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VOLUME II

INDUCED POLARIZATION AND RESISTIVITY DATA PLOTS ON THE G. C.-HAB-BUY CLAIM GROUPS DURING 1962

104G/3W&4E

LIARD MINING DIVISION, B. C.

FOR

KENNCO EXPLORATIONS (WESTERN) LIMITED

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VOLUME I

McPHAR GEOPHYSICS LIMITED

NOTES ON THE THEORY OF INDUCED POLARIZATION AND THE METHOD OF FIELD OPERATION

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 effectively stop all 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 "metal factor" or "M. F." are a measure of the amount of polarization present in the rock mass being surveyed. This parameter has been found to be very successful in mapping areas of sulphide mineralization, even those in which all other geophysical methods have been unsuccessful. The induced polarization measurement is more sensitive to sulphide content than other electrical measurements because it is much more dependent upon the sulphide content. As the sulphide content of a rock is increased, the "metal factor" of the rock increases much more rapidly than the resistivity decreases.

Because of this increased sensitivity, it is possible to locate and outline zones of less than 10% sulphides that can't be located by E. M. Methods. The method has been successful in locating the disseminated "porphyry copper" type mineralization in the Southwestern United States.

Measurements and experiments also indicate that it should be possible to locate most massive sulphide bodies at a greater depth with induced polarization than with E. M.

Since there is no I. P. effect from any conductor unless it is metallic, the method is useful in checking E. M. anomalies that are suspected of being due to water filled shear zones or other ionic conductors. There is also no effect from conductive overburden, which frequently confuses E. M. results. It would appear from scale model experiments and calculations that the apparent metal factors measured over a mineralized zone are larger if the material overlying the zone is of low resistivity.

Apropos of this, it should be stated that the induced polarization measurements indicate the total amount of metallic constituents in the rock. Thus all of the metallic minerals in the rock, such as pyrite, as well as the ore minerals chalcopyrite, chalcocite, galena, etc. are responsible for the induced polarization effect. Some oxides such as magnetite, pyrolusite, chromite, and some forms of hematite also conduct by electrons and are metallic. All of the metallic minerals in the rock will contribute to the induced polarization effect measured on the surface.

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 a distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes. The distance between the nearest current and potential 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 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. The resistivity values are plotted above the line and the metal factor values below. 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. These 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, model and theoretical investigations. The position of the electrodes when anomalous values are measured must be used 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 100 feet to 1000 feet for (X). In each case, the decision as to the distance (X) and the values of (N) 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 1 below demonstrates the method used in plotting the results. Each value of the apparent resistivity and the apparent "Metal factor" 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.

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

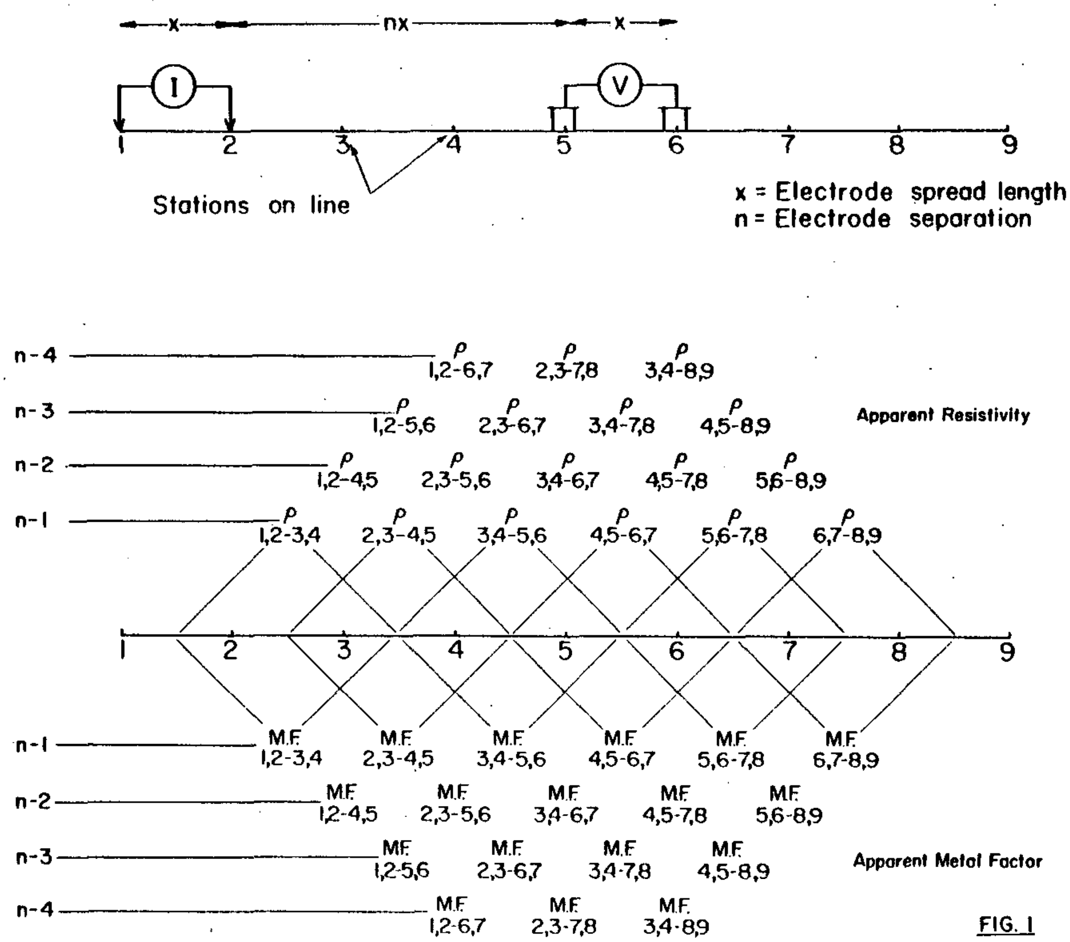


FIG. I

McPHAR GEOPHYSICS LIMITED

REPORT ON THE INDUCED POLARIZATION AND AFMAG SURVEYS ON THE G. C. -HAB-BUY CLAIM GROUPS DURING 1962 LIARD MINING DIVISION, B. C. FOR KENNCO EXPLORATIONS (WESTERN) LIMITED

1. INTRODUCTION

Two previous reports entitled "Report on the Induced Polarization and Resistivity Survey on the G. C. -Hab-Buy Claims, Liard Mining Division, B. C. for Kennco Explorations (Western) Limited" dated September 13, 1961 and "Supplementary Report on the Geophysical Investigations on the G. C. -Hab-Buy Claim, Liard Mining Division, B. C. for Kennco Explorations (Western) Limited" dated October 25, 1961 describe the results measured at Galore Creek during the 1961 field season. The geophysical work was extended during the 1962 field season, and the results are described in this report.

The previous induced polarization and resistivity results were all measured using large electrode separations. In most cases the anomalies indicated shallow sources, and during the 1962 programme detailed measurements were made on many of the lines using shorter electrode intervals. In addition, the I. P. survey was extended to cover a larger portion of the claim groups.

During the 1961 field season, measurements were made using d.c. and 5.0 cps for the I. P. measurements; however, the presence of large natural electrical transients in the ground usually interfered with the measurements. The progress of the survey was slowed due to the need for repeated measurements. In the work this year the electrical transients were so large that d.c.-5.0 cps were impossible. Therefore, the measurements were made using .31 and 5.0 cps.

The limited amount of Afmag data measured during the 1961 field season indicated the potential usefulness of the method in outlining conductors correlating with the I. P. anomalies. During the early part of the 1962 field season, the Afmag survey was extended to cover more of the grid.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results measured during 1962 are shown on the following data plots in the accompanying booklet. The results are plotted in the manner described in the notes preceding this report.

Line O	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-1
Line P	.31 and 5.0 cps	300' Spreads	Dwg. I. P. 2931-2
Line 160N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-3
Line 168N (West)	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-4

Line 168N (East)	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-5
Line 176N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-6
Line 184N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-7
Line 192N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-8
Line 200N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-9
	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-10
Line E	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-11
Line F	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-12
Line G	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-13
Line D	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-14
Line A	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-15
Line C	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-16
Line B	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-17
	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-18
Line 264N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-19
Line 272N (West)	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-20
	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-21
Line 281+60N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-22
Line 288+90N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-23
Line 294+50N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-24
Line K	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-25
Line 208N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-26
	.31 and 5.0 cps	100' Spreads	Dwg. I. P. 2931-27
Line 216N	.31 and 5.0 cps	200' Spreads	Dwg. I. P. 2931-28

Line 224N + Line J	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-29
Line 232N	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-30
Line 240N	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-31
Line 248N	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-32
Line 248N	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-33
Line 256N	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-34
	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-35
Line 264N	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-36
	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-37
Line 272N (East)	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-38
	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-39
Line 280N	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-40
	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-41
Line 288N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-42
	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-43
Line 296N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-44
Line 304N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-45
Line 312N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-46
Line M	.31 and 5.0 cps	400' Spreads	Dwg. I.P. 2931-47
Line M	.31 and 5.0 cps	200' Spreads	Dwg. I.P. 2931-48
Line 320N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-49
Line 326N	.31 and 5.0 cps	300' Spreads	Dwg. I.P. 2931-50

Enclosed with this report is Dwg. Misc. 4725, a plan map of the grid at 1" = 1000 feet. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as 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.

The anomalies shown on Dwg. Misc. 4725 are only from the 1962 results, the anomalies from the previous results have not been included. Most of the work for 1962 consisted of detailed checks using short electrode intervals on lines surveyed previously using larger separations. Since the anomalies are located more accurately with shorter electrode separations, the new results are more useful. Some of the lines shown on the plan map have not been surveyed before, and larger electrode separations have been used; in these cases, the electrode spacing has been indicated.

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 spread length; i. e. when using 200' spreads the position of a narrow sulphide body can only be determined to lie between two stations 200' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the center 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 Afmag results are shown on Dwg. AF4726, which is enclosed with this report. The conductors suggested by the data have been indicated.

3A. DISCUSSION OF I. P. RESULTS

The induced polarization and resistivity results will be discussed one line at a time. The lines will be discussed in the order in which they are listed in Part (2).

Line O

This line extends south of the main area covered by the survey. The resistivities are quite uniform in this area, and about average in magnitude for the non-anomalous parts of the grid. There is a slight increase for the near-surface I. P. effects at 16E to 20E, and the source seems to extend at depth to the west.

Line P

This line is south and east of the main part of the grid, and the apparent resistivities are an order of magnitude larger than on Line O. There were no I. P. effects measured along the line.

Line 160N

The eastern part of this line was surveyed with 200' electrode intervals to check an anomaly located in 1961. The earlier results (from 400' spreads) show an anomaly at depth, with the shallowest source to the east at 216E to 220E. This year's results indicate a weak I. P. anomaly in this area, and the I. P. effects increase with separation suggesting that the metallic mineral content increases with depth.

Line 168N

The previous results using 400' spreads indicated a shallow anomaly at 156E to 162E. The results using 200' electrode intervals indicate an anomaly at depth in the same area. The apparent I. P. effects increase with separation. The western edge of the anomaly is evident in the data, but the eastern edge is east of 166E.

The detailed measurements using 200' spreads east of the glacier indicate several narrow, moderately anomalous zones. The most important is a narrow source at depth at 206E.

Line 176N

On this line the main anomaly, west of the glacier, is still shallow when 200' electrode intervals are used. The source appears to extend from 158E to 165E, which is approximately the position indicated by last year's results. There is another definite anomaly centered at 204E. The pattern suggests a relatively narrow source at depth. This anomaly correlates with a weaker anomaly of similar appearance on Line 168N. In addition, there are two other zones of above background I. P. effects on this line.

Within the two definite anomalies located on Line 176N, the apparent resistivities are lower than the average. However, there is a general trend of increasing resistivities from west to east. The apparent resistivities at depth in the area from 150E to 155E are only 10% of those at depth from 215E to 220E. These changes in resistivity are caused by changes in porosity, and therefore probably indicate variations in alteration, rock type, etc.

Line 184N

The 400' spread results on this line indicated a single source, and the 200' spread results from this year indicate an anomaly from 149E to 163E. Within this broad, moderately anomalous, area there are several local zones of larger I. P. effects. The shallow, narrow, weak anomaly at 186E correlates with a similar feature to the south, and should be checked with even shorter spreads.

The anomaly at 204E to 206E is of less magnitude on this line, but the pattern is still similar to the correlating anomaly on Line 176N and 168N. The anomaly at the eastern end of the line is much more definite on this line, and the pattern suggests a shallow, narrow source. It should be detailed with shorter spreads also.

The resistivity patterns on this line are similar to those on Line 176N, with an increase in apparent resistivities from west to east. For this reason, the anomaly at 228E to 230E must be considered to be more important than a similar anomaly of the same magnitude at the western end of the line.

Line 192N

The main anomaly west of the glacier can be separated into two zones. There is a shallow, narrow source at 150E to 152E, and a weaker anomaly at depth just to the east. The weak anomaly at 182E to 184E appears to be at some depth. The new data does not extend far enough to the east to locate the anomalies to the east.

Line 200N

The major anomaly at the western edge of the grid is not evident on this line. The detail using 100' spreads shows a narrow, shallow, moderate magnitude anomaly at 181E to 182E. This anomaly correlates with others to the south, but the pattern has changed on this line.

The detailed results on the eastern part of the line were measured using 200' spreads. As on the other lines to the south, the apparent resistivities increase to the east. In this case, there is a sharp increase in the resistivities at about 230E. There is a definite anomaly at depth, just to the west of this resistivity change. The resistivities in this area are very high, so this moderate magnitude anomaly is more important than a similar anomaly of similar magnitude at 202E to 206E where the resistivities are less.

Line E

This is the southernmost of the short, irregularly placed lines on the west side of the grid. The 400' spread results measured in 1961 indicated a shallow source at 16W to 20W. The detailed results using

200' spreads show that there is some depth to the best part of the source, and that it is of limited width.

Line F

The detailed measurements on this line show that the apparent resistivities are much the same as on Line E, but the I. P. effects are less.

Line G

The I. P. anomaly on this line is the same magnitude as on Line F; however, the source is much wider. The effects increase a little at depth at the eastern edge of the anomaly.

Line D

The anomaly on this line is very weak, as it was on last year's data. The pattern suggests a broad zone with a small amount of metallic mineralization.

Line A

The anomaly is of less width on this line, but the magnitude is still small.

Line C

The anomaly at 16W to 18W on this line correlates with a narrow, definite anomaly located at the same position in 1961. The source is still shallow and narrow, and it could be due to a narrow zone of rather massive mineralization. The line should be surveyed again with 100' electrode intervals.

Line B

The detailed results using 100' intervals show two narrow anomalies at the west end. They are both of low magnitude, but either could correlate with the narrow anomaly on Line C. The apparent resistivities are high along this line, but they become very high east of 11E.

Line 264N

The apparent resistivities are high along all of this line, and there are no anomalous I. P. effects.

Line 272N

The apparent resistivity values are also high on this line. There are a few I. P. values that are greater than background, but they do not appear to be important.

Line 281+60N

There are a few, small magnitude anomalies on this line. However, the contour patterns are definite. The magnitudes of the I. P. effects are small, but the apparent resistivities are very high, and this is expected to reduce the effects.

Line 288+90N

The anomaly on this line is somewhat larger in magnitude. The pattern is not simple, and suggests a broad zone of slightly anomalous effects with several zones of larger values.

Line 294+50N

There are three separate anomalies on this line. They are all of small magnitude, but the patterns are definite, and the anomalies warrant further investigation.

Line K

This line is considerably north of the others. A narrow, shallow anomaly was located at 12E to 16E in the 1961 reconnaissance data. The anomaly is confirmed by the detail done this year. The anomaly is definite, but the magnitude is small.

Line 208N

This is the southernmost of the lines that cover the eastern part of the grid. The resistivities are lower at the eastern end of this line, than to the south. There is a narrow, shallow anomaly at 226E, that confirms an anomaly from last year's work.

The western part of the line was surveyed using 100' spreads, and there is a weak anomaly at depth. The anomaly is broad, and the edges are not evident in the data.

Line 216N

There were several anomalies located by the reconnaissance survey on this line. They have all been confirmed by the detailed work. There is a narrow, shallow, definite anomaly at 190E that must be checked with even shorter electrode intervals. The anomaly at about 200E appeared to be at some depth when 400' spreads were used, and looks even deeper with 200' spreads.

The weak anomaly at 226E was not evident in the reconnaissance results. There is a definite anomaly at 244E to 246E, in a high resistivity area, and two weaker anomalies at depth to the east.

Line 224N + Line J

Only part of this long line was surveyed in 1961 with large spreads. The detailed results using 200' electrode intervals indicate several anomalies. The most important anomaly is at 197E to 209E on Line 224N. There are two definite, shallow anomalies close to each other. One of them may correlate with the narrow anomaly on the west end of Line 216N. These anomalies are of moderate magnitude, and should be checked with shorter spreads. There are several, weaker anomalies to the east, but the 200' spread results do not extend far enough to the east to check the shallow anomaly located previously at 20E to 24E on Line J.

The resistivities increase slightly in the eastern part of this line, but they are not as large as to the south.

Line 232N

The apparent resistivities are of moderate magnitude and fairly uniform on this line also. They increase with separation along much of the line, reflecting the lower resistivity overburden in the valleys.

Several weak anomalies have been indicated on the data plot, but they do not appear to be important. The shallow anomaly at 212E to 216E correlates with a similar feature in the reconnaissance data.

Line 240N

The reconnaissance results did not indicate any definite anomalies along this line, and the detailed data from this year shows two narrow, weak anomalies. The resistivity values are similar to those on the lines immediately to the south.

Line 248N

This part of the grid was surveyed at the end of the 1961 programme, using d.c. - 5.0 cps. A weak anomaly was indicated at about 210E. The line was first repeated this year using 400' spreads, but the frequencies used were 0.31 and 5.0 cps. The anomaly is still present, but as would be expected the magnitude is reduced. The line was also surveyed this year using 200' electrode separations. A shallow, narrow, indefinite anomaly was located at 208E to 210E.

The surface resistivities are low in this area, due to the overburden present, and the anomaly is of small magnitude. It is difficult to attach much importance to the anomaly, but since the source appears to be shallow it could be checked with shorter intervals.

Line 256N

The results from this line were measured during the last days of the 1961 programme, using 400' spreads and d.c. - 5.0 cps. The apparent resistivities increased with separation, and some I. P. effects were measured along all of the line. The 400' spread data for this year, using 0.31 and 5.0 cps did not confirm the anomaly. The results using 200' electrode separations show unusually low apparent resistivities in the center of the line, but no anomalous I. P. effect.

A study of the data sheets from the 1961 survey has revealed the reason for the discrepancy. The measurements made using d.c. and 5.0 cps during the 1961 programme were disturbed by a large amount of natural electrical noise. The influence of the noise required that most measurements be repeated several times. The natural noise was so great during the 1962 field season, that measurements using d.c. could not be made at all. The low frequency filtering possible when 0.31 cps is used for the measurements eliminates disturbances from the noise.

The d.c. measurements made on Line 240N and Line 248N (which were confirmed in 1962) were taken on September 6, 1961. The noise problems were not unusually great, and it was possible to obtain two sets of d.c. measurements at each station which agreed reasonably well.

The d.c. measurements on Line 256N (and on Line 264N) were made on September 8, 1961. The electrical noise was larger in magnitude on this day, and the d.c. measurements could not be made to repeat exactly. At each station, an average value was used. In most cases, the variations between the two d.c. measurements were greater then the difference between d.c. average and the a.c. value measured. The results on those lines were much more questionable than those on Line 240N and Line 248N.

Unfortunately, the weather was very bad during this period in 1961, and the programme was terminated shortly afterward. The crew did not return after September 8th and it was therefore not possible to check the results until the 1962 field season.

Line 264N

The d.c. - 5.0 cps results on this line were measured on the same day during the 1961 field season as those on Line 256N. The more reliable results from this year's programme indicate a shallow, weak anomaly at 220E to 224E when both 400' and 200' electrode separations were used.

Line 272N

The apparent resistivities continue to be low on this part of the grid, but there are no anomalous I.P. effects.

Line 280N

The apparent resistivities are unusually low at the eastern end of this line, where it is near Galore Creek. There is a weak I.P. anomaly at 216 to 220E, but further investigation would be necessary to evaluate its importance.

Line 288N

There is also a weak anomaly on this line, but it does not correlate with those to the north or south.

Line 296N

During the last part of the 1962 field season, several lines on the northern part of the grid were surveyed using 300' spreads. There was no time available to do detail on the resulting anomalies. The reconnaissance results on this line indicate a narrow source at 221E to 224E. There seems to be some depth to the top of the source.

Line 304N

There is only a slight increase in the I. P. effects at 222E to 225E on this line.

Line 312N

The I. P. effects on this line are not large in magnitude, but the pattern is definite. The source appears to be shallow, and the anomaly should be checked with shorter spreads.

Line M

This line was surveyed parallel to the valley. A weak anomaly at 16N to 20N was confirmed by 200' spreads detail. However, the effects are of small magnitude.

Line 320N

The apparent resistivities on this line are larger than on the lines immediately to the south, probably reflecting the presence of less overburden. There were no anomalous I. P. effects.

Line 326N

The results on this line are similar to those on Line 320N.

3B. DISCUSSION OF AFMAG RESULTS

The Afmag data from the 1961 season was measured during September, when the Afmag field strengths were past the seasonal high. As a result, the signals were weak, and the angles measured were frequently difficult to measure and therefore unreliable.

The Afmag measurements during 1962 were made early in the season when the Afmag fields were stronger. The strike direction of the field was definite at each station, and consistent. Unfortunately, the field direction is roughly parallel to the conductors, and the positions are not well indicated.

The conductors indicated on Dwg. AF4726 correlate approximately with those from the 1961 results. On the northern lines, where I. P. data is available, the conductors correlate with the resistivity lows.

The main purpose of the Afmag survey was to detect conductors beneath the glacier. It was only possible to take a limited number of measurements on the glacier, and no definite conductors were located. However, there is a definite change in field strike and dip between Line 123N and all of the lines to the north. One explanation for this would be the presence of an east-west conductor at about 123N. It would be of interest to have results on north-south lines across this area, particularly south of Line 123N.

4. CONCLUSIONS AND RECOMMENDATIONS

The anomalies from the more detailed measurements during the 1962 field season can be roughly correlated into zones as shown on Dwg. Misc. 4725. The anomalies within the zones are variable in magnitude, width, depth of source, etc. , and certainly the zones differ from each other. There are several other scattered anomalies which do not seem to correlate with others.

Several holes were drilled during the 1962 field season to determine the source of the anomalies. Most of these were concentrated on Zone A, but several of the other anomalies were checked. The results of this drilling should be correlated carefully with the I. P. anomalies. I understand that in some cases only copper mineralization was present in the holes; therefore, only a few per cent metallic mineralization could be of economic interest. In this situation, even very weak I. P. anomalies must be considered as being potentially important.

In each of the zones marked, there are one or two lines where the I. P. anomalies appear to be of greater importance. These locations should be given special consideration. They are listed below.

Zone A - Line 168N, Line E, Line C

Zone B - Line 281+60N, Line 294+50N

Zone C - Line 200N

Zone D - Line 168N, Line 176N

Zone E - Line 184N, Line 208N

Zone F - Line 216N, Line 224N

Zone G - Line 312N

The most important of the scattered anomalies that do not correlate into zones is located at about 245E on Line 216N.

The planning of future geophysical work and further drilling to test the anomalies should be done after the results of the drilling to date are compared with the I. P. results.

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Robert A. Bell.

Robert A. Bell,
Geologist.

Dated: October 4, 1962.

ASSESSMENT DETAILS

SPONSOR: Kennco Explorations (Western) Limited

MINING DIVISION: Liard

LOCATION: Galore Creek Area

PROVINCE: British Columbia

TYPE OF SURVEY: Induced Polarization

OPERATING MAN DAYS:	273	DATE STARTED:	June 28, 1962
EQUIVALENT 8 HR. MAN DAYS:	409	DATE FINISHED:	August 31, 1962
CONSULTING MAN DAYS:	6.5	NUMBER OF STATIONS OCCUPIED:	736
DRAUGHTING MAN DAYS:	20	NUMBER OF READINGS TAKEN:	5291
TOTAL MAN DAYS:	435.5	MILES OF LINE SURVEYED:	26.26

CONSULTANTS:
P. G. Hallof, 5 Minorca Place, Don Mills, Ontario
R. A. Bell, 15 Hemford Crescent, Don Mills, Ontario

FIELD TECHNICIANS:
F. Bottos, 172 Hillmount, Toronto 19, Ontario
F. Mackulowick, 1429 Birchmount Road, Scarborough, Ontario
3 Helpers supplied by client.

DRAUGHTSMEN:
F. R. Peer, 38 Torrens Avenue, Toronto 6, Ontario
R. MacKenzie, 55 Shannon Drive, Scarborough, Ontario
R. Martin, 1028 Davenport Road, Toronto, Ontario
D. Grant, 1987A Lawrence Avenue, East, Scarborough, Ontario
D. R. Stone, 4373 Lawrence Avenue, East, West Hill, Ontario

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Dated: October 4, 1962.

ASSESSMENT DETAILS

SPONSOR: Kennco Explorations (Western) Limited

MINING DIVISION: Liard

LOCATION: Galore Creek Area

PROVINCE: British Columbia

TYPE OF SURVEY: Afmag

OPERATING MAN DAYS: 20

EQUIVALENT 8 HR. MAN DAYS: 30

CONSULTING MAN DAYS: 1

DRAUGHTING MAN DAYS: 5

TOTAL MAN DAYS: 36

DATE STARTED: June 18, 1962

DATE FINISHED: July 6, 1962

NUMBER OF STATIONS: 296

MILES OF LINE SURVEYED: 5.39

CONSULTANTS:
P. G. Hallof, 5 Minorca Place, Don Mills, Ontario
R. A. Bell, 15 Hemford Crescent, Don Mills, Ontario

FIELD TECHNICIANS:
E. MacDonald, 23 Connaught Avenue, Middleton, N. S.
1 helper supplied by client

DRAUGHTSMEN:
F. R. Peer, 38 Torrens Avenue, Toronto 6, Ontario
D. R. Stone, 4373 Lawrence Avenue, East, West Hill, Ontario
D. Grant, 1987A Lawrence Avenue, East, Scarborough, Ontario

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Dated: October 4, 1962.

SUMMARY OF COST

I. P. Survey - Contract #D250

2.9 Line Miles using 400' Spreads
2.5 Line Miles using 300' Spreads
19.2 Line Miles using 200' Spreads
1.66 Line Miles using 100' Spreads

Total Charge $10,590.54

Afmag Survey - Contract #D252

5.39 Line Miles

Total Charge $ 1,671.76

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Dated: October 4, 1962.

CERTIFICATE

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

1. I am a geophysicist residing at 5 Minorca Place, Don Mills (Toronto), Ontario.

2. I am a graduate of the Massachusetts Institute of Technology with a B. S. 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 Exploration Geophysicists.

4. I have been practising my profession for ten years.

5. I have no direct or indirect interest, nor do I expect to receive any interest, direct or indirect, in the property or securities of Kennco Explorations (Western) Limited.

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

Dated at Toronto

This 4th day of October 1962

Philip G. Hallof

Philip G. Hallof, Ph. D.

CERTIFICATE

I, Robert Alan Bell, of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geologist residing at 15 Hemford Crescent, Don Mills (Toronto) Ontario.

2. I am a graduate of the University of Toronto in Physics and Geology with the degree of Bachelor of Arts (1949); and a graduate of the University of Wisconsin in Economic Geology with the degree of Ph.D. (1952).

3. I am a member of the Society of Economic Geologists and a fellow of the Geological Association of Canada.

4. I have been practising my profession for over ten 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 Kennco Explorations (Western) Limited.

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

Dated at Toronto

This 4th day of October 1962

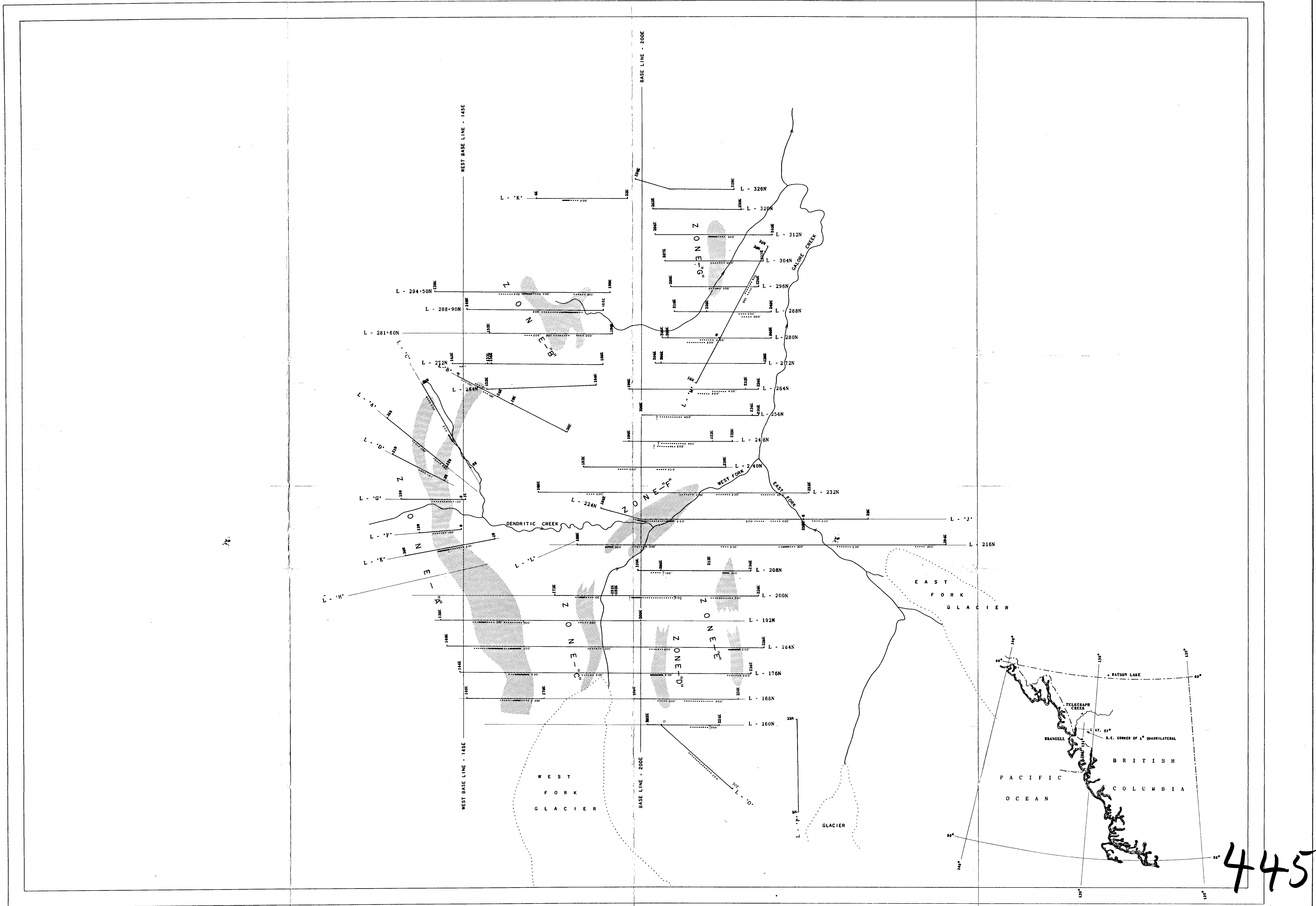
Robert A. Bell

Robert A. Bell, Ph.D.

McPHAR GEOPHYSICS LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

LOCATION MAP



N

ANOMALOUS ZONE

POSSIBLE ANOMALOUS ZONE

NUMBERS AT END OF ANOMALIES INDICATE SPREAD USED

KENNCO EXPLORATIONS (WESTERN) LIMITED

GALORE CREEK—LIARD MINING DIVISION, B.C.

SCALE

1000 500 0 1000 2000 3000 4000 5000 FEET

One Inch = One Thousand Feet

NOTE:

HEAVY LINE INDICATES EXTENT OF 1962 SURVEY.

THIN LINE INDICATES EXTENT OF 1961 SURVEY

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 445 MAP 1

Report 445

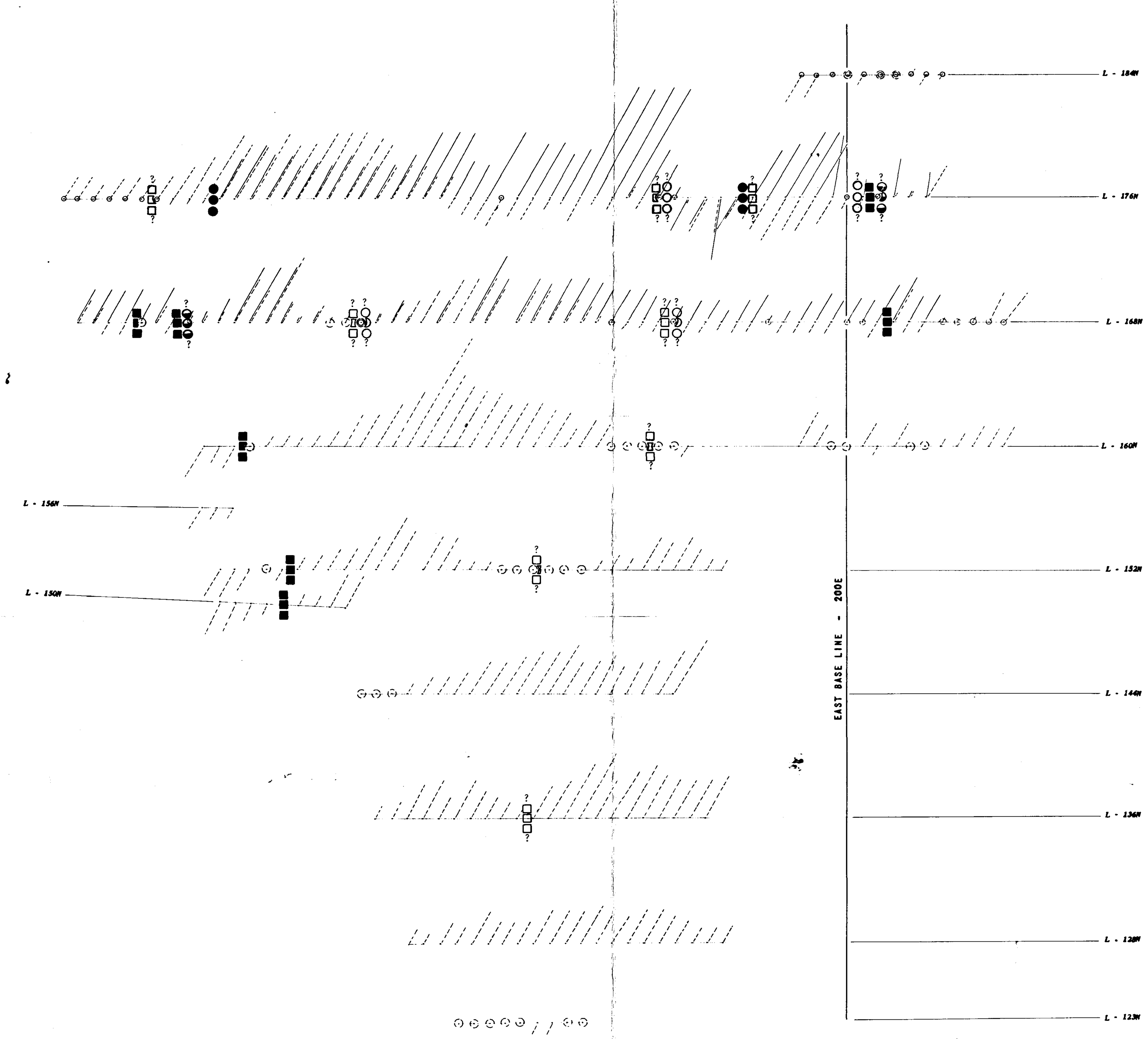
DRAWN: F.R.P.
DATE: OCT. 1962
APPROVED: PH
DATE: 10/3/62

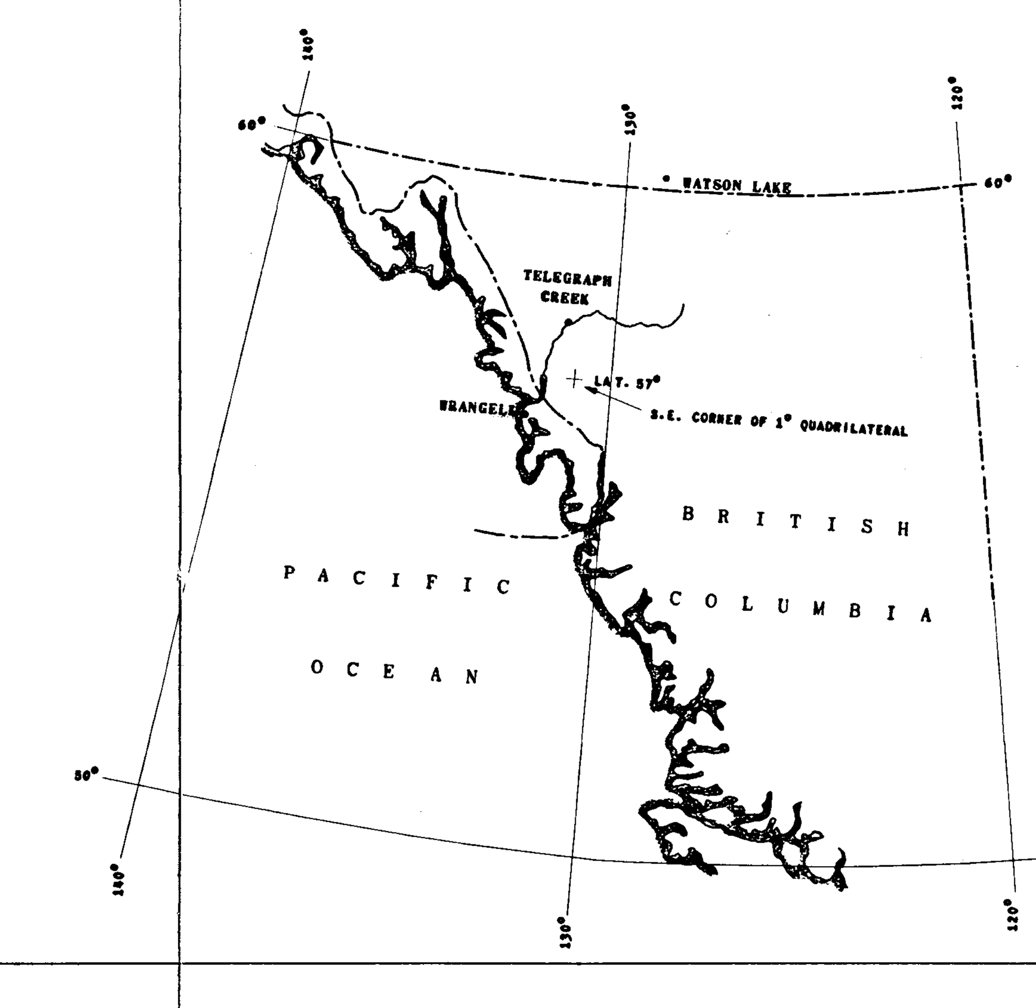
#445

DWG. MISC.-4725

McPHAR GEOPHYSICS LIMITED

AFMAG SURVEY





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KENNCO EXPLORATIONS (WESTERN) LIMITED

GALORE CREEK–LIARD MINING DIVISION, B.C.

SCALE

One Inch Four Hundred Feet

LOW FREQUENCY
HIGH FREQUENCY

DIRECTION OF FIELD AND DIP ANGLE
LENGTH INDICATES MAGNITUDE 1" = 10°

SYMBOLS

LOW	HIGH	
●●●	■■■	CONDUCTOR AXIS ESTABLISHED
?◐◐◐?	?▣▣▣?	POSITION OF CONDUCTOR AXIS UNCERTAIN
?○○○?	?□□□?	EXISTENCE OF CONDUCTOR AXIS UNCERTAIN

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 445 MAP 2

DRAWN: D.R.S.
DATE: AUGUST/62
APPROVED:
DATE: 10/3/62

DWG. AF-4726