2337

VOLUME I
REPORT ON
INDUCED POLARIZATION
AND RESISTIVITY SURVEY
OF THE
REXSPAR PROJECT
BIRCH ISLAND AREA, KAMLOOPS M.D. B.C.
FOR
DENISON MINES LIMITED
DWG. IP 5380-1 to IP 5380-19

BY

R. A. BELL, Ph.D.

DAVID K. FOUNTAIN, P.ENG.

NAME AND LOCATION OF PROPERTY:

REXSPAR PROJECT, BIRCH ISLAND AREA

KAMLOOPS MINING DIVISION, BRITISH COLUMBIA 51°N, 119°W SE

DATE STARTED: APRIL 27, 1969

DATE FINISHED: OCTOBER 22, 1969

TABLE OF CONTENTS

Part A:	Notes on theory and field procedure	9 pages	
Part B:	Report	22 pages	**Page**
1.	Introduction		1
2.	Presentation of Results		2
3.	Discussion of Results		7
4.	Summary and Recommendations		15
5.	Assessment Details		19
6.	Statement of Cost		20
7.	Certificate - Robert A. Bell		21
8.	Certificate - David Kirkman Fountain		22

Part C: Illustrations — 88 pieces

#1 - Location Maps, 1" = 20 miles — Page 1a

#'s 2-8 Plan Maps (in pockets) — Dwgs. I. P. P. 4559-1 to -7

I. P. Data Plots — Dwgs. I. P. 5380-1 to -81

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2337 MAP

McPHAR GEOPHYSICS

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

Induced Polarization as a geophysical measurement refers to the blocking action or polarization of metallic or electronic conductors in a medium of ionic solution conduction.

This electro-chemical phenomenon occurs wherever electrical current is passed through an area which contains metallic minerals such as base metal sulphides. Normally, when current is passed through the ground, as in resistivity measurements, all of the conduction takes place through ions present in the water content of the rock, or soil, i.e. by ionic conduction. This is because almost all minerals have a much higher specific resistivity than ground water. The group of minerals commonly described as "metallic", however, have specific resistivities much lower than ground waters. The induced polarization effect takes place at those interfaces where the mode of conduction changes from ionic in the solutions filling the interstices of the rock to electronic in the metallic minerals present in the rock.

The blocking action or induced polarization mentioned above, which depends upon the chemical energies necessary to allow the ions to give up or receive electrons from the metallic surface, increases with the time that a d. c. current is allowed to flow through the rock; i. e. as ions pile up against the metallic interface the resistance to current flow increases. Eventually, there is enough polarization in the form of excess ions at the interfaces, to appreciably reduce the amount of current flow through the metallic particle. This polarization takes place at each of the infinite number of solution-metal interfaces in a mineralized rock.

When the d. c. voltage used to create this d. c. current flow is cut off, the Coulomb forces between the charged ions forming the polarization cause them to return to their normal position. This movement of charge creates a small current flow which can be measured on the surface of the ground as a decaying potential difference.

From an alternate viewpoint it can be seen that if the direction of the current through the system is reversed repeatedly before the polarization occurs, the effective resistivity of the system as a whole will change as the frequency of the switching is changed. This is a consequence of the fact that the amount of current flowing through each metallic interface depends upon the length of time that current has been passing through it in one direction.

The values of the per cent frequency effect or F. E. are a measurement of the polarization in the rock mass. However, since the measurement of the degree of polarization is related to the apparent resistivity of the rock mass it is found that the metal factor values or M. F. are the most useful values in determining the amount of polarization present in the rock mass. The MF values are obtained by normalizing the F. E. values for varying resistivities.

The induced polarization measurement is perhaps the most powerful geophysical method for the direct detection of metallic sulphide mineralization, even when this mineralization is of very low concentration. The lower limit of volume per cent sulphide necessary to produce a recognizable IP anomaly will vary with the geometry and geologic environment of the source, and the method of executing the survey. However, sulphide mineralization of less than one per cent by volume has been detected by the IP method under proper geological conditions.

The greatest application of the IP method has been in the search for disseminated metallic sulphides of less than 20% by volume. However, it has also been used successfully in the search for massive sulphides in situations where, due to source geometry, depth of source, or low resistivity of surface layer, the EM method can not be successfully applied. The ability to differentiate ionic conductors, such as water filled shear zones, makes the IP method a useful tool in checking EM anomalies which are suspected of being due to these causes.

In normal field applications the IP method does not differentiate between the economically important metallic minerals such as chalcopyrite, chalcocite, molybdenite, galena, etc., and the other metallic minerals such as pyrite. The induced polarization effect is due to the total of all electronic conducting minerals in the rock mass. Other electronic conducting materials which can produce an IP response are magnetite, pyrolusite, graphite, and some forms of hematite.

In the field procedure, measurements on the surface are made in a way that allows the effects of lateral changes in the properties of the ground to be separated from the effects of vertical changes in the properties. Current is applied to the ground at two points in distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes is an integer number (n) times the basic distance (X).

The measurements are made along a surveyed line, with a constant distance (nX) between the nearest current and potential electrodes. In most surveys, several traverses are made with various values of (n); i.e. (n) = 1, 2, 3, 4, etc. The kind of survey required (detailed or reconnaissance) decides the number of values of (n) used.

In plotting the results, the values of the apparent resistivity, apparent per cent frequency effect, and the apparent metal factor measured for each set of electrode positions are plotted at the intersection of grid lines, one from the center point of the current electrodes and the other from the center point of the potential electrodes. (See Figure A.) The resistivity values are plotted above the line as a mirror image of the metal factor values below. On a second line, below the metal factor values, are plotted the values of the per cent frequency effect. In some cases the values of per cent frequency effect are plotted as superscripts of the metal factor value. In this second case the frequency effect values are not contoured. The lateral displacement of a given value is determined by the location along the survey line of the center point between the current and potential electrodes. The distance of the value from the line is determined by the distance (nX) between the current and potential electrodes when the measurement was made.

The separation between sender and receiver electrodes is only one factor which determines the depth to which the ground is being sampled in any particular measurement. The plots then, when contoured, are not section maps of the electrical properties of the ground under the survey line. The interpretation of the results from any given survey must be carried out using the combined experience gained from field results, model study results and theoretical investigations. The position of the electrodes when anomalous values are measured is important in the interpretation.

In the field procedure, the interval over which the potential differences are measured is the same as the interval over which the electrodes are moved after a series of potential readings has been made. One of the advantages of the induced polarization method is that the same equipment can be used for both detailed and reconnaissance surveys merely by changing the distance (X) over which the electrodes are moved each time. In the past, intervals have been used ranging from 25 feet to 2000 feet for (X). In each case, the decision as to the distance (X) and the values of (n) to be used is largely determined by the expected size of the mineral deposit being sought, the size of the expected anomaly and the speed with which it is desired to progress.

The diagram in Figure A demonstrates the method used in plotting the results. Each value of the apparent resistivity, apparent metal factor, and apparent per cent frequency effect is plotted and identified by the position of the four electrodes when the measurement was made. It can be seen that the values measured for the larger values of (n) are plotted farther from the line indicating that the thickness of the layer of the earth that is being tested is greater than for the smaller values of (n); i. e. the depth of the measurement is increased. When the F. E. values are plotted as superscripts to the MF values the third section of data values is not presented and the F. E. values are not contoured.

The actual data plots included with the report are prepared utilizing an IBM 360/75 Computer and a Calcomp 770/763 Incremental Plotting System. The data values are calculated, plotted, and contoured according to a programme developed by McPhar Geophysics. Certain symbols have been incorporated into the programme to explain various situations in recording the data in the field.

The IP measurement is basically obtained by measuring the difference in potential or voltage (ΔV) obtained at two operating frequencies. The voltage is the product of the current through the ground and the apparent resistivity of the ground. Therefore in field situations where the current is very low due to poor electrode contact, or the apparent resistivity is very low, or a combination of the two effects; the value of (ΔV) the change in potential will be too small to be measurable. The symbol "TL" on the data plots indicates this situation.

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

In certain situations negative values of Apparent Frequency Effect are recorded. This may be due to the geologic environment or spurious electrical effects. The actual negative frequency effect value recorded is indicated on the data plot, however the symbol "NEG" is indicated for the corresponding value of Apparent Metal Factor. In contouring negative values the contour lines are indicated to the nearest positive value in the immediate vicinity of the negative value.

The symbol "NR" indicates that for some reason the operator did not attempt to record a reading although normal survey procedures would suggest that one was required. This may be due to inaccessible topography or other similar reasons. Any symbol other than those discussed above is unique to a particular situation and is described within the body of the report.

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

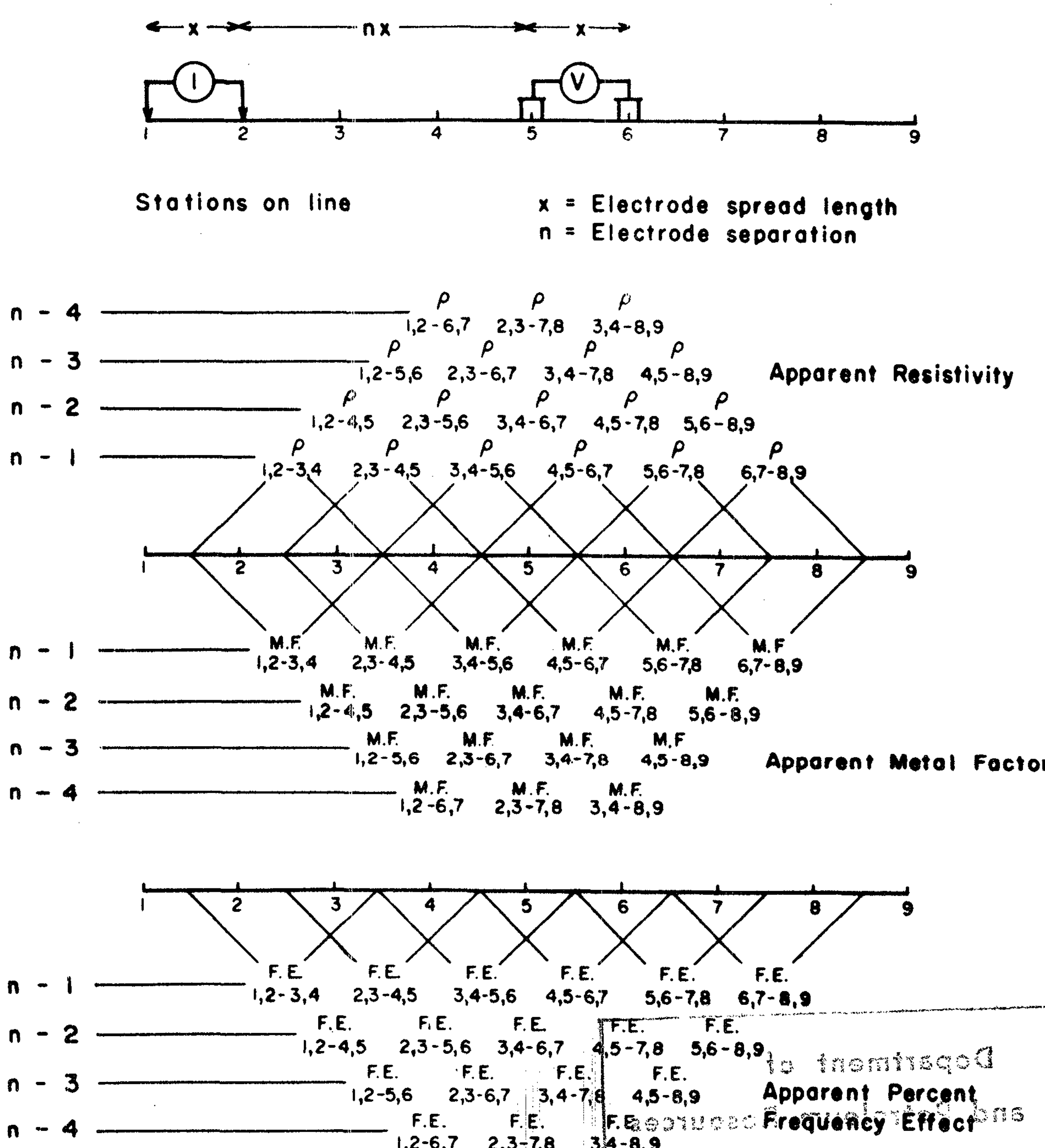


Fig. A

McPHAR GEOPHYSICS LIMITED

REPORT ON INDUCED POLARIZATION AND RESISTIVITY SURVEY OF THE REXSPAR PROJECT BIRCH ISLAND AREA, KAMLOOPS M.D. B.C. FOR DENISON MINES LIMITED

1. INTRODUCTION

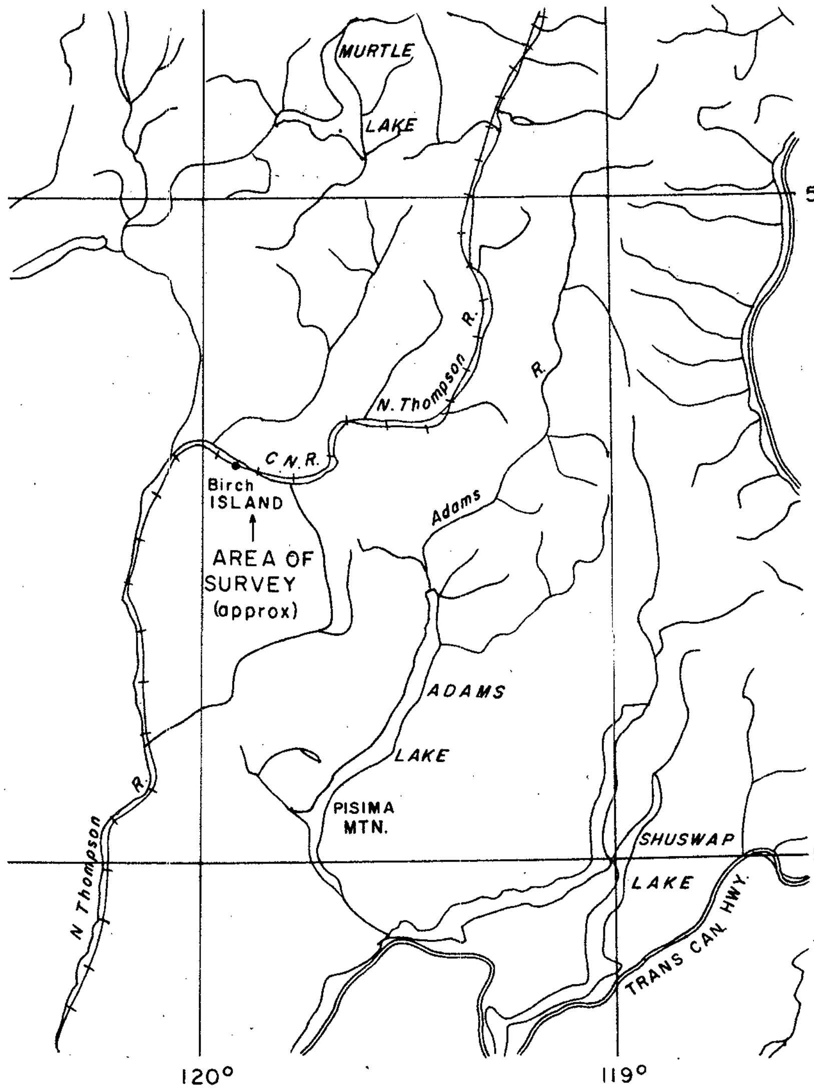
During the period from April 27, 1969 to October 22, 1969 an extensive induced polarization and resistivity survey was carried out on the Rexspar Project for Denison Mines Limited. The claims are situated south of the village of Birch Island and about 80 miles north of Kamloops in the Kamloops Mining Division of British Columbia. The centre of the property is situated in the northwest quadrant of the one degree quadrilateral whose southeast corner is at 51 ° North latitude and 119 ° West longitude. Access is via a secondary road from the town of Birch Island, which is served by B.C. Highway # 5 and the main line of the Canadian National Railways.

Interest in the property stems from the discovery of several uranium deposits of possible economic importance and a sizable zone of flourite mineralization. The uranium occurs in a series of relatively flat-lying lenses within a trachyte sill or flow, associated with zones of coarse-grained biotite and pyrite (and locally magnetite). A test survey carried out in the fall of 1968 confirmed the ability of the IP method to locate these

1a

LOCATION MAP

1" = 20 mi



FROM G. S. C MAP. 932A

mineralized zones due to the anomalous response from the associated pyrite. (See our report of December 10, 1968).

The present survey was part of an intensive program to explore for other uranium deposits in the main trachyte body and adjacent portions of the enclosing schists. Lines were run 300 feet apart, using a 200-foot dipole-dipole electrode array with four separations (i.e. n = 1, 2, 3 and 4). The survey was carried out with a McPhar Variable Frequency IP unit operating at 0.3 and 5.0 cps. In addition to the IP survey, the Company has carried out geologic mapping, geochemical soil sampling, radon sampling and preliminary diamond drilling.

The geophysical survey work discussed in this report was carried out on the following claim groups of the Rexspar Project, all of which are located in the Kamloops Mining Division.

Ray 1	Group	ACTIVE 1	Group
Ray 2	Group	ACTIVE 2	Group
Top	Group	ACTIVE 3	Group
Jam 1	Group	ACTIVE 4	Group
Jam 2	Group	PA 1	Group
Radio	Group	PA 2	Group

The claims are all owned or held under option by Denison Mines Limited.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results are shown on the following data plots in the manner described in the notes preceding this report.

Line	Spreads	Dwg. No.
108N	200'	IP 5380-1
102N	200'	IP 5380-2
96N	200'	IP 5380-3
93N	200'	IP 5380-4
90N	200'	IP 5380-5
87N	200'	IP 5380-6
87N	100'	IP 5380-7
84N	200'	IP 5380-8
81N	200'	IP 5380-9
78N	200'	IP 5380-10
78N	100'	IP 5380-11
75N	200'	IP 5380-12
72N	200'	IP 5380-13
69N	200'	IP 5380-14
66N	200'	IP 5380-15
63N	200'	IP 5380-16
60N	200'	IP 5380-17
60N	100'	IP 5380-18
57N	200'	IP 5380-19
54N	200'	IP 5380-20
54N	100'	IP 5380-21
51N	200'	IP 5380-22
48N	200'	IP 5380-23
45N	200'	IP 5380-24

Line	Spreads	Dwg.No.
42N	200'	IP 5380-25
39N	200'	IP 5380-26
36N	200'	IP 5380-27
33N	200'	IP 5380-28
30N	200'	IP 5380-29
27N	200'	IP 5380-30
24N	200'	IP 5380-31
24N	100'	IP 5380-32
21N	200'	IP 5380-33
18N (2 parts, East & West)	200'	IP 5380-34
18N	100'	IP 5380-35
15N	200'	IP 5380-36
12N (2 parts, East & West)	200'	IP 5380-37
9N (2 parts, East & West)	200'	IP 5380-38
6N (2 parts, East & West)	200'	IP 5380-39
3N	200'	IP 5380-40
0 (2 parts, East & West)	200'	IP 5380-41
3S	200'	IP 5380-42
4+50S	200'	IP 5380-43
6S	200'	IP 5380-44
9S	200'	IP 5380-45
9S	100'	IP 5380-46
12S	200'	IP 5380-47
15S	200'	IP 5380-48

Line		Spreads	Dwg. No.
18S	(2 parts, East & West)	200'	IP 5380-49
21S		200'	IP 5380-50
24S	(2 parts, East & West)	200'	IP 5380-51
27S		200'	IP 5380-52
30S	(2 parts, East & West)	200'	IP 5380-53
33S		200'	IP 5380-54
36S		200'	IP 5380-55
39S		200'	IP 5380-56
42S	(2 parts, East & West)	200'	IP 5380-57
45S		200'	IP 5380-58
48S	(2 parts, East & West)	200'	IP 5380-59
51S		200'	IP 5380-60
54S		200'	IP 5380-61
57S		200'	IP 5380-62
60S		200'	IP 5380-63
66S		200'	IP 5380-64
72S		200'	IP 5380-65
78S		200'	IP 5380-66
84S		200'	IP 5380-67
90S		200'	IP 5380-68
96S		200'	IP 5380-69
114S		200'	IP 5380-70
126S		200'	IP 5380-71
138S		200'	IP 5380-72

Line	Spreads	Dwg. No.
150S	200'	IP 5380-73
156S	200'	IP 5380-74
162S	200'	IP 5380-75
168S	200'	IP 5380-76
180S	200'	IP 5380-77
186S	200'	IP 5380-78
21W	200'	IP 5380-79
23W	200'	IP 5380-80
27W	200'	IP 5380-81

Enclosed with this report are Dwgs. I.P.P. 4559-1 to -7, plan maps of the grid at a scale of 1" = 300' showing the IP anomalies in relation to the main lithologic units and known ore zones. 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.

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 centre of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

The location of survey lines relative to claim boundaries, the names and relative positions of the claims, and the geologic data indicated on the maps discussed in the report are based upon information supplied by Denison Mines Limited.

3. DISCUSSION OF RESULTS

Anomalous IP response was measured on a large portion of the grid, particularly in the area underlain by the trachyte host rock. On several lines it is difficult to distinguish between high background IP effects and true anomalies. The classification of definite, probable and possible anomalies shown on the data plots and accompanying maps is based on the magnitude of the Apparent Metal Factor and Apparent Frequency Effect values, as well as on the contour patterns. However, some of the lower magnitude probable anomalies within the trachyte may be economically more important than definite anomalies in the areas underlain by schist.

In view of the great number of anomalies it is not practical to describe them individually. Instead, the definite anomalies have been grouped into zones and these have been numbered to facilitate discussion. This grouping should be regarded as a first approximation only, as there is still some uncertainty regarding the correlations.

In addition to the pyrite-mica-uranium zones, the trachyte also contains appreciable disseminated pyrite. Apparently this is unrelated to the ore mineralization and the concentration is highly variable, both vertically and horizontally. It would not be possible to discriminate between these two types of mineralization with the IP method. Samples of pyrite-mica from Hole # 69-2 were sufficiently magnetic to suggest that detailed magnetometer surveying of the trachyte would be warranted, but apparently not all the known ore zones are magnetic.

As a further complicating factor, some of the schists are now known to be pyritic and graphitic. These would also give rise to anomalous response.

Zone # 1

Zone # 1 consists of definite anomalies at the west end of Line 96N and Line 93N, and may also include the probable anomaly at 46W on Line 90N. This part of the grid is believed to be underlain by schists, rather than the favourable trachyte, but a drill test may still be warranted since the anomalies are fairly strong.

Zone # 2

Strong anomalies were found at 8W - 10W on Line 93N and at 2E - 6E on Line 90N. These have been tentatively correlated to form a zone trending WNW but they could represent separate features. Surveying two or three short north-south lines would be required to confirm the continuity but this may not be warranted since both anomalies are in the schists.

Zone # 3

This zone is also in the northwestern section of the property that is believed to be underlain by schists. Line 87N was detailed with 100- foot spreads and the results show a very strong anomaly centred at 22W to 23W;

the source appears to be broad (i.e. at least 2 units) with some depth to the top. Weaker anomalies on strike to the southeast suggest an extension of Zone #3 at least as far as Line 63N. A short vertical hole might be drilled at or near station 22W if the anomaly cannot be explained by surface investigation.

<u>Zone #4</u>

Zone #4 occurs 2,000 feet east of the Base Line on Line 81N and Line 78N. This feature is also underlain by schist and therefore probably does not merit a drill test unless there are other favourable factors, such as a geochemical anomaly.

<u>Zone #5</u>

Definite anomalies were found about 2,000 feet west of the Base Line from Line 66N to Line 51N, forming a north-south zone within the schists. The strongest response was obtained on Line 60N and this was subsequently detailed with 100-foot dipoles. The resulting anomaly is one of the strongest found on the property and would merit a drill test except for the apparently unfavourable geological setting.

<u>Zone #6</u>

This small zone is located between the southern part of Zone #5 and the Base Line and is also in the schist. Detailing on Line 54N indicated a strong anomaly at 10W to 11W, with some depth to the top of the source.

<u>Zone #7, Zone #8 and Zone #9</u>

An extensive area of anomalous IP response was found east of the

Base Line, extending from Line 51N to Line 36N. The more definite anomalies within this region have been grouped into three zones. Zone #7 and Zone #8 occur within the schists and are of moderate magnitude; further investigation may not be warranted.

Zone #9 is probably the strongest, most persistant feature located by the survey and occurs at or near the schist-trachyte contact. An attempt was made to drill this feature on Line 42N but the angle hole could not be completed. A vertical hole should be drilled at 21E, Line 39N unless the terrain is too rugged in which case the hole could be moved to either adjoining line.

<u>Zone #10</u>

Zone #10 is centred just east of the Base Line on Line 33N. It appears as a strong wide anomaly that would normally merit a drill test; however, this location is within the main schist band which is not the favourable host rock.

<u>Zone #11</u>

Zone #11 is south of Zone #9 and also along the schist-trachyte contact. If this feature has not been drilled, a test may be warranted on Line 21N, between 10E and 11E.

<u>Zone #12</u>

This feature occurs within the favourable trachyte and correlates in part with the southern section of the "H.C." mineralized zone. The anomaly on Line 24N was detailed with 100-foot dipoles and a vertical hole should be drilled at 36+50E to determine the source.

Zone # 13

Strong anomalies were found near the east end of Line 24N and Line 18N. Apparently this zone correlates with a known mineralized shear and hence may not merit further work.

Zone # 14

A wide zone of anomalous IP effects was measured on the eastern part of Line 21N. The main part of the anomaly extends from 70E to 84E but there are weaker effects to at least 66E and 88E. Three vertical holes have been completed on the strongest section of the anomaly: # 69-9 at 78E; # 69-13 at 75+50E; and # 69-14 at 73E. All three encountered radioactive pyrite-mica bands, similar to the known ore zones, within the trachyte.

No comparable anomalies were found on the adjacent lines. On Line 24N there is a broad zone of low magnitude from about 73E to 95E and on Line 18N there is a narrow definite anomaly centred at 72E, within a very wide band of low magnitude IP effects. Hole # 69-11 drilled at 72E, Line 18N intersected only minor pyrite-mica mineralization in weakly pyritic trachyte. Apparently the main section of Zone # 14 is roughly parallel to Line 21N and hence a small grid of N-S lines should be surveyed. Drilling should be extended east and west of the existing holes on Line 21N to determine the extent of the mineralized zone and to locate the best mineralization. A north-south section should then be drilled.

Zone # 15

Zone # 15 is a large complex feature centred on Line 15N, in the western part of the main trachyte band. Drill Hole # 69-2 at 21E, Line 18N intersected about 20 feet of ore type mineralization and Hole #69-4 at 20E, Line 15N encountered a few feet of similar mineralization. A few more widely-spaced holes should be drilled on this zone to search for a thicker or higher grade section of pyrite-mica-uranium mineralization.

Zone #16 and Zone #17

These two zones represent portions of an area of complex response straddling the contact between the trachyte and upper schists. The correlation shown on Dwg. I. P. P. 4559-6 is tentative only and several other interpretations are possible for this sector of the grid. A vertical hole drilled at 9W on Line 12N (#69-7) was entirely in the upper schists. Tests on a few pieces of drill core in our laboratory indicated the presence of pyrite and graphite in anomalous amounts. Consequently further drilling is not warranted unless detailed geologic mapping can definitely place portions of the zones within the trachyte.

Zone #18

Zone #18 occurs along the western edge of the grid and has been traced from Line 12N to Line 18S and is still open to the north. On most lines the source appears to be broad, but on Line 12S and Line 18S it is much narrower (i.e. less than 1 unit wide). In addition, the zone appears to mark a change in rock type as the resistivity level is markedly higher to the west than it is to the east. If the source of the anomaly can not be established by geological investigation, a drill test might be warranted on Line 12S.

Zone #19

Zone #19 is located in the eastern part of the Trachyte band, southwest of Zone #14. A single hole drilled at 57E, Line 12N reportedly intersected radioactive pyrite-mica mineralization. Here again, additional drilling is warranted on a widely spaced grid pattern.

Zone #20

This narrow feature occurs in the central part of the trachyte and may represent a southern extension of Zone #15. A drill test is warranted, either at 15E, Line 6N or 15E, Line 9N.

Zone #21

This strong anomaly is in the western part of the trachyte band, immediately north of the Flourite Zone. Drill Hole #69-8 at 4+50W, Line 3N intersected weakly mineralized trachyte (i.e. 1-2% pyrite with local concentrations of 4-5% plus minor molybdenite). At least 1 or 2 more holes should be drilled farther east to evaluate this feature (e.g. at 2+00W).

Zone #22

Zone #22 is also within the central section of the trachyte. If a drill test has not yet been carried out, a vertical hole is recommended at 23E, Line 0 or 22E, Line 3S.

Zone #23

A definite anomaly was found on Line 9S coincident with the "E" ore zone. Strong anomalies are also present on Line 12S, Line 6S and Line 4+50S, hence additional drilling is warranted unless the area covered by the IP zone has been thoroughly tested.

Zone # 24

No strong IP anomalies were obtained over the "A" ore zone which is centred immediately east of the Base Line on Line 15S. There are anomalies with low to moderate magnitude Metal Factor values on Line 12S, Line 15S and Line 18S and these features have fairly definite patterns. This indicates that potential ore zones cannot be identified solely on the basis of magnitude of the IP effects. Consequently it will be necessary to test several of the probable anomalies in the trachyte, in addition to the stronger, more definite ones that have been grouped into zones.

Zone # 25

Definite anomalies of moderate magnitude were measured on Line 18S and Line 21S, coincident with the "BD" ore zone. This feature has probably been adequately tested by previous drilling.

Zone # 26

Zone # 26 correlates in part with the "F" ore zone but only every second line was extended far enough west to cross this feature. If previous drilling has not fully explored this sector of the property, additional holes would be warranted.

Zone # 27

This feature is also within the main trachyte band, about 1,000 feet east of the Base Line. It has been traced from Line 24S to Line 48S although there may be a gap or offset in the vicinity of Line 36S. A vertical drill hole at 11E, Line 30S encountered some pyrite-mica mineralization but no significant uranium values. Further drilling is warranted, to complete the section on Line 30S and to test the zone along strike, either on Line 45S or Line 48S.

Zone # 28

Zone # 28 consists of strong anomalies at 104E - 106E on Line 30S and 105E - 107E on Line 36S. The source appears to be shallow and narrow relative to the 200-foot electrode interval; the anomaly pattern is suggestive of a concentrated sub-vertical source rather than an extensive flat-lying sheet. This location is apparently within the lower schists but a drill test may still be warranted; an inclined hole would be preferable, to pass under 106E, Line 36S at a vertical depth of 200 - 250 feet.

Zone # 29

Definite anomalies occur west of the Base Line on Line 60S, Line 66S and Line 72S, within the lower schists. Detailed geologic and geochemical investigations might be carried out in order to determine if a drill test is warranted.

Zone # 30

Low magnitude anomalies occur on the east part of the grid from about Line 66S to Line 96S. This area is presumed to be underlain by the lower schists but this assumption should be confirmed before arbitrarily omitting the zone from the drilling program.

4. SUMMARY AND RECOMMENDATIONS

The strongest and most definite anomalies on the Rexspar grid have been grouped into thirty zones as shown on the accompanying plan. The zones have been related to the general geology and those correlating with the favourable trachyte have been selected as being of prime interest. Some of the zones have already been tested by drilling and in several instances favourable pyrite-mica mineralization was intersected. In these cases a fence of vertical holes should be drilled across the anomaly, with additional holes to the north and south to locate the best mineralization. Previously untested zones should be drilled as indicated in the following list.

Zone #9 and Zone #11: at schist - trachyte contact; drill vertical holes at 21E, Line 39N and 10E - 11E, Line 21N.

Zone #12: drill at 36+50E, Line 24N.

Zone #13: apparently related to a shear zone, omit from initial program.

Zone #14, Zone #15 and Zone #19: pyrite-mica bands in initial holes; require grid drilling.

Zone #20: drill initial hole at 15E, Line 6N.

Zone #21: drill at 2W, Line 3N.

Zone #22: drill at 23E, Line 0.

Zone #23: correlates with the "B" ore zone and probably has been drilled off.

Zone #24: correlates with the "A" ore zone.

Zone #25: correlates with the "BD" ore zone.

Zone #26: correlates with the "F" ore zone.

Zone #27: minor pyrite-mica in initial hole; warrants further drilling.

Isolated definite anomalies were found within the trachyte on Line 42N, Line 36N and Line 33S. These probably also merit a drill test, after a small amount of detail on intermediate lines.

Broad zones of low to moderate magnitude occur throughout the trachyte, as for example the probable anomaly from 56E to 90E on Line 18N. These responses are not unlike that obtained over the "A" ore zone. A similar feature at 57E on Line 12N was tested and the drill intersected a radioactive pyrite-mica zone. Consequently it may be necessary to drill all of the probable anomalies, but the stronger, definite zones should be drilled first.

The flourite deposit appears on several lines as a distinct resistivity high (e.g. Line 6S at 2W - 4E; Line 9S at 5W - 1E). Several other resistivity highs occur within the main band of trachyte and these probably warrant further investigation.

a) Line 63N at 25E

b) Line 42N to Line 30N, centred at 28E to 30E

c) Line 6N at 30E - 34E

d) Line 0 at 8W - 10W

e) Line 18S at 13W - 15W

f) Line 21S to Line 24S, at 1E - 5E

g) Line 30S and Line 33S at 8W

h) Line 54S at 2E - 6E.

Twelve of the zones occur in the section of the grid believed to be underlain by the upper schists (Nos. 1, 2, 3, 4, 5, 6, 7, 8, 10, 16, 17 and 18). A single hole drilled on Zones 16 and 17 encountered pyrite and graphite and this type of mineralization may be the source of the other anomalies. A few widely spaced vertical holes should probably be drilled to confirm this assumption, as follows:

Zone # 3:	22W, Line 87N
Zone # 5:	18+50W, Line 60N
Zone # 6:	10+50W, Line 54N
Zone # 18:	49W, Line 12S.

In addition to these zones, there are several strong anomalies that are more-or-less isolated (e.g. 17W, Line 96N; 18W, Line 93N; 21W, Line 27N; 2W, Line 21N; 33W, Line 12N and 34W, Line 0). Further investigation of these features is probably not warranted at this time.

Fewer anomalies were found in the lower schists than in the trachyte or upper schists. Zone #28 may warrant drilling an inclined hole (under 106E, Line 36S) but Zone #29 and Zone #30 should probably be omitted from the initial drill program. If encouraging results are obtained from the initial drilling of the zones in the upper or lower schists, the following anomalies would also merit re-evaluation: 130E, Line 18N; 114E, Line 36S; 13W, Line 60S; and 6E, Line 180S.

McPHAR GEOPHYSICS LIMITED

Robert A. Bell

Robert A. Bell,
Geologist.

David K. Fountain

David K. Fountain, P.Eng.
Geophysicist.

Dated: November 25, 1969

ASSESSMENT DETAILS

PROPERTY: Rexspar Project — MINING DIVISION: Kamloops

SPONSOR: Denison Mines Limited — PROVINCE: British Columbia

LOCATION: Birch Island Area

TYPE OF SURVEY: Induced Polarization

OPERATING MAN DAYS:	688	DATE STARTED:	April 27, 1969
EQUIVALENT 8 HR. MAN DAYS:	1032	DATE FINISHED:	Oct. 22, 1969
CONSULTING MAN DAYS:	12	NUMBER OF STATIONS:	3505
DRAUGHTING MAN DAYS:	10	NUMBER OF READINGS:	36,876
TOTAL MAN DAYS:	1054	MILES OF LINE SURVEYED:	127.27

CONSULTANTS:
Robert A. Bell, 50 Hemford Crescent, Don Mills, Ontario.
David K. Fountain, 44 Highgate Road, Toronto 18, Ontario.

FIELD TECHNICIANS:
J. Parker, Box 340, Choiceland, Saskatchewan
M. Bolgun, 333 2nd Avenue N.E. Apt. 7, Calgary 6, Alberta.
Plus 2 helpers from attached list

DRAUGHTSMEN:
P. Coulson, 77 Peter Street, Markham, Ontario.
B. Marr, 19 Kenewen Court, Toronto 16, Ontario.
N. Lade, 1355 Lakefield Street, Oshawa, Ontario.

McPHAR GEOPHYSICS LIMITED

Robert A. Bell.

Robert A. Bell,
Geologist.

Dated: November 25, 1969

STATEMENT OF COST

Denison Mines Limited - Rexspar Project
Birch Island Area - British Columbia

Contract No. G6241

2 Crews

1st Crew

38-3/4 days	Operating	@ $220.00	8,525.00
51½ days	Operating	@ $200.00	10,300.00

2nd Crew

61¼ days	Operating	@ $220.00	13,585.00
22 days	Operating	@ $200.00	4,400.00
25 days	Bad Weather)		
3½ days	Travel)		
26¼ days	Standby)	57½ @ $ 85.00	4,887.50
2-3/4 days	Prep.)		
Credit 54½ days		@ $ 20.00	(1,090.00)

Expenses

Fares Air	867.75	
Ground	458.78	
Transportation (Car Rental)	3,165.02	
Taxis	87.50	
Meals and Accommodation	4,965.72	
Telephone and Telegraph	168.50	
Camp Supplies	3,291.99	
Freight	298.90	
Supplies	1,792.46	
Mosaics	140.94	
	15,237.56	
Plus 10%	1,525.30	
		16,762.86
Extra Labour - see attached list	16,919.56	
Plus 20%	3,381.11	
		20,300.67
TOTAL		$77,671.03

McPHAR GEOPHYSICS LIMITED

Robert A. Bell,
Geologist.

Dated: November 25, 1969

CERTIFICATE

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

1. I am a geologist residing at 50 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. (1953).

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 fifteen 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 Denison Mines Limited or any affiliate.

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

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

Dated at Toronto

This 25th day of November 1969.

Robert A. Bell

Robert A. Bell, Ph.D.

CERTIFICATE

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

1. I am a geophysicist residing at 44 Highgate Road, Toronto 18, Ontario.

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

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

4. I am a registered Professional Engineer in the Province of British Columbia and Ontario, and have been practising my profession for eight 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 Denison Mines Limited or any affiliate.

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

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

Dated at Toronto

This 25th day of November 1969.

David K. Fountain

David Kirkman Fountain, B.A.Sc. P.Eng.

FIELD TECHNICIANS

Harvey McLeod	1005 Moncton Avenue, Kamloops, B.C.	83 days	@ $18.00	=	1,494.00
Murray McDonald	6135 Bow Cres. N.W. Calgary, Alberta	82½ days	@ $18.00	=	1,485.00
Larry Parsons	Box 114, Clearwater, B.C.	10 days	@ $18.00	=	180.00
Dennis Moss	Birch Island, B.C.	41 days	@ $20.00	=	820.00
Alvin Hornby	Clearwater, B.C.	34¼ days	@ $18.00	=	616.50
John Pisarczyk	Birch Island, B.C.	60 days	@ $20.00	=	1,200.00
David B. Service	653 Brentwood Ave. Kamloops, B.C.	13 days	@ $18.00	=	234.00
Brian Carl	2526 Valleyview Dr. Kamloops, B.C.	41½ days	@ $20.00	=	830.00
Barry Mould	973 Douglas Street, Kamloops, B.C.	6 days	@ $18.00	=	108.00
Barrie Anderson	#14, 150 Kitchner Cres.N. Kamloops, B.C.	70½ days	@ $18.00	=	1,269.00
Mike Allen	149 West Seymour St. Kamloops, B.C.	31 days	@ $18.00	=	558.00
Gordon McKinnon	8303 - 34th Ave, N.W. Calgary, Alberta	51½ days	@ $18.00	=	927.00
Willard Tobin	Clearwater, B.C.	14½ days	@ $18.00	=	261.00
Leonard Steinke	Vista Trailer Manor, Harold Rd. Kamloops, B.C.	24 days	@ $18.00	=	432.00
Fraser McLeod	7686 Argyle St. Vancouver, B.C.	33 days	@ $18.00	=	594.00
Keven Aylward	Clearwater, B.C.	27 days	@ $18.00	=	486.00
Robert Wall	Apt. 523, 12 Bergament Ave. Rexdale, Ont.	43½ days	@ $18.00	=	783.00
Paul Harpe	R.R.#1 West Side, Kamloops, B.C.	39½ days	@ $18.00	=	711.00
Mark E. Bennett	453 West Battle St., Kamloops, B.C.	3½ days	@ $20.00	=	70.00
William Dawson	1146 Douglas St. Kamloops, B.C.	2 days	@ $18.00	=	36.00
Patrick Hayes	380 Charles St. Buckingham, Quebec.	3½ days	@ $18.00	=	63.00
Christopher Masland	Box 1055, Windsor, Nova Scotia.	48 days	@ $18.00	=	864.00
William Murray	General Delivery, Kamloops, B.C.	43½ days	@ $18.00	=	783.00
George Parent	General Delivery, Monte Lake, B.C.	3½ days	@ $18.00	=	63.00
Terry Quinn	658 Alberni Ave.N. Kamloops, B.C.	7 days	@ $18.00	=	126.00
John Seymour	658 Alberni Ave.N. Kamloops, B.C.	8 days	@ $18.00	=	144.00
Donald Shields	802 Agossiz Road, Kamloops, B.C.	2 days	@ $18.00	=	36.00
Norman Treseng	Birch Island, B.C.	1 day	@ $18.00	=	18.00
Jack Wolfe	General Delivery, Kamloops, B.C.	1¼ days	@ $18.00	=	22.50
Ken Dunlop	620 Seymour St. Kamloops, B.C.	47 days	@ $18.00	=	846.00
Marcel L'Heureux	General Delivery, Kamloops, B.C.	30½ days	@ $18.00	=	549.00
Harris Parent	General Delivery, Monte Lake, B.C.	7½ days	@ $18.00	=	135.00
Douglas Kushner	7756 Muirfield Drive, Vancouver, B.C.	6 days	@ $18.00	=	108.00
					16,852.00
	Miscellaneous Expenses				67.56
					16,919.56
	Plus 20%				3,381.11
					20,300.67

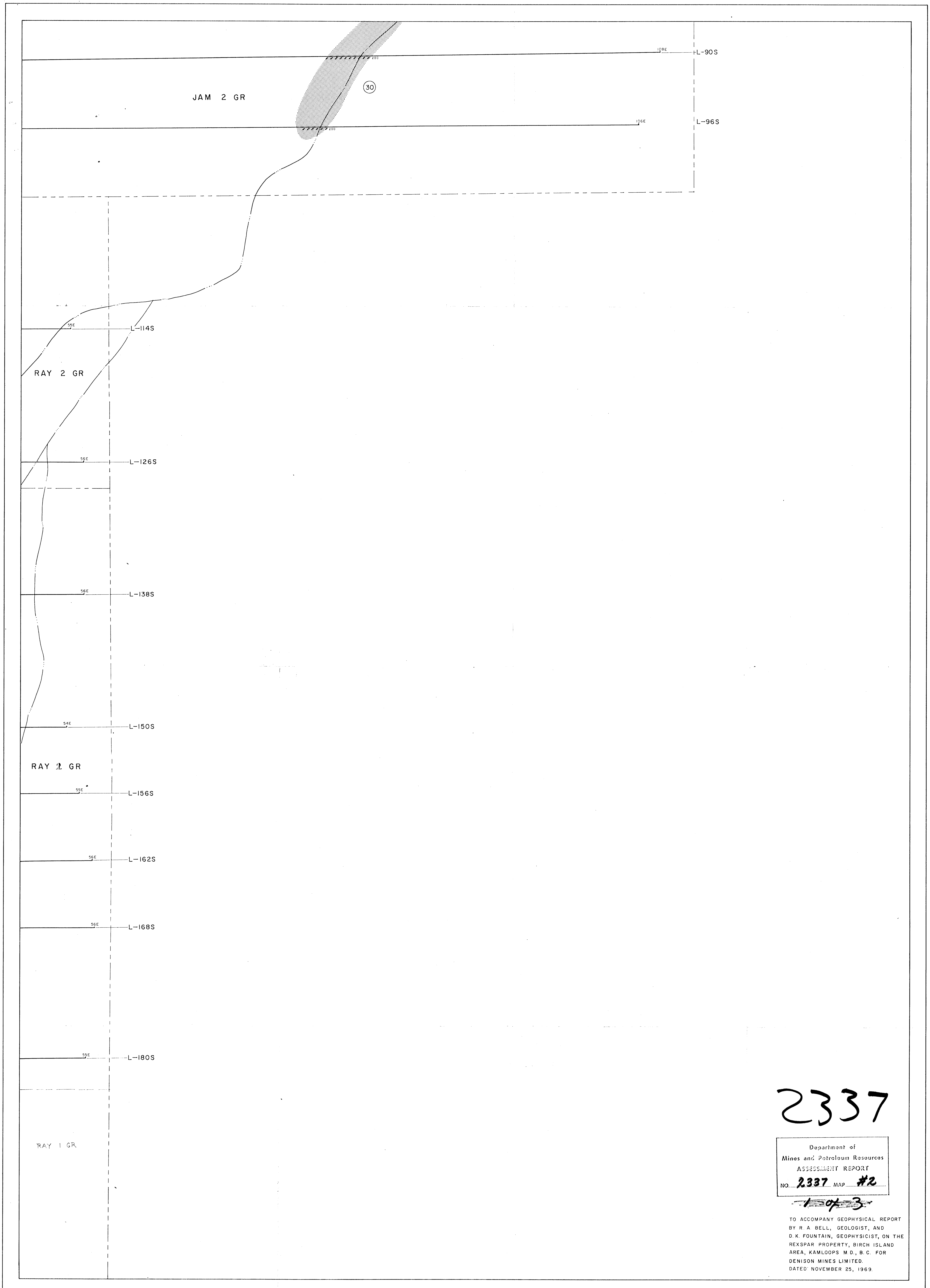
1/5 = $4,060.13

DWG.IPP-4559-I

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



N

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

SHEET INDEX

7	
6	5
4	3
2	1

INFERRED IP ZONE

DRAWN
DATE
APPROVED

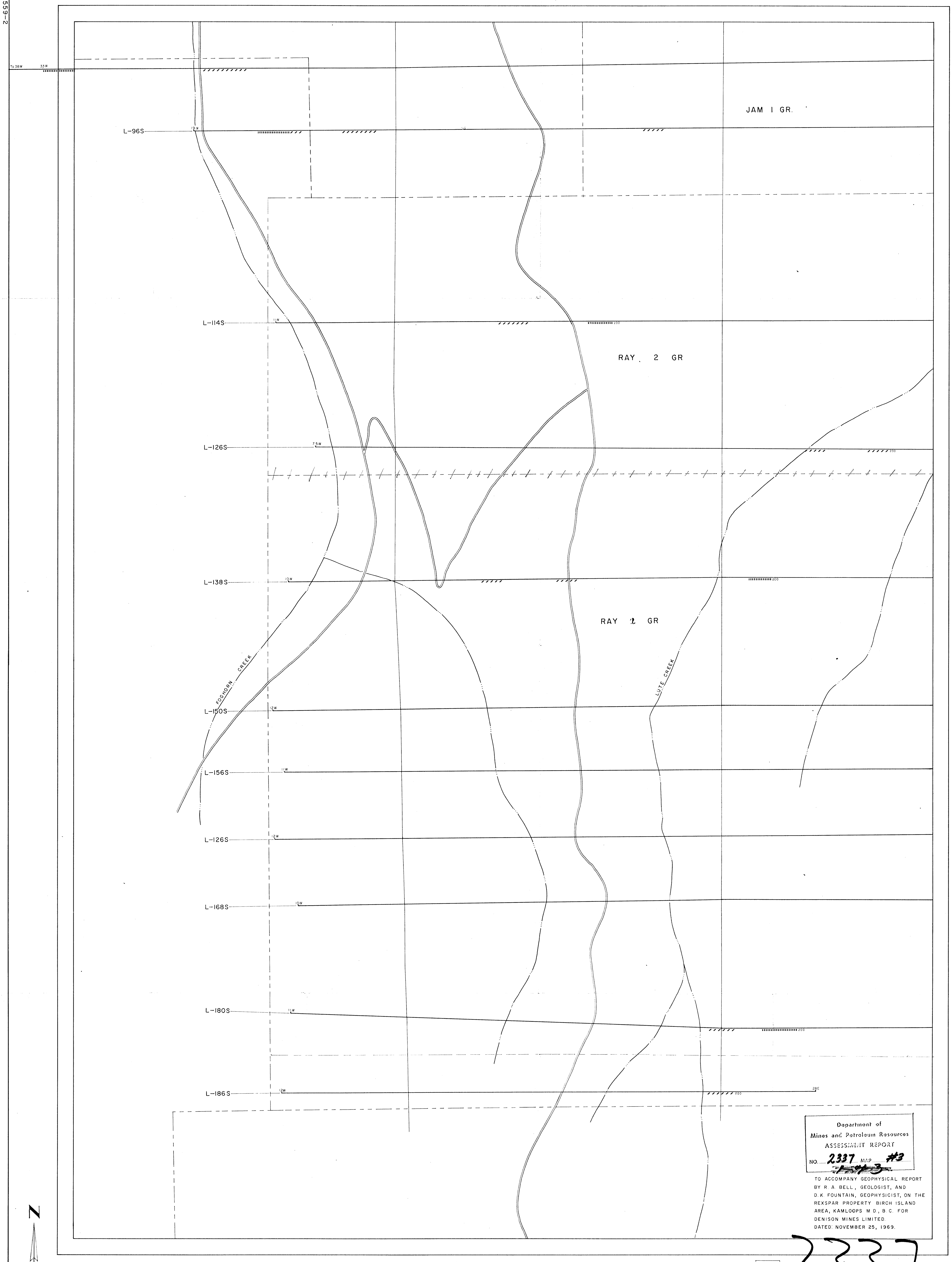
DWG.IPP-4559-I

DWG.IPP-4559-2

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



2337

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

SHEET INDEX

7	
6	5
4	3
2	1

INFERRED IP ZONE

DWG. IPP-4559-3

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP

N

SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates spread used.

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

INFERRED IP ZONE

7	SHEET INDEX
6	5
4	3
2	1

2337

1 UPPER SCHISTS
2 TRACHYTE
3 LOWER SCHISTS

DRAWN: D.C.
DATE: NOV 1969
APPROVED:
D. K. FOUNTAIN
DATE: Nov 25/69
Expiry Date: April 25, 1969

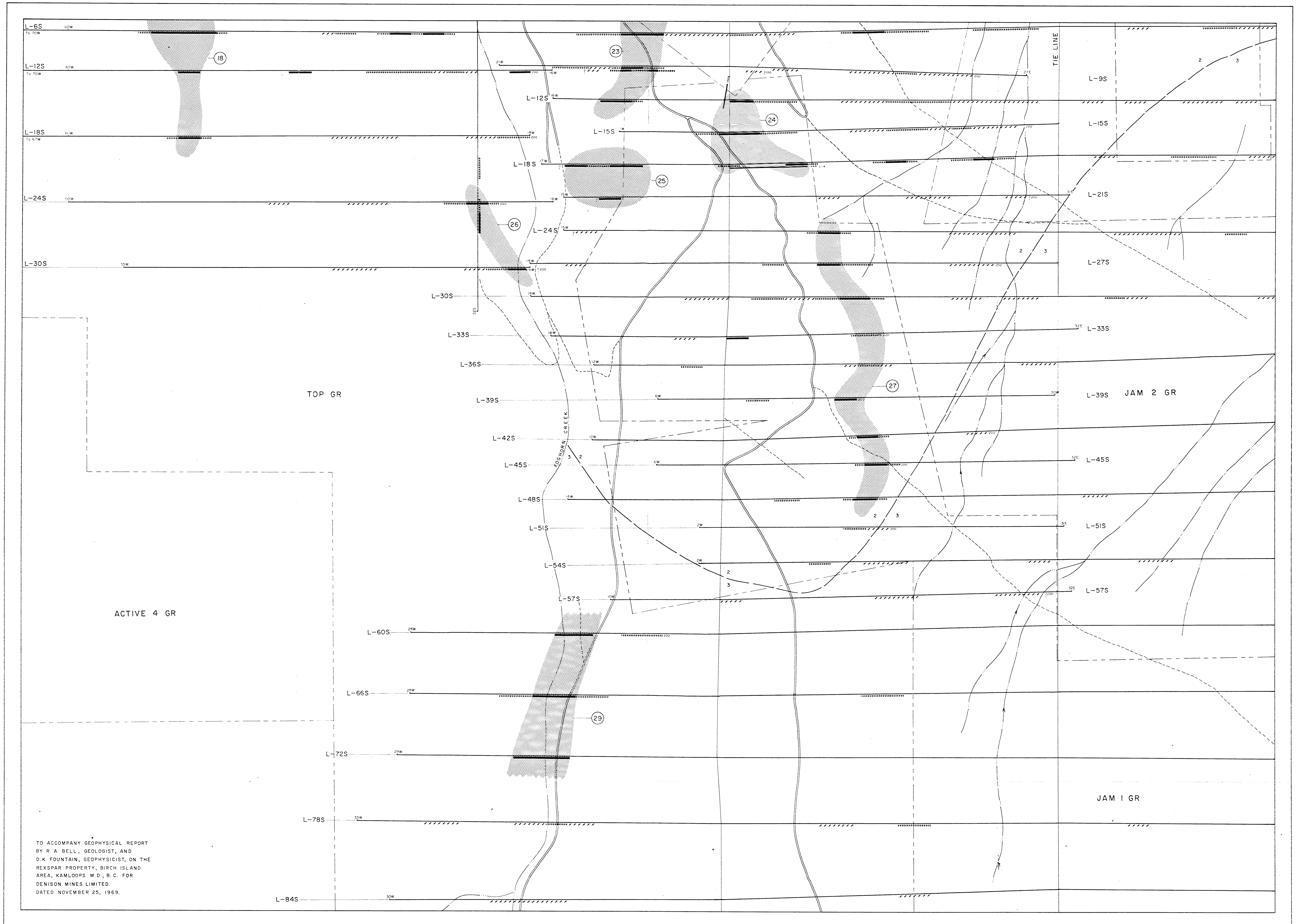
DWG. IPP-4559-3

DWG. IPP-4559-4

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



TO ACCOMPANY GEOPHYSICAL REPORT BY R. A. BELL, GEOLOGIST, AND D.K. FOUNTAIN, GEOPHYSICIST, ON THE REXSPAR PROPERTY, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C. FOR DENISON MINES LIMITED. DATED NOVEMBER 25, 1969.

N

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2337 MAP #5

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates spread used.

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

INFERRED IP ZONE

SHEET INDEX: 7, 6, 5, 4, 3, 2, 1

2337

1 UPPER SCHISTS
2 TRACHYTE
3 LOWER SCHISTS

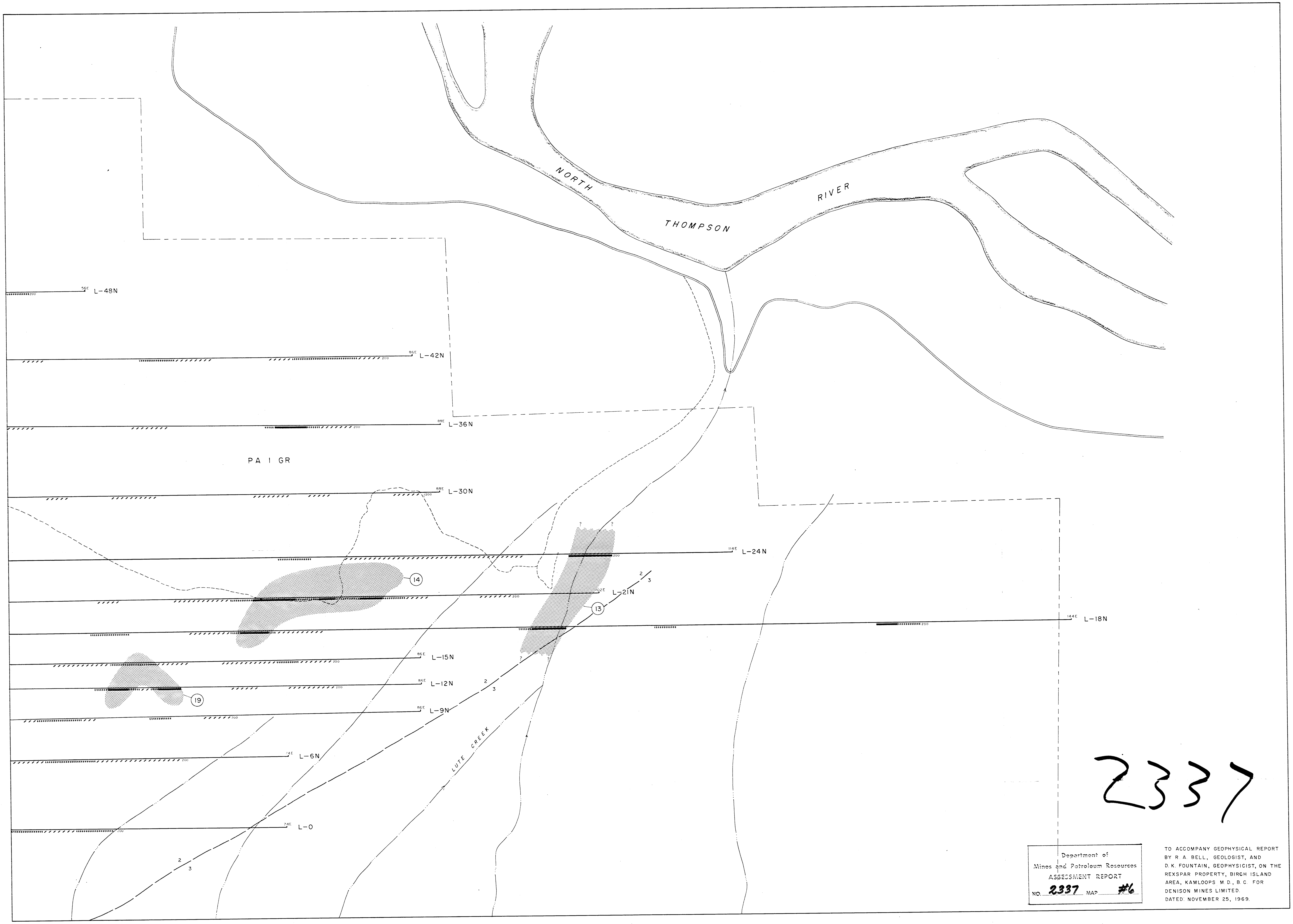
PROFESSIONAL ENGINEER — DRAWN — DATE NOV 1969 — APPROVED — David K. Fountain — Nov. 25/69

DWG. IPP.-4559-4

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



N

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used.

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

INFERRED IP ZONE

SHEET INDEX

7	
6	5
4	3
2	1

1 UPPER SCHISTS
2 TRACHYTE
3 LOWER SCHISTS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. K. FOUNTAIN

APPROVED

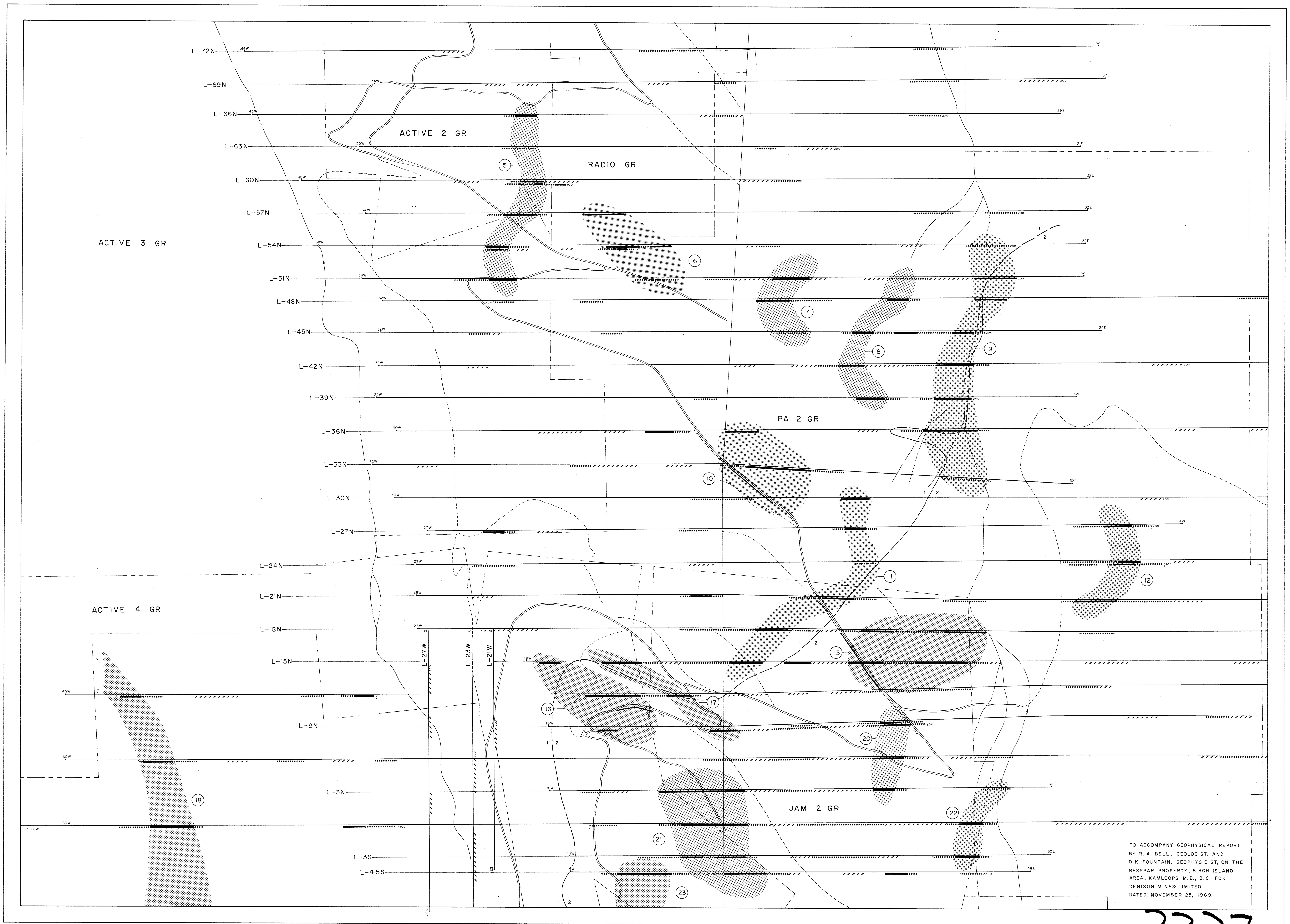
Nov. 25/69

DWG. IPP-4559-6

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



TO ACCOMPANY GEOPHYSICAL REPORT BY R. A. BELL, GEOLOGIST, AND D.K. FOUNTAIN, GEOPHYSICIST, ON THE REXSPAR PROPERTY, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C. FOR DENISON MINES LIMITED. DATED: NOVEMBER 25, 1969.

2337

N

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2337 MAP #7

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates spread used.

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

INFERRED IP ZONE

SHEET INDEX	
7	
6	5
4	3
2	1

1 UPPER SCHISTS
2 TRACHYTE
3 LOWER SCHISTS

PROFESSIONAL ENGINEER
DRAWN:
DATE: NOV 1969
APPROVED:
David K. Fountain
DATE
Nov 25/69

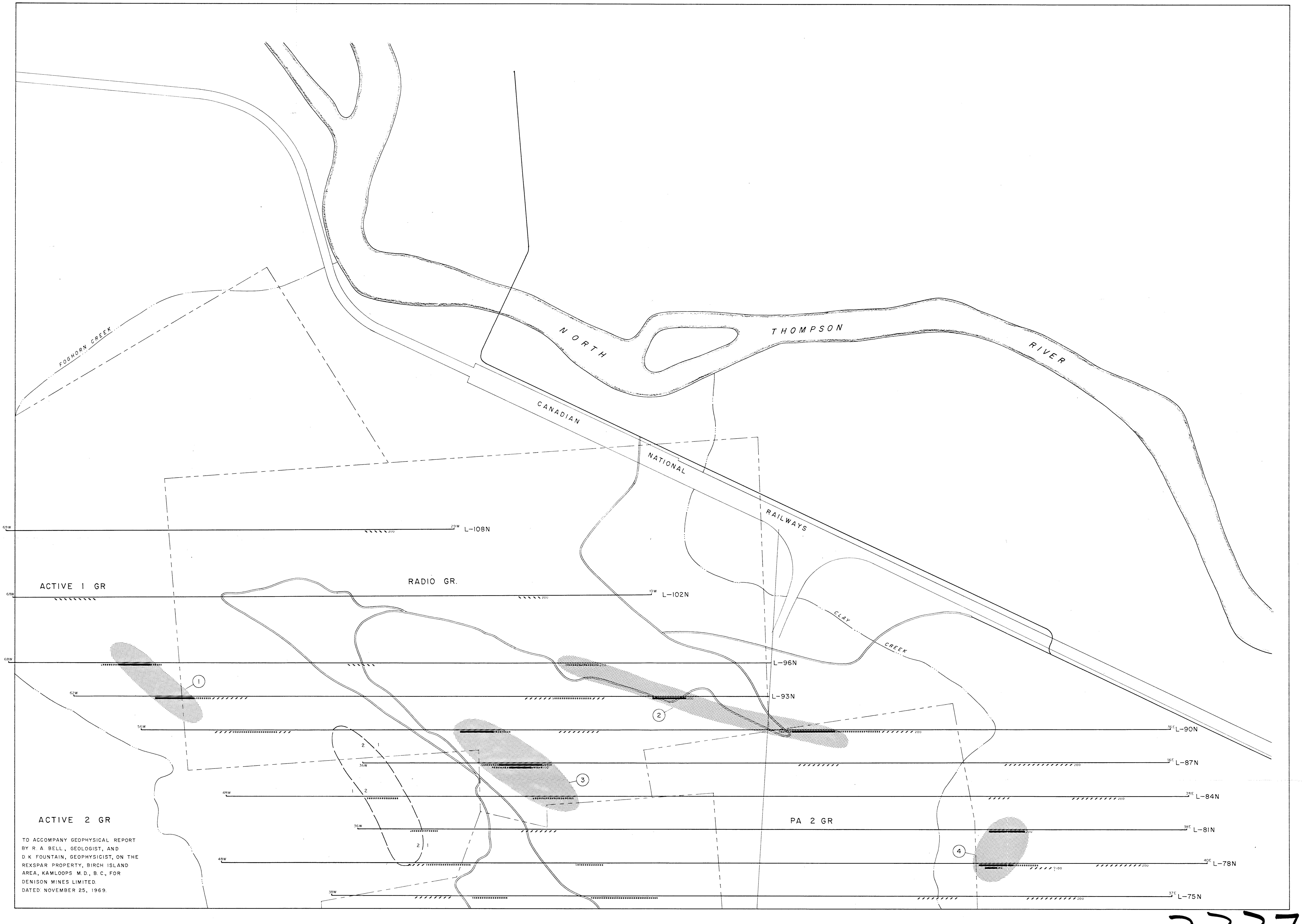
DWG. IPP-4559-6

DWG. IPP-4559-7

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



TO ACCOMPANY GEOPHYSICAL REPORT BY R. A. BELL, GEOLOGIST, AND D. K. FOUNTAIN, GEOPHYSICIST, ON THE REXSPAR PROPERTY, BIRCH ISLAND AREA, KAMLOOPS M. D., B. C., FOR DENISON MINES LIMITED.
DATED: NOVEMBER 25, 1969.

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2337 MAP #8

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE
Number at the end of anomaly indicates spread used.

DENISON MINES LIMITED

REXSPAR PROJECT, BIRCH ISLAND AREA, KAMLOOPS M.D., B.C.

SCALE

ONE INCH EQUALS THREE HUNDRED FEET

INFERRED IP ZONE

SHEET INDEX

7	
6	5
4	3
2	1

2337

1 UPPER SCHISTS
2 TRACHYTE
3 LOWER SCHISTS

DRAWN:
DATE: NOV. 1969
APPROVED: D. K. FOUNTAIN
DATE: Nov. 25/69

DWG. IPP-4559-7