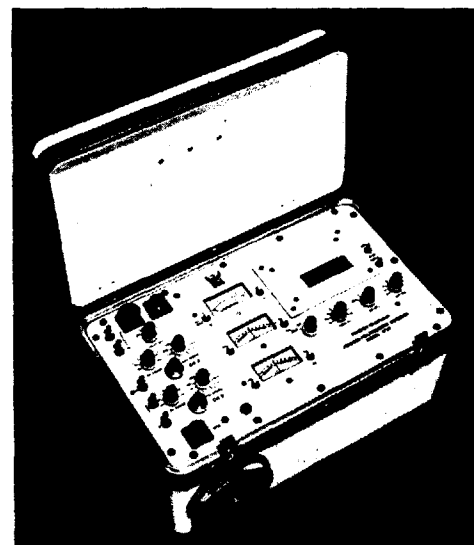
Dated at Toronto

This 16th day of December, 1981

Philip G. Hallof
Philip G. Hallof, Ph.D., P.Eng.

A circular professional seal for Philip G. Hallof, a Registered Professional Engineer in the Province of Ontario. The seal features his name "Philip G. HALLOF" in the center, with "REGISTERED PROFESSIONAL ENGINEER" around the top and "PROVINCE OF ONTARIO" around the bottom. There are two horizontal lines across the seal.

- Crystal Clock Synchronization With Transmitter
- Microprocessor controlled signal Stacking and Averaging
- Simultaneous Measurement Of Two Receiver Channels
- Bad Sample Rejection
- Multifrequency Operation



Specifications

INPUT

Channels

: Two input channels allow two dipoles to be measured simultaneously. The center electrode is common.

Impedance

: 1000 Megohms.

Protection

: The input is protected from excessive voltages by a 10,000 ohm fuse resistor.

Ranges

: 100 microvolts full scale to 3V full scale in ten half decade steps.

SP Cancellation

: Cancellation is automatic for SP voltages up to ten times the signal amplitude. Additional manual cancellation for each channel is provided in six ranges of $\pm 20\text{mV}$, $\pm 200\text{mV}$ and $\pm 2\text{V}$.

OPERATION

Frequencies

: 0.11, 0.33, 1, 3 and 9 Hz.

Calibration

: An internal 0.05 ohm transmitter current calibrating resistor allows precise calibration under all field conditions.

Synchronization

: Identical crystal clock modules are used as time/phase references in the TXD-2 transmitter driver and in the IPV-2 receiver. The clocks have an aging rate of only 5×10^{-10} /day (i.e. 0.011 mrad/hr at 1 Hz), so that synchronization is required only once per day.

SIGNAL PROCESSING

Analog Filtering

: Single pole bandpass.

Coherent Detection

: The signal is stacked and averaged in real time. Signal to noise enhancement is proportional to the square root of the measurement time.

Spheric Rejection

: Noise spikes may be rejected by means of an operator controlled acceptance window.



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 Vancouver Office: 214-744 West Hastings Street, British Columbia V6C 1A6 Tel: (604) 669-1070
 Denver Office: 4690 Ironston Street, Colorado, 80239, U.S.A. Tel: (303) 373-0332

Specifications

DISPLAY

Analog

: A meter for each input channel allows easy adjustment of SP and gain.

Digital

: Phase is displayed from $+PI$ to $-PI$ radians with a resolution of 0.1 milliradian. Amplitude is displayed from 100 microvolts full scale to 10 volts full scale with four digit resolution. The display is constantly refreshed with the latest stacked and averaged results. There are two display options which differ in temperature range and power consumption.

The LCD display provides continuous readout but operates only down to -20°C .

The LED display has a push-to-read to conserve battery life, but operates over the entire temperature range -40°C to $+60^{\circ}\text{C}$. An analog meter is provided for continuous display of averaged data.

GENERAL

Temperature

: Storage temperature range is -50°C to $+70^{\circ}\text{C}$. Operating temperature range is -40°C to $+60^{\circ}\text{C}$.

Humidity

: The instrument is moisture proof and may be operated during rain.

Altitude

: -1600 m to 10000 m.

Vibration

: Suitable for transport in light aircraft and bush vehicle.

Batteries

: Two 9V transistor radio batteries are used for SP cancellation. Twelve 2V Gates rechargeable sealed lead-acid batteries form the main 24V supply. Operating time without recharging is 8 hours at -40°C for 5.0 AH X cells, or 8 hours at -20°C for 2.5AH D cells. Two 12V chargers are used for recharging.

Weight

: 12.5 kg with 2.5AH D cells, 15.0 kg with 5.0AH X cells.

Case

: Fiberglass. This provides electrical insulation and freedom from tearing or denting.

Dimensions

: 24 cm H, 28 cm W, 44 cm L.

Features

TRUE PHASE

Unlike conventional IP units the IPV-2 system uses two extremely high precision crystal clocks. These clocks provide the time reference required for calculating the true phase difference between the transmitted current and received voltage. Recent research has indicated that phase is perhaps the most useful IP measurement for interpreting the electrical properties of the subsurface. It also appears to be the most accurate and the most efficient in terms of field data acquisition time.

HIGH RESOLUTION

The IPV-2 displays phase to 0.1 milliradian. This is an order of magnitude increase in resolution over earlier conventional time domain and frequency domain IP equipment.

SIGNAL-TO-NOISE ENHANCEMENT

With coherent detection and microprocessor-controlled stacking and averaging, the signal-to-noise enhancement is directly proportional to the square root of the total number of stacked cycles. This in turn depends upon the total measurement time and the operating frequency.

In many areas of the world, reconnaissance phase IP measurements may be made at 3 Hz with negligible influence from electromagnetic coupling. This type of survey is comparable to a variable frequency IP survey with the standard frequencies of 2.5 and 0.3 Hz. If the same time is spent in making the IP measurement, the 3 Hz phase measurement can be made at least three times more precise than the variable frequency measurement. Alternatively, the phase measurement may be made to at least the same precision in one tenth the time.

Conventional time domain measurements employ an unduly long 8 second cycle. 3 Hz phase measurements may be made at least 24 times as fast or five times as precise. The increase in speed or precision is actually larger than these figures since the natural noise per cycle is usually much worse at 0.125 Hz, due to telluric currents, than it is at 3 Hz.

DUAL CHANNEL CAPABILITY

Measurement time may be cut in half, or alternatively, the signal-to-noise ratio may be increased by a factor of 1.4, by making simultaneous measurements of two receiver dipoles.

DESIGNED FOR PRODUCTION

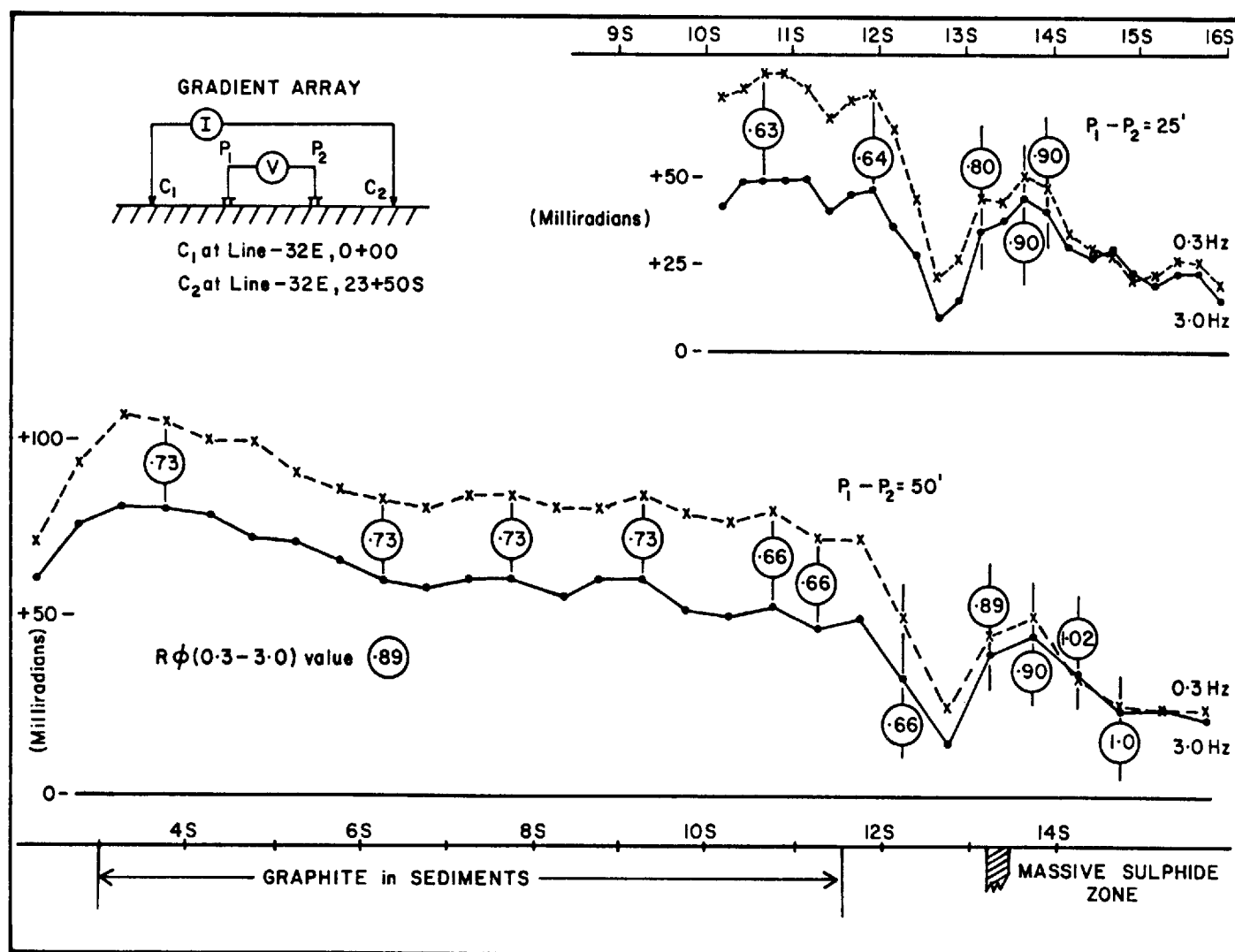
The IPV-2 was designed for production IP surveys by the staff of Phoenix Geophysics, the largest IP contracting company in the world. It was designed for simplicity, to decrease operator training time, for reliability, to decrease breakdown time, and for measurement speed, to decrease total survey time. Any decrease in total field time can result in very significant cost savings, particularly for exploration programs which are in remote areas.

POWERFUL INTERPRETATION

Although the IPV-2 was designed for production, it also provides simple, but powerful, interpretive capabilities. Phase angle measurements may be made at five frequencies, a factor of 3 apart, from .11 Hz to 9 Hz. This is sufficient to recognize and remove the effects of electromagnetic coupling. It is also sufficient for conducting rudimentary mineral discrimination. The type of mineral discrimination for which there is perhaps the greatest potential for immediate, significant, economic impact, is the ability to differentiate between graphitic schist and massive volcanogenic sulfides.

We have determined, through much laboratory and field research, that the maximum phase angle response over graphite mineralization typically occurs at frequencies less than 1 Hz. In other words, the phase angle is decreasing with frequency at 1 Hz, and the ratio of the 3 Hz phase angle to the .3 Hz phase angle is less than 1.0. For massive sulfides of volcanogenic origin we find that the peak phase angle response occurs at frequencies greater than 1 Hz. Therefore, when massive sulfides occur within, or in close association with graphitic sediments, there is a marked tendency for the ratio of 3 Hz phase to the 1 Hz phase to show an increase over the massive sulfides. The magnitude of the phase response indicates the location of the polarizable source. The ratio of the 3 Hz phase to the .3 Hz phase suggests the possible identity of the source. When massive volcanogenic sulfides occur alone, the phase ratio is typically greater than 1.0.

The data shown below are from a gradient IPV-2 survey in New Brunswick. Two distinct anomalies of differing phase ratio were observed with both 50 ft. and 25 ft. potential electrode separations. The phase ratios over the graphite were typically .66 and .73, but increased to .90 and 1.0 over the massive sulfides.



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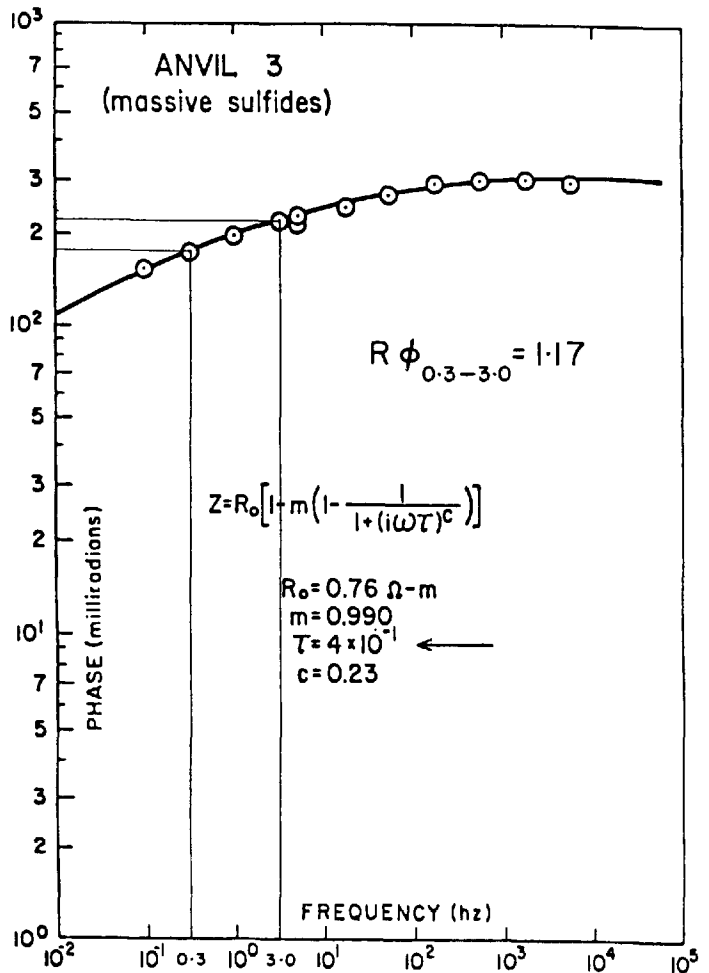
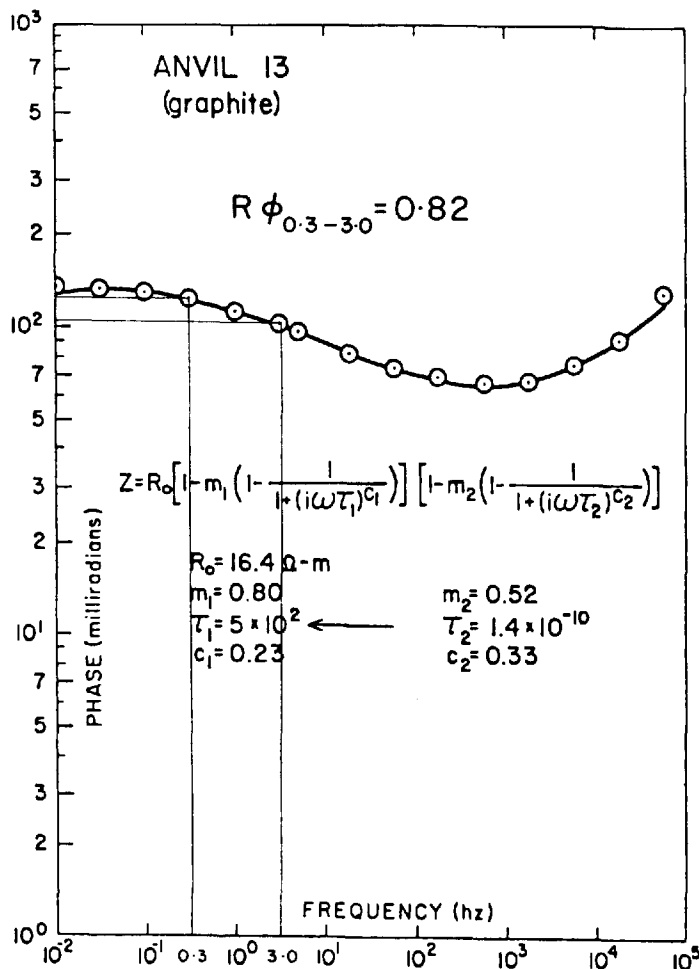
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GRAPHITE VS. MASSIVE SULPHIDES



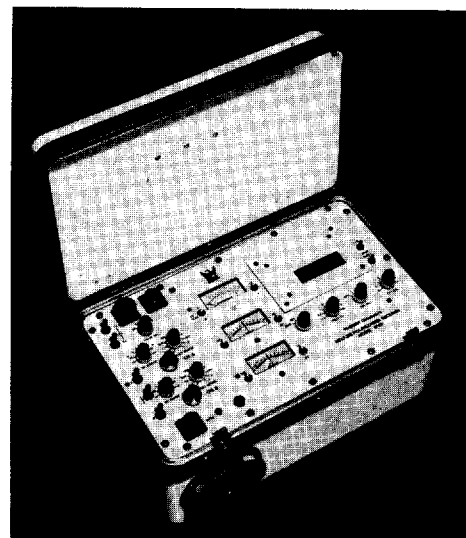
The data shown above were measured using a wideband IP system and a one meter electrode interval at the Faro property of Cyprus Anvil Mining Corporation in the Yukon. The spectra are very typical of those we have measured over graphite and massive sulphides in many localities in North America and Australia. A computer inversion routine has been used to determine the Cole-Cole dispersion parameters which best describe the field data. It can be seen that for graphite the time constant is large. For the massive sulphide mineralization the time constant is three orders of magnitude smaller.

IPV-2

Phase IP Receiver

CASE HISTORY: II Spectral Grain Size

- Crystal Clock Synchronization With Transmitter
- Microprocessor controlled signal Stacking and Averaging
- Simultaneous Measurement Of Two Receiver Channels
- Bad Sample Rejection
- Multifrequency Operation [0.11, 0.33, 1.0, 3.0, 9.0 Hz]



The Phoenix IPV-2, Phase IP receiver, was engineered to be a fast, reliable, reconnaissance IP unit. The system can be operated at a single frequency, without current-off time (as in time-domain IP) and without the need to change frequencies (as in variable frequency IP). For this reason, and because the dual-channel capability permits two measurements simultaneously, the IPV-2 can achieve a survey rate that surpasses all other types of IP measurement.

The system was initially designed to be used at a single frequency for reconnaissance, or detailed surveys. The five frequencies (0.11 Hz, 0.33 Hz, 1.0 Hz, 3.0 Hz, 9.0 Hz) were provided to give the geophysicist a choice of frequency so that he could speed survey production, reduce inductive coupling distortions, etc. However, our research into the spectral characteristics of the IP effect measured from metallic mineralization has suggested that even the limited spectral data from measurements at five frequencies can be useful to the interpreting geophysicist.

We have found that the frequency at which the maximum phase shift is measured (the critical frequency, F_c) for a given source, is related directly to the time-constant (τ) of the IP dispersion. Further, the time-constant can be shown to be directly dependent upon the grain-size of the metallic particles causing the IP effect. (see Hallof, et al, 1979*).

Changes in time-constant and grain-size can often be seen in the limited five-frequency spectra measured with the IPV-2. Two types of interpretation for exploration problems can be easily attempted:

- For a broad, "porphyry copper" type of anomaly, it is often possible to detect changes in "texture" or "grain-size" for the source. True disseminations are small grains; veinlets are detected as much larger grain-size.
- As outlined in Hallof, et al (1979*), it is often possible to separate massive sulphide sources from graphitic sources, based upon the position of the critical frequency (F_c) and the expected grain-size.

*Hallof, P.G., Cartwright, P.A. Pelton, W.H., (1979) "The Use of the Phoenix IPV-2 Phase IP Receiver for Discrimination between Sulphides and Graphite", presented at the S.E.G. Annual Meeting, New Orleans, November 1979.



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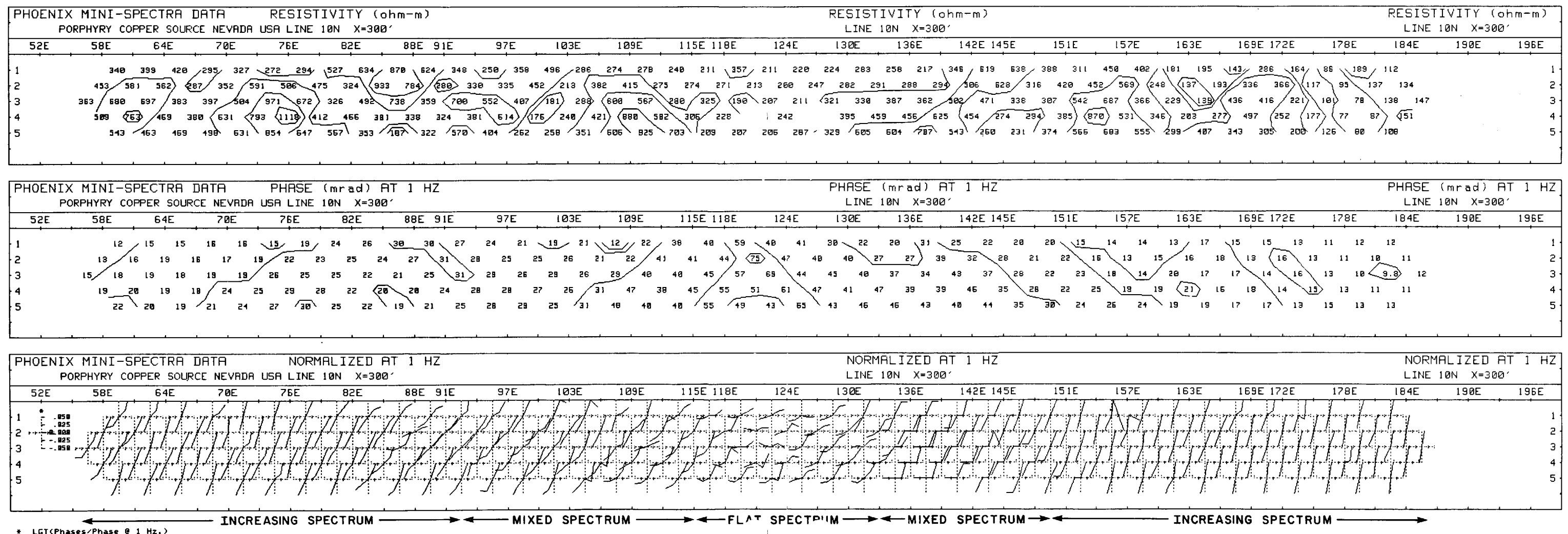
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The phase-shifts measured at 1.0 Hz also show a slight increase in magnitude at about this interval. To the east and west, the phase shifts measured show a uniform increase as the frequency is increased from 0.11 Hz to 9.0 Hz. For all of these dipole pairs, the critical frequency (F_c) of the source mineralization must be greater than 9.0 Hz. This is what would be expected for weakly disseminated metallic mineralization.

Five drill holes have now been completed to test this anomalous zone. The small grain size portions of the anomaly are due to finely disseminated pyrite and chalcopyrite, or magnetite with gold. However, the drill hole at about 120+00E intersected rather thick veinlets of pyrite and chalcopyrite.

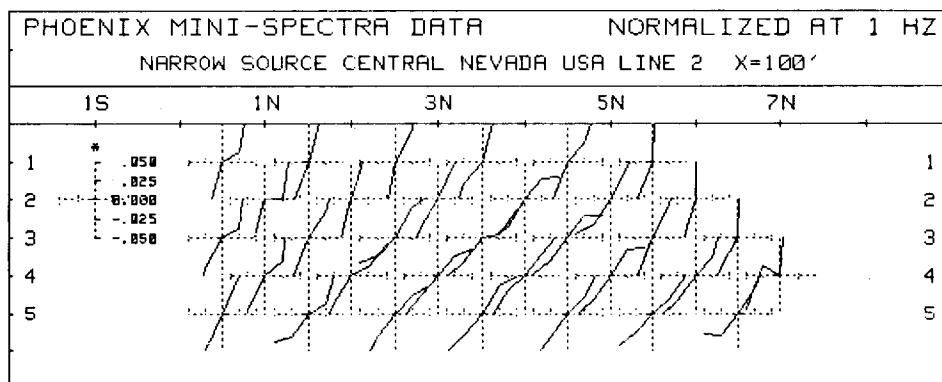
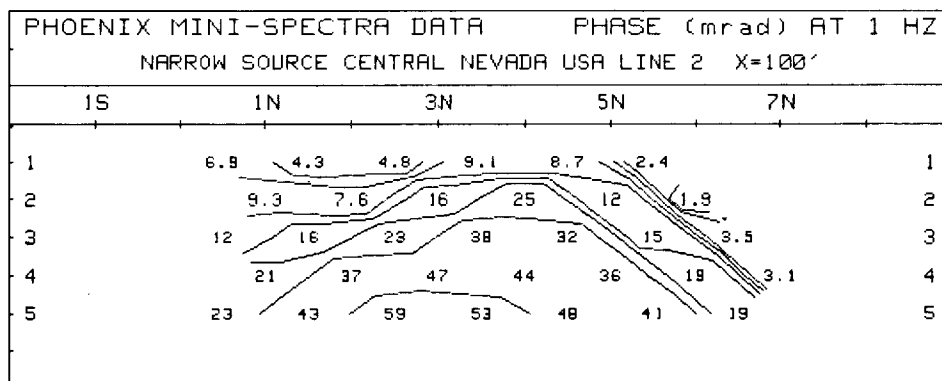
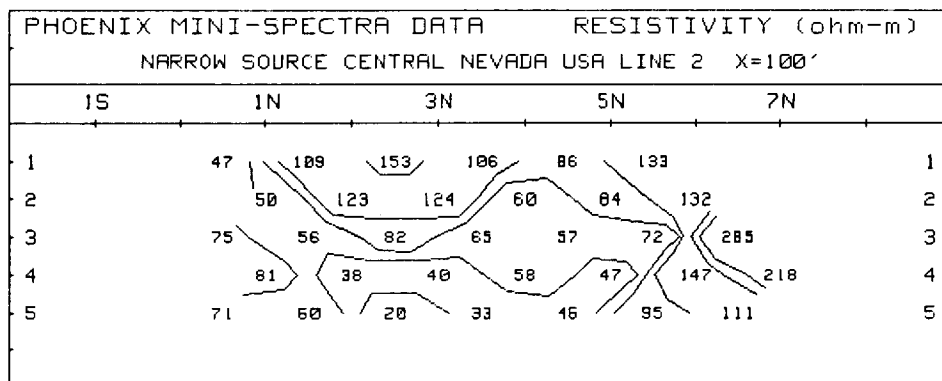


The Phoenix IPV-2 can be used with a single frequency, and relatively large electrode intervals, to complete a rapid, reconnaissance IP survey. If anomalies are located, detailed measurements with shorter electrode intervals, and/or more closely spaced lines, can be completed in the usual manner.

Further, at one or more locations on an anomalous zone, detailed measurements can be made at all five frequencies available on the IPV-2. This will permit limited spectra to be plotted for each dipole pair.

The results shown on the pseudosection below were measured using $X = 100$ feet, on one line across a narrow anomaly, previously located using $X = 400$ feet and $X = 200$ feet. A computer inversion of the anomaly gives a depth to the top of the source of perhaps as much as 100 feet. The product of the conductivity and the width of the source is approximately 50 mhos. The true IP effect in the source, at 1.0 Hz, would have to be approximately 100 milliradians.

The source has a strike length of about 2000 feet, and this fact, plus the parameters determined above, suggest that the source could have economic significance. The five-frequency spectral check was made using $X = 100$ feet. For all of the dipole pairs within the anomaly, the critical frequency (F_c) is indicated to be greater than 9.0 Hz. All of our laboratory and field experience indicates that this source would be sulphide mineralization, not graphitic material. (see Hallof, et al, 1979*).



* LGT(Phases/Phase @ 1 Hz.)

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APPENDIX

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. $d \ll X$) 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 $X = 300'$.

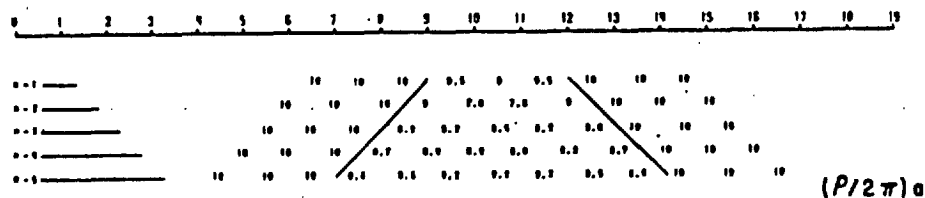
The data shown in Figure 5 and Figure 6 are field results from a greenstone area in Quebec. The expected sources were narrow (less than $30'$ in width) zones of massive, high-grade, zinc-silver ore. An electrode interval of $200'$ was used for the reconnaissance survey in order to keep the rate of progress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

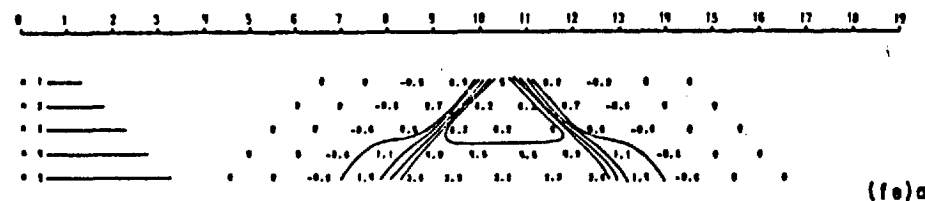
The change in the anomaly that results when the electrode interval is reduced is not unusual. The $X = 50'$ data more accurately locates the narrow source, and permits the geophysicist to make a better evaluation of its importance. The completion of this type of detail is very important, in order to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

Theoretical Induced Polarization and Resistivity Studies

Scale Model Cases



$(P/2\pi)a$



$(fe)a$



$(Mf)a$

$$\begin{aligned} (P/2\pi)_1 &= 10 \\ (Mf)_1 &= 0 \\ (P/2\pi)_2 &= 2.51 \\ (Mf)_2 &= 10000 \\ (fe)_2 &= 25\% \end{aligned}$$

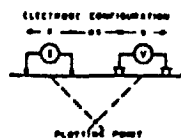
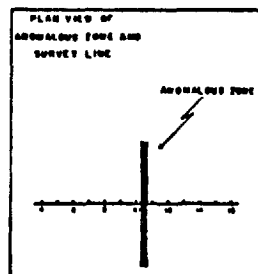


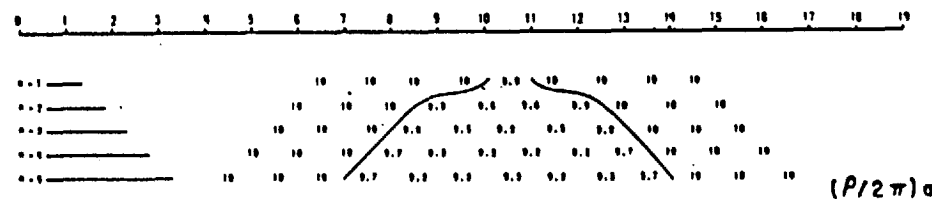
FIG 1



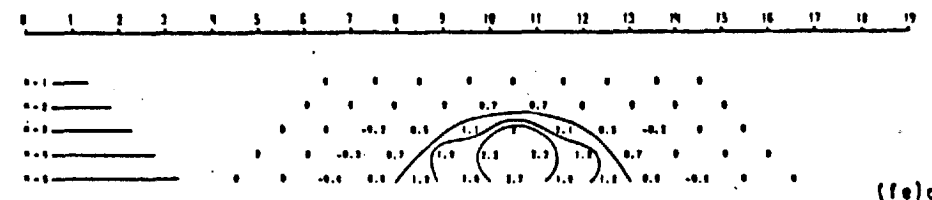
CASE II-0-5-BU-10-a

Theoretical Induced Polarization and Resistivity Studies

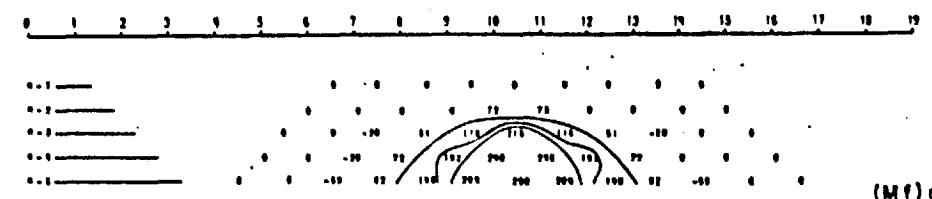
Scale Model Cases



$(P/2\pi)a$



$(fe)a$



$(Mf)a$

$$\begin{aligned} (P/2\pi)_1 &= 10 \\ (Mf)_1 &= 0 \\ (P/2\pi)_2 &= 2.6 \\ (Mf)_2 &= 9250 \\ (fe)_2 &= 24\% \end{aligned}$$

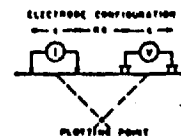
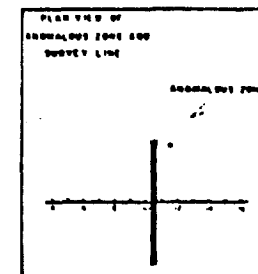


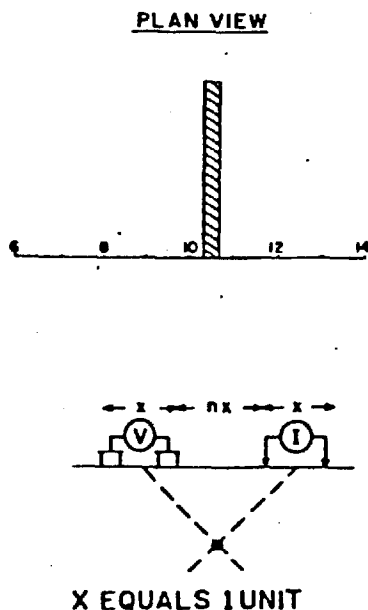
FIG 2



CASE II-15-BU-10-a

THEORETICAL INDUCED POLARIZATION AND RESISTIVITY STUDIES

SCALE MODEL CASE



	5	6	7	8	9	10	11	12	13	14	15	16
	$(\rho/2\pi)a$											
n-1	10	10	10	97	88	97	10	10	10			
n-2	10	10	10	95	87	87	95	10	10	10		
n-3	10	10	10	93	88	89	88	93	10	10	10	
n-4	10	10	10	90	88	90	90	88	92	10	10	10

	5	6	7	8	9	10	11	12	13	14	15	16
	$(Fe)a$											
n-1	-02	0	-05	07	36	07	-03	-02	-02			
n-2	0	0	-06	07	40	40	07	-06	0	0		
n-3	0	0	-05	07	47	43	46	07	-06	0	02	
n-4	0	-03	-06	11	35	42	42	35	11	-06	-03	0

	5	6	7	8	9	10	11	12	13	14	15	16
	$(Mf)a$											
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

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

$$(Mf)_1 = 0$$

$$(\rho/2\pi)_2 = 2.57$$

$$(Mf)_2 = 11700$$

$$(Fe)_2 = 30\%$$

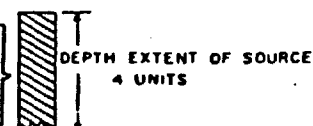
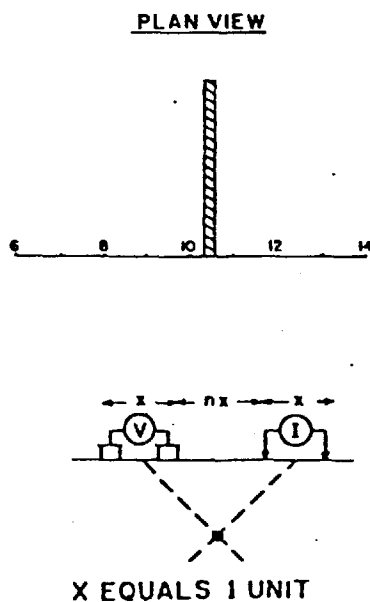


FIG 3

THEORETICAL INDUCED POLARIZATION AND RESISTIVITY STUDIES

SCALE MODEL CASE



	5	6	7	8	9	10	11	12	13	14	15	16
	$(\rho/2\pi)a$											
n-1	10	10	10	99	93	99	10	10	10			
n-2	10	10	10	97	91	91	97	10	10	10		
n-3	10	10	10	97	92	92	92	97	10	10	10	
n-4	10	10	10	96	93	93	93	93	96	10	10	10

	5	6	7	8	9	10	11	12	13	14	15	16
	$(Fe)a$											
n-1	0	0	-03	0	35	0	-03	0	0			
n-2	0	0	-08	0	38	38	0	-08	0	0		
n-3	0	0	-08	05	45	45	46	05	-08	0	0	
n-4	0	0	-07	08	42	51	51	42	07	-07	0	0

	5	6	7	8	9	10	11	12	13	14	15	16
	$(Mf)a$											
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

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

$$(Mf)_1 = 0$$

$$(\rho/2\pi)_2 = 2.41$$

$$(Mf)_2 = 22800$$

$$(Fe)_2 = 55\%$$

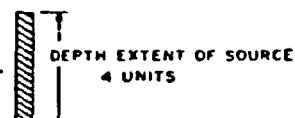
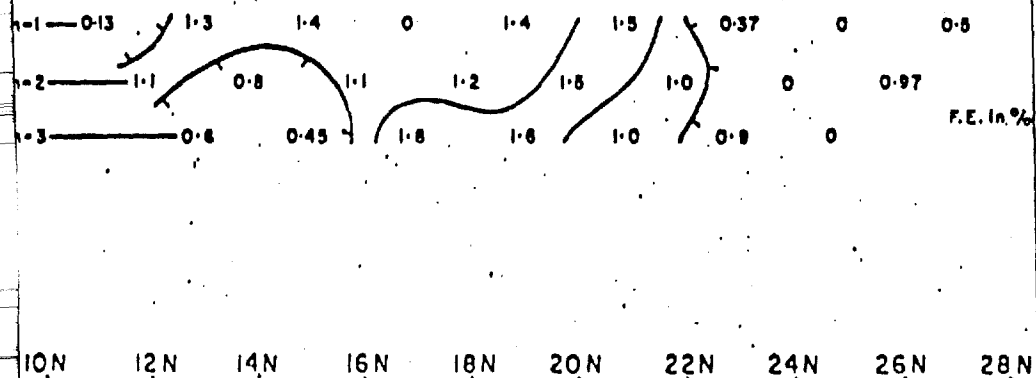
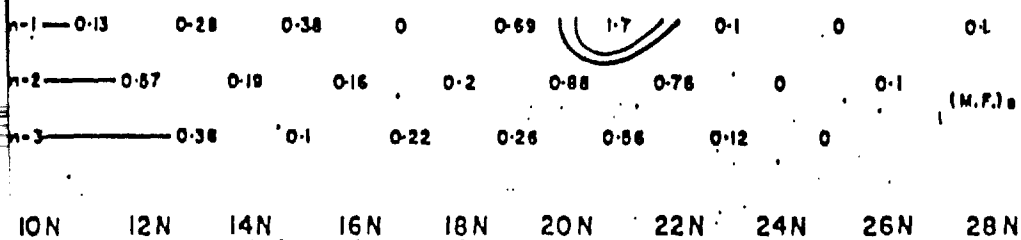
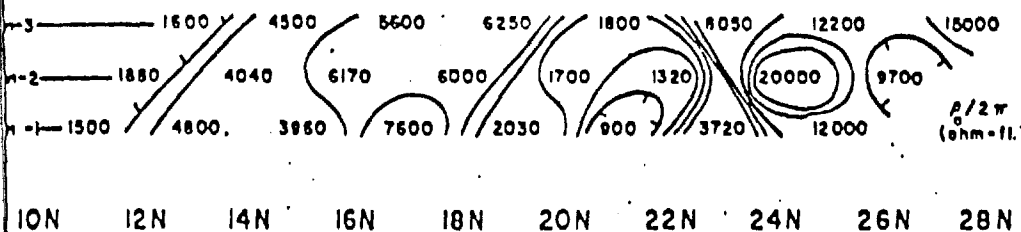


FIG 4

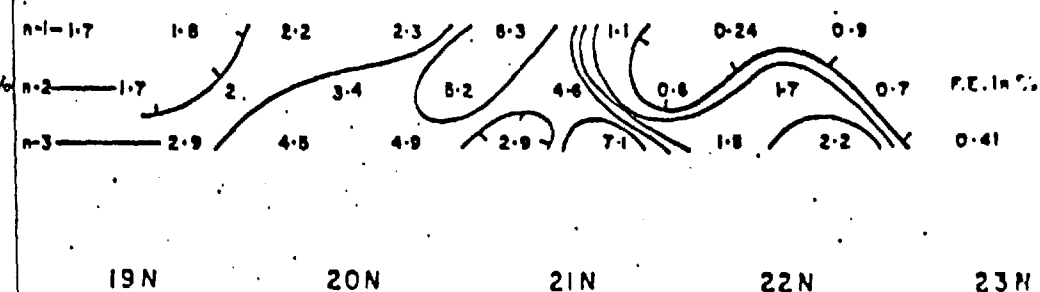
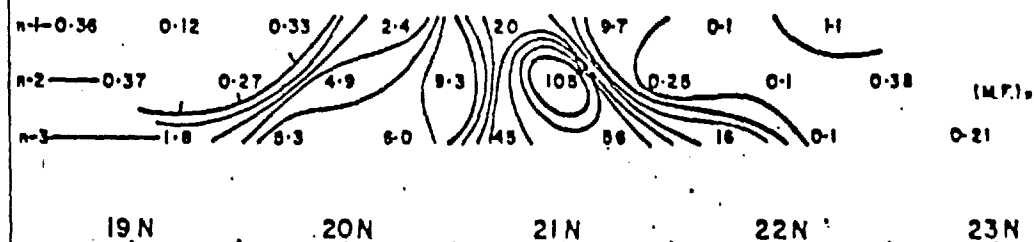
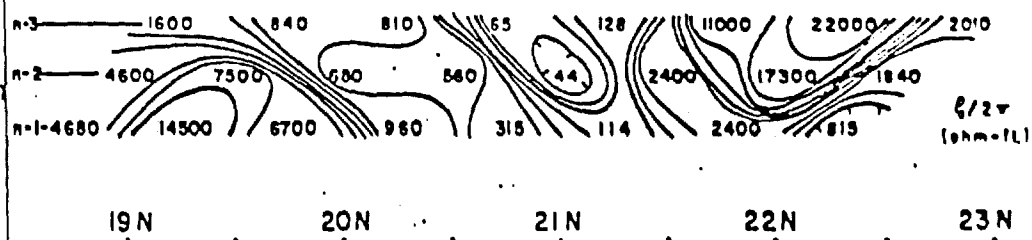
INDUCED POLARIZATION AND RESISTIVITY RESULTS
BATCHELOR LAKE AREA, QUEBEC.



MASSIVE SULPHIDE
ZONE

FIG. 5

INDUCED POLARIZATION AND RESISTIVITY RESULTS
BATCHELOR LAKE AREA, QUEBEC.



GLACIAL OVERBURDEN
GREENSTONE
MASSIVE SULPHIDE
ZONE

FIG. 6



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Ministère de l'Énergie et des Ressources
Gouvernement du Québec
Service du Potentiel minéral

724 RIVERST ROAD, OTTAWA, ONTARIO, K1G 0Z5

PHONE: 237-3110

Certificate of Analysis

DATE: 1 SEP. 1981

No G.M.: 39001

TO Derry Michener & Booth

2302-401 Bay Street

Toronto, Ontario. M5H 2Y4

REPORT NO. ... A-11-943

DATE ... October 8, 1981

Project: Lac Antoinette

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples

MARKED		oz/ton								
		. Au								
					CLAIM NO.					
7449		Trace			391014-4 (Lac Lev.)					
7450		Trace			385797-4 (Cuvier Cent.)					
7451		Nil			385493-1 (Lac Ant.)					
7452		Nil			" "					
7453		Nil			" "					
7455		Trace			" "					
7456		Nil			" "					
7457		Nil			" "					
7458		Trace			" "					
7459		Nil			" "					

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NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise required.

John R. Clegg



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Geochemical Lab Report

REPORT: 111-1288

Jae Comming

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SAMPLE NUMBER	ELEMENT UNITS	Au PPB	wt/Au GM	CLAIM NO.	NOTES	SAMPLE NUMBER	ELEMENT UNITS	Au PPB	wt/Au GM	CLAIM NO.	NOTES
7401		ND		389406-3		7431		ND		389406-3	
7402		ND		"		7432		ND		"	
7403		5		"		7433		ND		"	
7404		20		"							
7405		ND		"							
7406		ND		"							
7407		ND		"							
7408		ND		"							
7409		ND		"							
7410		ND		"							
7411		ND		"							
7412		5		"							
7413		ND		"							
7414		ND		"							
7415		ND		"							
7416		ND		"							
7417		ND		"							
7418		ND		"							
7419		ND		"							
7420		ND		"							
7421		ND		"							
7422		ND		"							
7423		ND		"							
7424		5		"							
7425		ND		"							
7426		5		"							
7427		ND		"							
7428		ND		"							
7429		ND		"							
7430		10		"							



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SAMPLE NUMBER	ELEMENT UNITS	AU PPB	wt/AU GM	CLAIM NO	NOTES
7434		ND		389406-3	
7435		ND		"	
7436		ND		"	
1		5		385786-4	<i>McKenzie Roy property</i>
2		60		"	



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Geochemical Lab Report

REPORT: 111-1565

McKenzie Roy Property

PAGE 1

SAMPLE NUMBER	ELEMENT UNITS	AU PPB	wt/AU GM	CLAIM NO	NOTES
7437		ND		385784-2	
7438		ND		"	
7439		ND		"	



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Geochemical Lab Report

REPORT: 111-1866

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SAMPLE NUMBER	ELEMENT UNITS	AU PPB	wt/AU GM	CLAIM NO.	NOTES
7440		ND		385493-1	I a e Antoinette property
7441		ND		"	
7442		ND		"	
7443		ND		391013-3	
7444		ND		391012-3	Roy - McCaskill property
7445		ND			
7447		1890		391012-4	

Otz vcm



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REPORT: 111-1883

PAGE 1

SAMPLE NUMBER	ELEMENT UNITS	AU PPB	wt/AU GM	CLAIM NO	NOTES
7448		5	10.00	385493-1	



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Geochemical Lab Report

REPORT: 111-1289

PAGE 1

SAMPLE NUMBER	ELEMENT UNITS	AU PFB	wt/AU GM	CLAIM NO	NOTES
1T		ND		389999-5	
1B		ND		"	
2T		ND		"	
2B		ND		"	
3T		ND		"	
3B		ND		"	
4T		ND		"	
5T		ND		"	
5B		ND		"	
6		ND		"	
7T		ND		"	
7B		ND		"	
8		ND		"	