6018

PART 2 of 2

ALCO OPTION part 2 of 2
Grand Forks, B. C.

Report on Induced Polarization and Magnetometer Surveys

J. A. McCance November, 1976

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 6018

REGISTERED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

82-E-9/W

ALCO OPTION

Grand Forks, B. C.

I.P. and MAGNETIC SURVEYS, 1976

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82-E-9/W

ALCO OPTION
Grand Forks, B.C.

I.P. AND MAGNETIC SURVEYS, 1976

SUMMARY

In June of 1976, induced polarization and magnetometer surveys were carried out over a property located 50 kilometres north of Grand Forks, British Columbia. A 15 line grid was surveyed to identify the dimensions, depth and mineral potential of a 'porphyry type' target located by prior reconnaissance geologic mapping. A Cu, Mo mineralized area had been recently exposed by blasting during the construction of the Burrell Creek logging road.

The induced polarization survey revealed three weakly anomalous areas.

The magnetometer results may suggest that the recognized fractured zone in the Nelson granodiorite forms a weak magnetic 'high'. However, general correlation between magnetic results and electrical anomalies is lacking.

This report contains a detailed interpretation of these surveys results with recommendations.

ALCO OPTION

Grand Forks, B. C.

I.P. AND MAGNETIC SURVEYS, 1976

82-E-9/W

1. INTRODUCTION

In June of 1976, induced polarization and magnetometer surveys were completed over the ALCO, ALCO 2, and ALCO 3 claims, totalling 30 units, held by Rio Tinto Canadian Exploration Ltd., near Grand Forks, British Columbia. These surveys were initiated to identify the dimensions, depth and approximate mineral content of a 'porphyry type' target identified by prior reconnaissance geologic mapping as a large surface exposure of fractured and weakly altered and mineralized rock. Several Cu, Mo mineralized areas had recently been exposed by blasting during the construction of the Burrell Creek logging road in 1975 and were of distinct interest.

The field operations phases of these surveys were completed between June 1 and June 30, 1976. Don Sexsmith, a member of the Rio Tinto geophysical staff, conducted on-site training and supervised an efficient crew which was temporarily employed by Rio Tinto at the time of the survey.

2. LOCATION ACCESS AND TOPOGRAPHY

The claim block is situated in southern British Columbia within the National Topographic System area designated 82-E-9/W. A point whose geographic co-ordinates are 49°31' N latitude and 118°22' W longitude lies within the claim block. The town of Grand Forks is approximately 50 air kilometres to the south. Locally, the claim group is located 3 to 4 miles southeast of Mt. McKinley, astride both the Burrell and Nicoll Creeks, immediately south of the junction of Burrell Creek and Franklin Creek.

Access is by two-lane government logging road from Grand Forks that follows the Granby River northwards until the Burrell Creek road turn-off. The approximate centre of the ALCO claim is at mile post 12 1/2 on the Burrell Creek road. It requires a little more than one hour to travel the well maintained road from Grand Forks to the property.

The topography is generally moderate. The claim group lies within a topographic low between Burrell and Nicoll Creeks. West and east of these two creeks respectively, the land rises from an approximate elevation of 850 metres in the southwest to an elevation of 1,230 metres in the southeast. Moderate to steep slopes are encountered on both the west and east sides of the predominantly northeast trending valley.

3. HISTORY AND GENERAL GEOLOGY

After the First World War, until the 1960's, very little mining activity is known for the Burrell Creek Area. Prior to this time, an account of the Franklin mining camp (Drysdale, 1915) records some activity in the area.

In 1968 Dr. G. W. H. Norman recorded his findings on behalf of Newmont Mining Corporation for the area now covered by the Alco claim (B. C. Assessment Report No. 1845). No other historical accounts of exploration activity in this area are known.

Rio Tinto's current program for this area is well described by D. B. Petersen (1976).

The area has been mapped by the G.S.C. (Little, 1957) and by Drysdale (1915). Identified regional geologic relationships indicate that Paleozoic age paragneiss and limestone units of the Monashee Group and volcanics and limestone of the Anarchist Group have been intruded by granodiorites of the Nelson Group during the Upper Triassic Period. Skarnification and mineralization of the Anarchist limestones resulted. This was followed in the lower Cretaceous Period by intrusion of the Valhalla granites (Little, 1962). Syenitic intrusion typified by the Coryell Group syenites; volcanism, the Kettle River Group volcanics; and the deposition of the Phoenix Group andesites, tuffs and shale units appear to characterize the Cenozoic Period.

Mapping within the property by Rio Tinto personnel (Petersen, 1976) has shown that six major rock units exist. These rocks include Anarchist Formation limestones and amphibolite, believed to be the two oldest rocks on the property; a porphyritic and non-porphyritic variety of the upper Triassic Nelson granodiorites; Valhalla granites including an outcrop of veined gneiss; a limited exposure of what is thought to be Coryell Syenite; and volcanic conglomerates and shallow inliers of dacitic tuffs of the Kettle River Formation. Mapping has also indicated an altered fractured zone containing Cu, Mo mineralization, in the Nelson granodiorites, believed to cover an area approximately 1,300 metres by 700 metres. Alteration is hydrothermal and varies in type and intensity in this fractured zone. Copper and molybdenum mineralization predominate in the form of malachite and molybdenite with occasional occurrences of quartz-chalcopyrite and quartz-molybdenite.

4. SURVEY PROCEDURE

4.1 Geophysical Grid

A fifteen line grid was cut from a base line bearing 330°. All lines were established perpendicular to this base line (bearing 060°) at 200 metre intervals. These lines, designated L00 to L28N extend to the property boundaries, with line numbers increasing towards the northwest. Pickets, bearing the grid relative co-ordinates of the station east or west of the baseline were placed at 50 metre intervals along the lines. An old adit on the property is positioned at approximately L20N-0+20E. The scale and orientation of this grid relative to the claims, showings, road and prominent topographical features are indicated in the accompanying map, DWG. G.C. 8436.

In total 3.0 kilometres of baseline and 29.9 kilometres of survey line were cut. D. Bragg of Vancouver was the line cutting contractor.

4.2 Magnetometer Survey

A Scintrex MF-2 fluxgate-type magnetometer was used for this work. Requiring only "bull's-eye" levelling, it has a sensitivity of 20 gammas per scale division and a reading accuracy of 10 gammas on the most sensitive scale. On all other scales reading accuracy can be maintained at 1% of full scale. Five switch-selectable scales are available which allow the observer to monitor an overall range of relative vertical field magnetic values of ±100,000 gammas. A manufacturer's brochure outlining all instrument specifications is appended (see APPENDIX II).

The base line was initially surveyed using ABAB type closed loops to establish drift free magnetic-base stations spaced at 400 metre intervals. The lines were traversed in successive hourly loops beginning and ending at one of the previously established base line magnetic bases. Readings were taken at 25 metre intervals along the lines. Hourly drift and diurnal variations were removed from each set of daily traverses, with magnetic adjustments being applied to all observed values by a linear distribution of the observed magnetic variation over the time between base checks.

In total 1,142 readings were taken and 1,142 stations were occupied over 28.2 kilometres of the grid.

4.3 Induced Polarization Survey

A Huntec MK III time domain induced polarization receiver was used for this work with a 7.5 Kw transmitter and related accessories. A manufacturer's brochure outlining equipment specifications is provided in APPENDIX II. Transmitter timing parameters were set as follows:

Period = 2 seconds
Duty Ratio = 1 : 1
td = 240 ms
tp = 60 ms

The dipole-dipole array using 12-inch iron spikes as electrodes was employed as past experience using this array and the symmetrical properties from this configuration were felt to be advantageous within this geologic environment. The power lines were laid out to avoid any coupling effects between the power and receiver potential lines. For every potential dipole location, data was obtained to calculate apparent resistivity and composite chargeability values for each of four dipole separations. Measurements were recorded at 100 metre intervals along lines 1,200N, 1,600N, 1,800N, 2,000N, 2,200N and 2,400N and 2,600 N.

Apparent chargeability data from the Huntec MK III receiver using the above timing parameters has been converted to the equivalent Newmont response parameter, Mc, by the follwing operation:

$$Mc = 4.05\ (M_3+2M_4)$$

Mc is the composite apparent chargeability expressed in millivolts per volt; M_3 and M_4 are Huntec digital voltmeter displays expressed as percentages of Vp; the primary voltage at time "t" = 0; which represent the integrals under the Vp decay curve from "t" = 420ms to "t" = 660ms and "t" = 660ms to "t" = 1140ms respectively.

Apparent resistivity data was calculated from the following expression: Rho = K Vp/I

Rho is the apparent resistivity in ohmmetres; Vp is the observed potential difference at the receiver in volts; I is the transmitter output current in amperes and K is a composite constant combining a geometrical factor for the electrode configuration and a conversion factor to derive ohmmetres from a footage-chained grid.

Over a total line distance of 12.5 kilometres 486 stations were occupied and the following chargeability and resistivity coverage was obtained :

Approximate Depth Penetration	No. of Stations	Traverse Length
(with an 'x' of 100 metres)		
100 metres	132	12.5 Km
150 metres	125	11.8 Km
200 metres	118	11.1 Km
250 metres	111	10.4 Km

5. PRESENTATION OF RESULTS

5.1 Magnetometer Survey

The magnetic data, corrected for hourly drift and diurnal variation are presented in plan form at a horizontal scale of 1 : 5000. This contoured data and the grid system for the survey area together with prominent topographic features are presented with this report as drawing M-4495.

Magnetic values between 0 gammas and 600 gammas are contoured at intervals of 200 gammas. Negative values or values in excess of 600 gammas are not contoured.

The magnetic data at a vertical scale of 1 : 1000 are also presented as profiles against a horizontal scale of 1 : 5000 on all I.P. pseudosection plots. Interpolated elevation data with no vertical exaggeration are also presented at a scale of 1 : 5000 with these magnetic profiles.

5.2 Induced Polarization Survey

Chargeability and resistivity values are presented on seven accompanying drawings, DWG. IP 2746-1 to IP 2746-7, all at a scale of 1 : 5000. The data are presented as pseudosections with no vertical exaggeration. Chargeability values, given in millivolt per volt units (termed "mils"), are contoured linearly at 2 mil intervals. Resistivity values are plotted to an accuracy of 10 ohmmetres such that a map value of 130 represents an actual calculation between 1295 and 1305 ohmmetres. The basic contour interval for all resistivity data is 1000 ohmmetres with the 500 ohmmetre contour added for clarity. The data plotting points are illustrated in the legend on each drawing with the data being plotted beneath a point midway between dipoles at a depth equal to half the electrode separation. The resistivity and I.P. pseudosections are plotted as mirror images of one another, the upper section being inverted. This inversion technique of data presentation has been found convenient for interpretation purposes.

The magnetic data and interpolated topographic information have also been indicated in profile form directly above the inverted resistivity pseudosection. This information is provided for comparison purposes, to facilitate identification of 'rock signatures' and to indicate where slope corrections might be necessary for the accurate location of electrical anomalies.

Recognizable I.P. anomalies have been indicated on the profile section at the top of each I.P. drawing. The solid and dashed bars represent the surface projection of the definite and less definite anomalies respectively, as interpreted

To accommodate a broad scale presentation of the chargeability and resistivity data, all line sections have been stacked and accompany this report as DWG. IP 4482 and DWG. R 4481 respectively. General pattern recognition and line to line correlations are greatly facilitated by this method of presentation.

6. DISCUSSION OF GEOPHYSICAL RESULTS

Information provided by D. B. Petersen's geological map of the property (DWG. G 8436) has provided a useful aid to interpretation.

6.1 Magnetometer Survey

No significant correlation was seen between the magnetic and induced polarization results. Generally the magnetic data consists of a central core-like feature of marginally higher magnetic susceptibility surrounded by an area of lower amplitude results and a zone of variable amplitude higher frequency results. Magnetic relief within the central magnetic high is subdued with values between 200 gammas and 600 gammas considered characteristic. No negative values are recognized. An isolated peak between 700E and 1000E on line 26 North and a single line response near 300W on line 14 North appear to be the only exceptions to the generally subdued magnetic relief. Bordering this magnetic high is a fringe area best characterized by the magnetic relief south of line 10 North, and the magnetic pattern near the Western extremities of all lines.

The area South of line 10 North and generally East of the baseline is an area characterized by extremely high frequency variable amplitude magnetic data. Magnetic amplitudes range between 2350 gammas and negative 3670 gammas. Most anomalies in this area are elliptical in shape with a northerly trending major axis. The wavelength of these features although again highly variable might be characterized as less than 100 metres, along the lines.

The magnetic zone located along the western extremities of all lines and which appears to predominate on lines 28N and 30N is characterized as a small amplitude magnetic low. Values range between 300 gammas and negative 300 gammas with few exceptions.

Geologically these magnetic patterns cannot be considered as diagnostic. The fractured zone in the Nelson granodiorite may be associated with the 'weak' magnetic high. However, this magnetic feature also extends to areas mapped as Kettle River conglomerates and tuffs. The 'high frequency' magnetic zone is associated with an area mapped as Valhalla granite. If it can be considered that the mafic constituents of the Valhalla veined gneiss may be of similar composition to the amphibolites in the area then this zone may prove somewhat recognizable as the Valhalla Group. However, the effect of topographic irregularity and unconsolidated surface material may also prove significant factors in establishing the source of this 'high frequency' pattern. The 'low' zone magnetics correlates loosely with areas mapped as Kettle River Group rocks and fresh Nelson granodiorite with limited areas identified as fractured, altered and mineralized granodiorite and amphibolite rocks. This amphibolite unit recognized in outcrop as extremely mafic and magnetite-rich may be the source of a small magnetic high within this zone located between 600W and 700W on line 16 North.

Recognition of prominent structural features must be considered fortuitous because of the strongly elongate contoured magnetic patterns and the generally high frequency and variable amplitude of these results.

6.2 Induced Polarization Survey

The apparent chargeability data varies from slightly negative values to values approaching 50 mils. Background is somewhat variable ranging from 5 or 6 mils over granodiorite to 8 or 9 mils over the Kettle River volcanics. Responses less than 4 or 5 mils probably reflect significant negative contributions to the overall chargeability arising from the geometry and size of the array and sequence of resistivity contrasts within this geologically complex region.

The patterns of anomalous chargeability suggest numerous sources for the I.P. phenomena including sulphides, alteration minerals, clay minerals and perhaps even the micaceous minerals. Three complicated zones have been identified as weakly chargeable.

The apparent resistivity data ranges from low to very high values with extremes of 190 ohmmetres and 7764 ohmmetres respectively. Background values over most of the grid range between 1500 ohmmetres and 2000 ohmmetres. Isolated limestone inliers and volcanic remnants are generally highly resistive. The erratic behaviour of the observed resistivity values appears to further substantiate the complexity of this electrical environment.

The following are descriptions of the salient features of each zone as observed line by line.

Line 12 North

Generally background chargeabilities show a slight increase with depth between 150W and 1200W. Recognizable resistivity zones on this section of the line may suggest several lateral geologic variations occur. Resistivity values steadily increase from 400 ohmmetres near 00 to a maximum in excess of 4000 ohmmetres near 900W. A well defined chargeability anomaly between 100E and 200E with values of 10 - 12 mils shows broad correspondence with a marked resistivity low (values less than 400 ohmmetres) between 100W and 100E on the line. Faulting, possibly mineralized may be a source. A deeper feature of similar chargeability (10 to 11 mils) correlates with moderate resistivity values below a depth of approximately 150 metres. This deep seated zone between stations 500E and 600E appears overlain by an area of high resistivity.

Line 16 North

From the baseline to 1500W, the chargeability data appear horizontally stratified, increasing steadily from an average of 6.6 mils on n = 1 to 10.3 mils on n = 4. Resistivity values increase across this feature from East to West with a well defined resistivity gradient occurring between 500W and 700W. The high resistivity values from 600W to 1500W and moderate chargeability values may suggest a source associated with or underlying an extension of the amphibolite unit mapped on line 18N. Increased chargeabilities and decreased resisitivity values for the n = 4 separation may suggest a deep source.

Between 450E and 550E a chargeability anomaly from a shallow source displays 'pant-leg' geometry. A broad resistivity low correlates with this narrow feature which is interpreted as a weakly mineralized area along a fault zone. West along the flank of this near surface feature is a broader anomaly suggesting a deeper source may be located between 75E and 150E. A probable depth to top for this feature could be in excess of 200 metres.

Chargeabilities from 10.9 to 13.5 mils correlate with resistivities near 1300 ohmmetres between 750E and 950E on line 16N. A similar chargeability feature at depth is located on line 12N between 500E and 600E.

Line 18 North

West of 500W on this line sharply higher resistivity values and moderate chargeability values are interpreted as suggesting either the presence of amphibolites or a more competent geological unit such as unaltered granodiorite. The inferred geologic contact between altered and fresh granodiorite positioned by mapping at 400W appears geophysically justified by these results. Limestone capping characterized by high resistivity and a strongly delineated 'pant-leg' response of high chargeability is located between 100E and 200E on this line. However, the tail-off in resistivity values at deeper spacings and the sudden increase in chargeability at n = 3 may suggest the presence of a mineralized horizon at the base of the limestone. The extension of suggested faulting may be interpreted from the pronounced resistivity low between 450E and 550E on this line. Chargeability data is inconclusive for this area.

Line 20 North

Between the baseline and 100W, a zone of high chargeability correlates with a near surface low resistivity zone. This feature is located near an old adit which has excavated material near the base of the limestone unit mapped between 125E and 400E on the grid. The limestone capping unit can be readily recognized on this line as a high chargeability and high resistivity feature which correlates directly with this limestone 'inlier', the most prominent topographical feature within this section of the Burrell Creek valley. However, it remains unresolved as to whether the observed I.P. effects may be related to sources within the limestone or a silicified transition zone at the base of this unit. The depth-limited nature of this unit appears to be indicated by the sharp change with depth of both I.P. parameters. This unit creates a very effective mask when attempting to extrapolate deeper seated features to the north. Between 600E and 700E, a narrow, weakly anomalous chargeability zone correlates with a pronounced resistivity low. It is suggested once again that such a correlation represents the Nicoll Creek fault structure which may be weakly mineralized at this point.

The strongly delineated chargeability feature between 900E and 1000E on the n = 2 data appears too restricted, with no obvious changes in resistivity pattern, to offer any economic interest.

Line 22 North

An I.P. feature designated 'Zone' 1, characterized by horizontally uniform moderately anomalous chargeabilities which increase steadily with larger separations, extends from 250E to 250W where it appears to terminate abruptly. This feature within an area, mapped as fractured Nelson granodiorite overlain by patchy volcanic cover, extends westwards to within 100 metres of the mapped contact with unmineralized fresh granodiorite, and thus correlates well with a mineralized alteration zone. Between 250E and 400E a moderately strong, well defined chargeability zone flanks a poor chargeability feature which may be under the influence of an unrecognized source of negative chargeability effects. This feature, correlating with a near surface resistivity low appears similar to one not far from an old adit into the base of the limestone inlier west of the baseline on line 20N.

Isolated chargeability effects near surface and at depth between 500E and 600E and between 600E and 800E respectively, are difficult to interpret but may suggest the termination of a more prominent I.P. feature to the north. A low resistivity feature with mixed chargeability response between 800E and 900E suggests once again the presence of the Nicoll Creek fault.

Overlying the Zone 1 response between 150E and 100W a pronounced chargeability low is believed to correlate with an isolated volcanic remnant. Between 200W and 50W a highly resistive feature showing slight moderation at maximum dipole separation is interpreted as a prophyry dike.

Line 24 North

An I.P. feature designated 'Zone 2' is characterized as moderately polarizable and highly resistive between 500E and 800E. The best chargeability response, 15.9 mils at 400E on n = 4 coincides with the point of maximum resistivity for this line. Massive granite has been mapped at 700E, 20 metres North of the line. 'Zone 2' appears to have an associated halo of depressed chargeability responses at 400E and 700E respectively.

Zone 1, is again recognized by appreciably higher apparent chargeability responses on n = 4 between 500W and 200E. This zone appears to approach surface between 200W and 300W. A marginally anomalous and isolated near surface response between 250E and 300E may represent an eastern extension of the deeper Zone 1 feature as well.

The low resistivity 'signature' of the interpreted Nicoll Creek structure is identified between 750E and 850E. Background chargeabilities are associated with the fault on this line.

Line 26 North

Uniform, near background, chargeabilities from 350W to 200E on n = 1 increase on average 27 per cent from n = 1 to n = 4. Of considerable significance on this line is the topographical relief factor towards the West. In comparing the results from Zone 1 on line 24N with these results it is suggested that the I.P. array did not 'see through' the greatly increased thickness of Kettle River volcanics (conglomerate and tuff) present in Line 26N.

A strong chargeability response with direct high resistivity correlation is recognized between 600E and 1000E. This feature is identified as Zone 2. 'Pant-leg' geometry with the apex occurring at 700E, n = 2 suggests a narrow source. The associated high resistivity and proximity of the resistivity gradient between 800E and 1000E may suggest that silicification has concentrated a polarizable mineral assemblage near a lithological contact. The closest surface exposures, outcrops of veined Valhalla granite occur at grid co-ordinates 900E, 25+30N; and between 800E and 1200E, 27N. Again the main area of high chargeability in Zone 2 is flanked by pronounced chargeability lows.

The Nicoll Creek fault generally recognized as a low resistivity zone with mixed chargeability response is indicated as slightly chargeable occurring between 950E and 1050E on this line.

A minor chargeability response flanks the more easily recognized Zone 2 response at 400E. This zone is interpreted as relatively narrow but may be open to depth.

A weak isolated chargeability response on n = 4 at 100E remains unexplained.

7. CONCLUSIONS

Complex, generally weak chargeability anomalies and generally erratic resitivity patterns suggest a complex electrical environment with numerous sources for the I.P. phenomena. However, two electrical zones designated Zone 1 and 2 may hold some economic potential.

Zone 1 extends from line 20N to line 24N and may be present at depth on line 26N and from 300E to 400W on the grid. This zone is characterized by above-background chargeability and background resistivity responses.

Zone 2 extends from line 22N to line 26N and from 500E to 850E on the grid. This zone is characterized by above-background chargeability and high resistivity responses.

Zone 3, recognized as a pronounced resistivity low with variable chargeability characteristics, extends in a North-South direction in the vicinity of Nicoll Creek. This feature is interpreted as a fault zone.

The near-surface 'masking effect' of a limestone inlier recognized as a distinct electrical feature on line 20N and line 18N has made recognition of any continuation of Zone 1 and Zone 2 impossible under present survey conditions.

Three magnetic features can be recognized but no significant geological or electrical correlations seem possible. A central 'weak-high' magnetic zone is surrounded towards the Southeast by an area of 'high frequency, variable amplitude' magnetics and towards the West by a magnetic 'low'. A possibility that the fractured zone in the Nelson granodiorite may host sufficient magnetite to form the prominent source of the 'weak-high' in relation to the surrounding rocks is not disputed.

8. RECOMMENDATIONS

A drill program is recommended. Electrical targets should be expected to be deep and consequently may warrant diamond drilling. Collar positions can only be identified after further discussions with the project geologist. Drilling should be confined to the vicinity of the recognized electrical zones with consideration for a single test hole to penetrate the base of the limestone inlier near the old adit on line 20N.

No further geophysics is recommended until such time as the drilling is completed.

9. REFERENCES

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Norman, G. W. H., 1969, Geological Report on the Bear - Doe Group, Franklin District: B.C. Dept. of Mines and Pet. Resources Assessment Rpt. 1845

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CERTIFICATE

I, John A. McCance of the City of Toronto, Province of Ontario do hereby certify:

1. That I am a geophysicist and reside at 113 Hendon Avenue, Willowdale, Ontario.
2. That I graduated from Queen's University at Kingston in 1970 with the degree of Bachelor of Applied Science and have completed post-graduate courses at the University of Western Ontario, London.
3. That I am a member of the Association of Professional Engineer's of the Province of Ontario (Mining Branch).
4. That I have been practising my profession for a period of five years.
5. That I am employed by Rio Tinto Canadian Exploration Limited.
6. That I supervised this survey program.

November 1976

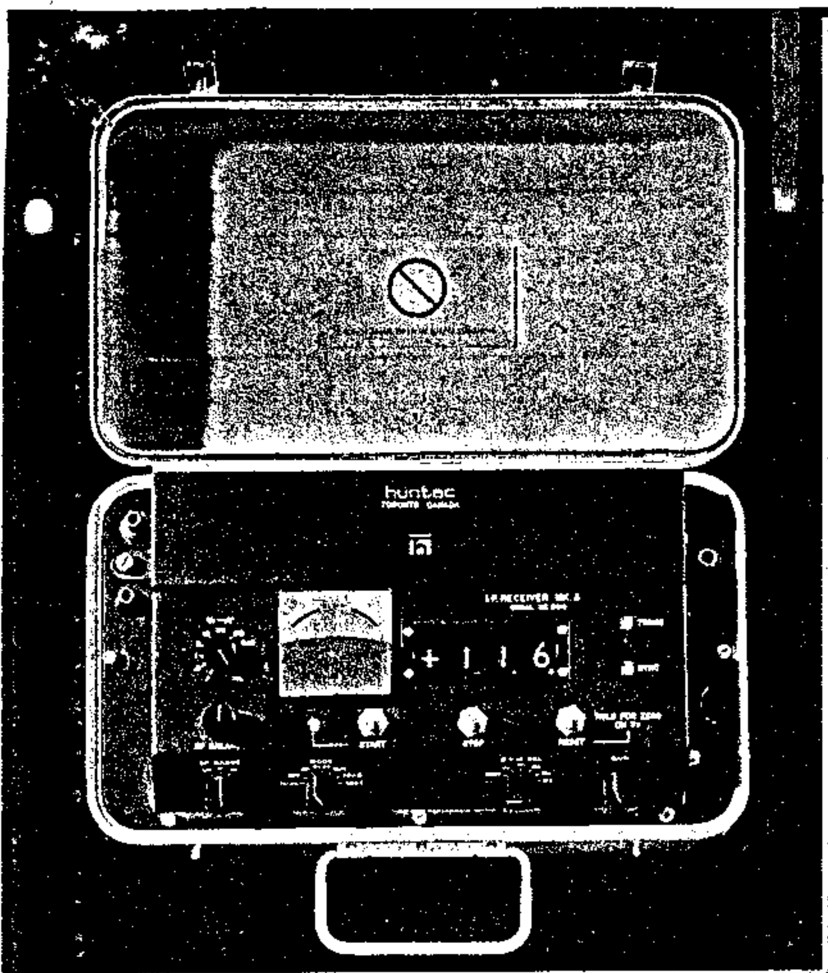
J. A. McCance, P.Eng.

J. A. McCANCE

APPENDIX I

LIST OF PERSONNEL EMPLOYED

Name	Position	Sign-on Point	Employment Period
D. Sexsmith	Party Chief	Permanent staff	May 28, 1976 to July 2, 1976
J. Lindsey	Junior geophysicist	Toronto	May 28, 1976 to June 30, 1976
K. Gossen	Geophysical Ass't	Vancouver	May 28, 1976 to June 30, 1976
A. Loo	Geophysical Ass't	Vancouver	May 28, 1976 to June 30, 1976
S. Lowe	Geophysical Ass't	Victoria	May 28, 1976 to June 30, 1976
H. Ngo	Geophysical Ass't	Kamloops	May 28, 1976 to June 30, 1976
A. Aeichele	Cook	Grand Forks,	June 9, 1976 to June 30, 1976



M-3 Induced Polarization Receiver

FEATURES

- Adjustable timing cycle
- Automatic self potential buck out
- Automatic signal acquisition for triggering
- Direct digital readout of V_P and four M factors
- No need to count number of cycles
- Both V_P and M factors measured and stored in memory registers simultaneously
- Mistriggering will not affect readings
- Patented phase lock triggering loop enables operation in high noise areas with V_P levels down to 30 microvolts with 0.1 microvolt resolution
- Rapid and accurate operation possible with low power transmitters
- 250,000 ohms input impedance

DESCRIPTION

The Huntec M-3 I.P. Receiver is a pulse type unit which presents digitally the polarization voltage (V_P) and normalized amplitude of the decay curve at four different points in a single reading. Additional points on the decay curve may be obtained on successive readings. This feature permits the interpreter to distinguish between inductive and chargeability effects, and obtain a more accurate estimate of apparent chargeability. The M-3 performs these measurements in less time than conventional receivers take to obtain a single value.

The M-3 receiver employs a variable timing cycle that can be set anywhere between 1.8 seconds and 30 seconds total, and is therefore particularly well suited for operation in a variety of geological conditions.

Utilizing an advanced method of synchronization without direct wires, the M-3 is immune to

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TELEX: 06–22797

false triggering signals, and is able to operate reliably on lower transmitter power than would otherwise be possible. To exploit this advantage, Huntec has produced a light weight battery operated transmitter ("LOPO") as a companion unit. The M-3 receiver also operates in conjunction with the Huntec M-2 and M-1 2.5, 7.5, and 10 Kilowatt transmitters, as well as other pulse type transmitters.

The M-3 is powered by rechargeable nickel cadmium batteries in a removable battery pack. The set is almost completely automatic, and does not require a skilled operator.

True integration of the V_P and V_S signals are accomplished by five sample and hold integrating registers. Each register stores the sum $\sum_1^N \int V dt$, where N is the number of samples. There is no need to count cycles since the reference for the digital voltmeter (DVM) is the content of the V_P memory register. When switched to M, the DVM displays the ratio:

$$\sum_1^N \frac{\int V_S \, dt}{\int V_P \, dt}$$

The registers have a capacity of ten volts, and operation will automatically stop when the contents of any register reach this level. The DVM displays three digits plus sign. The operator may stop the accumulation at any point should he be satisfied that sufficient accuracy has been obtained (last digit of DVM not changing). He may start integration again by pushing the start button.

The absolute value of V_P is easily obtained by multiplying the DVM V_P display by a scale factor shown on the input attenuator.

Continuing research in I.P. interpretation theory reveals that the apparent chargeability cannot be reliably estimated from a single measurement but can be estimated by factoring the I.P. decay curve to separate the inductive from the chargeability effects.

The shape of the I.P. decay curve is also related to the size and orientation of the anomaly, relative to the measuring electrodes. The M-3 receiver provides this information in a rapid and reliable manner, and at the same time, can be utilized as a high production field instrument for reconnaissance purposes.

TIMING

The M-3 receiver cycle time t_C is adjusted internally. It is continuously variable from 1.8 seconds to 30 seconds. The cycle time is defined as 2 (time ON plus time OFF) or:
$t_C = 2 (t_{ON} + t_{OFF})$.

The M-3 duty ratio R is defined as $t_{ON} \div t_{OFF}$ or:

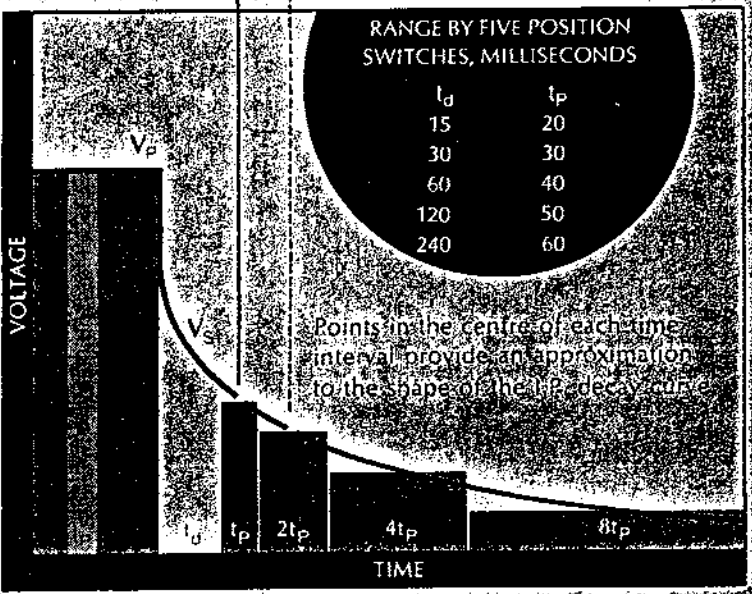
$$R = \frac{t_{ON}}{t_{OFF}}$$

This is also adjustable from 1:1 to 3:1 by means of an internal control.

INDUCED POLARIZATION DECAY CURVE

$$M_1 = \sum_1^N \frac{\int_{t_d}^{(t_d + t_P)} V_S \, dt}{V_P \, t_P}$$

$$M_2 = \frac{1}{2} \sum_1^N \frac{\int_{(t_d + t_P)}^{(t_d + 3t_P)} V_S \, dt}{V_P \, t_P}$$



RANGE BY FIVE POSITION SWITCHES, MILLISECONDS

t_d	t_P
15	20
30	30
60	40
120	50
240	60

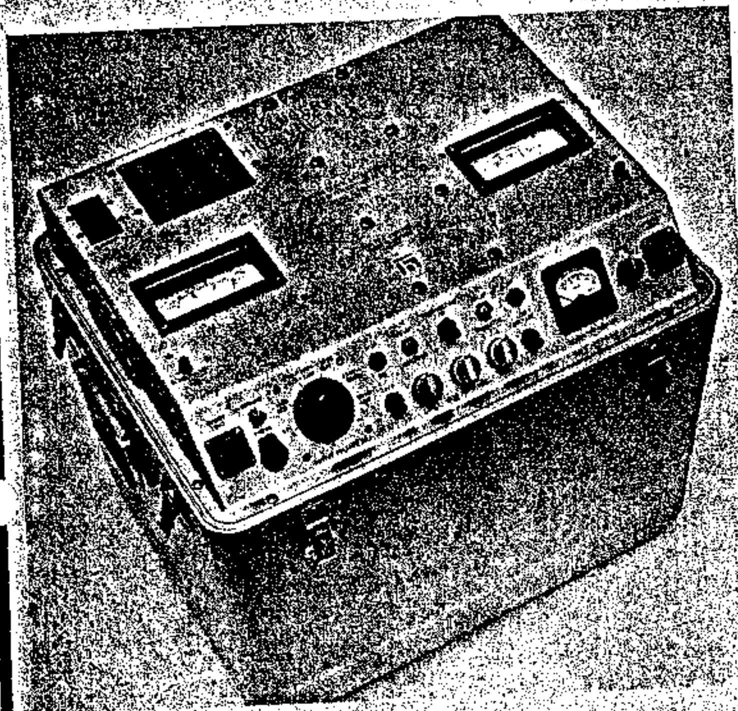
Points in the centre of each time interval provide an approximation to the shape of the I.P. decay curve.

The sample points illustrated above can be shifted in time by altering the delay time t_d and the integration constant t_P. The parameters t_d and t_P are adjusted by two sub panel switches to values shown in the table.

SPECIFICATIONS

Sensitivity	$V_P = 10^{-7}$ to 10^{-6} volts for low noise 1% resolution. $V_P = 10^{-6}$ to 10 volts for 0.1% resolution. Total range = 30 x 10^{-6} to 10 volts in 11 steps. V_S readings are expressed as a percent of V_P. V_S = 0.1%, plus sign, for values larger than 10%. V_S = 0.01%, plus sign, for values less than 10%.
Self Potential	Maximum ± 1 volt.
Batteries	Rechargeable nickel cadmium, nominal 12 volts four ampere hour, in detachable pack.
Power Consumption	0.7 amperes at 12 volts.
Dimensions	16 x 9 x 5½ inches (40.6 x 23 x 14 cm).
Weight	Console = 12.5 lbs. (5.7 Kg). Battery pack = 4.5 lbs. (2.05 Kg).
Accessories	Dual battery charger and spare battery pack.
Ambient Temperature	—30°F to +120°F (—34.5°C to 49°C).

Induced Polarization 7.5 Kw Transmitter



SPECIFICATIONS

Output:	100 to 3250 volts in 10 steps. 16 amps maximum.
Input:	3 phase 400 Hz 120/208 volts.
Cycling Rates:	2 sec. ON, 2 sec. OFF, or to suit customer requirements. SCR current on/off switching
Temperature Range:	−30°F to +120°F
Current Output Meter:	2 ranges: 0-10 amp and 0-20 amp.
Ground Resistance Meter:	2 ranges: 0-10 K ohms and 0-100 K ohms.
Input Voltmeter:	0 to 150 volts A.C.
Dummy Load:	2 level: 2 Kw and 6 Kw. Switched in during OFF time to smooth generator load.
Over/Under Voltage Protection:	Automatic shutdown for excessive input voltage changes.
Construction:	Welded aluminum frame. All solid state circuits on removable printed circuit boards.
Size:	21 in. x 17 in. x 17 in. (53.0 cm x 43.2 cm x 43.2 cm)
Weight:	Console 75 lb. (34.0 Kg)

2.5 Kilowatt Engine Driven Alternator

SPECIFICATIONS

Output:	120 volts 400 Hz 3 phase.
Engine:	1 cylinder, air cooled 6 HP at 3600 RPM. Optional engines available.
Fuel:	Regular gasoline. Capacity = 1 Imp. gallon.
Alternator:	4000 RPM belt driven. Sealed bearing. Rotating field.
Construction:	Resiliently mounted in protective carrying frame.
Size:	30 in. x 18½ x 21 in. (76.2 cm x 47.0 cm x 53.0 cm)
Weight:	Operational: 90 lb. (40.8 Kg)

7.5 Kilowatt Engine Driven Alternator

SPECIFICATIONS

Output:	18 KVA 120/208 volts 3 phase 400 Hz 52 amps/phase.
Engine:	Two cylinder, 4 cycle air-cooled 16.5 HP at 3600 RPM. Mechancially speed governed.
Fuel:	Regular gasoline. Diaphragm fuel pump. Consumption: Less than 2 gal. per hour.
Alternator:	3600 RPM direct drive from engine. Sealed bearings. Rotating field.
Construction:	Resiliently mounted in protective carrying frame.
Size:	42 in x 17 in. x 26 in. (106.7 cm x 43.2 cm x 66.0 cm)
Weight:	Operational: 225 lb. (102.1 Kg).

SCINTREX

MF-2

FLUXGATE MAGNETOMETER

The MF-2 is a completely new concept in vertical force fluxgate magnetometers. These instruments, which are designed for fast and accurate mineral ground surveys, are orientation independent, self levelling and require no tripod.

The MF-2 combines in one compact 5½ lb. package electronics, sensor and rechargeable batteries. With the latest I.C. and F.E.T. circuitry and high precision components, a temperature stability better than 1 gamma per degree is standard (with .25 gamma on special order) over a range of —40° to +40° centigrade.

The instrument has a built-in hemisphere polarity switch providing two overlapping ranges. For the Northern hemisphere the full range is +80,000 to —20,000 gammas, and reversible for the Southern hemisphere.

A calibrated feedback system can be provided which makes it possible to determine the total vertical component strength.

Measuring accuracy, on the 100 gamma scale is 0.5 gamma, and on the 1000 gamma scale 5 gammas.
The Scintrex MF series of magnetometers have been in use for many years in varied applications, e.g. ground reconnaissance, base station recording and monitoring, study of magnetic properties of rocks, observatory monitoring and recording of both vertical and horizontal components.

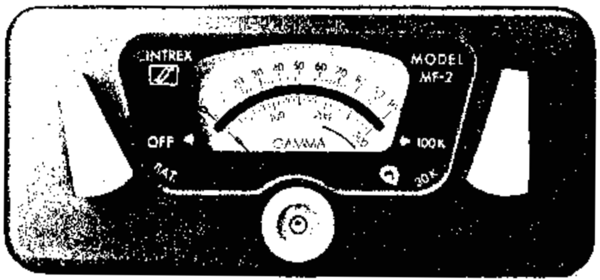
OPTIONAL

a) MF-2G

The MF-2G Fluxgate Magnetometer has the same electronics and specifications as the MF-2, but the sensor is detached and enclosed in a small cylindrical tube which permits it to be oriented and tilted in any desired direction. A 25 foot cable connects the sensor to the instrument housing. This version is particularly suitable for the study of the magnetic properties of rocks, and the measurement of magnetic field components of any orientation, etc.

b) MF-2GS

The MF-2GS Magnetometer again has the same electronics and specifications as the MF-2 but has two sensors, the enclosed self-levelling sensor of the MF-2 as well as the detached geoprobe of the MF-2G, either one of which can be employed at any one time. Thus, this instrument can be employed as the standard MF-2 as well as for vertical gradient measurements, and for the determination of the magnetic properties of rocks, etc.



SCINTREX

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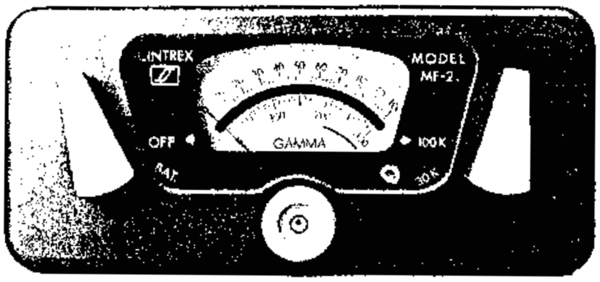
The MF-2GS Magnetometer again has the same electronics and specifications as the MF-2 but has two sensors, the enclosed self-levelling sensor of the MF-2 as well as the detached geoprobe of the MF-2G, either one of which can be employed at any one time. Thus, this instrument can be employed as the standard MF-2 as well as for vertical gradient measurements, and for the determination of the magnetic properties of rocks, etc.

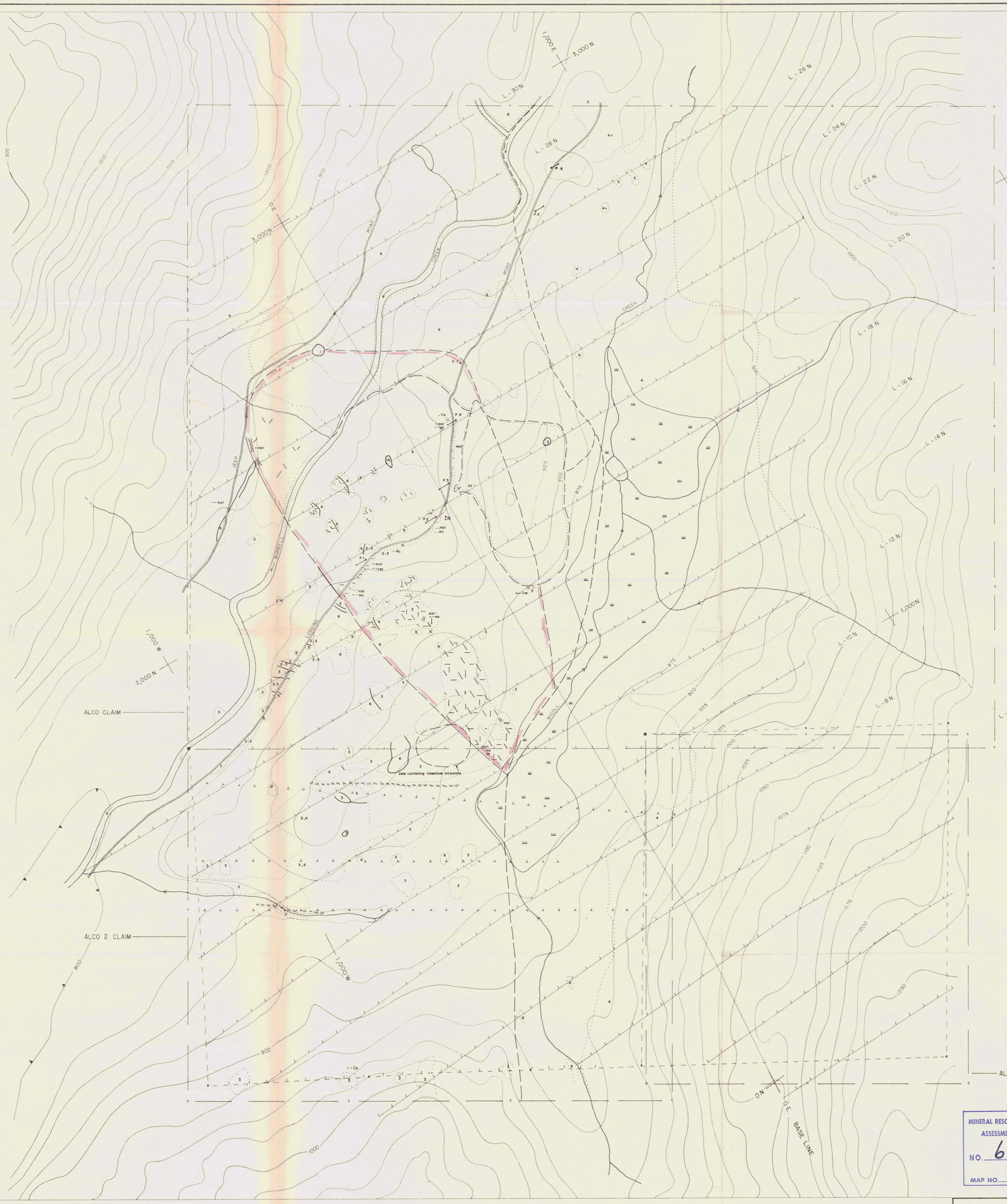


SPECIFICATIONS OF FLUXGATE MAGNETOMETER MODEL MF-2

	RANGES	SENSITIVITY
Standard:	Plus or minus	
	1,000 gammas f.sc.	20 gammas/div.
	3,000 gammas f.sc.	50 gammas/div.
	10,000 gammas f.sc.	200 gammas/div.
	30,000 gammas f.sc.	500 gammas/div.
	100,000 gammas f.sc.	2000 gammas/div.
Optional:	100 gammas f.sc.	2 gammas/div.
	300 gammas f.sc.	5 gammas/div.
Meter:	Taut-band suspension 100 gamma scale 2.1" long — 50 div. 300 gamma scale 1.9" long — 60 div.	
Accuracy:	1000 to 10,000 gamma ranges ±0.5% of full scale.	
Operating Temperature:	—40°C to +40°C —40°F to +100°F	
Temperature Coefficient:	Less than 1 gamma per °C (½ gamma/°F)	
Noise Level:	Less than 1 gamma P-P	
Bucking Adjustments: (Latitude)	—20,000 to +80,000 gammas 9 steps of 10,000 gammas plus fine control of 0 - 10,000 gammas by ten turn potentiometer. Reversible for southern hemisphere.	
Recording Output:	Optional.	
Electrical Response:	D.C. to 0.3 cps (3db down) on 1000 gamma range with meter in circuit. D.C. to 20 cps with meter network shorted for recording purposes.	
Connector:	Cannon KO2-16-10SN for plug Cannon KO3-16-10-PN and cover KO6-16-⅜.	
Batteries:	Internal 3 x 6V-1 amp/hr. Sealed Lead Acid rechargeable Centralab GC 6101; recharge time 8 Hrs.	
Consumption:	60 milliamperes — GC6101 batteries are rated for 16 hours continuous use.	
Dimensions:	6¼"x 2¾"x 10" Instrument. 161 mm x 71 mm x 254 mm	
Weights:	5 lb. 8 oz. — 2.5 kg.	
Battery Charger:	6"x 2½"x 2½" 155 mm x 64 mm x 64 mm 110V - 220V 50/60 Hz supply or 28 - 42V D.C. supply Automatic charge rate and cutoff preset for Centralab GC6101 batteries.	

SCINTREX LIMITED
79 Martin Ross Avenue, Downsview, Ontario, Canada

PLEASE NOTE OUR NEW ADDRESS
222 Snidercroft Rd., Concord, Ontario.



MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 6018 PART 1
MAP NO. #1

D.B. Petersen

ROCK TYPES

EOCENE	6	KETTLE RIVER	.... Conglomerate , tuff
PALEOCENE	5	CORYELL	..... Syenite
CRETACEOUS	4	VALHALLA	..... Granite , massive
CRETACEOUS	4v	VALHALLA	..... Granite , veined
JURASSIC	3	NELSON	.... Granodiorite , fractured , altered , mineralised
JURASSIC	3	NELSON	.... Granodiorite , no detectable mineralisation
JURASSIC	2-3		.... Amphibolite , partially digested
PERMIAN	2	ANARCHIST	... Amphibolite
PERMIAN	1	GLOUCESTER	.. Limestone

STRUCTURES

〰 〰	FAULTS
⋯	OUTCROPS
———	CONTACTS , observed
— — —	CONTACTS , infered

MINERALISATION

cpy	CHALCOPYRITE
bn	BORNITE
Mo	MOLYBDENITE
py	PYRITE
mal	MALACHITE
lim	LIMONITE (Cu)

ALTERATION

H	ARGILLIC
Al	PHYLLIC
Ca	PROPYLITIC

INTENSITIES

+	INTENSE
±	MODERATE
_	WEAK
_ _	VERY WEAK

WORKINGS

≻═≺	TRENCHES
—<	ADITS
ш	SWAMPS
⊢o P.2	PERCUSSION HOLES (1976)

GEOCHEMISTRY

⊥ ⊥	CUT LINES , picketed
⊥ ⊥	FLAGGED LINES

CLAIMS

■	LEGAL CORNER POSTS
——o	BOUNDARIES , actual
— — —●	BOUNDARIES , as existing on ground

N.T.S 82-E-9

SCALE 1: 5000

Metres 100 50 0 100 200 300 400 Metres

Contour Interval 25 Metres

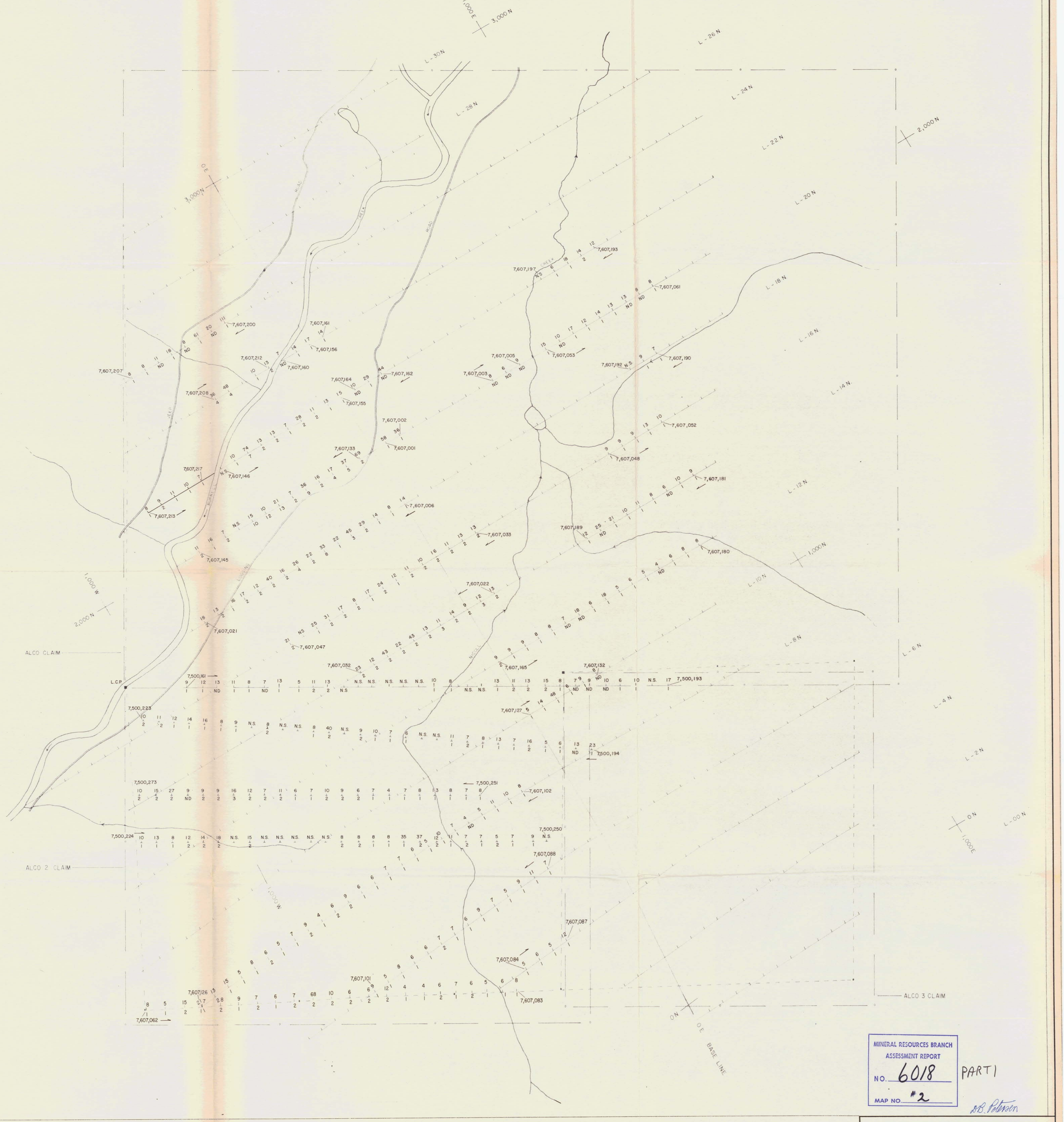
6018

RIO TINTO CANADIAN EXPLORATION LIMITED

ALCO OPTION GREENWOOD MINING DIVISION

GEOLOGY

SEPT. 1976 | D.P. / y.m. | DWG. G.-8436



MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 6018 PART I
MAP NO. #2

D.B. Petersen

7,607,126 ····· Soil Sample Location Number

18 Cu Results in p.p.m.

1 Mo Results in p.p.m.

—■— Legal Corner Post

———o Boundaries , actual

— — —● Boundaries , as existing on ground

N.T.S 82-E-9

SCALE 1: 5000

Metres 100 50 0 100 200 300 400 Metres

6018

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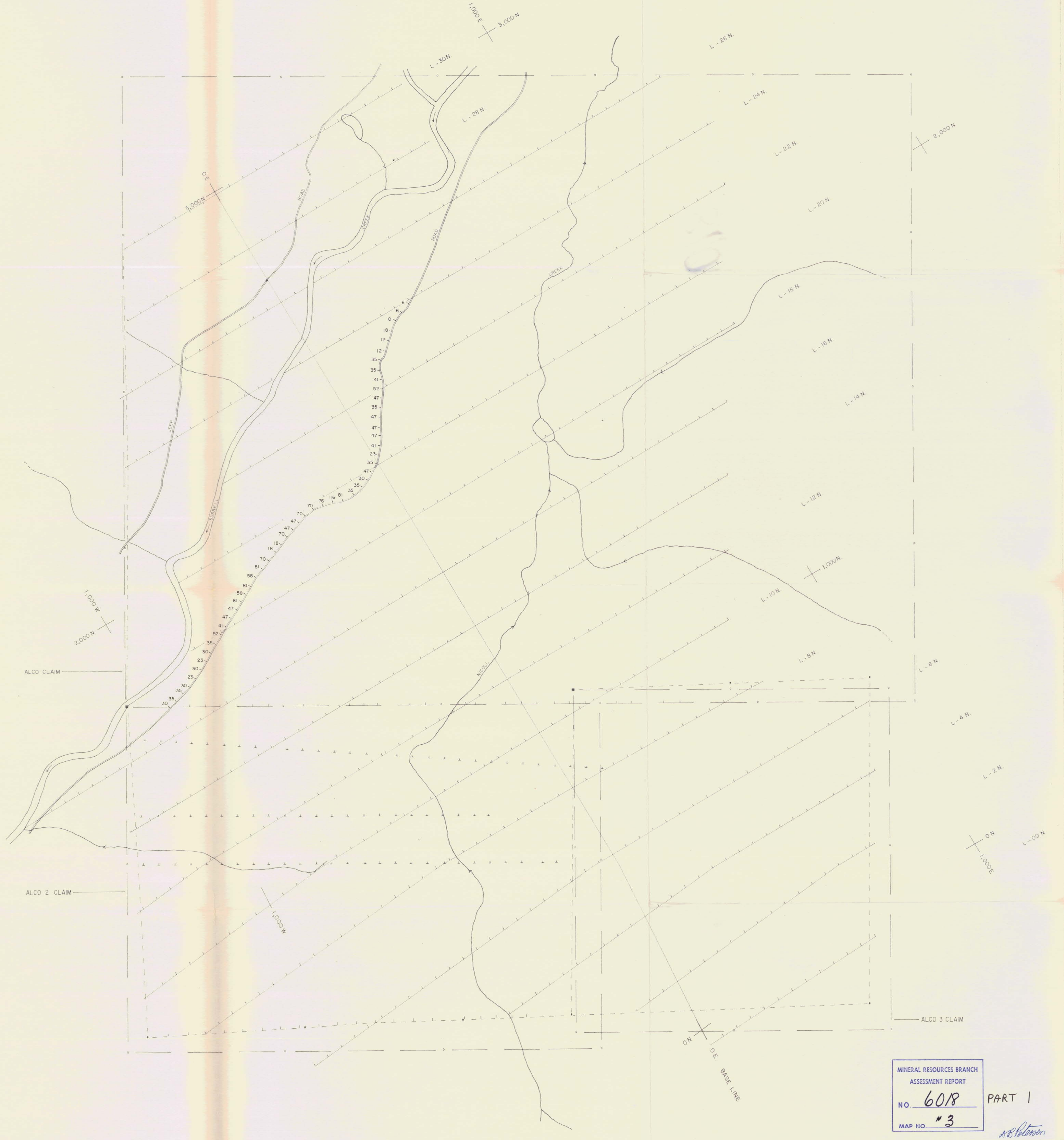
CU , MO RESULTS IN P.P.M.

SEPT. 1976 | D.P. / y.m. | DWG. G.C. - 8437



MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 6018
MAP NO. #3

PART I

ABPetersen

⁄ Sample Stations

35 Ppm. Uranium Equivalents

N.T.S. 82-E-9

SCALE 1: 5000

Metres 100 50 0 100 200 300 400 Metres

6018

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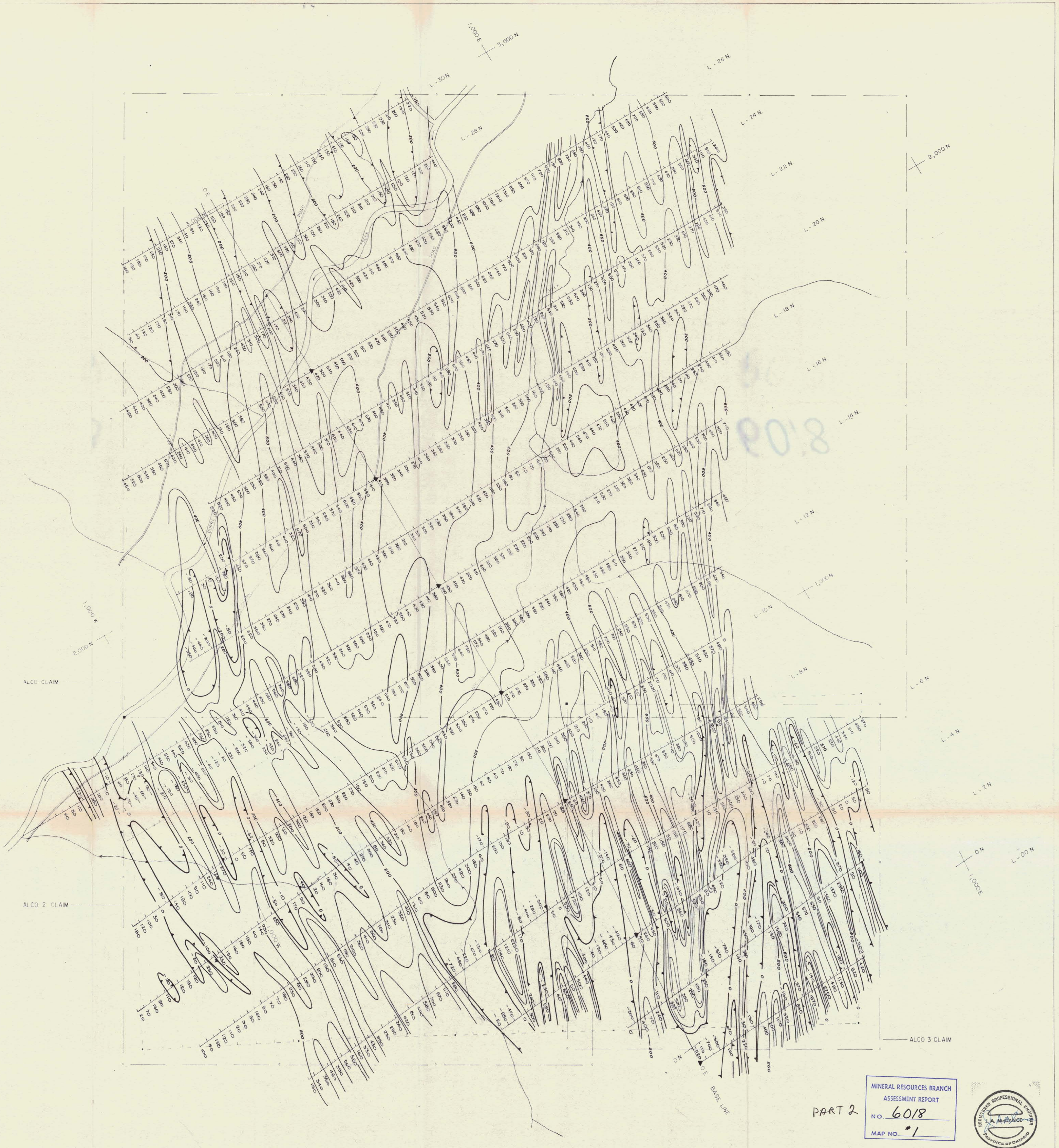
ALCO OPTION GREENWOOD MINING DIVISION

RADIOACTIVITY MAP

OCT. 1976 D.P. / y.m. DWG. R - 8448



PART 2

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 6018
MAP NO. #1

J. A. McCANCE

LEGEND

150	Values in gammas
▲	Magnetic base stations
Contours	
—	0– gammas
—	200– gammas
—	400– gammas
—	600– gammas
⬭	Magnetic low

N.T.S 82-E-9

SCALE 1: 5000

Metres 100 50 0 100 200 300 400 Metres

6018

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ALCO OPTION GREENWOOD MINING DIVISION

MAGNETOMETER SURVEY

OCT. 1976 | DNS | DWG. M 4495