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REPORT ON AN AIRBORNE GEOTEM AND MAGNETIC SURVEY WITH 'OUTPUT' DATA PROCESSING OVER MICHAELSON CLAIMS, ONTARIO FOR ALMADEN RESOURCES CORPORATION

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EXECUTIVE SUMMARY

During January of 1987, a combined airborne EM and magnetic survey was carried out by A-Cubed Inc. for Almaden Resources Corporation over their Michaelson property in Shoal Lake, Ontario. The objectives of the survey were to map in detail the geological structure of the area and to identify horizons of potential economic value. A total of 140 line kilometres were flown.

Data compilation and processing included flight path recovery preparation and generation of maps of the total magnetic field. The electromagnetic data were compiled and plotted using the A-Cubed Inc. OUTPUT processing technique to create maps of early time (Pseudo-channel 1) and late time (Pseudo-channel 8) EM transient response. The geophysical interpretation carried out by A-Cubed geophysicists was based on the OUTPUT processed EM data, the total magnetic field, and a limited knowledge of the geological setting. It identified a number of target horizons for high priority ground follow-up. Some of these correlate with previously known mineral occurrences.

A total of 6 unique targets have been recommended for follow-up. Overall, the combination of processed EM and magnetic data together have sucessfully mapped the geological structure within the Michaelson property and identified geological horizons which may have economic value. A detailed program of ground geophysics and drilling follow-up on selected targets is recommended.

1. INTRODUCTION

On January 8th, 1987, a combined airborne transient electromagnetic and magnetic survey was carried out by A-Cubed Inc. for Almaden Resources Corporation on their Michaelson claims in the vicinity of Gull Bay in Shoal Lake, Ontario. The objectives of the survey were to identify EM conductors within the property and to map the structural geology in detail. A total of 140 km of line were flown in two survey areas. The northern area is in the vicinity of the the Duport Mine in Shoal Lake, Ontario.

The setting of survey specifications and on-site data monitoring were carried out by A-Cubed Inc. personnel. The survey data was acquired with the GEOTEM system via a subcontract to Geoterrex Ltd. of Ottawa.

The EM data were levelled, processed, and plotted by A-Cubed Inc. using the OUTPUT processing technique. The maps of processed EM data revealed several conductive trends. Those deemed worthwhile for ground follow-up have been identified in the following report.

This report describes the logistics for the survey operation, the processing and presentation techniques used on the data, and an interpretation of the results. The products produced are listed in Table 7.

2. SITE DESCRIPTION

The property is located in the vicinity of Gull Bay in Shoal Lake, Ontario (See Figure 1). Several lines were also flown over Dominique and Stevens Islands located northeast of Gull Bay. The area surveyed is encompassed within the following geographic coordinates:

95° 00' W to 95° 13' W in longitude
49° 28' N to 49° 37' N in latitude

The coordinates used on the maps are expressed in metres north of the Equator and east of the false easting for the local UTM grid. The false easting origin is a line 500,000 metres west of 93° W longitude. The UTM limits of the survey are:

340,000 to 355,000 metres East
5,482,000 to 5,498,000 metres North

The Michaelson property encloses a NE-SW trending belt of meta-volcanics in the Superior tectonic province. The Duport deposit is situated on the belt and 5 test lines were flown over it during the course of the survey. Most of the survey is over water; however, the ground surface that was covered is characteristically flat and swampy and the surface elevation changes by less than 25 metres over the entire property. Potential sources of cultural noise include the Duport Mine site itself. Gull Bay also produced a significant background EM response.

3. FIELD WORK

3.1 Survey Specifications

The survey specifications were set by A-Cubed Inc. based on detailed knowledge of the GEOTEM system performance and some **a priori** knowledge of the regional geological setting. The latter was derived from existing regional geology maps and airborne geophysical data, especially aeromagnetics.

The two line spacings of 500 metres over Gull Bay and 250 metres over Duport were chosen to map the areas in sufficient detail to resolve structures within the metavolcanic belt. The line direction of N45°W was selected to cross the NE-SW trending geology in a perpendicular manner. Any conductors within the geology would then show their strongest responses.

The flying specifications in Table 1 are commensurate with industry standards. See Section 4.3 for a description of the GEOTEM window placement.

3.2 Survey Operations

The survey operations are described by the airborne sub-contractor in Appendix A of this report. Described are their field personnel, instrumentation, and production rates. On-site data monitoring was carried out by C. Vaughan, a Geophysicist from A-Cubed Inc.

4. DATA COMPILATION, PROCESSING AND PRESENTATION

4.1 Flight Path Recovery

The flight path recovery was carried out using interpolation between visual picks from the air photos and flight filmstrip and subsequent matching to NTS topographic maps. The finalized flight path has been plotted on a screened photomosaic base at a scale of 1:50,000.

4.2 Total Magnetic Field

The total magnetic field measured during the survey was levelled and edited by the airborne sub-contractor using the tie lines and 4th difference channels. The final edited magnetic data were then plotted in shaded stacked profile at 1:50,000 with a uniform background value of 60,000 nT subtracted. See Appendix A in this report for more information on magnetic data compilation, processing and presentation.

4.3 Electromagnetic Data

All of the GEOTEM data were compiled and processed by A-Cubed Inc. during January of 1988. The data for the survey area were available from the original airborne data tapes. Before processing could be carried out, the raw data had to be prepared. The following section describes the preparation of corrected EM data.

Figure 2 presents the principles of operation of the GEOTEM system. When a conductor is nearby, the receiver measures a transient waveform as the induced secondary field decays away. A number of time slices through the transient produce a set of channel amplitudes. It is these amplitudes that are plotted versus time on the chart records. When the aircraft approaches a conductor the amplitude of the transient grows, returning to zero as the conductor is left behind. The detailed manner in which the amplitudes vary in the interim provide target type and geometry information. In the GEOTEM system, a set of 12 channel amplitudes are recorded 6 times every second corresponding roughly to one transient every 10-15 metres of flying.

There are 20 selectable EM windows available in the GEOTEM receiver. These have been combined into 12 channels representative of the decay of the transient. The windows used for the present survey are summarized in Table 2. The raw GEOTEM data from tape were processed to remove bird motion noise and spherics. The high rate of sampling permits spherics to be eliminated by statistical means rather than by filtering thus preserving the fidelity of the ground response. As the GEOTEM data are levelled and calibrated during the data collection, no calibration was necessary.

To examine the characteristics of the EM data, a histogram of amplitude occurrences was computed for each channel. The results are presented in Figures 3a and 3b. The range of amplitudes available in the histograms is -100 to +1900 ppm. Each histogram contains the same area so that amplitudes falling within close range of 0 will produce a narrow, peaked histogram while channels with more variability in amplitude produce broad, flat histograms. Where a number of amplitudes were counted above 1900 ppm (as in Channels 1 and 2), these counts are collectively plotted at 1900 producing the single spike there.

The key features of the histograms is summarized in Table 3 where the peak amplitude values and the first standard deviations above and below them are supplied. The peak amplitude tells the average amplitude in that channel. For late time channels the peak amplitude is usually equivalent to the zero level of the channel. For early time channels it is the average ground response in that channel.

Levelling errors appear as a shift of the peak away from zero. The standard deviation values in the late time channels is a good estimate of the measured noise level in the data and is more reliable than contractor's quoted values that are based on visual examination of the chart records.

The non-zero residual peak values in the last channels represent a small amount of d.c. level remaining from the pre-processing. This residual bias was taken into account during the OUTPUT processing. The steadily increasing amplitude value of the histogram peak from Channel 12 to Channel 1 is produced by the background response due to widespread conductive cover. The peak-to-peak noise level based on these unfiltered data is approximately 50 ppm. This value falls well below the survey specification of 40 ppm when a 1.5 second time constant filter is applied.

The 1.5 second time constant filter used for display during the survey is adequate for the airborne real-time analogue chart, but not for processing and interpretation as it phase-shifts the anomalies and wipes out important anomaly nulls. For post-flight processing and presentation, a symmetric filter with a shorter effective length was used to reduce noise while preserving the anomaly peak shapes and their locations. The filter employed was a symmetric 3.0 second wide filter with uniform weighting coefficients.

The corrected and filtered EM data are presented in profile form on the chart record in Appendix B. From top to bottom of the chart, the various plotted parameters are summarized in Table 4. The zero values and scales for each of these profiles is provided in the Configuration Table at the start and end of each roll. The zero position for each profile is measured in centimetres from the top of the chart downward.

The nominal value for the primary field measured at the receiver is 1 million. The cyclic variation in it, especially at the start of each line is the bird swing as the aircraft settles onto course after the turn. Normally the survey line on the chart starts after this settling has taken place. Likewise, the altimeter channel moves to its nominal value of 400 feet above terrain.

Severe manueuvering of the aircraft produces severe fluctuations in the primary field profile. The EM responses may also show a distorted shape in that event. The magnetic field channel is presented on a scale to easily detect magnetic correlation. A 60,000 nT background level has been subtracted. Where its net amplitude exceeds 5,000 nT (gammas) it wraps to the bottom of the chart.

The 12 GEOTEM channels are all plotted at the same scale except Channel 1 which has been reduced by half to keep it on the plotting surface. The zero levels are a constant 0.5 cm apart for every channel. As discussed in Appendix A of this report, the EM channels are lagged in time by 4 seconds compared to the magnetics. To check the magnetic correlation of an EM anomaly, the EM must be shifted to the left on the chart by 4 seconds (0.6 cm).

Each new line is separated from the last and labelled with line and flight number. Fiducials are labelled across the bottom of the chart every 20 seconds.

4.5 Electromagnetic Data OUTPUT Processing and Display

The corrected data were processed using A-Cubed Inc.'s OUTPUT program. Every point in the survey consists of a sampled transient yielding 12 EM channel amplitudes. A simple exponential decay is matched with each set of channels in the survey using a weighted least squares algorithm. In Figure 4 the channels are plotted as symbols and the fitted exponential runs smoothly through them. The values generated by the OUTPUT program are the Initial Amplitude of the exponential decay, the Time Constant of the exponential decay and the Quality of fit of the decay to the measured channels.

In general, the depth and orientation of a conductor affects the initial amplitude of the EM response while the conductivity and spatial extent of the conductor is proportional to the fitted time constant. An ideal conductor, such as a well-connected deposit of massive sulphides at shallow depth would have a strong initial amplitude and large time constant. The manner in which the signal amplitude changes along line indicates the general shape of the body that is producing the response (i.e., a thin plate, a horizontal ribbon, or a sphere).

Conductive overburden responses typically decay quickly (having a short time constant). They have a very high initial amplitude because of their proximity to the EM system. For areas of extensive continuous cover, the time constant can remain at the same value along the line or lines; however, the initial amplitude may change if the aircraft changes altitude or if the towed bird receiver swings around. This phenomenon generates false anomalies on traditional interpretation maps and charts, but not on OUTPUT maps that key on time constant, because time constant is less affected by geometry changes than amplitude.

Variations in time constant can occur even where no anomaly peak is observed. This is true when a survey is flown sub-parallel to conductor strike or where bedrock responses are embedded within larger anomalies from surficial conductors. In both cases, targets may be missed during standard compilation procedures that place emphasis on anomaly peaks.

Where data are noisy or low amplitude or where the decay dies too fast to be of interest, only the first few channels are reliable to fit with. In this survey, a minimum number of 4 channels was specified to obtain a reliable fit. In the more resistive parts of the survey area the minimum number of channels may not be available, so the OUTPUT results are blank there.

The processing results are summarized in Table 5. A large percentage of the data points were successfully fitted by OUTPUT. The rest of the table provides the distribution of time constants fitted for a number of Quality levels. At the 60% Quality level the large percentage of fits shorter than 200 microseconds reflects the effect of the conductive sediments in Gull Bay.

The OUTPUT processed data have been presented in both analogue chart and map form. The chart records bear resemblance to the archived data in format. The line numbers and fiducials are labelled in the same manner. The chart contents are summarized in Table 6.

In lieu of using initial amplitude, Pseudo-channel 1 amplitude is presented on the chart. Pseudo-channel is a useful form to express the OUTPUT results in. It is defined as the amplitude of the fitted exponential after it has decayed from its initial amplitude for a specified period of time. Since each measured EM channel represents a fixed delay time following the transmitter shut-off, one can use the same delay time to compute a corresponding pseudo-channel using the formula

$$PS_i = Ao\ e^{-t_i/c}$$

where	PS_i	is the Pseudo-channel i amplitude,
	Ao	is the fitted initial amplitude,
	t_i	is the specified Channel i delay time,
	c	is the fitted time constant.

The pseudo-channel approach has also been applied to the maps. The data are presented in a shaded stacked profile format where the height of the profile at each location is pseudo-channel amplitude and is coloured according to its time constant value. The shortest time constants are given black and fall below 250 microseconds. The medium time constants are given green and fall between 250 and 300 microseconds. The largest time constants (best conductors) are coloured red and include all values above 300 microseconds. All data with Quality higher than a specified value, 60%, are included.

OUTPUT maps for each of Pseudo-channel 1 (delay time of .273 milliseconds) and 8 (delay time of 1.458 milliseconds) have been produced at a scale of 1:50,000. The former is useful for examining all conductors in the area, while the latter serves to accentuate the higher conductivity responses because any fast decaying surficial responses have decayed away leaving the more slowly decaying good conductors.

In each map, flight lines from both directions have been included. The line number is always labelled at the start of the line. Fiducials have been identified by tick marks at intervals of 10. The first multiple of 10 is labelled. Because the survey is flown with lines in alternating directions, the line and fid label are normally at opposite ends of adjacent flight lines. The direction of survey is always away from the line and fid labels.

The towed EM receiver follows the aircraft some 4 seconds worth of flying time behind. The anomalies are recorded at the aircraft position instead of the transmitter-receiver midpoint. The true anomaly location is thus at a point 4 seconds back down the line (approximately 245 metres). Generally speaking, the conductor axis lies down the middle of the shifted anomalies.

The good conductors are best distinguished from the overburden by looking later in time after the short time constant surficial or host ground response decays away leaving the longer time constant anomalies on the map. In the map of Pseudo-channel 8 this has been done. The amplitudes plotted are those that would be measured 1.458 milliseconds after the transmitter shuts off or about half way through the transient in Figure 4. The interpretation will be discussed in Section 5 below.

5. INTERPRETATION OF RESULTS

5.1 Introduction

The following interpretation is just that, an interpretation. As such it reflects the biases of the interpreter. It was generated based on the OUTPUT processing results, the various magnetic deliverables and a limited knowledge of the geological setting. The interpretation may be refined with modelling of EM responses and addition of more ground control.

In general, an optimum bedrock conductor should have a large time constant and strong amplitude. The anomaly profile will show a fairly narrow cross-section (a few hundred metres half-width) if it is caused by a localized bedrock conductor such as a graphitic horizon or massive sulphide lens. Broader anomalies can be caused by regional changes in basement lithology or widespread flat-lying conductors including swamps, lake sediments, and glacial or fluvial clays.

Power lines, buildings, railways, and other cultural features can create anomalies that resemble bedrock conductors in time constant and shape; however, they are readily identified by a signal in the power line monitor (HYDR) on the chart records or by visually inspecting the air photo and filmstrips for signs of man-made structures. Due to their 2-D nature, power line responses are strongest when the survey is flown normal to their orientation and may give no response at all when flown parallel to them. Where EM anomalies have power line signals but no visual evidence and a good correlation with the magnetics, they may be attributable to real geological conductors since power lines can induce currents to flow in local conductors.

Poor conductors with short time constants are often good targets for precious metal exploration where they have good correlation with favourable geology. Sometimes such responses are similar in character to surficial responses of finite extent such as a narrow stream bed. In situations where a conductive sediment response has a time constant above average (i.e., 200 microseconds vs 100 microseconds), there may be a bedrock conductor beneath those sediments. Magnetic data are normally used to distinguish the authentic bedrock responses.

To be sure of catching even the subtle responses, the interpretation was carried out with reference to the charts of Appendix B and C, pseudo-channel maps, and the total magnetic field data.

The interpretation maps have been generated to present both the picked anomaly peaks and the interpreted conductors. Note that the human interpreter takes over when OUTPUT is finished, so that all anomalies picked and plotted on the interpretation map were selected by a geophysicist.

The anomaly peaks have been shifted by the lag factor and plotted as dots on the Interpretation map. The dots show position only, not grade or strength of response. The shifted anomaly peaks were then overlain upon the other parameter maps and the axes were sketched in. Where an axis was not obvious, it was left off. A solid line indicates a definite axis while a dashed line implies tentative line-to-line correlation and/or uncertainty in location. The location of the conductor top depends on the anomaly shape and the flight direction. The profiles in Figure 5a and 5b are those that would be seen from flying over a thin plate-like body in two directions. Two peaks are observed when the aircraft flies up-dip. The plate top lies between them. One peak is observed in the other direction. The plate top lies just before the peak. These kinds of rules were used to position the axes.

The major trends on each survey area were given a name. The named anomalous trends are all summarized in Table 8. The anomalies are discussed in the following sections. In some cases dip and depth estimates are provided. Related ones are discussed together. Note that all anomalies discussed are recommended for follow-up with ground geophysics unless specifically noted otherwise.

5.2 Interpretation

A number of the large anomalies appear to be responses from lake-bottom sediments, since they bear a spatial relationship to the shoreline. The decay rates are short (less than 200 microseconds) and the amplitudes diminish when presented in Pseudo-channel 8 form.

Within the lake responses are a series of strong responses of considerably longer decay rate indicating higher conductivity and a probable bedrock source. These responses are marked on the map and discussed individually.

Anomaly D1 is a strong EM response with long decay rates hence good conductivity. The mag correlation is strong. The pattern of peaks can be interpreted as multiple zones dipping to the west although quite vertical. The EM responses seem to occur within the so-called Duport Deformation Zone (DDZ).

Anomaly D2 is a set of EM responses having good conductivity and poor magnetic correlation. Spatially it has not been correlated with any geological structures in the literature.

Anomaly D3 is strong and has only a moderate time constant. It has the appearance of lake bottom sediment responses, but may in fact be those enhanced by underlying mineralization in the Sirdar Deformation Zone. (SDZ).

Anomaly M1 consists of a short trend of good EM response with long decay rate hence good conductivity. It appears to lie along the northwest edge of a wide magnetic high, making it a good target structurally.

Anomaly M2 is weak, but the decay rates are good and there is a weak magnetic response similar to D2. It may also represent an extension of DDZ.

Anomaly M3 is a complex series of strong EM responses having locally better conductivity. While lake bottom sediment responses produce anomalies like these, it has substantially better time constant and may represent a continuation of the SDZ underneath lake bottom sediments. Note that this trend lies along the southeast edge of the broad magnetic high described for M1 above.

6. CONCLUSIONS AND RECOMMENDATIONS

The combination electromagnetic and magnetic survey of the Michaelson property provided an exceptionally good picture of the structure of the metavolcanic belt. The OUTPUT processed EM maps were able to identify many EM targets that have strong correlation with magnetic horizons. A total of six targets are listed and rated in Table 8. In most cases a detailed program of ground geophysics will be necessary to pinpoint targets before drilling. Where drilling has already taken place, the results of this survey will serve to map the extensions of the targets for additional drilling.

As more geological information becomes available, a more detailed program of modelling and interpretation can be carried out to refine the present interpretation.

Respectfully submitted,

A-CUBED INC.

C. Vaughan, B.Sc.
Geophysicist

TABLE 1 - Survey Flying Specifications

Line Spacing:	- 500 and 250 metres
Line Direction:	- N 45° W
Tolerance:	- up to 0.75 of line spacing allowed for a distance along line not to exceed 3 km.
Survey Altitude:	- 120 metres + - 15 metres.
Survey Speed:	- 115-120 knots.
Geotem Peak to Peak Noise Levels:	- Not to exceed 40 ppm after a 1.5 second time constant applied.
Calibration Sequences:	- Minimum 3 per flight. The second one approximately one hour into the flight.
Real-Time Chart Display:	- Altimeter, Magnetics, Magnetics 4th Difference, 6 out of 12 processed EM channels, Primary Field, Culture monitor.
Magnetic Diurnal Tolerance:	- Not to exceed 10 nT change during a 2 minute interval.

TABLE 2 - GEOTEM Receiver Windows

Channel	Start Time	End Time	Centre	Width
1	234	312	273	78
2	313	417	365	104
3	417	521	469	104
4	521	729	625	208
5	729	937	833	208
6	938	1146	1042	208
7	1146	1354	1250	208
8	1354	1562	1458	208
9	1563	1771	1667	208
10	1771	1979	1875	208
11	1771	2189	1979	418
12	1979	2265	2122	286

Note: All times are in microseconds and start, end and centre times are measured after the transmitter shut-off.

TABLE 3 - GEOTEM Channel Histogram Analysis

Channel	One S.D. Below Peak	Peak Value	One S.D. Above Peak	Width
1	662 ppm	5380 ppm	>19000 ppm	>19000 ppm
2	136	1888	10700	10564
3	42	728	4710	4668
4	6	268	1896	1890
5	-4	96	688	692
6	6	60	326	320
7	0	38	178	178
8	-12	20	102	114
9	-26	2	56	82
10	-20	6	44	64
11	-14	6	38	52
12	-12	8	36	48

Note: "S.D." is Standard Deviation. "Width" refers to the span between the two standard deviations.

TABLE 4 - Archived Data Chart Record Contents

Parameter	Scale	Zero Position
Line Number	- Block number x 100 + line number	-
Fiducial	- Every 10 seconds (the labelled fiducial position is given by the small vertical tick at the bottom of the chart record).	-
Primary Field Monitor (PRIM)	- at 200,000 ppm/chart cm	6.0 cm
Altimeter (ALTM)	- at 100 feet/chart cm	8.0 cm
Edited Final Magnetic Field (PMAG)	- at 250 nT/chart cm	10.0 cm
GEOTEM Channel 1 (EM01)	- at 400 ppm/chart cm	23.5 cm
GEOTEM Channel 2 (EM02)	- at 400 ppm/chart cm	24.0 cm
GEOTEM Channel 3 (EM03)	- at 400 ppm/chart cm	24.5 cm
GEOTEM Channel 4 (EM04)	- at 400 ppm/chart cm	25.0 cm
GEOTEM Channel 5 (EM05)	- at 400 ppm/chart cm	25.5 cm
GEOTEM Channel 6 (EM06)	- at 400 ppm/chart cm	26.0 cm
GEOTEM Channel 7 (EM07)	- at 400 ppm/chart cm	26.5 cm
GEOTEM Channel 8 (EM08)	- at 400 ppm/chart cm	27.0 cm
GEOTEM Channel 9 (EM09)	- at 400 ppm/chart cm	27.5 cm
GEOTEM Channel 10 (EM10)	- at 400 ppm/chart cm	28.0 cm
GEOTEM Channel 11 (EM11)	- at 400 ppm/chart cm	28.5 cm
GEOTEM Channel 12 (EM12)	- at 400 ppm/chart cm	29.0 cm
Culture or Hydro Monitor (HYDR)	- at 10,000 ppm/chart cm	30.0 cm

Note: Zero Position is measured from the top of the chart down.

TABLE 5 - OUTPUT Processing Summary

TOTAL NUMBER OF TRANSIENT MEASUREMENTS .. 4548
TOTAL NUMBER OF FITTED MEASUREMENTS 3765
PERCENTAGE OF MEASUREMENTS FITTED 82.784

PERCENTAGE OF FITTED DATA MEASUREMENTS VS ERROR RATIO FOR TIME CONSTANTS
****

ERROR RATIO	<.1	<.2	<.3	<.4	<.5	<.6	<.7	<.8	<.9	<1.0	>1.
QUALITY VALUE	>90%	>80%	>70%	>60%	>50%	>40%	>30%	>20%	>10%	> 0%	<0%
PERCENT FITTED	12.86	43.13	71.87	88.90	94.21	97.34	99.44	99.81	99.89	99.89	.11
TIME CNST RANGE						PERCENTAGE					
0. - 99.	19.21	7.88	4.84	3.91	3.69	3.57	3.50	3.49	3.48	3.48	0.00
100. - 199.	53.93	62.75	60.16	54.97	52.27	50.61	49.55	49.36	49.32	49.32	50.00
200. - 299.	20.04	25.92	31.23	36.06	38.03	37.57	36.78	36.64	36.61	36.61	0.00
300. - 399.	4.13	2.46	3.03	4.24	4.79	5.65	5.80	5.80	5.80	5.80	0.00
400. - 499.	2.69	.99	.74	.81	1.04	1.47	1.79	1.86	1.86	1.86	50.00
500. - 599.	0.00	0.00	0.00	0.00	.03	.22	.61	.75	.77	.77	0.00
600. - 699.	0.00	0.00	0.00	0.00	0.00	.30	.88	.96	1.01	1.01	0.00
700. - 799.	0.00	0.00	0.00	0.00	0.00	.16	.37	.37	.37	.37	0.00
800. - 899.	0.00	0.00	0.00	0.00	0.00	.16	.37	.37	.37	.37	0.00
900. - 999.	0.00	0.00	0.00	0.00	0.00	.08	.13	.16	.16	.16	0.00
1000. - 1199.	0.00	0.00	0.00	0.00	0.00	.03	.03	.03	.03	.03	0.00
1200. - 1399.	0.00	0.00	0.00	0.00	0.00	.03	.03	.05	.05	.05	0.00
1400. - 1599.	0.00	0.00	0.00	0.00	.03	.03	.03	.03	.03	.03	0.00
1600. - 1799.	0.00	0.00	0.00	0.00	.06	.05	.05	.05	.05	.05	0.00
1800. - 1999.	0.00	0.00	0.00	0.00	.03	.03	.03	.03	.03	.03	0.00
2000. - 2999.	0.00	0.00	0.00	0.00	.03	.03	.05	.05	.05	.05	0.00
3000. - 3999.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4000. - 4999.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5000. - 9999.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10000. -100000.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 6 - OUTPUT Processed Data Chart Record Contents

Parameter		Scale	Zero Position
Line Number		- Block numberx100 + Line number -	
Fiducial		- Every 10 seconds	
Quality (QUAL)		- at 100%/chart cm	4.0 cm
Time Constant (TAU)		- at 500 microseconds/chart cm	7.0 cm
Edited Final Magnetic Field (PMAG)		- at 250 nT/chart cm	15.0 cm
OUTPUT Pseudo-channel	1	- at 800 ppm/chart cm	22.5 cm
	2	- at 800 ppm/chart cm	23.0 cm
	3	- at 800 ppm/chart cm	23.5 cm
	4	- at 800 ppm/chart cm	24.0 cm
	5	- at 800 ppm/chart cm	24.5 cm
	6	- at 800 ppm/chart cm	25.0 cm
Primary Field Monitor (PRIM)		- at 200,000 ppm/chart cm	6.0 cm

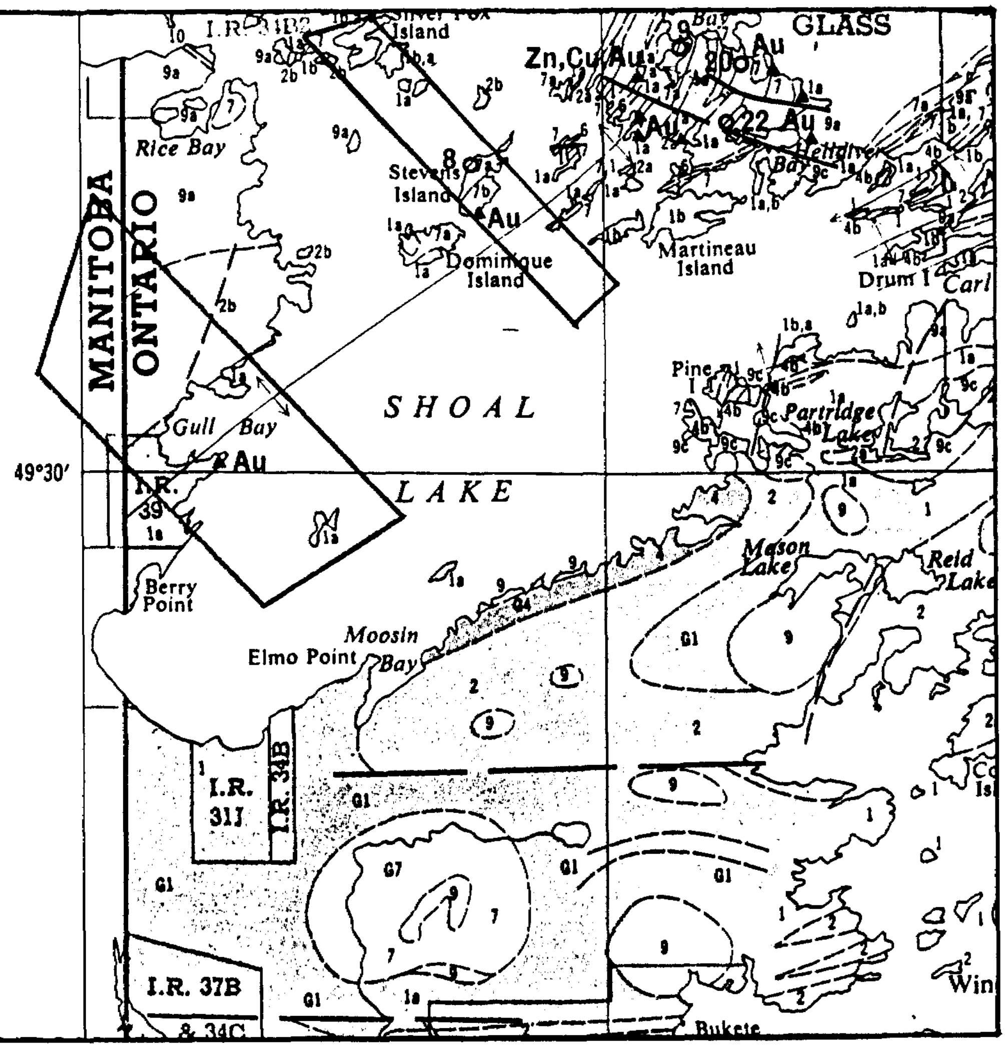
Note: Zero position is measured from top of chart down.

TABLE 7 - Project 5062A Deliverables

Flight path recovery on photomosaic background - Mylar	1 sheet
Flight path recovery on photomosaic background - Whiteprint	1 sheet
Magnetic Field in stacked profile - Mylar	1 sheet
OUTPUT Pseudo-channel 1 - on Bond	1 sheet
OUTPUT Pseudo-channel 8 - on Bond	1 sheet
OUTPUT Interpretation Map on Photomosaic Background - on Mylar	1 sheet
Chart records of Archived Raw Data	Roll Format
Chart records of OUTPUT Processed Data	Roll Format
9-track Magnetic Tapes of Airborne Data	1 tape
9-track Magnetic Tapes of Archive Data	1 tape
Analogue Charts of Airborne Data and Base Station Magnetometer	
Flight Logs	
Filmstrips	
Original of in-field Flight Path Recovery	
Airborne survey Contractor's Processing Report	
OUTPUT Data Processing/Interpretation Report	

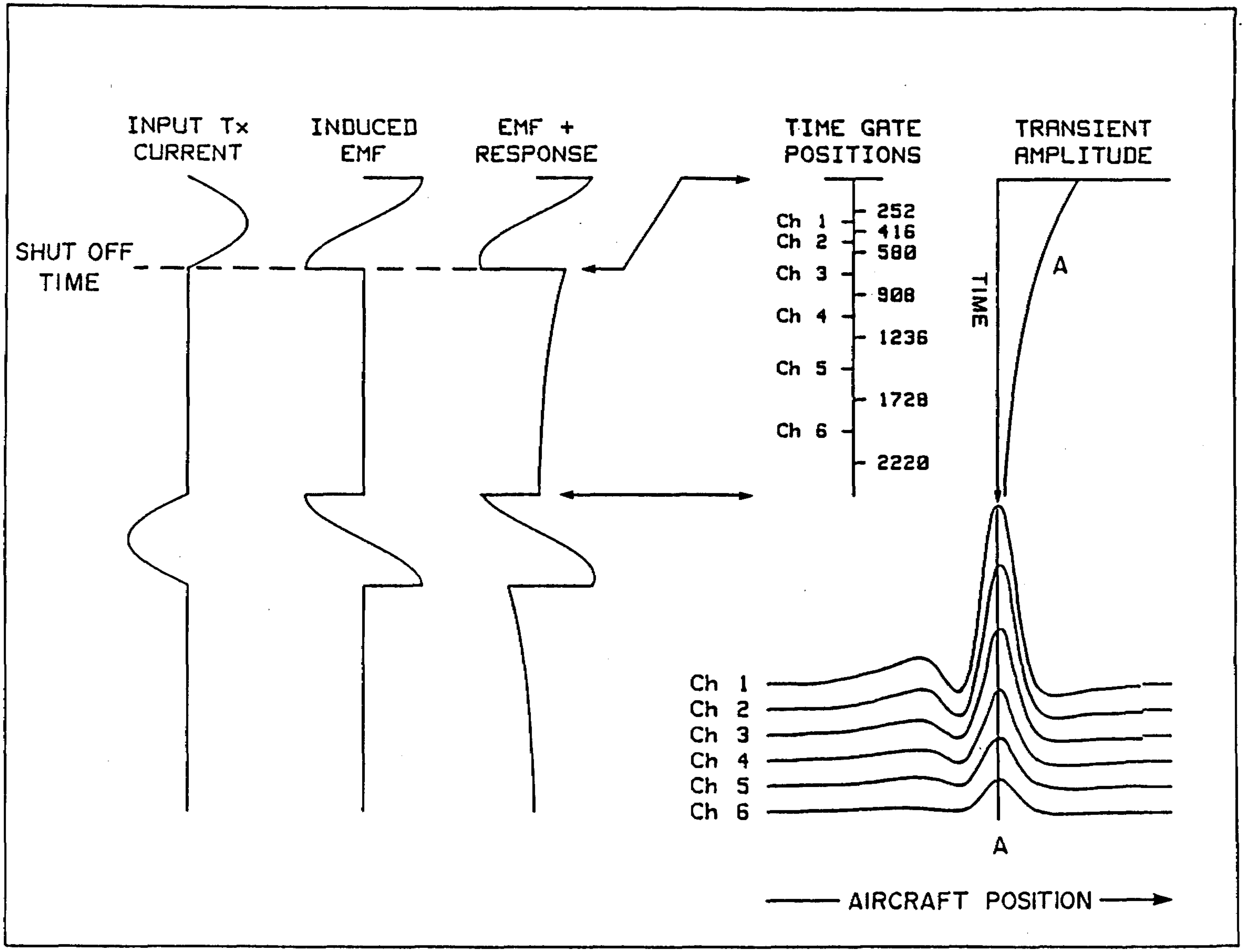
TABLE 8 - Summary of Targets for Follow-Up

Name	Line Range	Priority
M1	107 - 108	High
M2	101 - 103	Moderate
M3	102 - 106	High
D1	201 - 205	High
D2	201 - 204	Moderate
D3	201 - 203	Moderate



A-CUBED INC.

MICHAELSON CLAIMS SURVEY AREA SITE MAP	
5062A	Figure 1



A-CUBED INC.

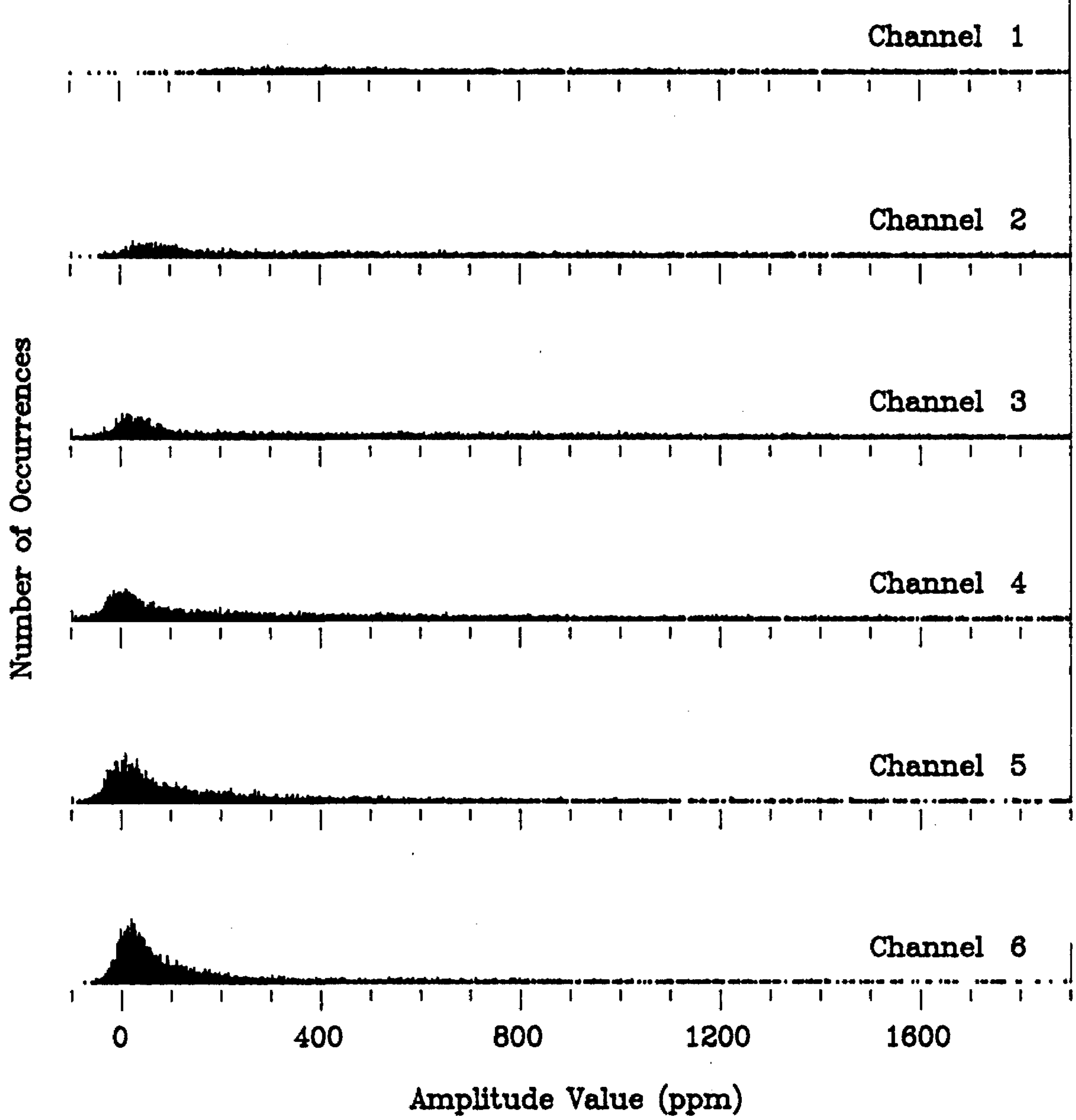
Airborne Transient EM Principles of Operation

5062A

Figure 2

EM CHANNEL HISTOGRAM ANALYSIS

File Name : TEST_COMPRESS_1_6.N02
Start Record : 1
End Record : 4550
Resolution : 2 ppm
Accept : ALL LINES

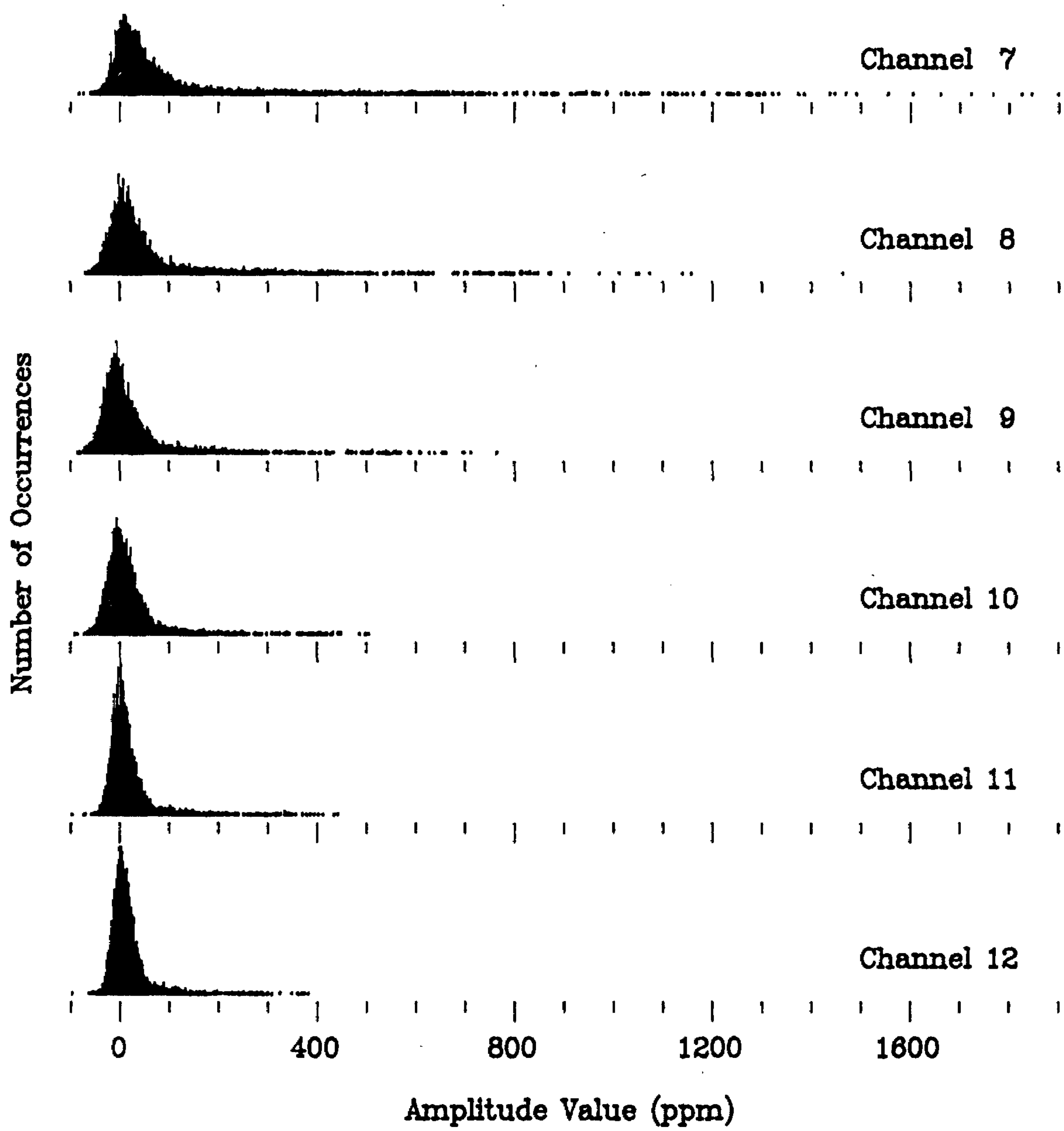


N.B. Equal area under all histograms. Blanks signify no occurrences.

A-CUBED INC.	GEOTEM Channels 1 – 6 HISTOGRAM ANALYSIS	
	5062A	Figure 3A

EM CHANNEL HISTOGRAM ANALYSIS

File Name	: TEST_COMPRESS_7_12.N02
Start Record	: 1
End Record	: 4550
Resolution	: 2 ppm
Accept	: ALL LINES



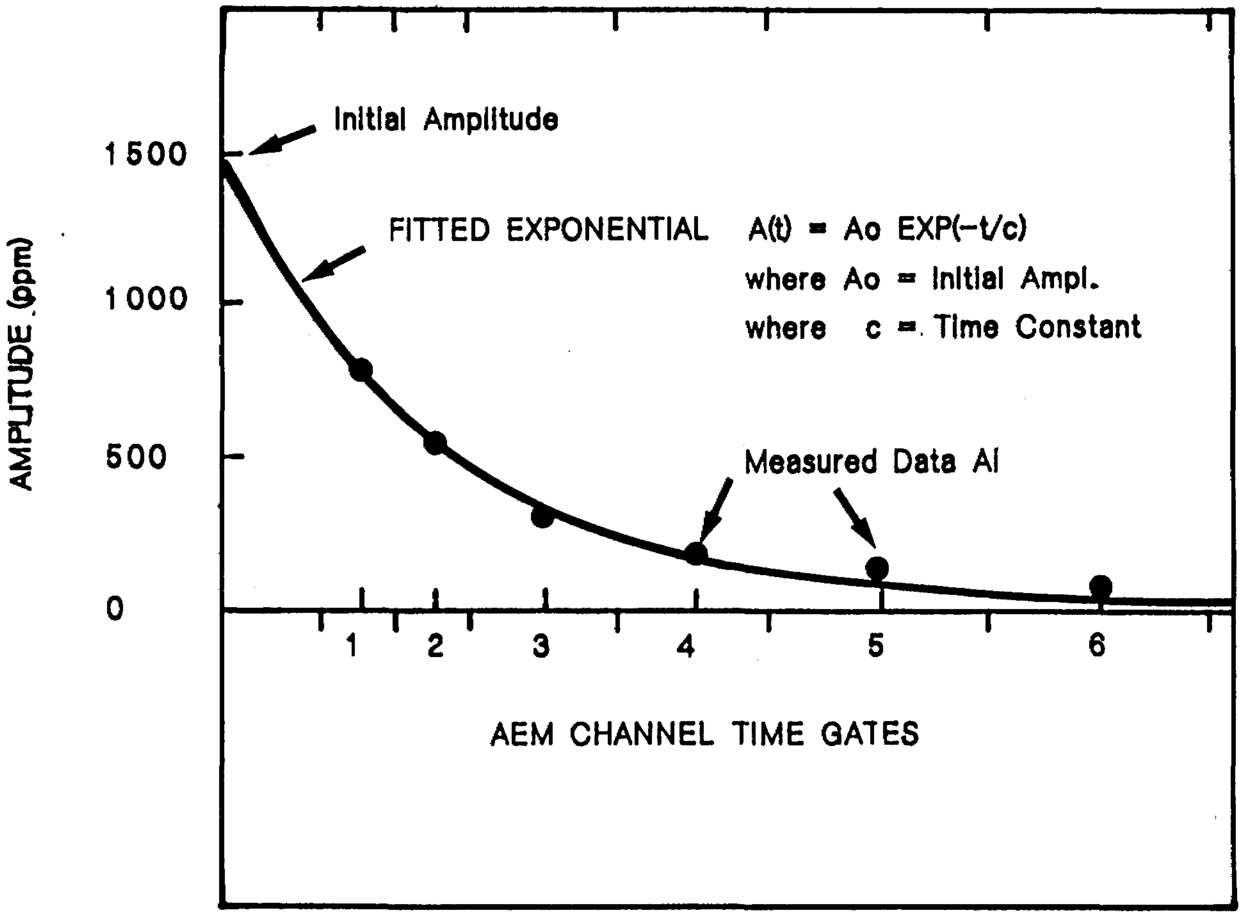
N.B. Equal area under all histograms. Blanks signify no occurrences.

A-CUBED INC.

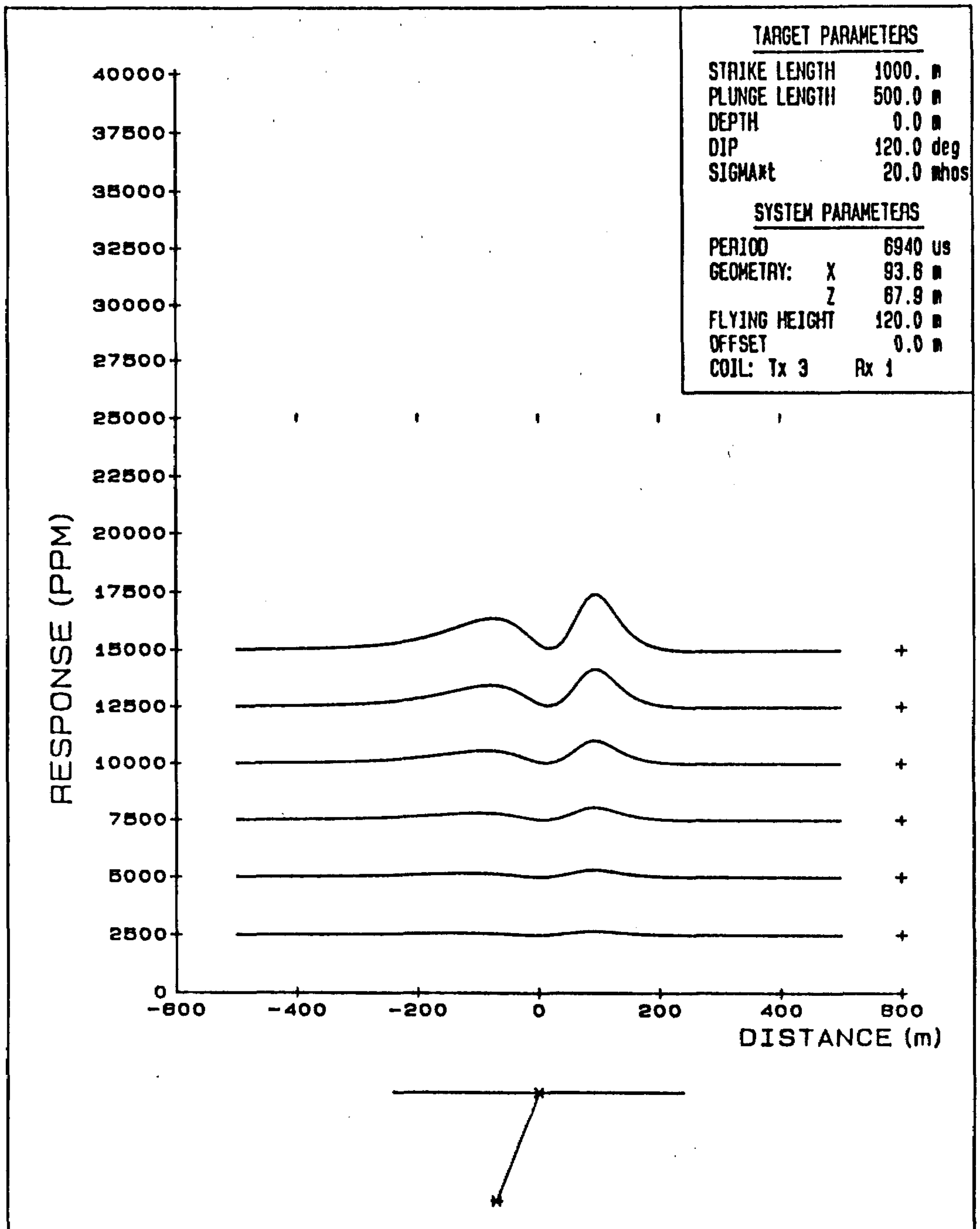
GEOTEM Channels 7 - 12
HISTOGRAM ANALYSIS

5062A

Figure 3B



A³ A-CUBED INC.	OUTPUT Processing Principles of Operation	
	5062A	Figure 4



SYNTHESIZED INPUT RESPONSE FOR PLATE

A-CUBED INC.

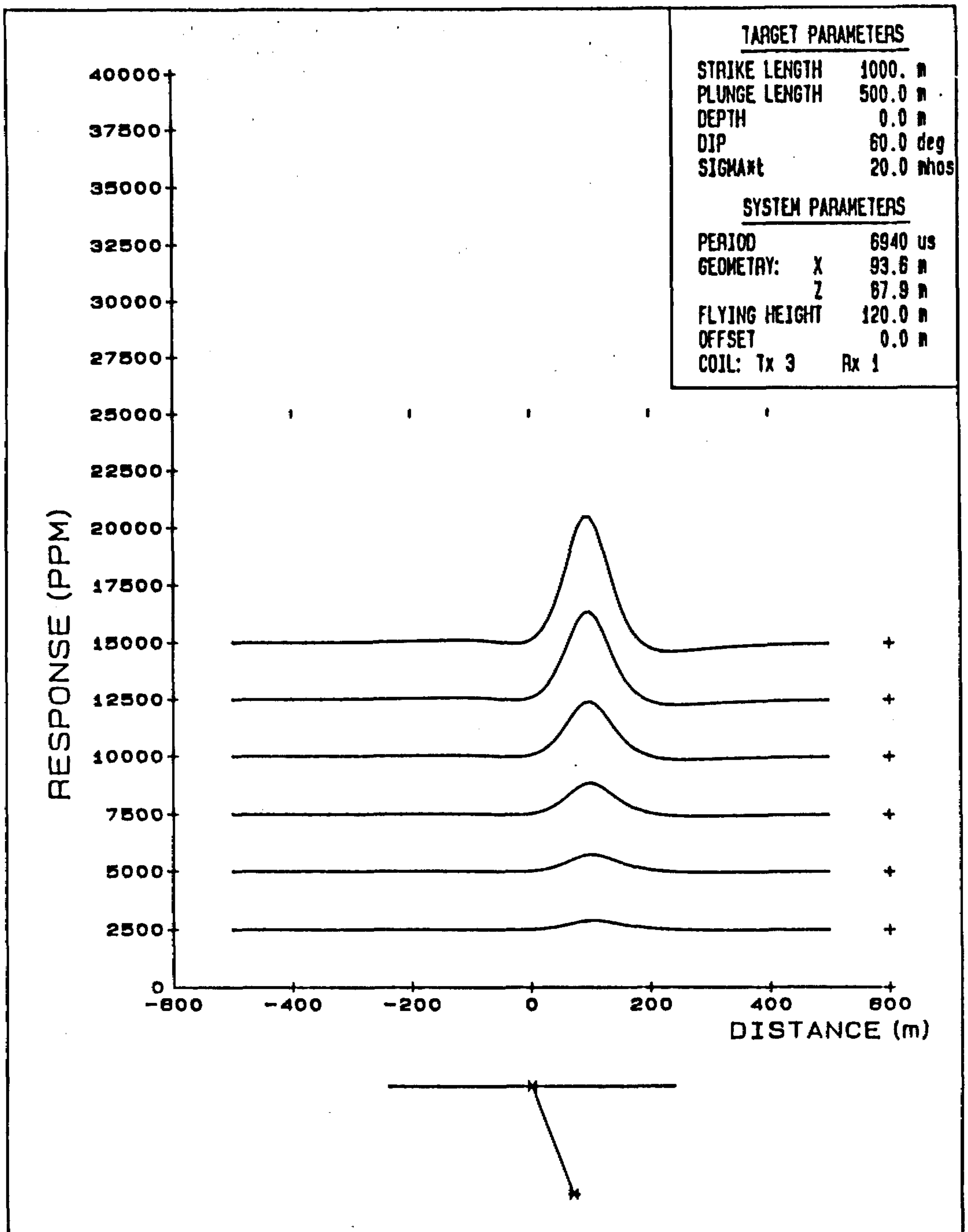
A-CUBED INC.

TYPICAL THIN PLATE GEOTEM ANOMALY

FLYING UP DIP OF 60°

5062A

Figure 5A



SYNTHESIZED INPUT RESPONSE FOR PLATE

A³ A-CUBED INC.

A³ A-CUBED INC.

TYPICAL THIN PLATE GEOTEM ANOMALY

FLYING DOWN DIP OF 60°

5062A

Figure 5B

APPENDIX A

Chart Records of Corrected GEOTEM, Magnetic, and Altimeter Data for Michaelson Survey.*

APPENDIX B

Chart Records of OUTPUT Processed GEOTEM, Magnetic, and Altimeter Data for Michaelson Survey.*

*Rolls of chart not bound in this document.

APPENDIX C

Airborne Sub-Contractor's Report

PROJECT NO. 290

PROCESSING REPORT

OF THE

AIRBORNE GEOTEM ELECTROMAGNETIC

AND MAGNETIC SURVEY

FOR

ALMADEN RESOURCES LTD.

BY

GEOTERREX LIMITED

FEBRUARY 1987

B. SCHACHT

Table of Contents

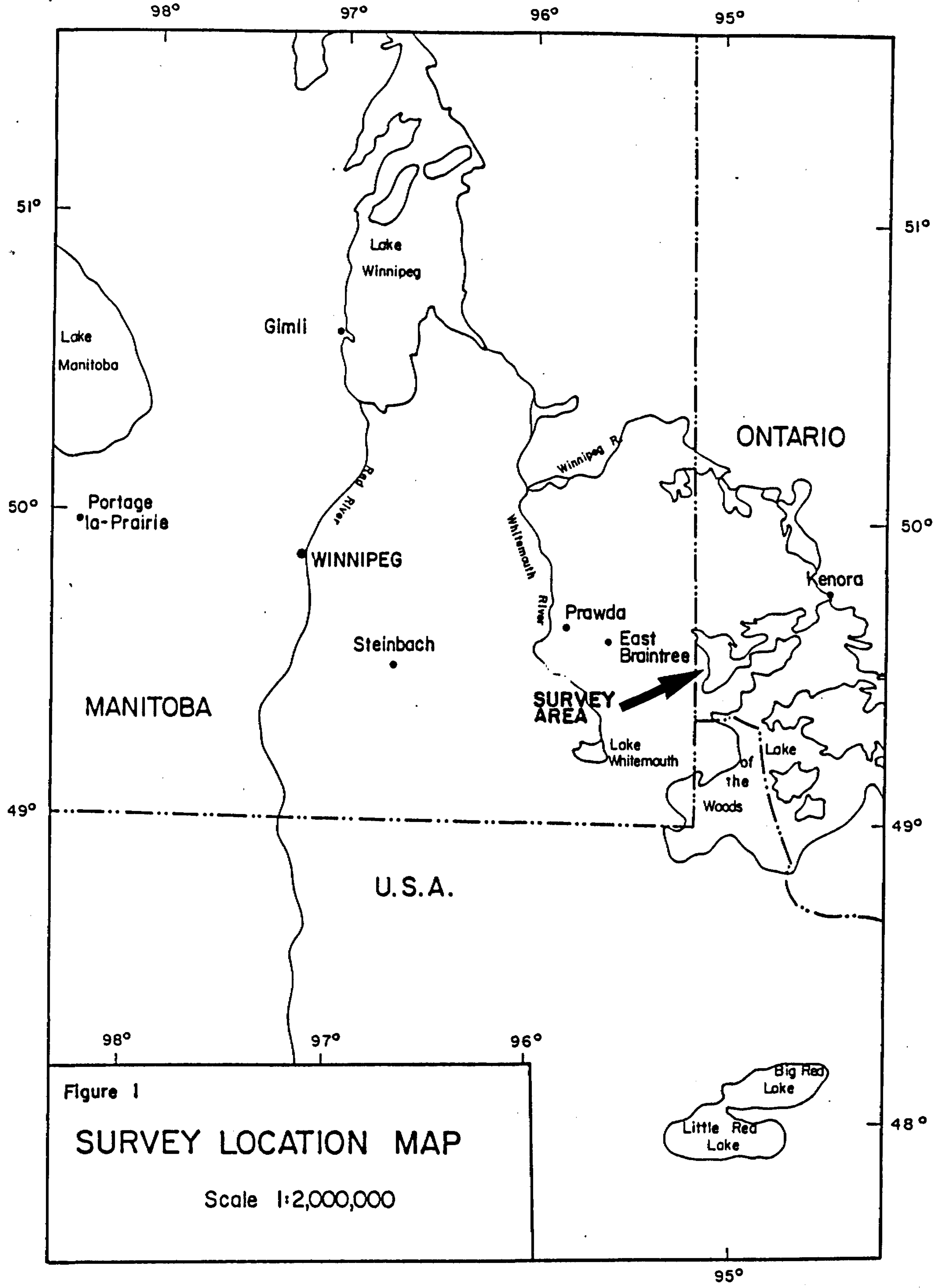


Figure 1

SURVEY LOCATION MAP

Scale 1:2,000,000

INTRODUCTION

During the period of January 5th to 11th, 1987, a combined airborne magnetic and GEOTEM electromagnetic survey was flown for Almaden Resources Limited by GEOTERREX LIMITED. In all, 140 kilometres of survey lines were flown (see figure 1).

The purpose of the survey was to locate areas of high conductivity that may be indicative of economic massive sulphides.

The data was compiled in Ottawa by GEOTERREX LIMITED and is presented as a magnetic total intensity contour map (regionally corrected), a calculated vertical gradient contour map, a flight path map, a set of analogs with flight path film and flight logs, a report, and a digital archive of all magnetic and GEOTEM data.

I SURVEY OPERATIONS

I.1 Flight Grid

The area was covered with flight lines at a 250 m interval, with heading north 45
500
degrees west.

The tie-lines were flown at right angles to the flight lines, approximately 10 kilometres apart.

A total of 140 line kilometres of data was flown.

I.2 Flight altitude

The survey was flown at a height of 120m above ground whenever possible, with regard to topographic relief and commensurate with the safety of the aircraft and bird. This flying altitude maintains the EM sensor (located at a towed bird at the end of a 135 m cable) at approximately 40 m above the ground.

I.3 Navigation

The navigation was visual, aided by Doppler, using airphoto mosaics at a scale of 1:50,000 prepared by GEOTERREX LIMITED.

I.4 Aircraft & Geophysical on-board equipment

The survey aircraft used was a CASA C212-200, twin turbo prop STOL aircraft, maintaining a survey speed of 120 knots (220 km/hr).

The following equipment was on-board the aircraft.

- GEOTEM Electromagnetic system: comprising a transmitter and loop; a digital receiver; and a sensor mounted in a towed bird. A full description of the system is included in Appendix B.

- MADACS Digital Acquisition system: combining an INTERDATA 6/16 16 bit microprocessor and a DIGIDATA 1640, 9 track, 1600 bpi tape drive. The following information was recorded digitally:

- 20 GEOTEM EM channels
- Magnetic total field
- Radar altitude
- Time (fiducials)
- Doppler velocity along track
- Doppler velocity across track
- Doppler heading
- Primary EM field
- 60 Hertz powerline monitor
- Noise Monitor
- 3 reference monitors

- Magnetometer: VARIAN cesium vapour, single-cell, split-beam magnetometer, mounted in a stinger on the tail of the aircraft, and compensated for aircraft magnetic effects. Its sample rate was 1 second. It recorded the earth's total field in units of 0.1 nT.*

* The S.I. unit, nanotelsa, is equivalent to one gamma.

- Altimeters: - Radar altimeter: COLLINS ALT 55

- Barometric altimeter: Rosemount 840 F3C

- Tracking camera: GEOCAM 35 mm, continuous strip camera.

- Analogue recorder: RMS-GR-33 heat sensitive graphic recorder, displaying the following information with a chart speed of 9 cm/min:

- 6 GEOTEM EM channels (low pass filtered in real time) at a vertical scale of 200 ppm/cm.
- Spherics monitor (EM channel 4 without the filter), at a vertical scale of 800 ppm/cm.
- The magnetic total field at vertical scales of 50 and 5000 nT/cm
- The barometric altimeter at a vertical scale of 87 m/cm, increasing downward.
- The radar altitude at a vertical scale of 15 m/cm (120 m lies at the centre of the chart paper) increasing upward.
- The primary EM field monitor at a vertical scale of 3×10^2mv/cm (EM21).
- 60 Hz powerline monitor (EM23).
- Fourth difference of the total magnetic field at a vertical scale of 4 nT/cm.
- Time markers (fiducials), ticked at every 2 seconds and labelled at every 20 seconds.

5 Diurnal Variation monitor equipment

- A VARIAN, single-cell, split beam, cesium vapour magnetometer measuring the total magnetic field at 0.1 nT sensitivity and 0.5 second sample rate.

- A MADACS digital acquisition system, based on an INTERDATA 6/16 microcomputer; recording time and the output from the magnetometer.

- A DIGI-DATA tape recorder.

- An RMS-GR-33 heat sensitive graphic analogue recorder, displaying the total magnetic field at 2nT/cm and 20nT/cm and the fourth difference, on 12 inch (30.5 cm) chart paper, run at 3 cm/minute.

The base station was set up at Winnipeg (see figure 1), the base of operations throughout the entire survey. The diurnal variation limit for acceptable data was 10 gammas over a 2 minute chord. As the magnetic diurnal was exceptionally good throughout this survey, the limit was never approached.

1.6 Pre-Survey Tests

a) Figure of Merit

The aircraft is put through a series of pitches, yaws, and rolls, to examine the noise induced in the magnetometer resulting from aircraft manoeuvres (due to the eddy currents generated by the aircraft itself plus the changes in orientation of the sensor with regard to the earth's field). This test shows how well the instrument is compensated.

Table 1

Direction	Manoeuvre	Noise (nT)	
East	Pitches	0.35	
East	Rolls	0.25	0.70
East	Yaws	0.10	
North	Pitches	0.30	
North	Rolls	0.18	0.58
North	Yaws	0.10	
West	Pitches	0.55	
West	Rolls	0.25	0.90
West	Yaws	0.10	
South	Pitches	0.85	
South	Rolls	0.25	1.15
South	Yaws	0.05	
Total (F.O.M.) = 3.33 nT			
Average noise per manoeuvre = 0.28 nT			

The results of the Figure of Merit obtained from the same magnetometer on-board the CASA in the spring of 1985 are presented in table 1.

b) Lag tests (magnetic & electromagnetic)

The camera on-board the aircraft records its position, A, relative to the ground at time t_0. In fact, the sensor will arrive over A at time t_1 greater than t_0. Furthermore, because of electronic delays, the reading performed at time t_1 will be recorded on the magnetic tape at time t_2 greater than t_1. The difference $t_2 - t_0$ represents the lag between the actual position of the aircraft and the position of the corresponding reading on the magnetic tape.

The test is performed by flying the aircraft at survey altitude in opposite directions over a well defined magnetic and electromagnetic anomaly. The difference in the position of the anomalies, recorded in both directions, is equal to twice the "lag". The following lag values were thus determined in the field:

- Magnetometer = 0.67 sec (equal to 4 EM sample intervals)
- GEOTEM EM = 4 sec (equal to 24 EM samples)

The magnetometer "lag" value was taken into account at the processing stage by shifting the digital values correspondingly back in time.

c) GEOTEM EM system

The GEOTEM EM system benefits from a completely digital receiver which monitors continuously (i.e. 6 times a second) the current in the transmitter and the amplitude of the primary field as seen at the bird-receiver. This feature permits an internal calibration in ppm and therefore, pre-survey calibrations are not required.

I.7 Field Operations

The following GEOTERREX personnel were present in the field:

R. Laroche	Project manager, Co-pilot
T. Stevenson	Pilot
M. Palko	Engineer
A. Proulx	Electronics technician
R. Smith	Dataman

II. DATA PROCESSING

II.1) Flight Path Recovery

The flight path was recovered by identifying points on the 35 mm tracking film and on the photomosaics, at a scale of 1:50,000. Every effort was made to identify a point at every 20 seconds (approximately 1.2 km on the ground) along the flight lines. These points were then digitized on a flat-bed digitizer table, directly from the photomosaics.

After checking for errors by calculating the average speed of the aircraft between picked points, the visual flight path was merged with the Doppler flight path and automatically plotted at a scale of 1:50,000. The flight path coordinates were recovered in UTM metres, using the Clarke 1866 Spheroid with a central meridian of 93°W, a false northing of 0, a false easting of 500,000 and a scale factor of 0.9996.

II.2 Magnetic Data Processing

a) Editing of air data

The recorded total magnetic intensity, the radar altimeter readings and the time fiducials were initially verified for continuity and validity by generating a listing of the first and second difference values. This will locate any major busts or gaps in the data.

Following this, obvious errors in the digital records of the raw total intensity were detected by creating an error listing using the fourth difference of the raw total intensity values. Such defeats as spikes or missing values were automatically corrected by the program or simply flagged and corrected manually when outside the limits of the program. The total magnetic intensity values were thus corrected down to a threshold of 5 nT on the fourth difference values, corresponding approximately to a noise level on the total intensity data of 0.4 nT. The noise level was actually much lower, (approximately 0.1 nT) but due to the low flying height and active magnetic field the fourth difference editing routine had difficulty separating noise from the more powerful geological sources. Refer to Appendix A for a description of the fourth difference editing technique.

II.3) GEOTEM Electromagnetic Data

After reformatting the field tapes, the data was verified and edited to produce files representing continuous EM coverage on a line by line basis, presented as a digital archive (described in Appendix C).

Parameter tables were included in 1600 bpi copies of field tapes.

We trust this data will assist your interpretation/exploration program. Should you have any questions concerning its collection or processing, do not hesitate to call at any time in the future.

Respectfully submitted

Brian Schacht

Brian Schacht

APPENDIX A
FOURTH DIFFERENCE EDITING ROUTINE

Short Note

Application of Fourth Differences in Aeromagnetic Surveys, By M.S. Reford.

A standard method of examining any set of data, sampled at regular intervals, is the calculation of numerical difference tables. These can be used, for instance, to detect errors, for interpolation, or for numerical differentiation (Scarborough, 1950). Digital recordings of aeromagnetic data are ideal for such study, and Hood et al (1979) discussed the use of fourth differences in detecting and correcting errors in their high resolution aeromagnetic measurements. The purpose of this note is to review such correction procedures and report on the recording of fourth differences in the aircraft, to provide an immediate monitor of noise.

The tables below show how three different types of error are propagated through difference tables. In each case the column T shows the error, which would be superimposed on the sequence of measurements; the column Δ^1 shows the first differences, obtained by subtracting each value from the following one; similarly Δ^2 shows the second differences, obtained by successive subtractions of the first differences; and so on.

SPIKE					STEP OR LEVEL SHIFT					NOISE				
T	Δ^1	Δ^2	Δ^3	Δ^4	T	Δ^1	Δ^2	Δ^3	Δ^4	T	Δ^1	Δ^2	Δ^3	Δ^4
o		o		S	o		o		L	o		2e		-8e
	o		S			o		L			e		-4e	
o		S		-4S	o		L		-3L	e		-2e		8e
	S		-3S			L		-2L			-e		4e	
S		-2S		6S	L		-L		3L	o		2e		-8e
	-S		3S			o		L			e		-4e	
o		S		-4S	L		o		-L	e		-2e		8e
	o		-S			o		o			-e		4e	
o		o		S	L		o		o	o		2e		-8e

The spike produces a characteristic fourth difference peak, flanked by a pair of lows. In contrast, the level shift forms a fourth difference high-low pair. The noise envelope of e on the original data is amplified to an envelope of 16e on the fourth difference. This amplification is of prime importance for measuring noise or for automatic error correction in aeromagnetic measurements. The original data consists of signal and noise. The noise is often obscured by a regional slope, which is completely removed by taking second differences. However, a sharp anomaly can have appreciable second differences. By going to fourth differences, the signal is almost completely destroyed, and only the noise and bad values remain.

Figure 1 and 2 show sample analog records from a high-resolution aeromagnetic survey, our first one to show both the total intensity and fourth difference traces in the aircraft. The measurements were made at 0.5 second intervals with a cesium-vapor magnetometer in a bird. The effect of turbulent air on the noise envelope is obvious on the fourth difference trace. This trace allows, for the first time, an immediate check of noise in the field, an important feature for quality control of the survey data. The magnetometer operator can decide to terminate a flight because noise has become too large.

The fourth difference values can also be used for automatic correction of simple errors in the data. To recognise the errors, we first set a threshold based on the general noise envelope, wishing to treat only those which exceed this threshold. For instance we have used a threshold of 0.40 gammas on the fourth difference for high-resolution aeromagnetic surveys, where measurements are made in units of 0.01 gammas. This threshold would detect spikes exceeding 0.40/6 or 0.07 gammas in the total intensity measurements, and level shifts exceeding 0.40/3 or 0.13 gammas.

The next step is one of pattern recognition, to try and determine the cause of a particular error. It is easy to examine the fourth difference patterns produced by various errors by a simple process of addition, as shown below:

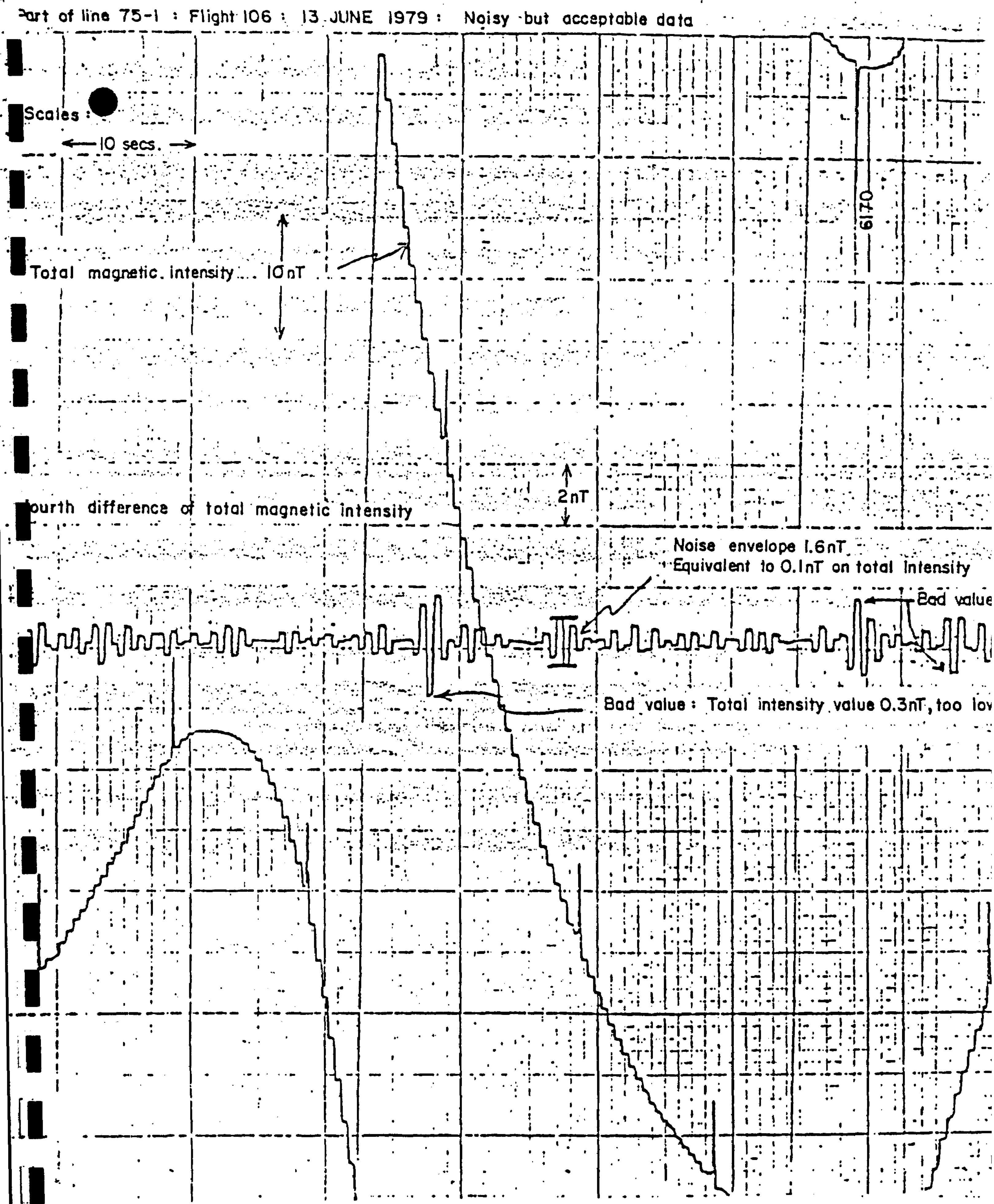

Part of line 75-1 : Flight 106 : 13 JUNE 1979 : Noisy but acceptable data
Scales :
10 secs.
Total magnetic intensity 10nT
2nT
Fourth difference of total magnetic intensity
Noise envelope 1.6nT
Equivalent to 0.1nT on total intensity
Bad value
Bad value : Total intensity value 0.3nT, too low
6170

Figure 1

Part of line 29-2: Flight 105: 16 June 1979: Very little noise

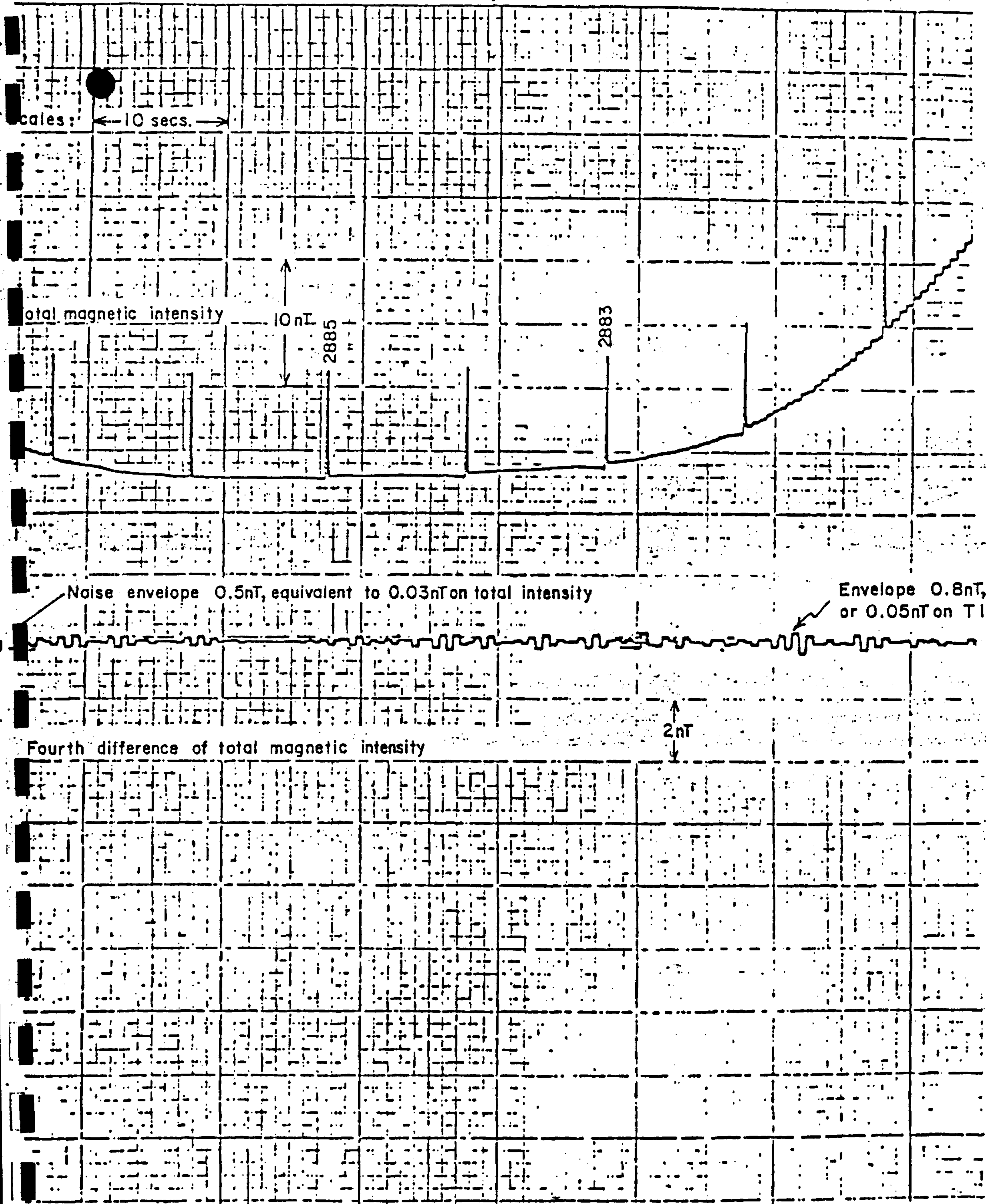


Figure 2

Unit Error | Fourth difference

1.  → +1 -4 +6 -4 +1

2.  →

```
  (+1  -4  +6  -4  +1          )
 +(        +1  -4  +6  -4   +1)
 = +1  -4  +7  -8  +7  -4   +1
```

3.  →

```
  (+1  -4  +6   -4   +1      )
 +(    -1  +4   -6   +4  -1  )
 = +1  -5  +10  -10  +5  -1
```

4.  → -1 +3 -3 +1

To distinguish between these different cases, we have found it useful to work with the peak fourth difference value, the two adjacent values on either side, and the ratios between them. These ratios are sufficiently different first to distinguish the symmetrical errors (Cases 1 and 2) from the antisymmetrical errors (Cases 3 and 4). It is not always so easy to distinguish between Cases 1 and 2. Note that if Case 2 is treated as if it were Case 1, the effect would be to raise the central value instead of lowering the two false peaks. Fortunately this does not seem to be a frequent type of error. Similarly it can be difficult to distinguish between Cases 3 and 4. This is important, since level shifts do sometimes occur, and if improperly corrected, they will create false pulls in contour maps. However, if a level shift is sufficiently large, it may be recognised on the total intensity trace.

At the present time, we are taking a cautious attitude towards automatic corrections of the data, and correcting only the simple spike, Case 1. Other errors are simply flagged, on an error list, and listed as possible steps if they are antisymmetrical in form. Inspection is needed before other corrections are made.

Figure 3 shows an example of the automatic correction. The four traces show the total intensity and fourth differences, before and after correction. Three noise spikes are obvious on the fourth difference. These are believed to be caused by interference from a radar system on the ground.

[illegible] the spike.

Figure 4 is a machine plot of actual data, which includes an error looking like a level shift of about 0.5 gammas on the total magnetic intensity peak. The table below lists the raw total field and fourth difference values, all in units of 0.01 gammas. The large fourth difference values could not be fitted by a level shift, but implied an unequal high-low pair. The corrections noted on the total field easily reduced the fourth differences to small values.

TOTAL FIELD		FOURTH DIFFERENCE		
Raw	Correction	Raw	Correction	Corrected
5509075		20		20
5509103		-7	12	5
5509119		50	-73	-23
5509127	+12	-172	172	0
5509181	-25	197	-198	-1
5509163		-112	112	0
5509152		30	-25	5
5509115		-3		-3
5509049		17		17
5509948		23		23

The purpose of correcting the data is to remove errors, and so reduce the noise envelope, before doing any linear processing, such as smoothing or filtering. Use of fourth differences allows a significant reduction in the basic noise envelope.

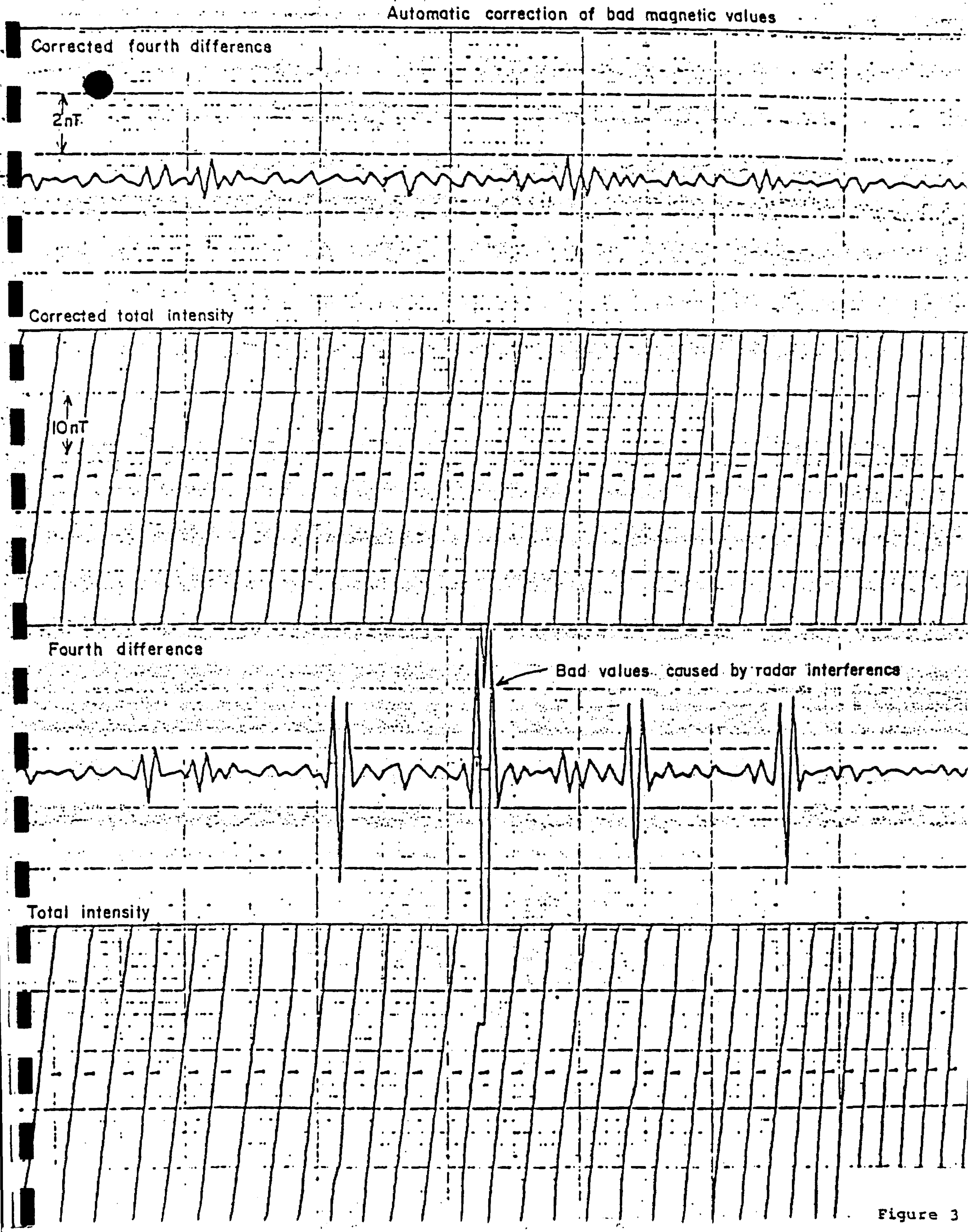

Automatic correction of bad magnetic values
Corrected fourth difference
2nT
Corrected total intensity
10nT
Fourth difference
Bad values caused by radar interference
Total intensity

Figure 3

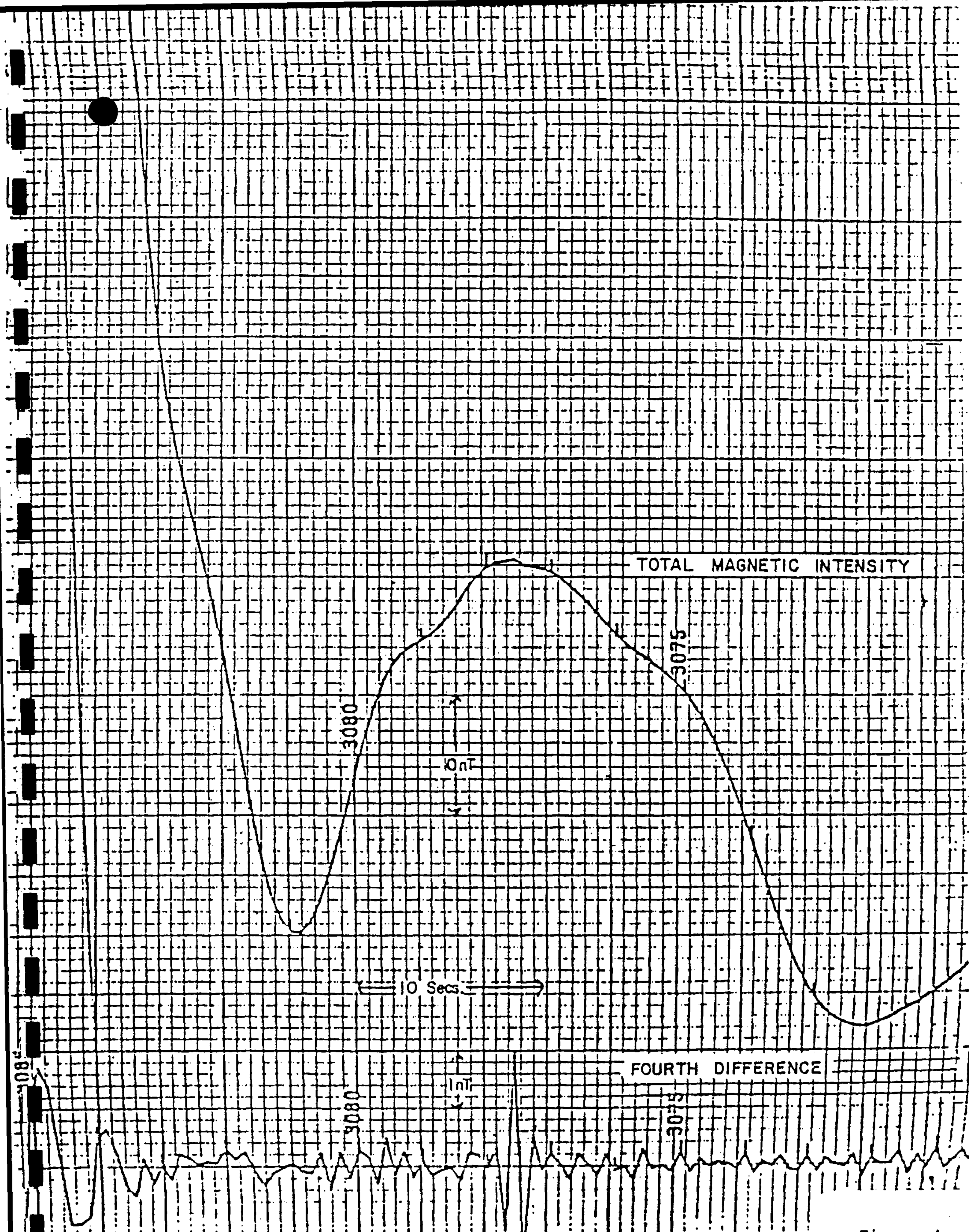

TOTAL MAGNETIC INTENSITY
3080
3075
10nT
10 Secs
FOURTH DIFFERENCE
1nT
3080
3075

Figure 4

REFERENCES

HOOD, P.J., HOLROYD, M.T., AND McGRATH, P.H., 1979, Magnetic methods applied to base metal exploration: in Geophysics and geochemistry in the search for metallic ores, P/J. Hood editor, Geol. Surv. Can. Econ. Geol. Report 31, p.77-104.

SCARBOROUGH, J.B., 1950, Numerical mathematical analysis, 2nd ed. Johns Hopkins Press, Baltimore.

APPENDIX B
GEOTEM EM SYSTEM (EQUIPMENT)

GEOTEM - Electromagnetic System

General

The operation of a towed bird time domain electromagnetic system involves the measurement of decaying secondary electromagnetic fields induced in the ground by a series of short current pulses generated from an aircraft mounted transmitter. Variation in the decay characteristics are analyzed and interpreted to provide information about the subsurface structure. The response of such a system utilizing a vertically oriented transmitter dipole and a horizontally oriented receiver coil has been documented by various authors including Palacky and West (1973).

The principle of sampling the induced secondary field in the absence of the primary field (during the "off time") gives rise to an excellent signal-to-noise ratio and an increased depth of penetration compared to conventional continuous wave (frequency domain) electromagnetic systems. Such a system is also relatively free of noise due to air turbulence.

Through free air model studies using the University of Toronto's Plate and Layered Earth programs it may be shown that the "depth of investigation" depends upon the geometry of the target. In a horizontally layered situation typical depth limits would be 250 m below surface for a homogeneous halfspace to 350 m for an inductively thin sheet or 200 m for a large vertical plate conductor. These values assume that a significant ponse at a delay time of 1.4 msec after turnoff is necessary and that the overlying or surrounding material is resistive. If fewer channels are deemed adequate to detect or resolve a given target, then the depth of investigation increases significantly.

In addition to substantial penetration, time domain AEM responds to a wide range of conductances. With measurements taken during the off time, significant effects are seen for values of 0.3 siemens or greater, thus covering the vast majority of physically realizable situations.

The method also offers very good discrimination of conductor geometry. This ability to distinguish flat-lying and vertical sources combined with profound depth penetration results in good differentiation of bedrock conductors from surficial conductors.

Equipment and Procedure

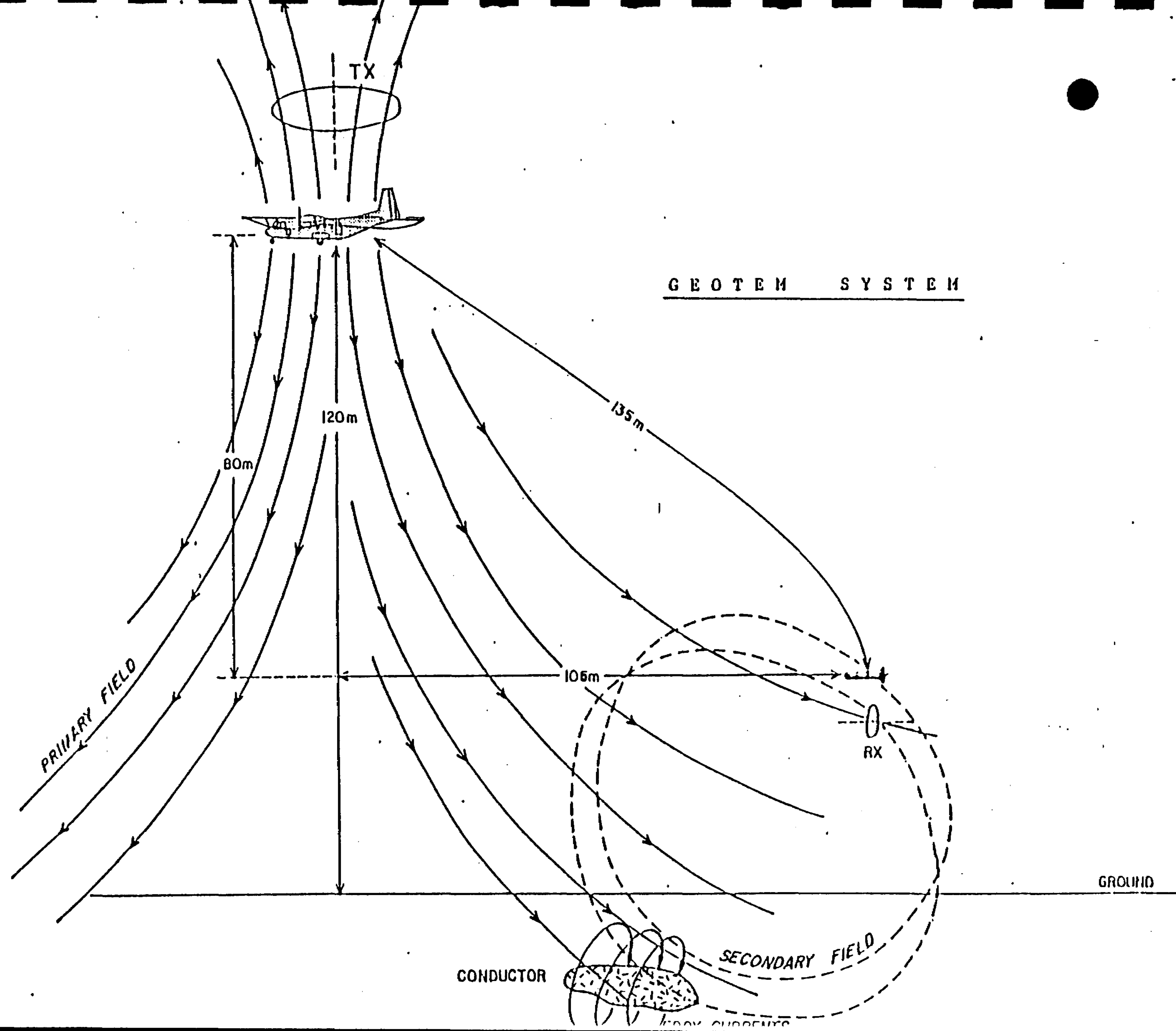
GEOTEM is a time domain towed bird electromagnetic system incorporating a high speed digital EM receiver. The primary electromagnetic pulses are created by a series of discontinuous sinusoidal current pulses fed into a three turn shielded transmitting loop surrounding the aircraft and fixed to the nose, tail and wing tips. The pulse repetition rate is typically 150 Hz (300 bipolar pulses per second) 125 Hz, 90 Hz or 75 Hz. At 150 Hz each current pulse lasts 1050 microseconds followed by 2280 microseconds of "off-time". Present peak amperage through the loop is 600 A resulting in a primary magnetic dipole moment of $4.5 \times 10^5 Am^2$.

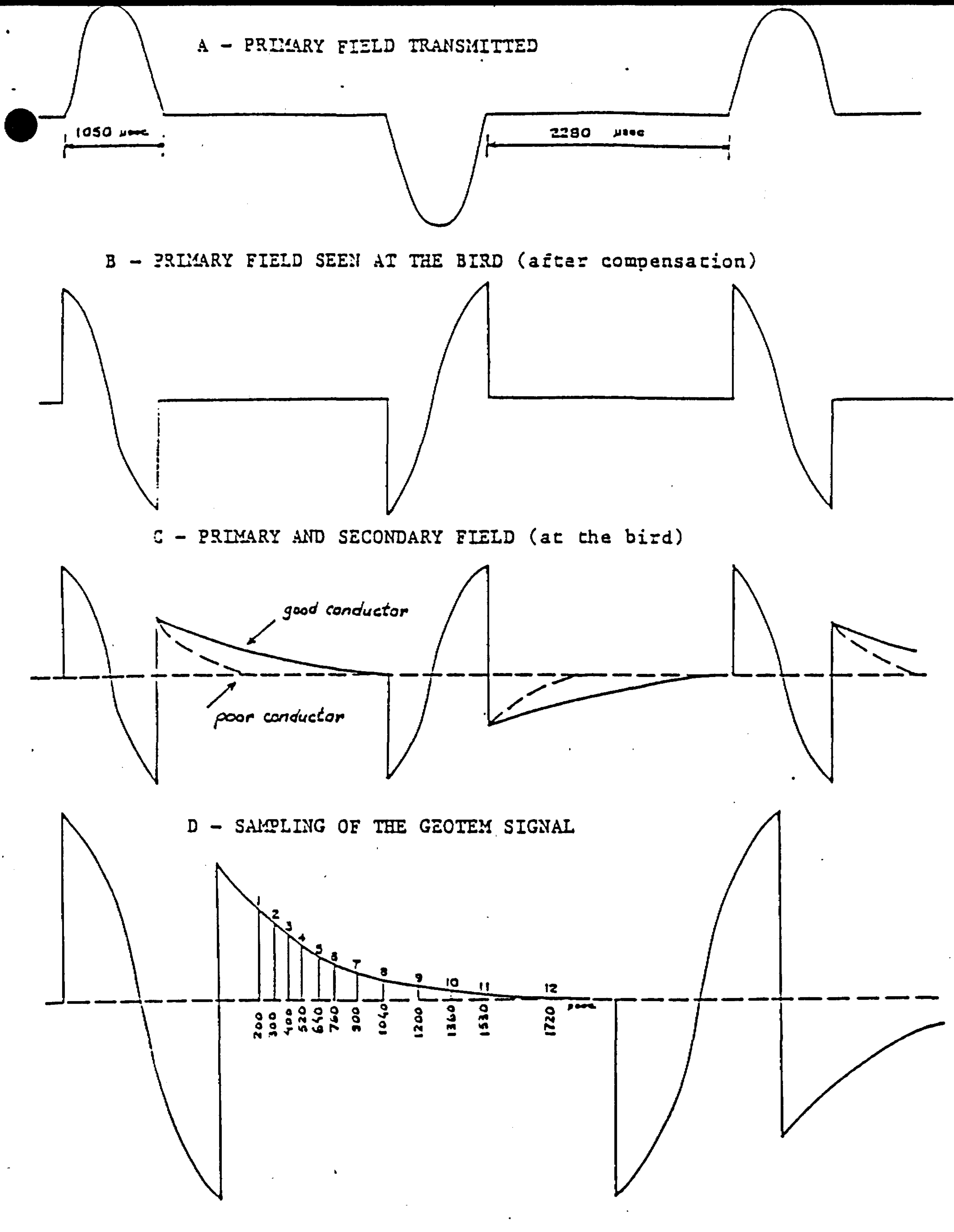
The receiver is a wire coil with a ferrite core and mounted horizontally in a "[illegible]d", towed by the aircraft on a 135 metre long cable. The cable is demagnetized to reduce noise levels. Mean terrain clearance for the aircraft is about 120 m with the bird being situated 80 m below and 105 m behind the aircraft. The geometry of the system is displayed in figure 1.

For each primary pulse a secondary magnetic field is produced by decaying eddy currents in the ground. These in turn induce a voltage in the receiver coil which is a measure of the electromagnetic field. The GEOTEM digital receiver samples the secondary and primary electromagnetic field over 20 time gates whose centres and widths are software <u>selectable</u> and which may be placed anywhere within or outside the transmitter pulse. This flexibility offers the advantage of configuring the gates to suite a particular survey, ensuring that the signal is samples as well as possible through its' entire dynamic range. A description of the gate settings used for this survey may be seen in table 1. Figure 2 gives a graphical display of the GEOTEM signal.

The signals received from each sample pass through anti-aliaing filters and are then digitized with an A/D converter at sampling rates of up to 100 kHz. The digital data flows from the A/D converter into an array processor where all the numerically intensive processing tasks, such as Fourier analysis, are carried out. The array processor is under the control of a multi-tasking minicomputer which provides all of the software management. Operations are carried out in the receiver are:

1.<u>Compensation.</u> During the flight the transmitter creates eddy currents within the structure of the aircraft and these have a measurable effect at the bird. This is achieved at the beginning of each flight by flying at an altitude such that no ground response is


GEOTEM SYSTEM
TX
120m
80m
135m
106m
RX
PRIMARY FIELD
GROUND
SECONDARY FIELD
CONDUCTOR



G E O T E M   S I G N A L

measurable. (Usually in excess of 600 m above ground level). Compensation for this signal is effected numerically within the receiver by a statistical analysis of the signal seen at the bird in the absence of ground response. The observed signal is used to define a compensation signal which is subtracted from the observed to produce a null and thus effectively buck out any response not due to ground sources.

2.Normalization. All EM response channels are automatically calibrated and reduced to parts per million of the primary field in the receiver. This is achieved by dividing the measured voltage by the voltage induced by the primary field at the bird.

3.Transient Analysis. Wideband frequency analysis enables the separation of noise from signal in real time.

4.Digital Stacking

5.Windowing of Transient Data

One of the major roles of the GEOTEM digital EM receiver is to provide diagnostic information on system functions and to allow for identification of noise events such as spherics which may be selectively removed from the EM signal.

The GEOTEM receiver automatically calibrates its received signal with reference to the primary field in ppm and hence compensates for the transmitter drift. Due to the fact that the receiver is digital, receiver drift in minimal. These factors result in much more reliable resisitivity mapping where base level shifts can dramatically affect results.

GEOTEM's high sampling rate (6 samples per second) as well as the fact that the samples are purely digital, results in maximum resolution of the secondary field. True amplitudes and anomaly shapes are recovered since there is no system time constant. Post flight processing then allows the user to optimize signal to noise ratio or lateral resolution.

Table 1

GEOTEM Gate Description

Pickle Lake Survey

Gate	Center	Width
1	200 usec	200 usec
2	300	200
3	400	200
4	520	200
5	640	300
6	760	400
7	900	400
8	1040	400
9	1200	400
10	1360	500
11	1530	600
12	1720 usec	600 usec
13-20	Used for diagnostic purposes.	

Note: All times shown are in microseconds after termination of the primary field.

APPENDIX C
DIGITAL ARCHIVE DESCRIPTION

DIGITAL ARCHIVE DESCRIPTION

Tape Number	:	R29001 & R29002
Area	:	S.E. Manitoba
Archive Date	:	Febuary 1987
Recording Density	:	9 Track, 1600 BPI
Recording Mode	:	32 - Bit Binary
Logical Record Length	:	156 Bytes (fixed)
Physical Blocksize	:	9984 Bytes (fixed)

Each physical block consists of 64 logical records of digital archived data. The composition of a single logical record is described below:

Logical Record Contents

Parameter	Bytes	Contents	
1	1 - 4	Line number x 100 + Part number	
2	5 - 8	Fiducial	
3	9 - 12	Easting	(utm metres)
4	13 - 16	Northing	(utm metres)
5	17 - 20	Edited magnetics	(gammas X 100)
6	21 - 24	Compensations	(gammas X 100)
7	25 - 28	Levelled magnetics	(gammas X 100)
8	29 - 32	Final magnetics	(gammas X 100)
9	33 - 36	Radar Altimeter	(feet)
10	37 - 40	Ground magnetics	(gammas X 10)
11	41 - 44	GEOTEM channel 1	(ppm)
12	45 - 48	GEOTEM channel 2	(ppm)
13	49 - 52	GEOTEM channel 3	(ppm)
14	53 - 56	GEOTEM channel 4	(ppm)
15	57 - 60	GEOTEM channel 5	(ppm)
16	61 - 64	GEOTEM channel 6	(ppm)
17	65 - 68	GEOTEM channel 7	(ppm)
18	69 - 72	GEOTEM channel 8	(ppm)
19	73 - 76	GEOTEM channel 9	(ppm)
20	77 - 80	GEOTEM channel 10	(ppm)
21	81 - 84	GEOTEM channel 11	(ppm)
22	85 - 88	GEOTEM channel 12	(ppm)
23	89 - 92	GEOTEM channel 13	(ppm)
24	93 - 96	GEOTEM channel 14	(ppm)
25	97 - 100	GEOTEM channel 15	(ppm)
26	101 - 104	GEOTEM channel 16	(ppm)
27	105 - 108	GEOTEM channel 17	(ppm)
28	109 - 112	GEOTEM channel 18	(ppm)
29	113 - 116	GEOTEM channel 19	(ppm)
30	117 - 120	GEOTEM channel 20	(ppm)
31	121 - 124	GEOTEM channel 21	(ppm)
32	125 - 128	GEOTEM channel 22	(ppm)
33	129 - 132	GEOTEM channel 23	(ppm)
34	133 - 136	GEOTEM channel 24	(ppm)
35	137 - 140	GEOTEM channel 25	(ppm)
36	141 - 144	GEOTEM channel 26	(ppm)
37	145 - 148	GEOTEM channel 27	(ppm)

38	149 - 152	GEOTEM channel 28	(ppm)
39	153 - 156	GEOTEM channel 29	(ppm)

Notes:

1. Levelled magnetics consist of the magnetic value plus the compensation value. Final magnetics consist of the levelled magnetics minus the I.G.R.F.
2. When the data for a line terminates in mid-block, the remainder of the block is zero filled.
3. Archived data terminates with a single end of file.

Projection	:	UTM
Spheroid	:	Clarke 1866
Central Meridian	:	93 degrees West
Scaling Factor	:	0.9996
False Easting	:	500000
False Northing	:	0

geoterrex limited
OTTAWA

GEOTEM – SPECTRO – DIGITAL

JOB NUMBER : 290 DATE : Jan 8/87 FLIGHT NUMBER : 5

OPERATIONS BASE : WINNIPEG. AREA NAME : ....

PILOT : BL CO-PILOT : TS OPERATOR : AP

		FID START	FID END	FILEMARK	CHECK
TAPE NUMBER : (Digital)	① 051	53180	59809	✓	OK
	②				
	③				
	④			BEGIN	END
FILM NUMBER :	①				
	②				
	③				

– ANALOG SCALES –

			FULL SCALE
GEOTEM SLOW TIME CONSTANT :	200	ppm/cm	20 cm
FAST TIME CONSTANT :	800	ppm/cm	5 cm
TOTAL FIELD :	3 X 10^5	mv/cm	5 cm
EM 23	1 X 10^5		5 cm
MAG FINE :	50	γ / cm	10 cm
COARSE :	5000	γ / cm	10 cm
4 th	.2	γ/cm	
BIRD SIGNAL :	1.9	volts	

			FULL SCALE
RADAR ALT :	15	m / cm	
BARO ALT :	AS 1	m / cm	
SPECTRO TOTAL :	—	Cts / cm	c
K 40 :	—	Cts / cm	c
UR :	—	Cts / cm	c
TH :	—	Cts / cm	c

PRE AMP SIGNAL : —

– POST FLIGHT COMMENTS –

TOTAL FLIGHT TIME : .... ON LINE : ....

MILES / KMS FLOWN : .... MILES / KMS ACCEPTED : ....

FLIGHT COMMENTS

WEATHER : ....

ATMOSPHERICS : ....

NAVIGATION : ....

WIND : .... mph

LINE No	PART	DIR.	FID START	FID END		FLT# 5 COMMENTS 82.0 + TESTS		MI K
4		S	53181	53315		1(Mod 2) Standlake TEST		
2		N	53361	53505				
3		S	53555	53703				
1		N	53755	53909				
205		S	54279	54409		Dupont TEST		
204		N	54459	54589				
203		S	54629	54753		5510		
202		N	54799	54927				
201		S	54977	55107				
108		N	55225	55329		Michal TEST		
107		S	55375	55483				
106		N	55529	55651				
105		S	55693	55819				
104		N	55865	55985				
103		S	56031	56155				
102		N	56195	56317				
101		S	56360	56485		Tape write errors		
						1(5x Table to tape).		
						2(Mod 2)		
154	2	S	57263	57379		Job 290	57270	57
153		N	57425	57565			57434	57
152		S	57611	57743		5520	57628	57
151	1	N	57793	57943	Sout	NAV	57804	57
150		S	57991	58121			58020	58
149		N	58171	58291			58186	58
148		S	58343	58459			58350	58
147		N	58513	58645			58526	58
146		S	58693	58833			58710	58
145		N	58881	58039			58876	5

LINE No	PART	DIR.	FID START	FID END		FLT # 5 COMMENTS	MILE KM
144		S	59081	59225		59080	592
143 ●		N	59267	59425		5520 59286	594
142		S	59471	59607		59470	596
141		N	59647	59809		59670	598
				WFM1			
				54 Table to tape			
				FFFFF			
						GROUND DATA ON TAPE #3	
						TAPE ID = DAY 8	

CALIBRATIONS

	PRE FLIGHT				POST FLIGHT			
	LINE NUMBER	FID START	FID END	ANALOG CHECK (√)	LINE NUMBER	FID START	FID END	ANA CHEC
SPECTRO								
BACKGROUND	8801				9801			
THORIUM	8802				9802			
URANIUM	8803				9803			
TEST LINE	8804				9804			
ALTIMETER	8400							
INPUT								
ZEROES	8901				9901			
Z → CAL → Z	8902				9902			
COMPENSATION	8903				9903			
BACKGROUND 2000'	8904				9904			
MAG ZERO, FULL SCALE								
TX ON / OFF								

COMMENTS

AIRCRAFT :

EQUIPMENT :

TABLE 1 - Survey Flying Specifications

Line Spacing:	- 250 metres
Line Direction:	- N 45° W east half, N0°W west half
Tolerance:	- up to 0.75 of line spacing allowed for a distance along line not to exceed 3 km.
Survey Altitude:	- 120 metres + - 15 metres.
Survey Speed:	- 115-120 knots.
Geotem Peak to Peak Noise Levels:	- Not to exceed 40 ppm after a 1.5 second time constant applied.
Calibration Sequences:	- Minimum 3 per flight. The second one approximately one hour into the flight.
Real-Time Chart Display:	- Altimeter, Magnetics, Magnetics 4th Difference, 6 out of 12 processed EM channels, Primary Field, Culture monitor.
Magnetic Diurnal Tolerance:	- Not to exceed 10 nT change during a 2 minute interval.

TABLE 2 - Processed EM Windows

Channel	Start Time	End Time	Centre	Width
1	0.23	0.31	0.27	0.08
2	0.31	0.42	0.36	0.10
3	0.42	0.63	0.52	0.21
4	0.63	0.94	0.78	0.31
5	0.94	1.77	1.35	0.83
6	1.98	2.19	2.12	0.29

Note: All times are in milliseconds and start, end and centre times are measured after the transmitter shut-off.

TABLE 3 - Geotem Channel Histogram Analysis

Channel	One S.D. Below Peak	Peak Value	One S.D. Above Peak
1	1420 ppm	4970 ppm	9500 ppm
2	330	720	2210
3	40	120	460
4	-10	20	80
5	-10	20	50
6	-10	10	40

Note: "S.D." is Standard Deviation.

TABLE 4 - Archived Data Chart Record Contents

Parameter	Scale	Zero Position
Line Number	- Line number x 100 + attempt number.	-
Fiducial	- Every 20th fiducial at 10 seconds/fiducial. (the labelled fiducial position is given by the small vertical tick at the bottom of the chart record).	-
Primary Field Monitor (PRIM)	- at 200,000 ppm/chart cm	5.0 cm
Altimeter (ALTM)	- at 100 feet/chart cm	8.0 cm
Edited Final Magnetic Field (PMAG)	- at 100 nT/chart cm (60000 nt removed)	20.0 cm
Geotem Channel 1 (EM01)	- at 400 ppm/chart cm	25.5 cm
Geotem Channel 2 (EM02)	- at 400 ppm/chart cm	26.0 cm
Geotem Channel 3 (EM03)	- at 400 ppm/chart cm	26.5 cm
Geotem Channel 4 (EM04)	- at 400 ppm/chart cm	27.0 cm
Geotem Channel 5 (EM05)	- at 400 ppm/chart cm	27.5 cm
Geotem Channel 6 (EM06)	- at 400 ppm/chart cm	28.0 cm
Culture or Hydro Monitor (HYDR)	- at 10,000 ppm/chart cm	30.0 cm

Note: Zero Position is measured from the top of the chart down.

TABLE 5 - OUTPUT Processing Summary

Lines Fitted: 1002 through 218001
Number of Data Points: 76510
Number of Fits: 73931
Percentage of Data Fitted: 96.63%

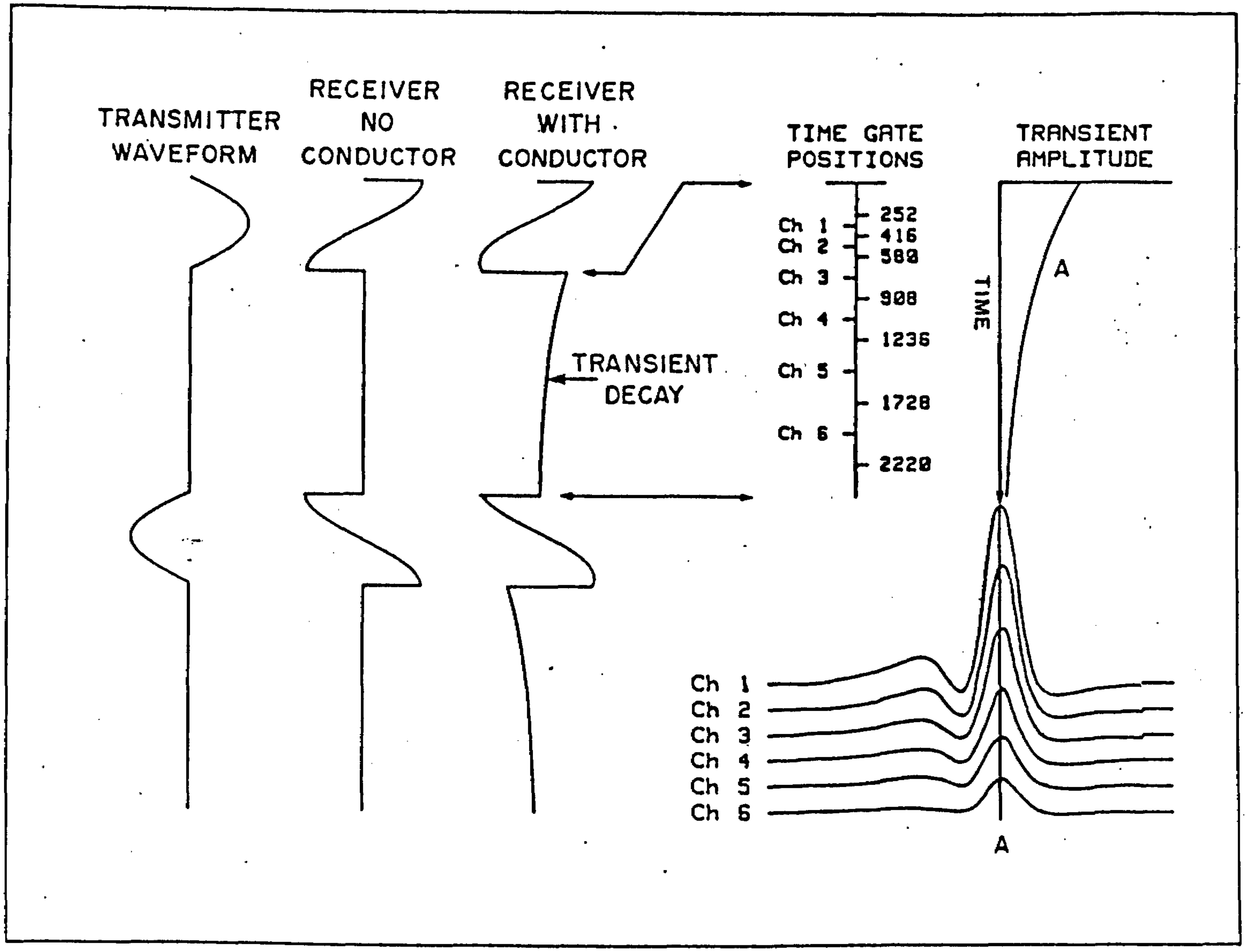
PERCENTAGE OF FITTED DATA MEASUREMENTS VS ERROR RATIO FOR
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

FILE: WHITE

ERROR RATIO =	.1	.2	.3	.4	.5	.6	.7	.8	
QUALITY VALUE	90.0	80.0	70.0	60.0	50.0	40.0	30.0	20.0	1
PERCENT FITTED	24.64	50.43	68.26	78.86	92.62	99.59	99.86	99.92	99
TIME CONSTANT									
0. - 99.	73.78	36.56	27.01	23.38	19.91	18.52	18.47	18.46	1
100. - 199.	26.20	62.14	66.67	59.94	51.04	47.46	47.34	47.31	4
200. - 299.	.01	1.27	6.26	16.51	19.64	18.43	18.38	18.37	1
300. - 399.	0.00	.00	.01	.07	8.88	10.19	10.25	10.24	1
400. - 499.	0.00	.00	.00	.02	.41	4.22	4.31	4.32	
500. - 599.	0.00	.00	.00	.02	.04	.84	.87	.89	
600. - 699.	0.00	0.00	.01	.01	.03	.21	.23	.24	
700. - 799.	0.00	.00	.01	.01	.02	.07	.08	.08	
800. - 899.	0.00	0.00	.00	.01	.01	.01	.02	.02	
900. - 999.	0.00	0.00	.00	.01	.01	.01	.02	.02	
1000. - 1199.	.01	.01	.00	.00	.00	.01	.01	.02	
1200. - 1399.	0.00	.01	.01	.01	.01	.01	.01	.01	
1400. - 1599.	0.00	.00	.00	.00	.00	.00	.00	.00	
1600. - 1799.	0.00	0.00	0.00	0.00	0.00	.01	.01	.01	
1800. - 1999.	0.00	0.00	0.00	.00	.00	.00	.00	.00	
2000. - 2999.	0.00	0.00	.00	.00	.00	.01	.01	.01	
3000. - 3999.	0.00	0.00	0.00	.00	.00	.00	.00	.00	
4000. - 4999.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5000. - 9999.	0.00	0.00	0.00	0.00	0.00	0.00	.00	.00	
10000. -100000.	0.00	0.00	0.00	0.00	0.00	.00	.00	.00	

TABLE 6 - OUTPUT Processed Data Chart Record Contents

Parameter		Scale	Zero Position
Line Number		- Line number	-
Fiducial			
Quality (QUAL)		- at 100%/chart cm	4.0 cm
Time Constant (TCST)		- at 250 microseconds/chart cm	5.0 cm
Edited Final Magnetic Field (PMAG)		- at 100 nT/chart cm	20.0 cm
OUTPUT Pseudo-channel	1	- at 800 ppm/chart cm	20.0 cm
Geotem Channel	1	- at 800 ppm/chart cm	22.5 cm
	2	- at 800 ppm/chart cm	23.0 cm
	3	- at 800 ppm/chart cm	23.5 cm
	4	- at 800 ppm/chart cm	24.0 cm
	5	- at 800 ppm/chart cm	24.5 cm
	6	- at 800 ppm/chart cm	25.0 cm
Residual Channel	1	- at 800 ppm/cm	27.0 cm
	2	- at 800 ppm/cm	27.5 cm
	3	- at 800 ppm/cm	28.0 cm
	4	- at 800 ppm/cm	28.5 cm
	5	- at 800 ppm/cm	29.0 cm
	6	- at 800 ppm/cm	29.5 cm
Primary Field		- at 20,000 ppm/chart cm	6.0 cm



A-CUBED INC.

PRINCIPLES OF GEOTEM OPERATION

572

Fig. 2

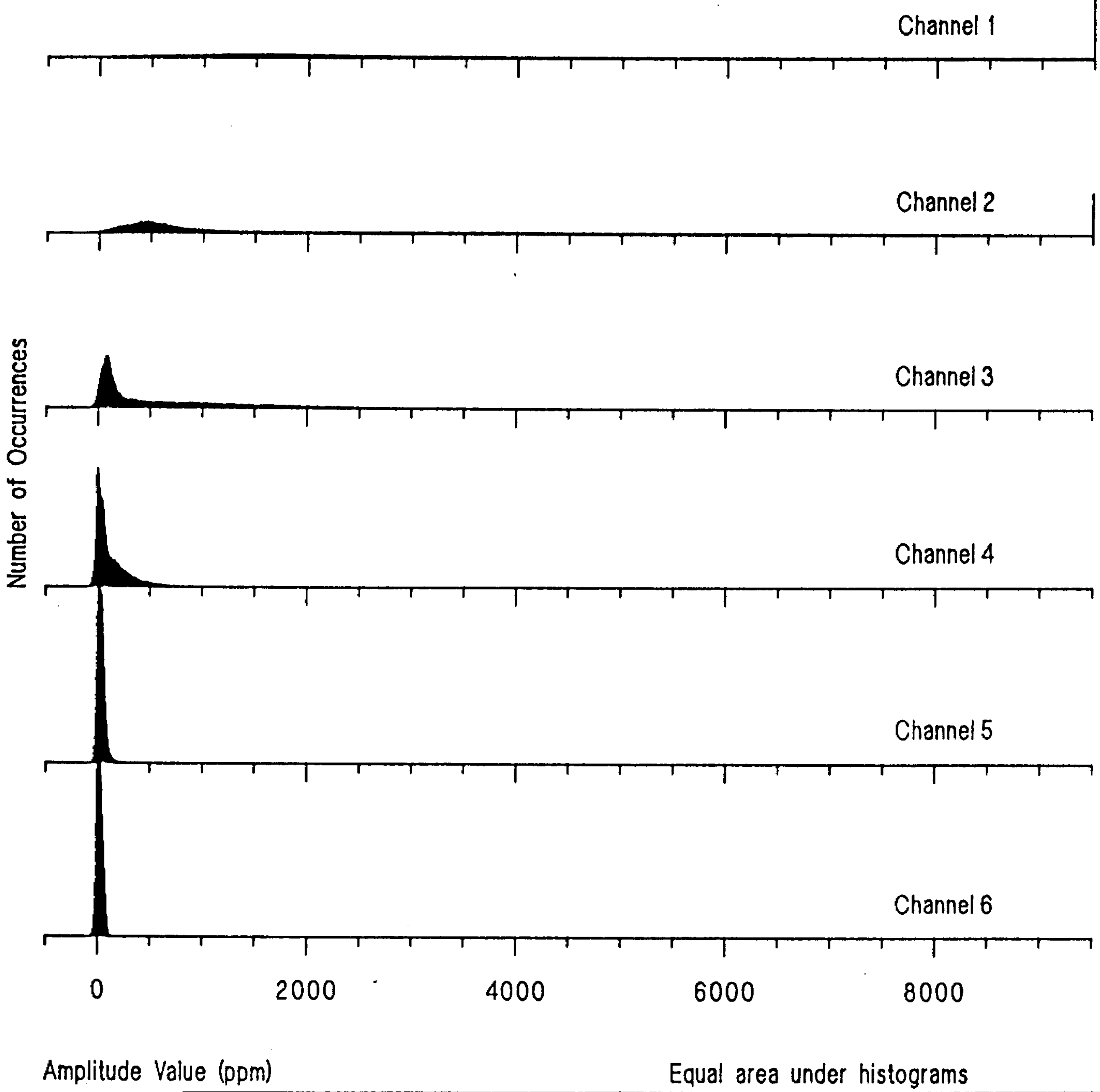
EM CHANNEL HISTOGRAM ANALYSIS FOR FILE: GEOTEM.NO2

Start Record: 1

End Record: 76510

Resolution: 10

Accept: WHITEMOUTH LAKE SURVEY AREA

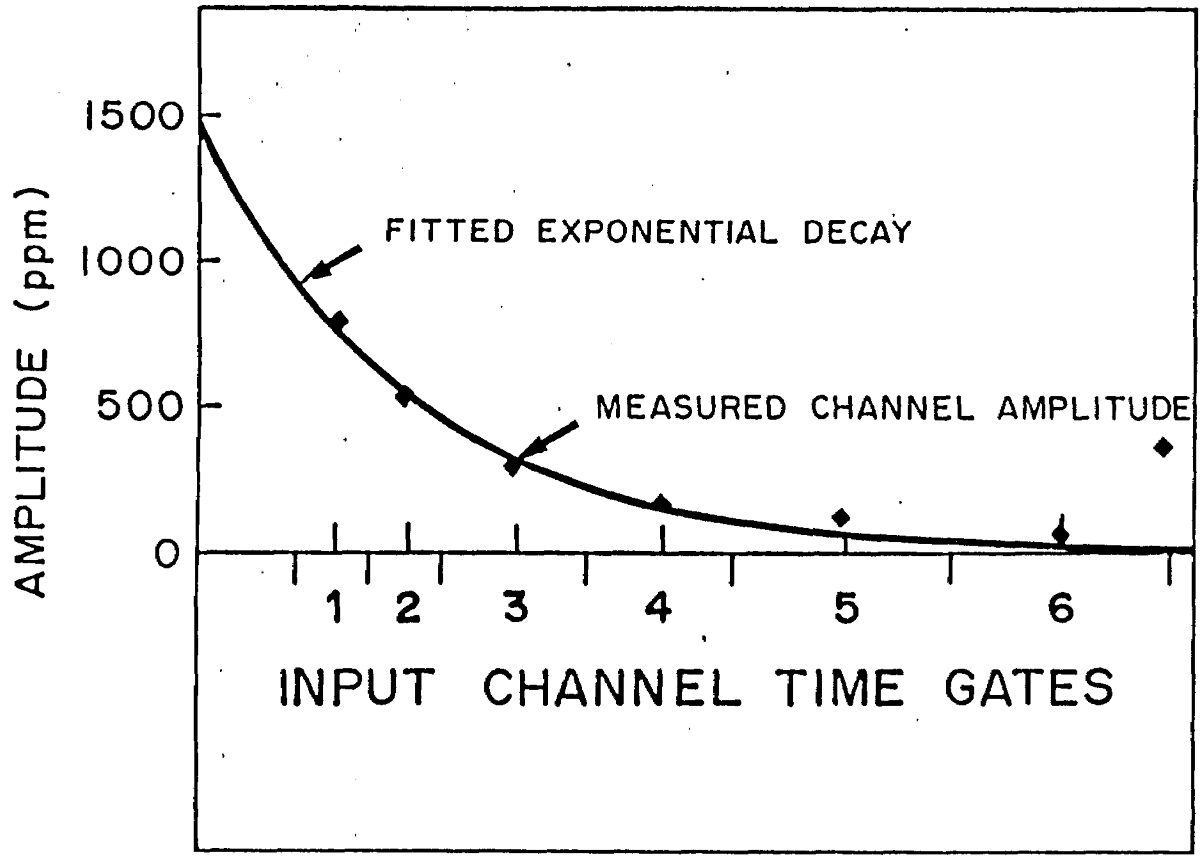


A-CUBED INC.

GEOTEM Channel 1 to 6 Histograms

6011

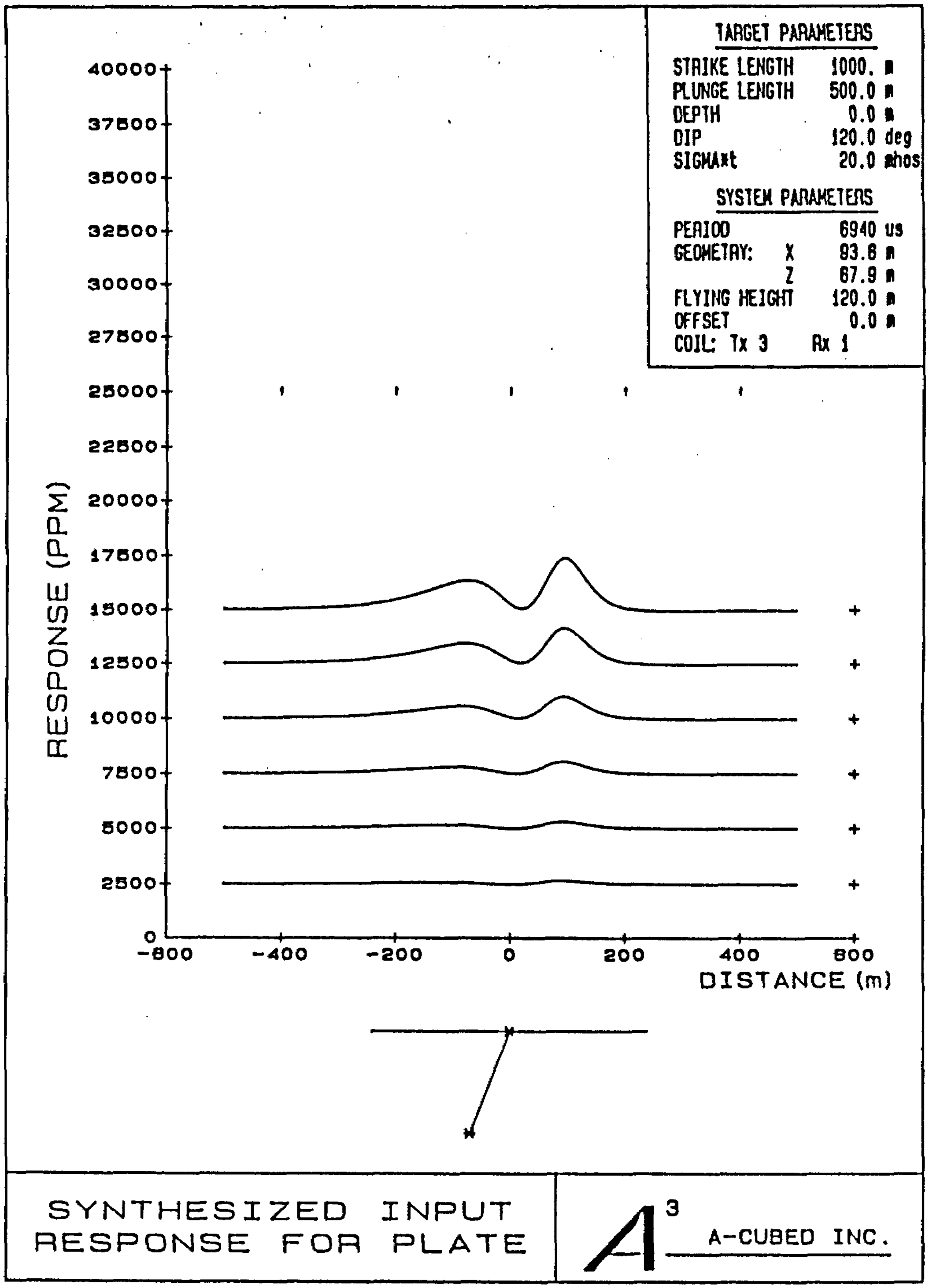
Fig. 3



A-CUBED INC.

PRINCIPLES OF OUTPUT PROCESSING

5 7 3	Fig. 4

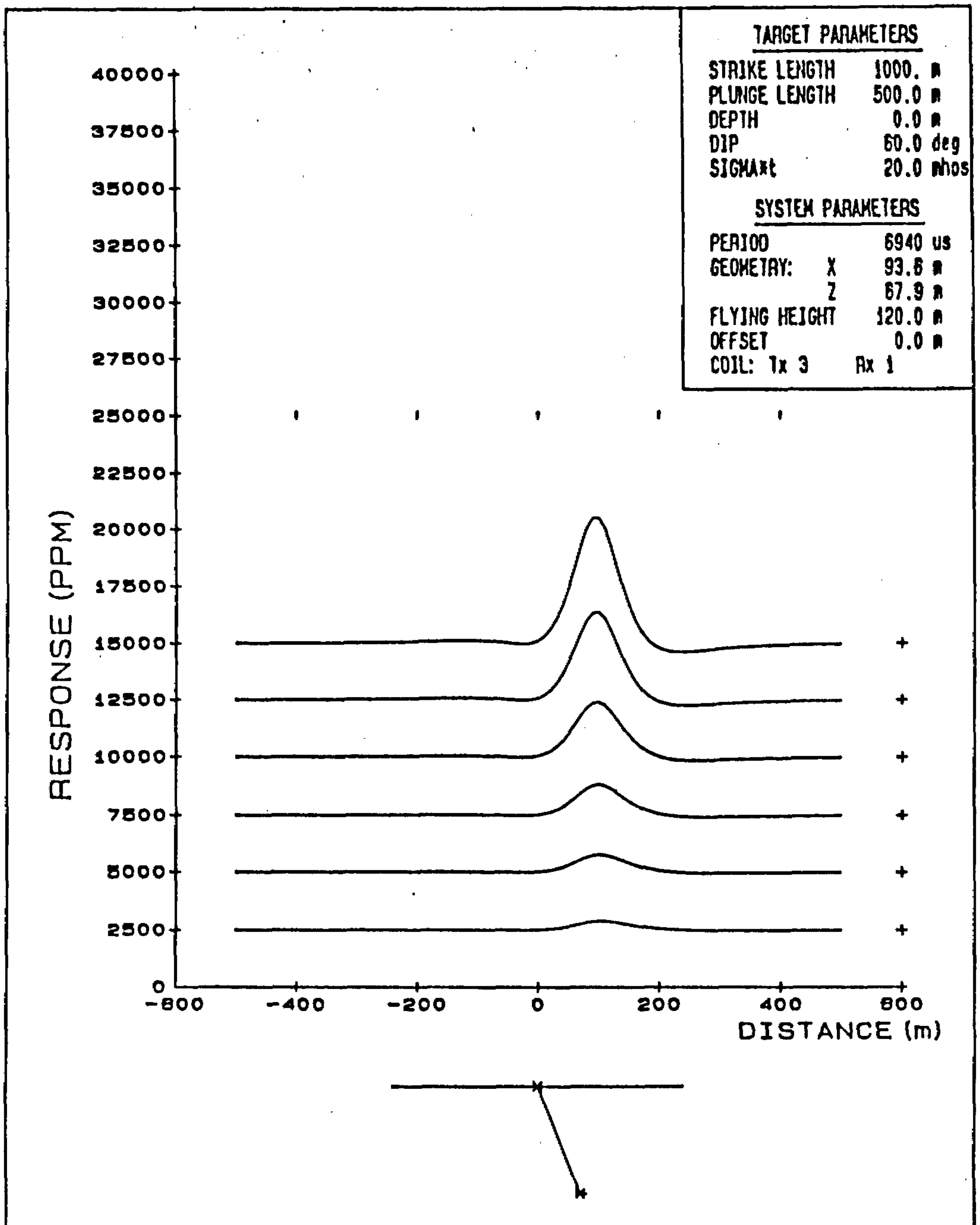


A-CUBED INC.

TYPICAL THIN PLATE GEOTEM ANOMALY FLYING UP DIP OF 60°

5 0 6 2

Fig. 5a



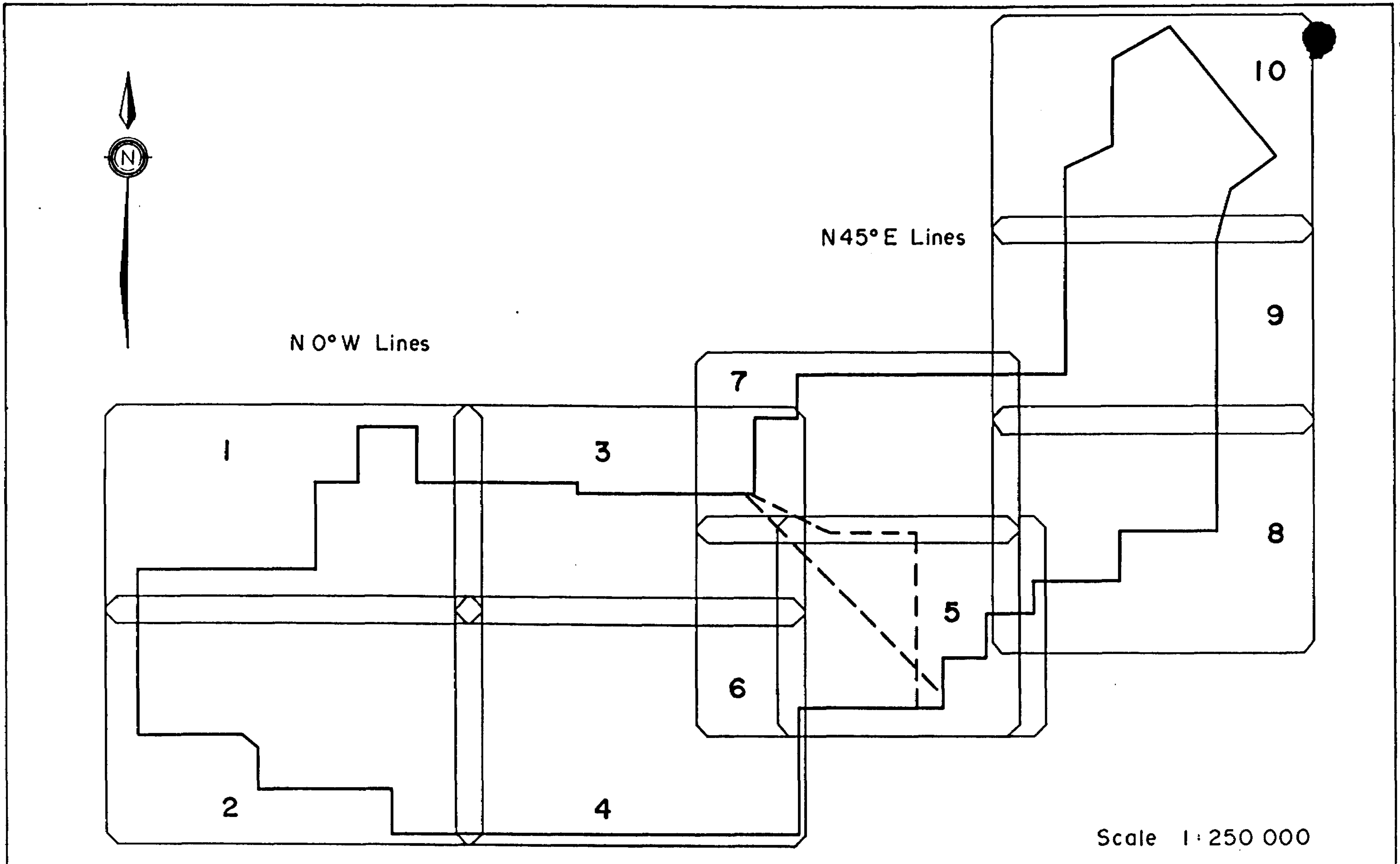
SYNTHESIZED INPUT RESPONSE FOR PLATE

A-CUBED INC.

A-CUBED INC.

TYPICAL THIN PLATE GEOTEM ANOMALY
FLYING DOWN DIP OF 60°

5062	Fig. 5b



A-CUBED INC.

OUTPUT Map Sheet Assignments

5 0 1 1	Fig. 6

ASSESSMENT WORK REPORT

GULL BAY - MACKAY ISLAND CLAIMS

SHOAL LAKE AREA   KENORA DISTRICT ONT.

CLAIM MAP G-2633 MOOSIN BAY AND G-2645 SNOWSHOE BAY

for

ALMADEN RESOURCES CORPORATION
807 - 475 HOWE ST.
VANCOUVER B. C. V6C 2B3

by

James M. L. Brown

April 30 1988

2.10116

RECEIVED
MAY 9 1988
MINING LANDS SECTION

TABLE OF CONTENTS

INDEX MAP

page 1

1.0 SUMMARY

1.1 Almaden Resources Corporation of Vancouver holds the mineral rights to the 91 claims referred to in this report.

1.2 An airborne EM-MAG survey was flown over the claims in June of 1987. Several anomalies of weak to moderate conductivity and some mag correlation were found.

1.3 Grids were established covering all the claims. Ground geophysics was carried out using Max-Min EM and vertical gradient mag. Diamond drilling tested some of the anomalies.

1.4 Access to the area is good but work for the most part is confined to the winter months.

1.5 Outcrop in the area is fair . The rocks in the area are felsic to mafic volcanic .

1.6 Ground EM anomalies show low to good conductivity. The mag gradient profiles indicate rock contact, shears and magnetic type anomalies.

1.7 Diamond drilling and mag gradient work is recommended.

2.0 INTRODUCTION

The following report describes the 1987 - 1988 exploration program on the Gull Bay - Mackay Island Shoal Lake project of Almaden Resources Corporation of Vancouver B.C.. The exploration program consisted of airborne geophysics , grids cut over selected anomalies , ground geophysics and diamond drilling .

3.0 LOCATION AND ACCESS

The claims are located on claim maps G-2633 Moosin Bay and G-2645 Snowshoe Bay . Physical location is in the Gull Bay , Calm Bay and Mackay Island areas of Shoal Lake - Topo map 52E/6 and 52E/11. The claims are approximately 55 kms. southwest by air from Kenora. Access by road from Kenora is west some 40 kms. on the TransCanada highway and then south some 12 kms. to the village of Kejeck on the Shoal Lake Indian reserve road. It is some 12 kms . further south by water or ice road.

4.0 SETTING

4.1 TOPOGRAPHY

The majority of the claims cover the waters of Shoal Lake. There are a few low islands and rocky shoals. The balance of the claims show a moderate relief.

4.2 VEGETATION

The ridges are pine covered and are bordered by black spruce and cedar muskeg . The islands are bordered by cedar and pine with some large elm trees and a jungle of juniper and thorny bramble in land from the lake shore.

4.3 CLIMATE

The climate is hot and humid in the summer and cold and dry in the winter.

4.4 SERVICES

The nearest good services are in Kenora. The property is accessible by air or by road and boat in the summer and by road and winter ice road in the winter.

5.0 CLAIMS

The following table is a summary of the claims covered by this report.

K 897445 - K 897463 inclusive
K 897466 - K 897472 inclusive
K 978354 - K 978401 inclusive
K 1018455- K 1018471 inclusive

6.0 HISTORY

Prospecting has been sporadic but thorough since about the turn of the century. Evidence of prospecting can be observed in the old shaft on Black Fox Island and some trenches on the Indian reserve at Calm Bay. Recently some airborne and ground geophysics has been done in the vicinity by Texas Gulf and by Lakelyn Mines in the late 1960's and early 1970's. BP-Selco also did some airborne and ground geophysics in the late 1970's and early 1980's. No diamond drilling has been done on the claims covered by this report to my knowledge.

7.0 GEOLOGY

Archean felsic ,intermediate and mafic volcanic rocks occur in the area. Drill core indicates flow units and some fragmental units indicating a nearby volcanic source. The rocks strike northeast and dip steeply to the northwest. There was one localized area showing a dip to the southeast. The rocks show greenschist alteration and quartz and quartz carbonate veinlets and fracture filling is common. Several narrow quartz feldspar porphyry units were found on some small islands in Gull bay. One low rocky shoal , the last one to the southwest in Gull Bay , is made up of a monzonite intusive. There is some evidence of shearing indicating it is a pre deformation intrusive. This may be the volcanic source - a volcanic neck?.

The Duport Deformation Zone passes through the Gull Bay claim group . The Duport Mine occurs within this zone some 5 kms. to the northeast. Some of the sulphide containing ore zones of the Duport mine show a banded appearance similar to the drilled sulphide anomalies in Gull Bay. The new Bag Bay discovery of St. Joe is some 15 kms. northeast of Gull Bay and may bear some relationship to the Sindar Deformation Zone.

There is a sulphide zone with low gold values whichs strikes from on shore , under the waters of Calm Bay . This zone occurs at the contact with a quartz feldspar porphyry unit and an intermediate volcanic flow unit.

The rocks in the vicinity of the shaft on Black Fox Island are mafic volcanic , possibly gabbroic. The rocks on Mackay Island indicate a mafic nature as well. There are quartz and quartz carbonate veinlets here as well. The Sindar Deformation Zone passes through this claim block.

8.0 AIRBORNE EM - MAG SURVEY

In June 1987 a combined EM and magnetic survey was carried out by A-Cubed Inc. for Almaden Resources Corp. . This was reconnaissance survey not detailed. It was to check whether there was a geophysical signature for the Duport mine as well as check for anomalies in the Gull Bay - Mackay Island area. A brief explanation of this survey is in the Appendix.

9.0 GROUND GEOPHYSICS

Three grids were established covering the three claim blocks comprising this property. They were laid out on ice and cut on land. Grid "G" was 101.575 kms., Grid "E" was 64.7 kms. and Grid "C" was 6.185 kms. for a total of 172.46 kms. of line. The lines were laid out at 100 meter intervals and stations chained at 25 meter intervals.

A Max-Min 11 + EM instrument was used for the ground survey. Coil separartion was 100 meters . Frequencies used were 444HZ and 888HZ.

The Max-Min 11 + instrument is designed to measure the in-phase and out-of-phase or quadrature components of anomalous electrically conductive zones.

The readings plotted on the maps are the profiles of the in-phase and out-of-phase components of the resulting field as detected at the receiving coil. These readings are percentage changes with reference to the primary field from the transmitting coil. A typical anomaly for a relatively thin , dike like conductor is positive readings while approaching the conductor and negative readings while the conductor lies between the coils followed by positive readings again as both coils are past the conductor. The in-phase and out-of-phase components show the same response and the ratio of of the two components gives an indication of the conductivity of the zone. The higher the ratio the better the conductivity. Ratios less one are considered poor conductors. The dip of the conductor is indicated by higher positive readings on the down dip side of the conductor. Areas of conductive overburden give positve in-phase readings and irregular negative out-of-phase readings. The edges of conductive overburden anomalies give negative responses in both in-phase and out-of-phase components with ratios less than one. Vertical conductors masked by conductive overburden show a negative response in the in-phase component but not necessariliy negative numbers . Profiles of the in-phase readings for two frequencies are compared to help grade anomalies.

A vertical gradient mag profile was run over several of the EM anomalies found on the three grids . The instrument used was a Geometrics G856x Proton mag with gradient option. The instrument uses a long staff and 2 sensors . The readings from both sensors are taken almost simultaneously thus eliminating the need for a base station. A computer was used for data reduction and automatic profiling. Both total field and gradient profile were obtained.

The G856x mag is capable of .1 gamma resolution. Profiles taken over EM anomalies help in assessing the EM anomalies and also indicate rock contacts and shears or faults if present.

10.0 DIAMOND DRILLING

Six holes for a total of 956 ft. were drilled . Core was BQ with N and B casing. All holes were drilled from the ice . Targets were EM anomalies on Grid "G". Two holes were abandoned with casing problems . The holes could not be redrilled because of spring ice problems. The other EM anomalies could not be drilled at this time for the same reason.

11.0 RESULTS

11.1 Airborne Mag-EM Survey

The airborne survey carried out by A-Cubed Inc. of Toronto found several interesting anomalies on the property as indicated in the brief report which is in the Appendix.

11.2 Ground Geophysics

Grid "G" - There are several EM anomalies on this grid which have merit. They show moderate to good conductivity. Some are single line anomalies and several are longer anomalies. The vertical mag gradient profiles correlate well with some of the EM anomalies indicating a contact anomaly or shear or else a mag anomaly (ie. pyrrhotite).

Grid "E" - There are a large number of EM anomalies on this grid showing poor to moderate conductivity. There is some conductive overburden and lake bottom effect on this grid making interpretation difficult. The vertical gradient mag profiles show some interesting rock contact and mag or shear zone anomalies .

Grid "C" - There is one EM anomaly on this grid with good conductivity and a coincident vertical gradient mag anomaly.

Mag and EM profiles , EM anomaly plan maps and grid location maps are in the Apendix.

11.3 Diamond Drilling

Two of the six holes drilled were abandoned . One of the holes had no mineralization. The other three holes all hit graphite schist with varying amounts of pyrite ,prrhotite and minor amounts of chalcopyrite and sphalerite. There was no economic mineralization indicated by assay. The logs , assay sheets and sections are in the Appendix.

12.0 CONCLUSION AND RECOMMENDATION

An early spring forced a halt to further drilling . Although no economic mineralization has been found in the drilling to date , the holes show some interesting alteration and rock types. The geophysical anomalies are also good . It is recommended that selected anomalies be drilled this coming winter.Further vertical gradient mag work is also recommended. The budget for this work is to decided upon later.

13.0 COSTS

Airborne geophysics	$ 5220.00
Line cutting	$ 38700.00
Ground geophysics	$ 23220.00
Diamond drilling	$ 41818.20
Vehicle rental	$ 750.10
Equipment rental	$ 620.80
Salaries	$ 2950.00
Miscellaneous	$ 375.00
	===========
TOTAL	$ 113655.10

PERSONNEL

GEOLOGISTS

J. Brown

D. Watt

AIRBORNE GEOPHYSICS CONTRACTOR

A-Cubed Inc. of Toronto

GROUND GEOPHYSICS CONTRACTOR

Carlson Explorations of Lac Du Bonnet

LINE CUTTING CONTRACTOR

Harry Nillson of Lac Du Bonnet

DIAMOND DRILLING CONTRACTOR

Wynne Drilling Ltd. Bissett Man.

STATEMENT OF QUALIFICATION
JAMES M. L. BROWN

1) I am a self employed exploration geologist residing at 17 Barton Ave. Winnipeg , Manitoba, with an office at 255 1/2 Provencher Ave.

2) I received a Bachelor of Science degree from the University of Manitoba in 1961 and have been practising my profession since that time.

3) I received considerable training and experience in conducting geophysical surveys and the interpretation of the results while working for a major mining company.

Respectfully submitted

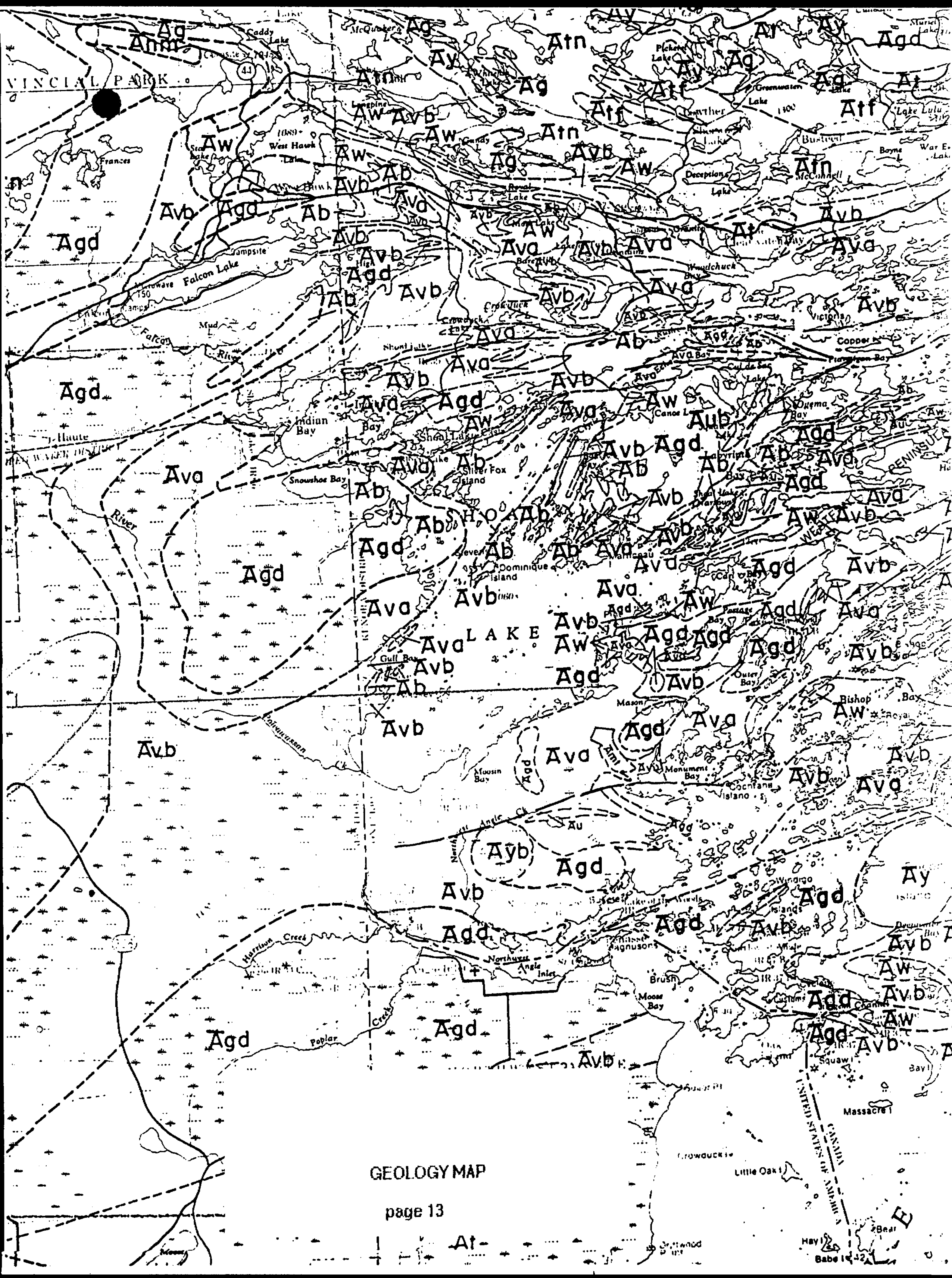
James M L Brown

James M. L. Brown

REFERENCES

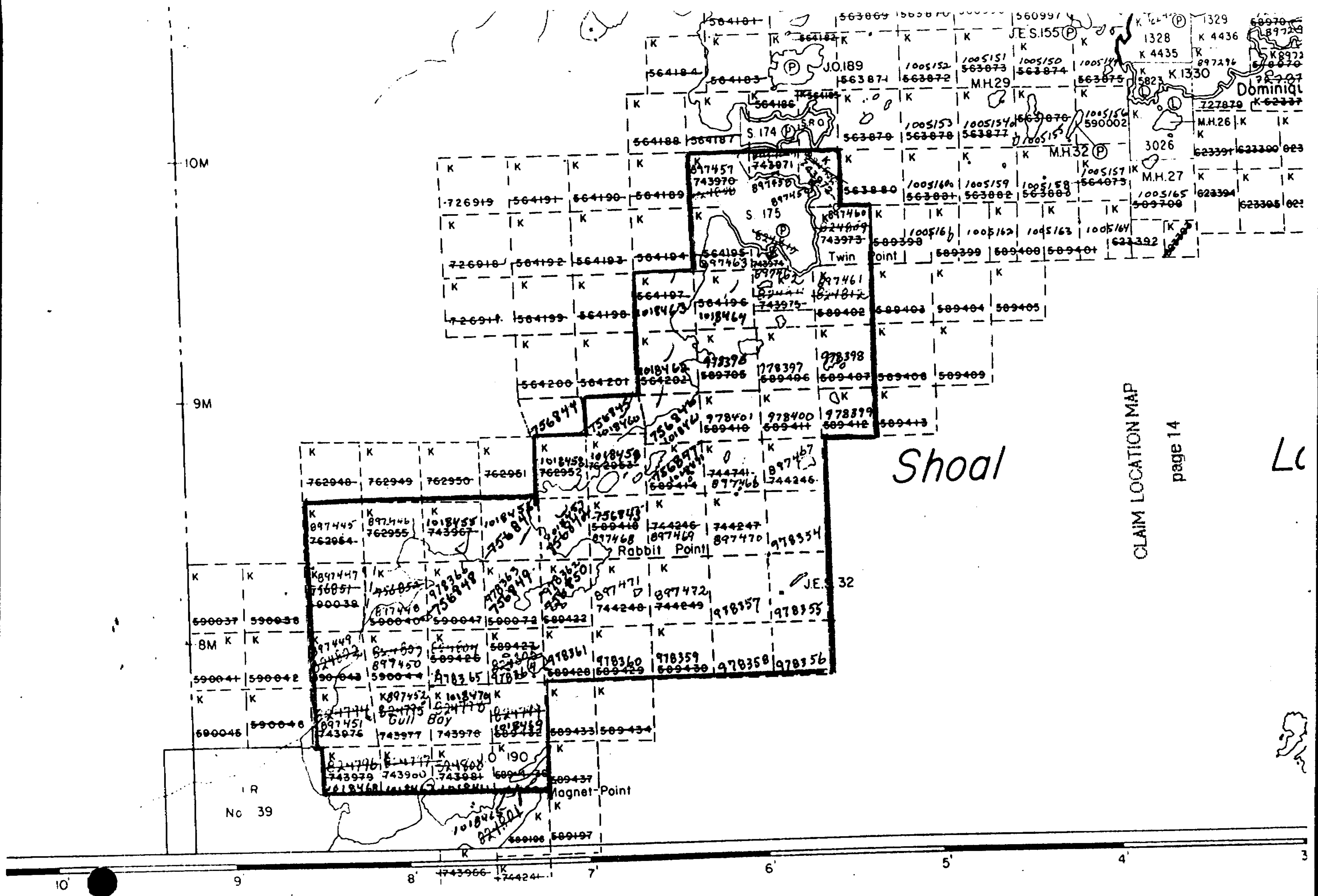
Percival, J.A., 1987, Geological compilation of Kenora (52E), Geological Survey of Canada Open File Map 1483.

Smith , P.M., 1985, The Geological Setting of the Duport Gold Mine , Shoal Lake , District of Kenora, in Summary of Field Work and Other Activities , 1985, Ontario Geological Survey Miscellaneous Paper 126, p. 210-214



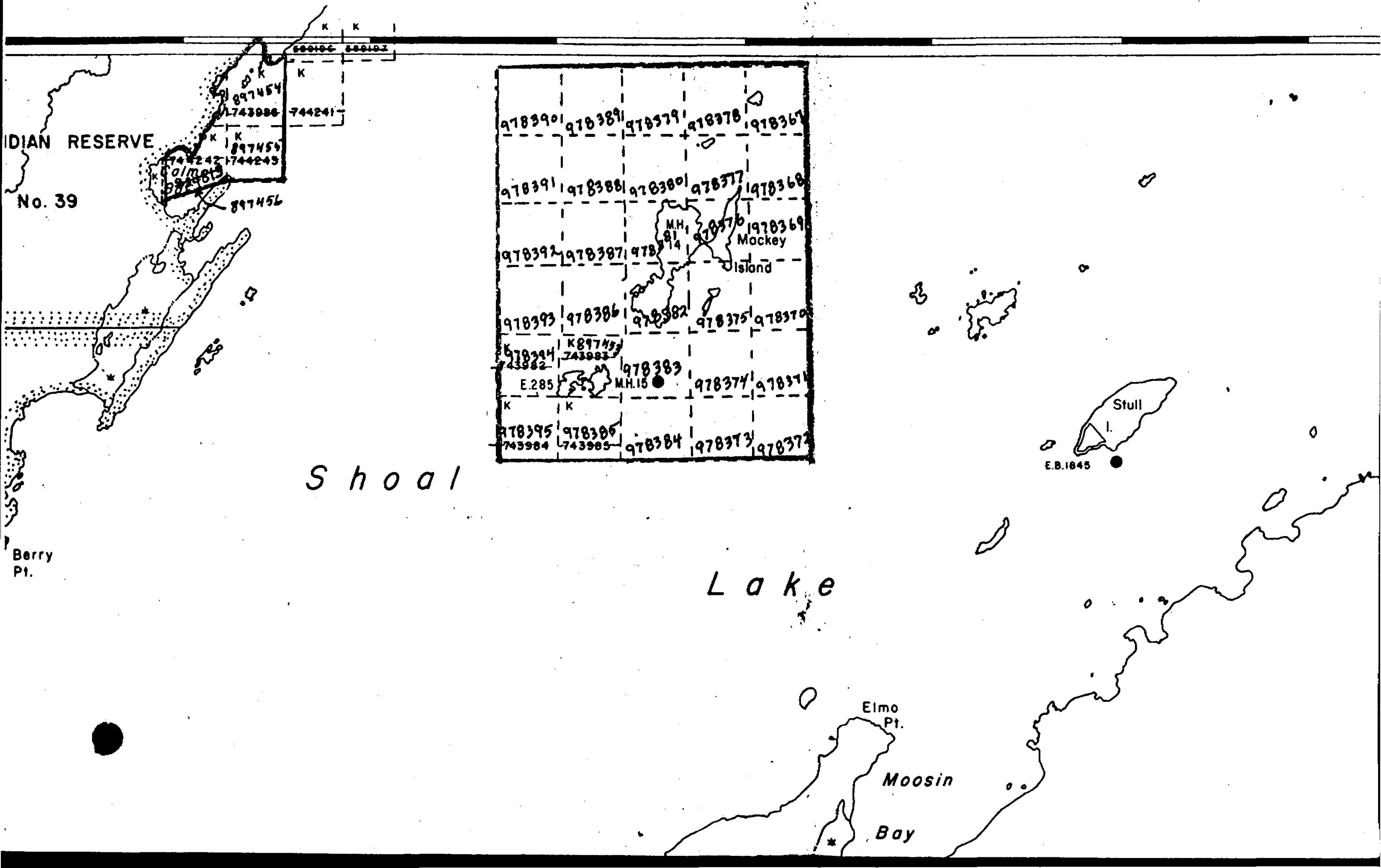
GEOLOGY MAP

page 13



CLAIM LOCATION MAP

page 14


IDIAN RESERVE
No. 39
Shoal
Lake
Mackey
Island
M.H.15
E.285
Stull
I.
E.B.1845
Berry
Pt.
Elmo
Pt.
Moosin
Bay

A-CUBED INC.
5566 TOMKEN ROAD
MISSISSAUGA, ONTARIO
CANADA L4W 1P4

Phone (416) 624-8878
Telex 06-965537
A-CUBED MSGA

January 12, 1988

File: 6011C

Mr. Duane Poliquin
Almaden Resources Corporation
Suite 807, 475 Howe Street
Vancouver, B.C.
V6C 2B3

Dear Duane:

Enclosed please find the materials I have prepared during our second look at the Michaelson Claim and Duport test lines. The following represents some points of interest.

i) The flight path (hence anomaly locations) are based on a simple fiducial-matching process using the accompanying flight photo-mosaic. It's the best we could do without the actual film-strips, but should serve to roughly position your anomalies. Please note that Line 101 is positioned incorrectly. It has been stretched, so don't pay a lot of attention to it.

ii) A number of the large anomalies appear to be responses from lake-bottom sediments, since they bear a spatial relationship to the shoreline. The decay rates are short (less than 200 us) and they disappear when presented in Pseudo-channel 8 form.

iii) Within the lake responses are a series of strong responses of considerably longer decay rate indicating higher conductivity and a probable bedrock source. These responses I have marked on the map and will discuss individually.

iv) The chart records are similar to the ones you already have except that I have carried out some spheric removal. The magnetics has been amplified to bring out more detail.

v) The interpretation map shows the approximate shoreline and the location of some selected anomalies. The last notes describe the selected anomalies.

vi) Anomaly D1 is a strong EM response with long decay rates hence good conductivity. The mag correlation is strong. The pattern of peaks can be interpreted as multiple zones dipping to the west although quite vertical. The EM responses seem to match the so-called Duport Deformation Zone (DDZ).

.../2

Anomaly D2 is a set of EM responses having good conductivity and poor magnetic correlation. Spatially it has not been correlated with any geological structures in the information I have.

Anomaly D3 is strong and has only a moderate time constant. It has the appearance of lake bottom sediment responses, but may in fact be those enhanced by underlying mineralization in the Sirdar Deformation Zone. (SDZ).

Anomaly M2 is much weaker, but the decay rates are good and there is weak magnetic response similar to D2. It may also represent an extension of DDZ.

Anomaly M3 is a complex series of strong EM responses having locally better conductivity. While lake bottom sediment responses produce anomalies like these, it has substantially better time constant and may represent a continuation of the SDZ.

I hope these notes are of value to you, Duane. Of course, there is more that could be done to refine this further including resurrecting your earlier plans to survey this area completely.

I have not issued any invoice for this work as we did not talk about costs when we visited; however, should you be able to help defray our expenses of $2,500.00 to do this second look work, it would help me a great deal. Let me know if you can, and we will issue an invoice.

Here's hoping you are successful both here and at Whitemouth. I mentioned to Dillon that we will be carrying out more GEOTEM surveys this year, particulalrly in Manitoba. Let me know if you need any flying done.

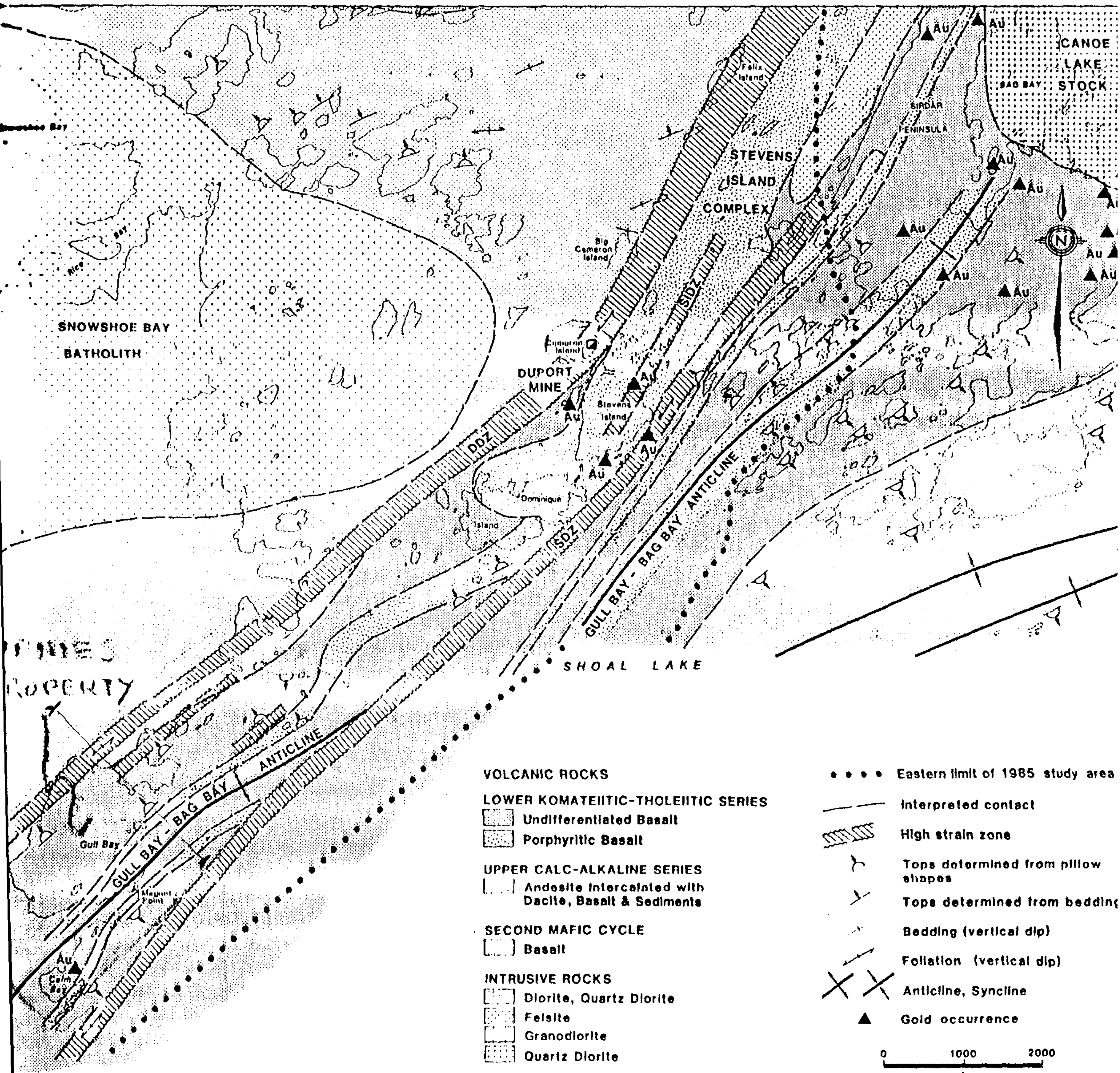
Yours truly,

A-CUBED INC.

Chris Vaughan
Manager - Data Services

CV/sgp

Encl.

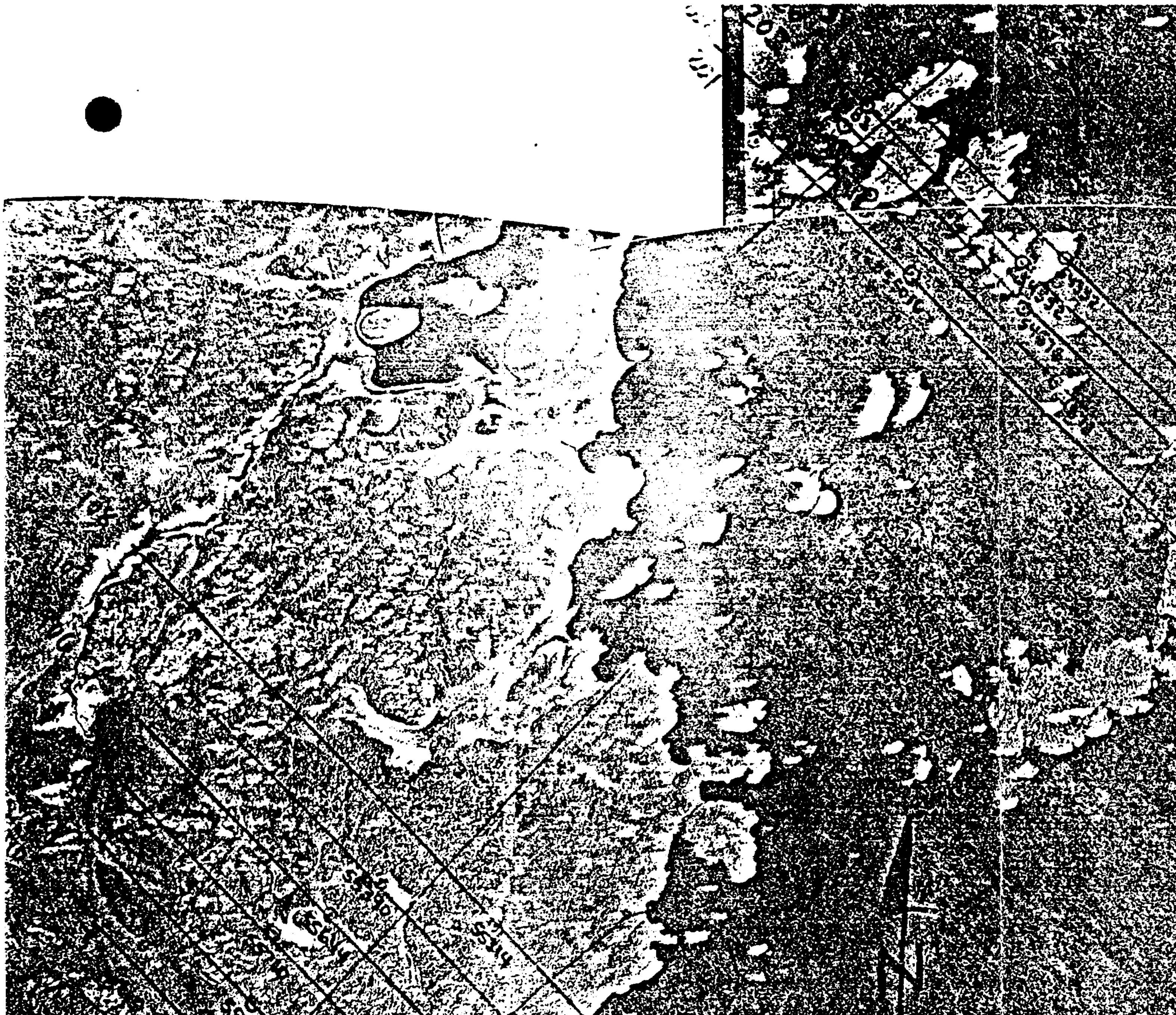


ure 1. Generalized geology of the Shoal Lake area (modified from Davies 1978). (Project 42.)

sill emplaced prior to tilting on the volcanic graphy.

small, elongated fine grained felsic body in- the LKTS along the western

2.708 b.y. (D. Davis, Geochronologist, Department Geology, University of Toronto, Toronto, persor communication, 1985).



1:50,000 SCALE

DIAMOND DRILL LOG

CLAIM K 897461 *LOCATION* SHOAL LAKE

MINING DIVISION KENORA

HOLE No: G88-1 *ANGLE* -50 ° *DIRECTION* GRID SOUTH

DEPTH 90 ft *GRID No:* "G" *CO-ORDINATES* 5+00 W 4+40 S

DATE STARTED MAR 24 1988 *FINISHED* MAR 26 1988 *LOGGED BY:* J. BROWN

DRILLED BY: WYNNE DRILLING

DEPTH FROM	DEPTH TO	DESCRIPTION OF CORE
0	90.0 T.D	Casing 0 - 35.0 water 35.0 - 90.0 clay Hole abandoned - casing broke off - moved to next hole rather than wait for more casing - couldn't get back because of poor ice conditions.

DIAMOND DRILL LOG

CLAIM K897467 *LOCATION* SHOAL LAKE

MINING DIVISION KENORA

HOLE No: G88-2 *ANGLE* -50° *DIRECTION* GRID SOUTH

DEPTH 197 ft *GRID No:* 'G" *CO-ORDINATES* 17+50 W 1+40 S

DATE STARTED MAR 26 1988 *FINISHED* MAR 27 1988 *LOGGED BY:* J. BROWN

DRILLED BY: WYNNE DRILLING

DEPTH FROM	DEPTH TO	DESCRIPTION OF CORE
0	86.0	casing 0-30.0 water 30-86.0 lake sediment
86.0	167.0	Altered andesite (chlorite schist) with some small quartz, carbonate fracture filled stringers. Several small zones of slight pyrite and pyyrhotite. (less than 3 cm.) 95.5-97.0 banded or layers of disseminated pyrite & pyyrhotite. 137.0-139.1 thin bands of pyrite and pyrrhotite with slight sphalerite in places and some thin minor quartz bands. 157.0-167.0 main mineralized zone: 10 % sulohides thin bands of pyrite & pyrrhotite with some slight sphalerite, chalcopyrite and marcasite in places.
167.0	177.0	metasediment - basalt tuff or greywacke.
177.0	197.0 EoH	altered andesite (chlorite schist)

DIAMOND DRILL LOG

CLAIM K1018459 *LOCATION* SHOAL LAKE

MINING DIVISION KENORA

HOLE No: G88-3 *ANGLE* -50° *DIRECTION* GRID NORTH

DEPTH 197 ft *GRID No:* "G" *CO-ORDINATES* 24+00 W
2+15 N

DATE STARTED MAR 30 1988 *FINISHED* MAR 31 1988 *LOGGED BY:* J. BROWN

DRILLED BY: WYNNE DRILLING

DEPTH FROM	*DEPTH TO*	*DESCRIPTION OF CORE*
0	47.0	Casing 0-15.0 water 15.0-47.0 lake sediments
47.0	197.0	biotite schist - (tuff?) - black - medium to coarse grained quartz & quartz carbonate veinlets some with minor pyrite crystals & blebs.
E o H		sections poorly to moderately siliceous 170.0-178.0 sections with minor pyrite 172 small quartz vein with slight pyrite 187.5 quartz veinlet with slight chalcopyrite. core angle @ 80 ft. 40 °

DIAMOND DRILL LOG

CLAIM K897468 *LOCATION* SHOAL LAKE

MINING DIVISION KENORA

HOLE No: G88-4 *ANGLE* -50° *DIRECTION* GRID SOUTH

DEPTH 197 ft *GRID No.* "G" *CO-ORDINATES* 28+00 W 2+15 N

DATE STARTED APRIL 1 1988 *FINISHED* APRIL 2 1988 *LOGGED BY:* J. BROWN

DRILLED BY: WYNNE DRILLING

DEPTH *FROM*	*TO*	*DESCRIPTION OF CORE*
0	50.0	Casing 0-25.0 water 25.0-50.0 lake sediment
50.0	72.0	biotite schist - dark green to grey - (tuff?) quartz & minor quartz carbonate stringers some occasional pyrite blebs & occasional fragmental textures core angle @ 60 ft 35°
72.0	98.0	chlorite schist - (altered andesite?) - green sileous, well fractured with quartz stringers (less than 5mm) - and minor pyrite blebs. Gradational contact.
98.0	123.0	biotite schist - (tuff?)- siliceous, black fine grained uppper sections talcose 110.0-123.0 mineralized zone banded pyrite and graphite < 20 % sulphides core angle @ 110 ft 40°
123.0	136.5	chlorite, biotite schist - flow unit - (andesite?) gradational contacts
136.5	137.2	mineral zone : pyrite band in siliceous biotite schist
137.2	147.5	chlorite schist - contorted with quartz stringers and minor pyrite
147.5	158.7	chlorite, biotite schist - green coarse grained
158.7	161.8	chlorite schist light green grey - flow unit - (rhyolite?) - minor pyrite
161.8	170.3	mineralized zone 161.8-163.8 sericite schist with minor pyrite 163.8-170.3 biotite graphitic schist with < 20% sulphides banded pyrite, pyrrhotite and minor chalcopyrite & sphalerite contorted, vuggy and some slump structure core angle 60 °
170.3	197.0	chlorite biotite schsit - light green to grey - moderately silceous - flow unit (rhyolite?) quartz & quartz carbonate fracure filling

E o H

DIAMOND DRILL LOG

CLAIM K897468 *LOCATION* SHOAL LAKE

MINING DIVISION KENORA

HOLE No: G88-5 *ANGLE* -50 ° *DIRECTION* GRID SOUTH

DEPTH 172 ft *GRID No:* "G" *CO-ORDINATES* 30+00 W 2+85 N

DATE STARTED APRIL 2 1988 *FINISHED* APRIL 4 1988 *LOGGED BY:* J. BROWN

DRILLED BY: WYNNE DRILLING

DEPTH FROM	*DEPTH TO*	*DESCRIPTION OF CORE*
0	17.0	Casing 0-3.0 water 3.0-17.0 lake sediments
17.0	37.5	biotite schist - siliceous brown to grey banded flow unit - (mafic tuff?) core angle 40 ° 25.0-27.0 mineral zone graphite schist with pyrite bands, < 2 cm. - mudflow unit - < 5% sulphides 30.8-32.0 mineral zone same as above
37.5	49.6	biotite schist - siliceous brown to green - fragmental flow unit - (rhyolite with chert?) 37.5-49.6 mineral zone interfragmental pyrite & thin pyrite bands & disseminated pyrite < 1% sulphides
49.6	65.6	biotite schist - siliceous grey banded flow unit grades to chlorite schist at the bottom (tuff to andesite?) 54.2-56.5 mineral zone siliceous (rhyolite?) with disseminated pyrite and thin pyrite bands < 2% sulphides - siliceous sericite schist at the hanging wall contact
65.6	84.8	chlorite schist - siliceous green fractured - (andesite?) - quartz & quartz carbonate fracture filling - broken core in places
84.8	112.0	biotite schist - siliceous black to grey coarse grained flow unit - (mafic tuff?) 99.0-117.2 mineral zone 99.0-102.0 graphite schist with slight pyrite 102.0-107.0 graphite schist contorted, cross bedding - flow unit - pyrite bands < 3cm. - < 2 % sulphides 107.0-112.0 graphite schist with slight thin pyrite bands 112.0-117.2 graphite schist with slight pyrite core angle 40 °

117.2	172.0	biotite chlorite schist - siliceous grey to green flow unit - (tuff to andsite with some rhyolite?)			
E o H		121.2-122.2	mineral zone	graphite schist (mudflow) - with slight pyrite	
		136.3-137.1	mineral zone	siliceous sericite schist (rhyolite) - with slight pyrite	
		139.5-140.5	mineral zone	siliceous sericite schist - hanging wall - slight pyrite	
		140.5-145.9	main mineral zone sharp upper & lower contacts - graphite schist contorted with crossbedding - > 40 % sulphides - pyrite & pyrrhotite		
		145.9-147.0	mineral zone	siliceous sericite schist - (rhyolite) - hanging wall slight pyrite & quartz carbonate - grades into chlorite biotite schist	

DIAMOND DRILL LOG

CLAIM	K897450			*LOCATION*	SHOAL LAKE
MINING DIVISION	KENORA				
HOLE No:	G88-6	*ANGLE*	-50 °	*DIRECTION*	GRID SOUTH
DEPTH	103 ft	*GRID No:*	"G"	*CO-ORDINATES*	46+50 W 8+25 N
DATE STARTED	APRIL 4 1988	*FINISHED*	APRIL 6 1988	*LOGGED BY:*	J. BROWN
DRILLED BY:	WYNNE DRILLING				

DEPTH FROM	DEPTH TO	DESCRIPTION OF CORE
0	103.0	Casing 0-13.0 water 13.0-73.0 clay 73.0-83.0 boulders 83.0-93.0 "ledge" 93.0-103.0 gravel & sand hole abandoned due to casing problems
E o H		

COMPANY ______

DIAMOND DRILL RECORD

DATE BEGAN MAR 24 /88 DATE COMPLETED MAR 26/88

PROPERTY SHOAL LAKE PROJECT No GULL DEPTH 90

HOLE No G88-1 CO-ORD 5+00 W HORIZONTAL LENGTH ______

SHEET No 1 4+40 S DIRECTION ~~50°~~ GRID SOUTH

CLAIM No K 897466 ELEVATION ______ ANGLE -50°

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

DEPTH	NUMBER	WIDTH	ASSAY AU	AG	CU	ZN	PB	NI	WIDTH X ASSAY						AVERAGES WIDTH	AU	AG	CU	ZN	PB	NI
0																					
90	waste		casing hole abandoned.																		

COMPANY

DIAMOND DRILL RECORD

DATE BEGAN MAR 26/88 DATE COMPLETED MAR 27/88

PROPERTY SHOAL LAKE PROJECT No GULL DEPTH 197

HOLE No G88-2 CO-ORD 17+50 W HORIZONTAL LENGTH

SHEET No 1 1+40 S DIRECTION GRID SOUTH

CLAIM No K 897467 ELEVATION ANGLE -50°

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

DEPTH	NUMBER	WIDTH	ASSAY AU	AG	CU	ZN	PB	NI	WIDTH X ASSAY						AVERAGES WIDTH	AU	AG	CU	ZN	PB	NI
0																					
86.0		86.0	casing.																		
95.5	waste	9.5																			
97.0	77201	2.5	<0.001	<0.01																	
137.0	waste	40.0																			
139.1	77202	2.1	<0.001	0.07																	
157.0	waste	17.9																			
159.0	77203	2.0	"	0.09																	
164.0	77204	5.0	"	0.09																	
167.0	77205	3.0	"	0.13																	
197.0	waste	30.0																			
T.D.																					

COMPANY ______

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

DIAMOND DRILL RECORD

DATE BEGAN MAR 27/88 DATE COMPLETED MAR 30/88

PROPERTY SHOAL LAKE PROJECT No GULL DEPTH 197

HOLE No G 88-3 CO-ORD 24+00W HORIZONTAL LENGTH

SHEET No 1 2+18N DIRECTION GRID NORTH

CLAIM No K 1018459 ELEVATION ANGLE -50°

			ASSAY						WIDTH X ASSAY						AVERAGES						
DEPTH	NUMBER	WIDTH	AU	AG	CU	ZN	PB	NI							WIDTH	AU	AG	CU	ZN	PB	NI
0 -38		38.0	Casing.																		
171.0	WASTE	133.0	~~Casing~~																		
172.1	77221	1.1	<0.001	0.04																	
197.	WASTE	24.9																			
T.D.																					

COMPANY

DIAMOND DRILL RECORD

DATE BEGAN MAR 31/88 DATE COMPLETED Apr. 2/88

PROPERTY SHORL LAKE PROJECT No GULL DEPTH 197

HOLE No G88-4 CO-ORD 28+00W HORIZONTAL LENGTH

SHEET No 1 2+15N DIRECTION GRID SOUTH

CLAIM No K 897468 ELEVATION ANGLE -50°

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

			ASSAY						WIDTH X ASSAY						AVERAGES						
DEPTH	NUMBER	WIDTH	AU	AG	CU	ZN	PB	NI							WIDTH	AU	AG	CU	ZN	PB	NI
0																					
50.0		50.0	casing																		
135.8	waste	85.8	<0.001	0.05																	
137.1	77222	1.3																			
159.5	waste	22.4																			
164.0	77223	4.5																			
170.3	77224	6.3																			
171.5	77225	1.2																			
197.0	waste.	25.5																			
TD.																					

COMPANY ______

DIAMOND DRILL RECORD

DATE BEGAN Apr. 2/88 DATE COMPLETED Apr. 4/88

PROPERTY SHOAL LAKE PROJECT No GULL DEPTH 172

HOLE No G88-5 CO-ORD 30+50 W HORIZONTAL LENGTH ______

SHEET No 1 2+85 N DIRECTION GRID SOUTH

CLAIM No K 897468 ELEVATION ______ ANGLE -50°

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

			ASSAY						WIDTH X ASSAY						AVERAGES						
DEPTH	NUMBER	WIDTH	AU	AG	CU	ZN	PB	NI							WIDTH	AU	AG	CU	ZN	PB	NI
0																					
17.0		17.0	casing																		
25.0	waste	8.0																			
27.0	77206	2.0		0.01																	
30.8	waste	3.8																			
32.0	77207	1.2		<0.01																	
37.5	waste	5.5																			
41.0	77208	3.5		0.01																	
46.0	77209	5.0																			
49.6	77210	3.6																			
54.2	waste	4.6																			
56.5	77211	2.3		<0.01																	
99.0	waste	42.5																			
102.0	77212	3.0		<0.01																	
107.0	77213	5.0		0.05																	
112.0	77214	5.0		0.02																	
117.2	77215	5.2		<0.01																	
121.2	waste	4.0																			
122.2	77216	1.0		0.01																	
136.3	waste	14.1																			
137.1	77217	0.8		0.08																	
139.5	waste	2.4																			
140.5	77218	1.0																			
145.9	77219	5.4																			
147.0	77220	1.1																			
172.0	waste	25.0																			
T.D.																					

COMPANY

DIAMOND DRILL RECORD

DATE BEGAN ~~MAR 2/88~~ April 4/88 DATE COMPLETED April 6/88

PROPERTY SHOAL LAKE PROJECT No GULL DEPTH 103 ft

HOLE No G 88-6 CO-ORD 46+50 W HORIZONTAL LENGTH

SHEET No 1 8+25 N DIRECTION GRID SOUTH

CLAIM No K 897450 ELEVATION ANGLE -50°

CORRECTED DIP TESTS

RESIDENT GEOLOGIST

DEPTH	NUMBER	WIDTH	ASSAY AU	AG	CU	ZN	PB	NI	WIDTH X ASSAY						AVERAGES WIDTH	AU	AG	CU	ZN	PB	NI
0																					
103	waste		casing		hole abandoned																

Initial Interpretation Report
School Lake/Whitemouth Project
for
Mr. Jim Brown

March 24, 1988

(1) Line 33W - Grid G.
   (a) Rock unit contact 8.40S based on 200 nT level change.
   (b) Variable rock unit between 2S and 6N based on level change and anomolous fluctuations.
   (c) Magnetic anomaly pair between 10N and 12N.

Note: Gradient fluctuations coincide with (a) and (c) above.

2. Line 38W - Grid G.
   (a) Rock unit between 11N and 4N based on smooth character of magnetic gradient.
   (b) Magnetic anomalies over the rest of the line visable in both total field and gradient profiles.

3. Shoal Lake and Whitemouth survey profiles interpreted on profile sheets P1 to P35. Qualitative interpretation of gradient profiles points to noise envelope varies due to overburden. Total field profile sheets have the interpretation.

Respectfully submitted

Chris Anderson
Ph.D., P.Eng.

PROVINCE OF MANITOBA
C. D. ANDERSON
REGISTERED ENGINEER

Report No. CDA 1088

①

P1

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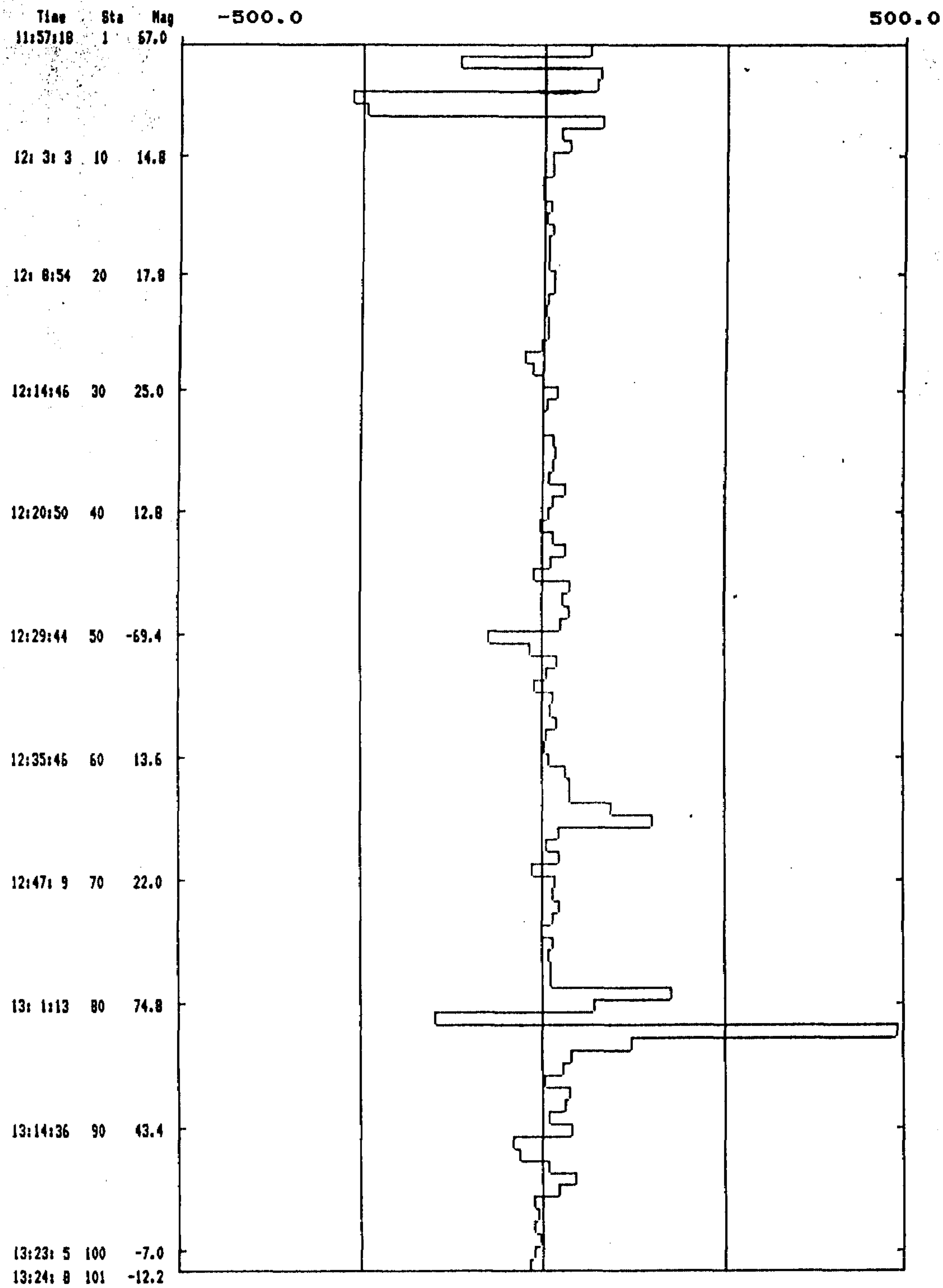

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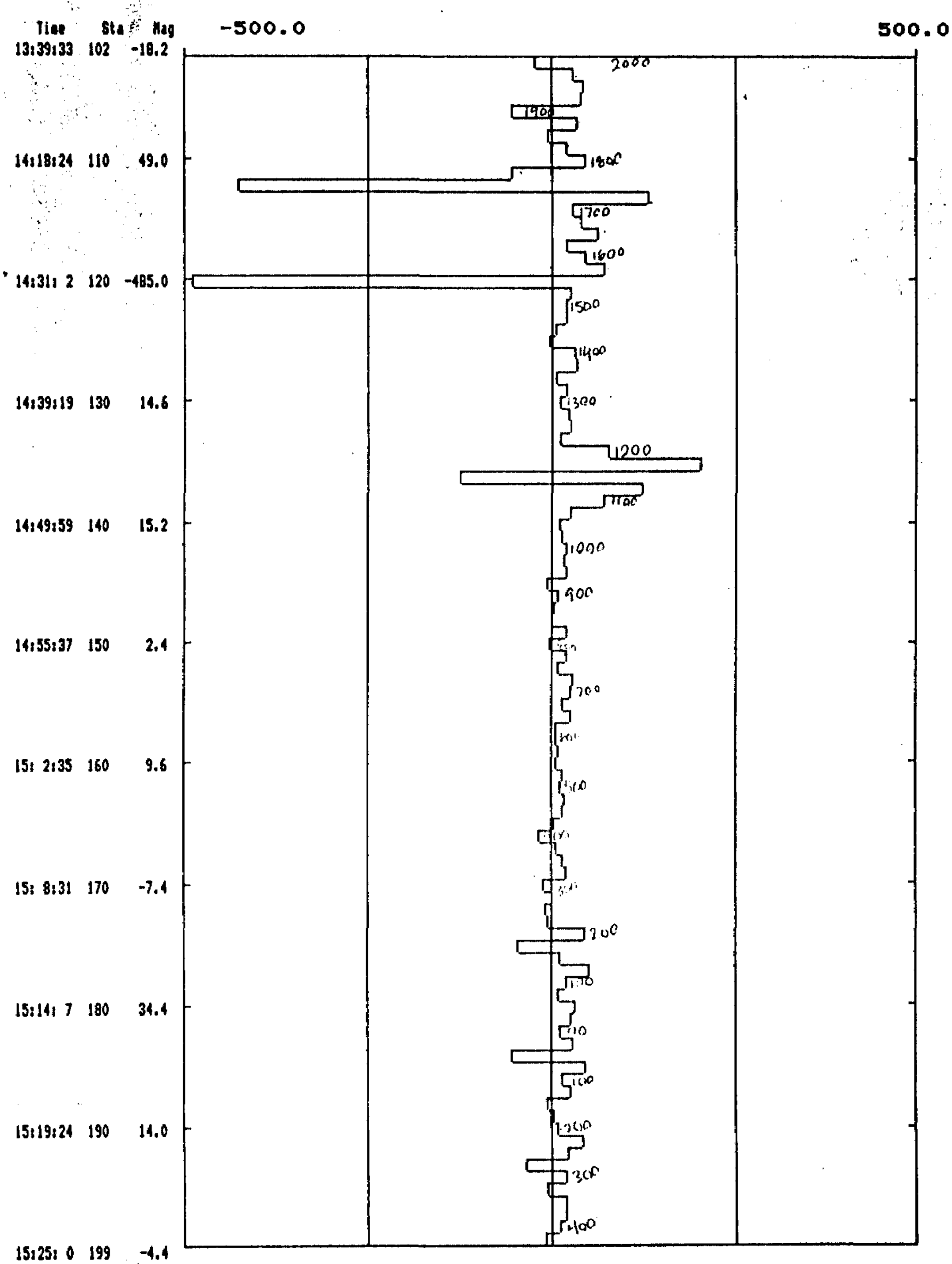

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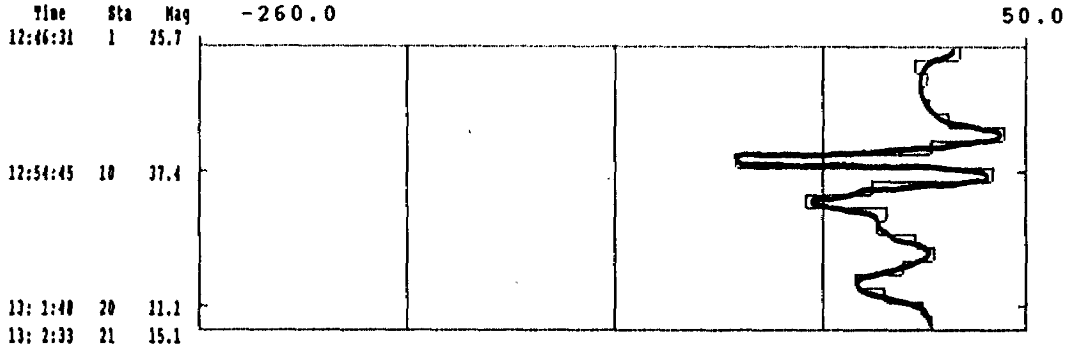

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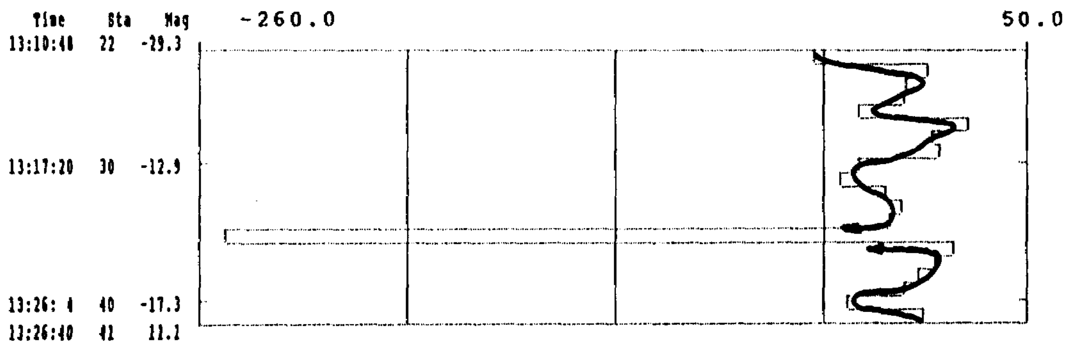

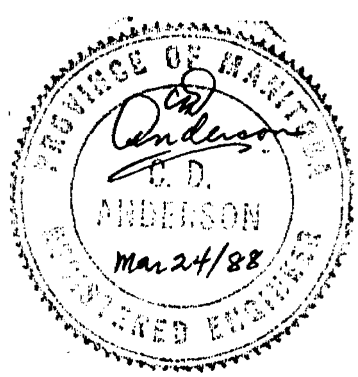

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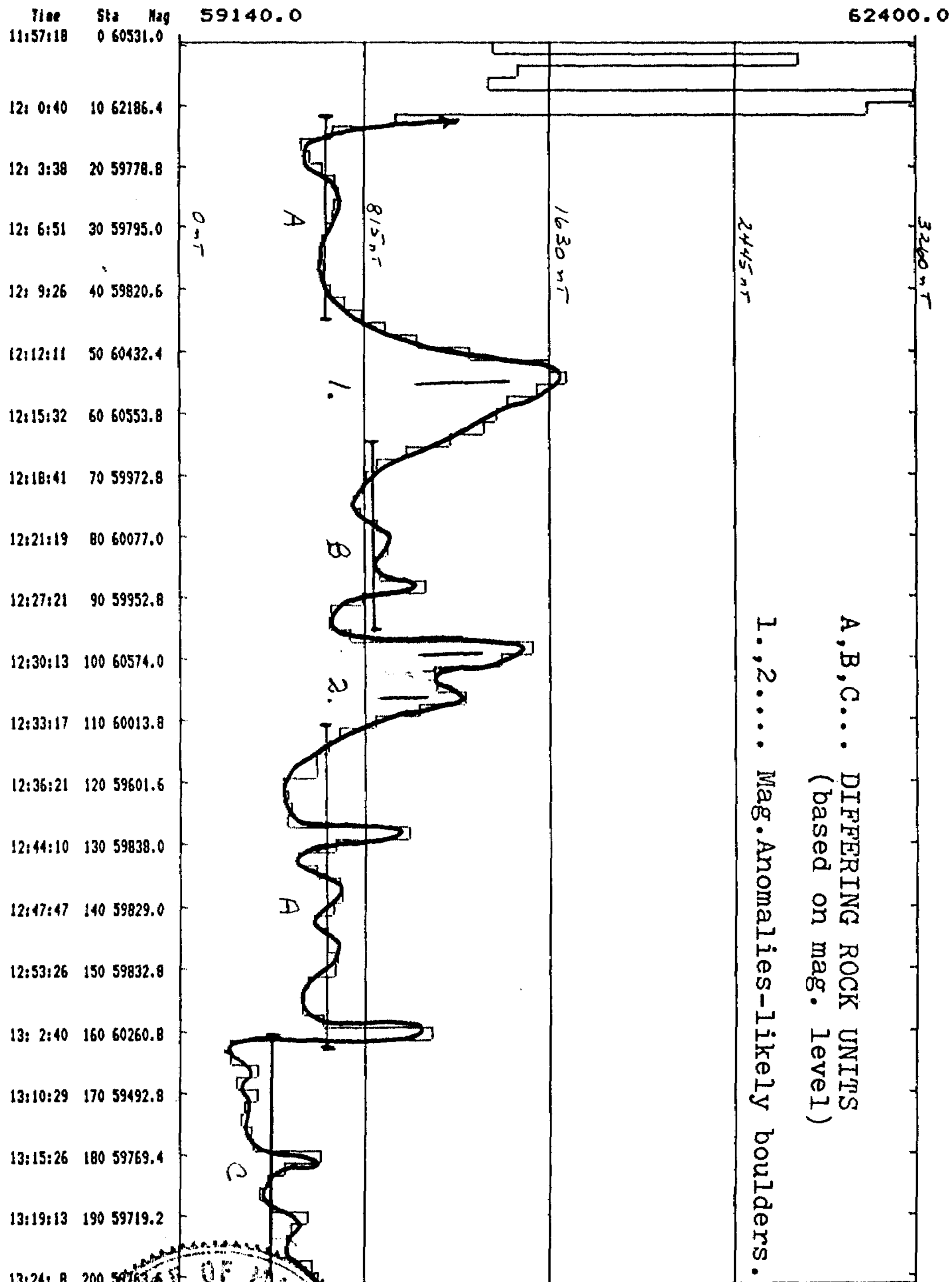
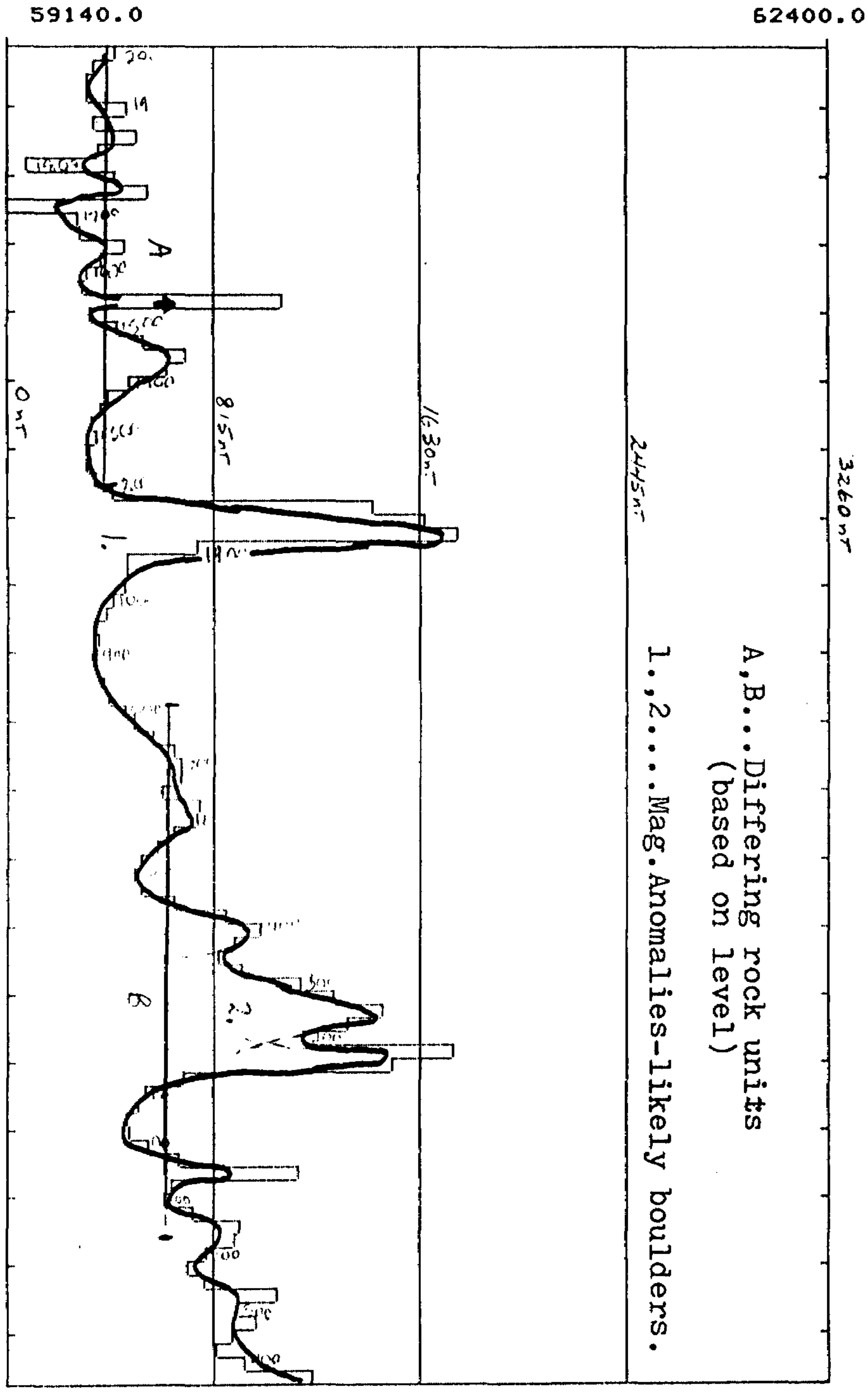


PROVINCE OF MANITOBA
C. D. ANDERSON
Mar. 24/88
REGISTERED ENGINEER

DATA FILE d:grdg3t.fld .
LINE NUMBER 38 .

Time	Sta	Mag
13:39:33	202	59576.8
14:14:26	210	59619.2
14:19:47	220	59578.0
14:26:15	230	59610.4
14:31:46	240	59478.8
14:36:21	250	59631.0
14:40: 1	260	59478.6
14:45:40	270	60806.8
14:50:33	280	59615.2
14:53:22	290	59500.2
14:56:38	300	59646.2
14:59:51	310	59761.6
15: 3:12	320	59679.2
15: 6:16	330	60156.8
15: 9: 2	340	60435.8
15:11:55	350	60676.0
15:14:39	360	59631.4
15:17:16	370	59772.4
15:20:29	380	59864.2
15:23:11	390	60036.4
15:25: 0	396	60360.0



C. D. ANDERSON
Anderson
Mar 24/88

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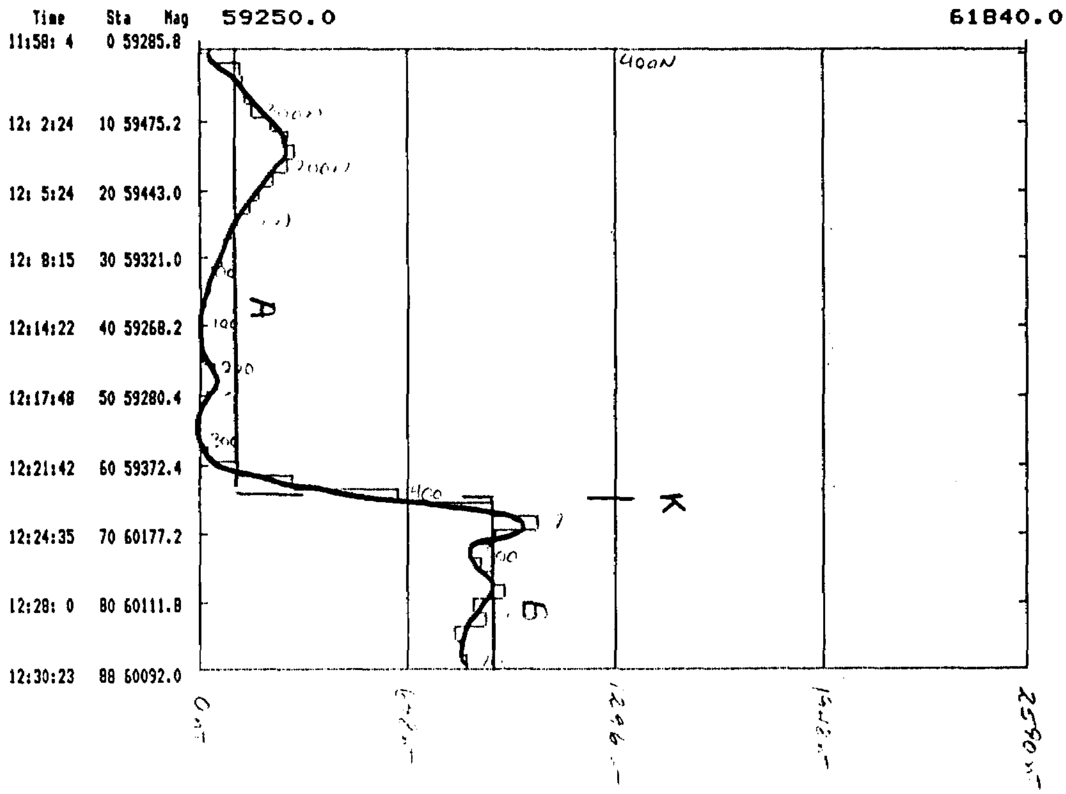
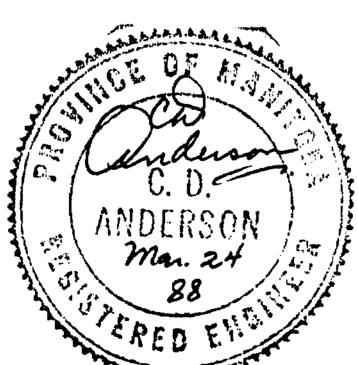
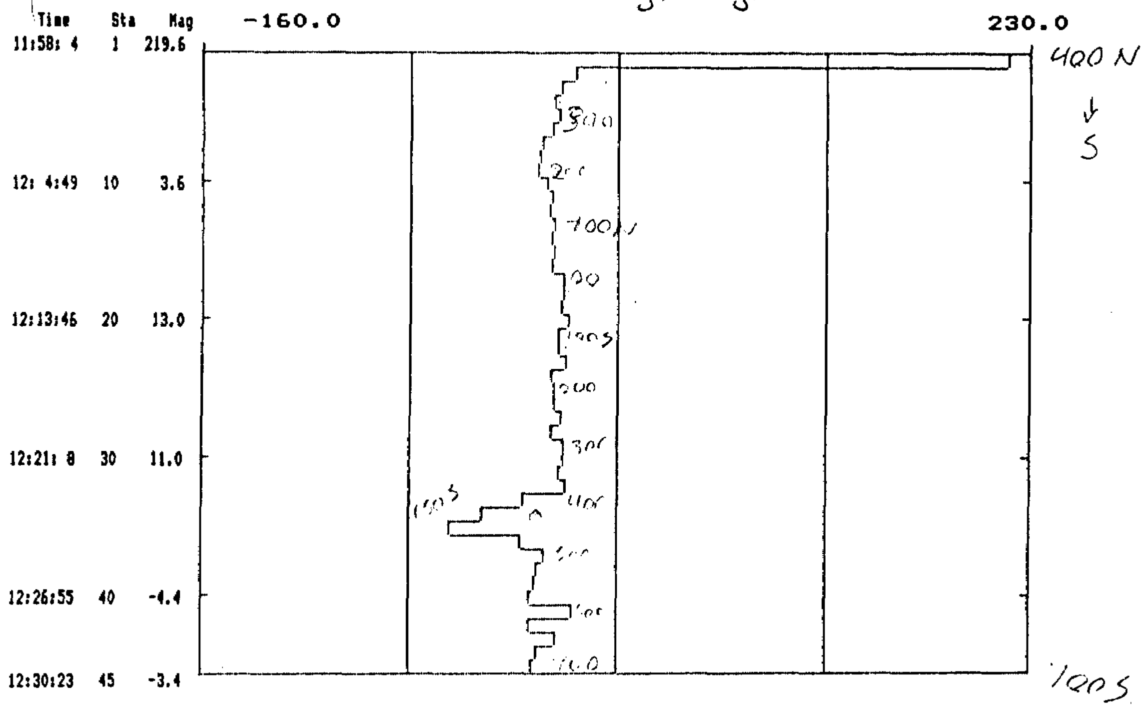


A,B...Differing rock units
(based on level)
K...Rock unit contact...



DATA FILE b:grdg2.fld .
LINE NUMBER 11 → Mackay Isl. grid.



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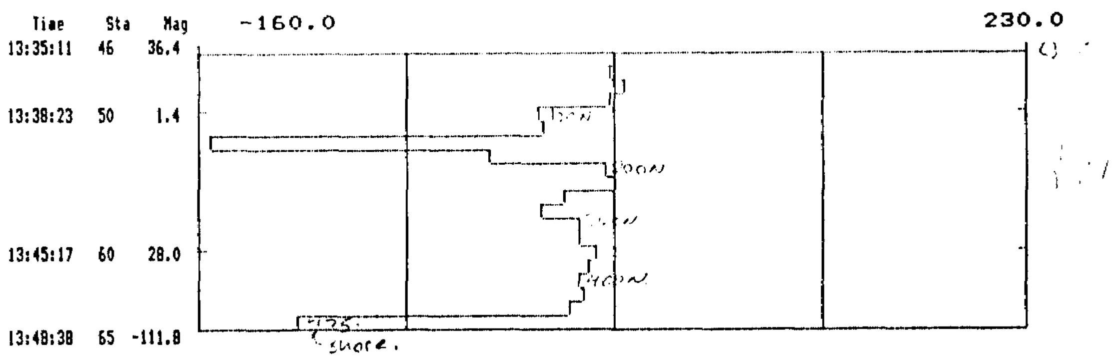

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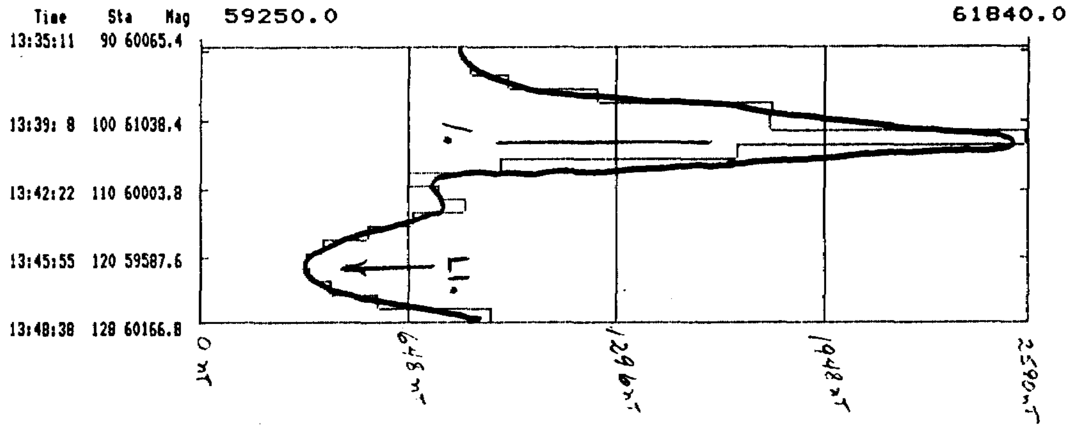
LINE NUMBER 24 .



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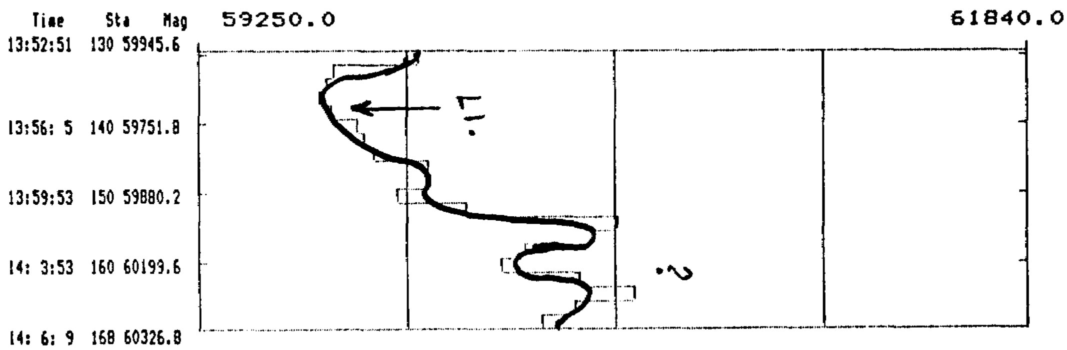


LINE 24

1.- Magnetic Anomaly.
(possibly in bedrock)

L1.-Low Magnetic Anomaly.
(possibly in bedrock)

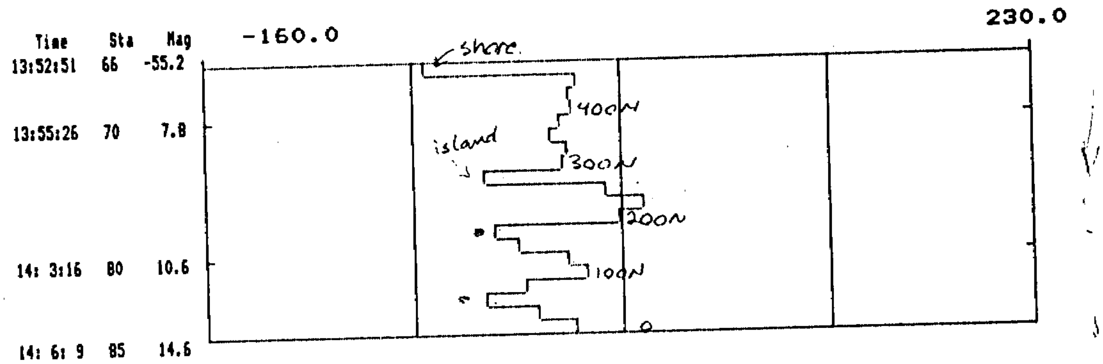
LINE 23

?- Related to 1. on line 24 ?

L1-see line 24....

PROVINCE OF MANITOBA
C. D. ANDERSON
REGISTERED ENGINEER
Mar 24/88

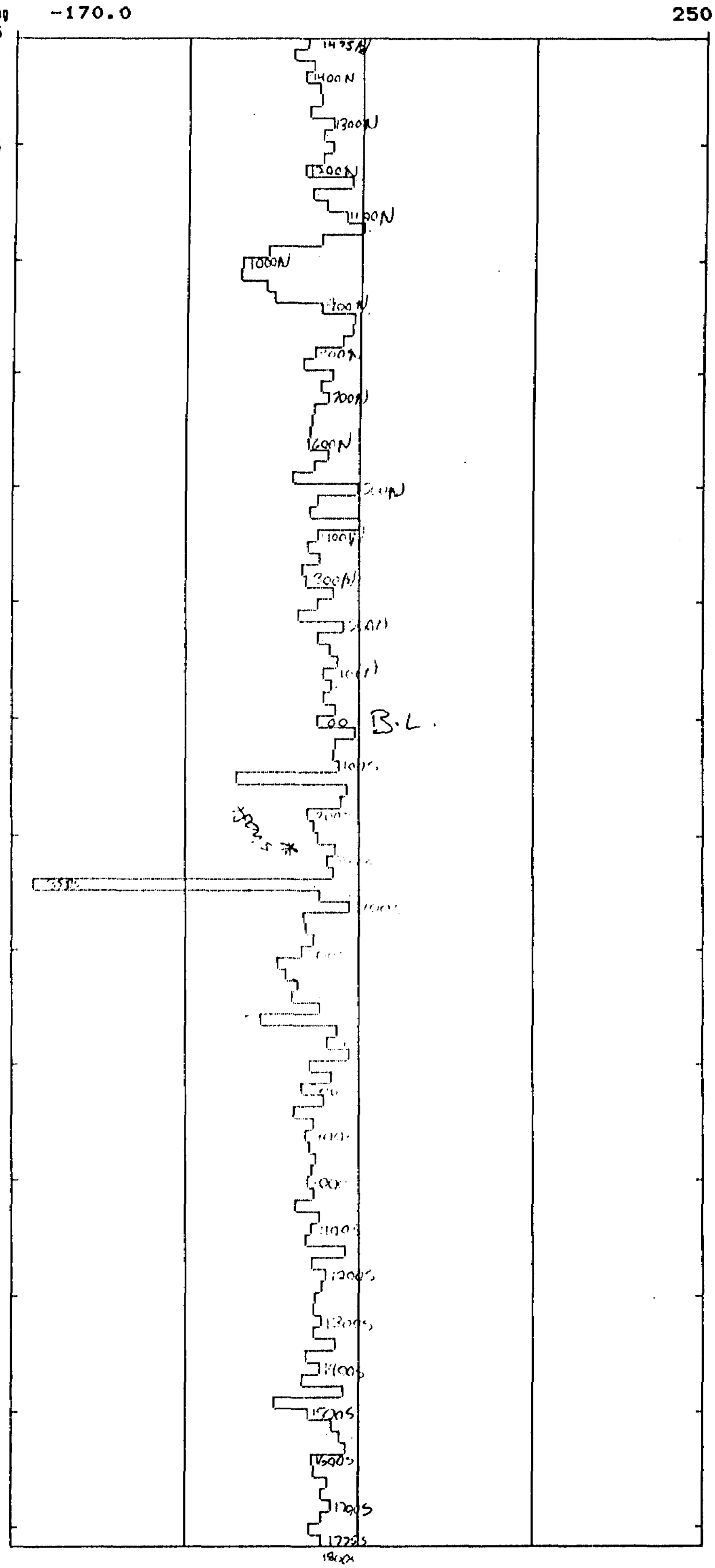
DATA FILE b:grdg2.fld .
LINE NUMBER 23 .



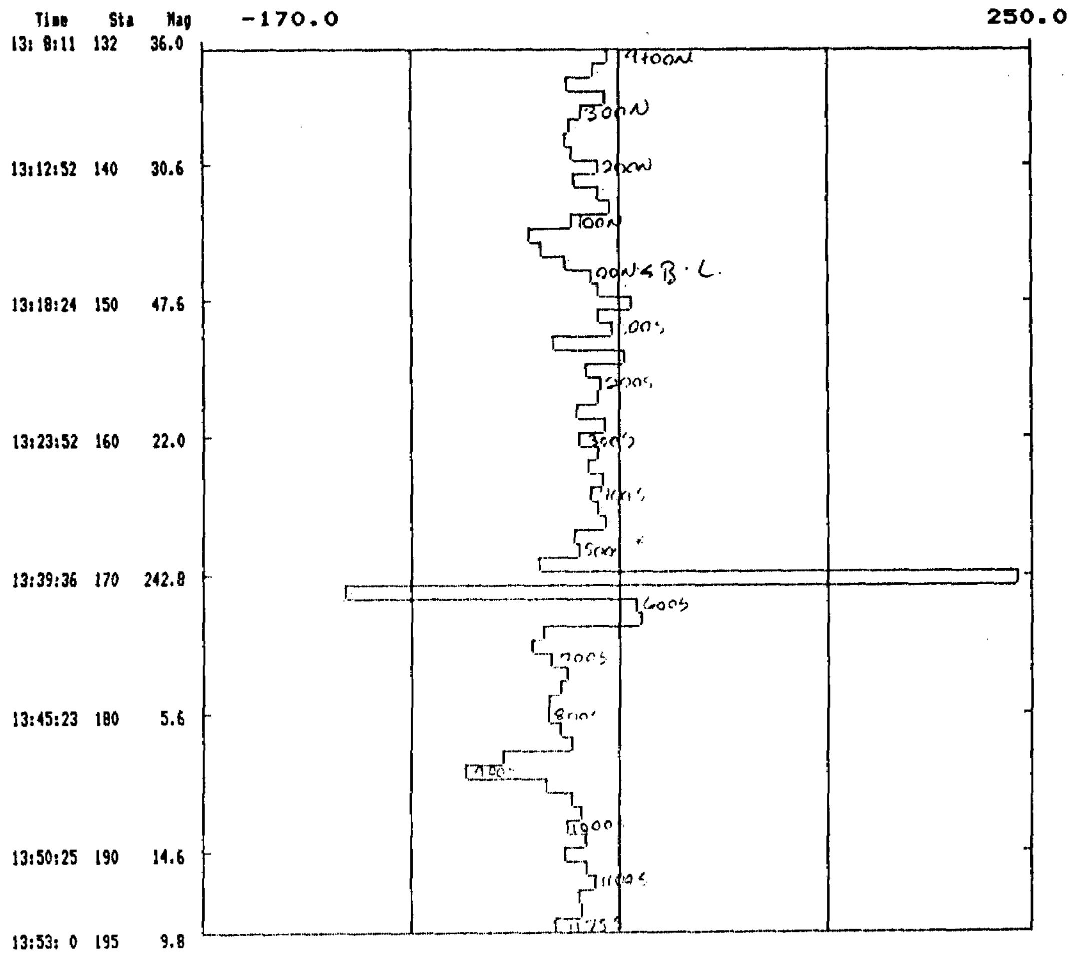
DATA FILE d:grde2.fld .
LINE NUMBER 15E

P11

Time	Sta	Mag
11: 6:11	1	8.6
11:11:14	10	24.4
11:16:41	20	-30.4
11:22:17	30	25.0
11:27:44	40	40.4
11:33:14	50	17.0
11:38:19	60	16.6
11:43:36	70	17.2
11:53:36	80	6.6
12: 1:57	90	11.6
12: 7:38	100	10.4
12:12:47	110	15.4
12:17:52	120	10.2
12:23:36	130	11.6
12:24:12	131	19.2



DATA FILE d:grde2.fld .
LINE NUMBER 6 E

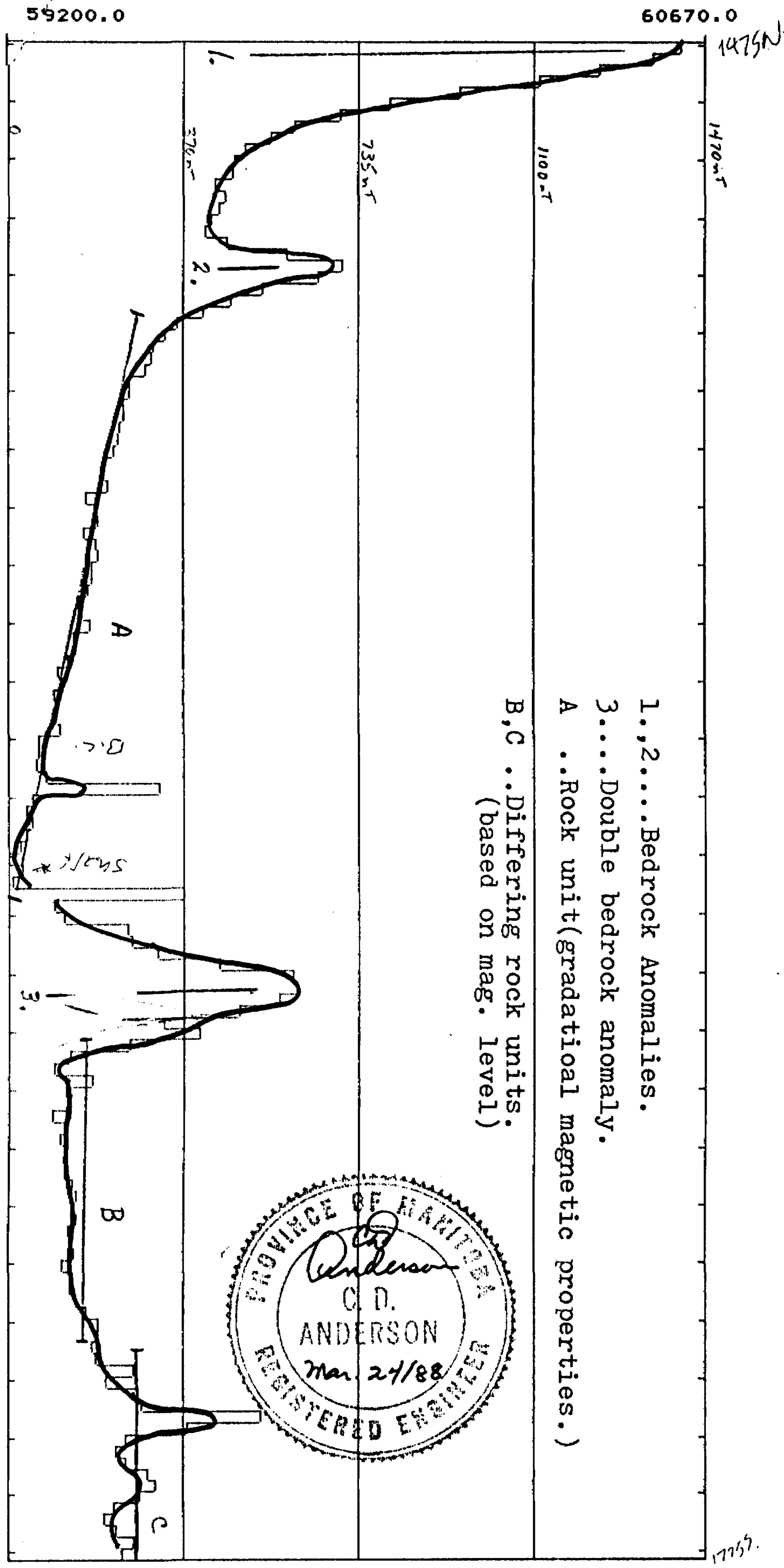


DATA FILE d:grde2t.fld .

LINE NUMBER 15 E

P13

Time	Sta	Mag
11: 6:11	0	60618.2
11: 9: 3	10	60010.2
11:11:45	20	59681.6
11:14:24	30	59633.2
11:17:16	40	59855.8
11:19:52	50	59533.6
11:22:49	60	59458.4
11:25:36	70	59426.0
11:28:14	80	59390.0
11:31:15	90	59378.2
11:33:44	100	59374.6
11:36:15	110	59319.2
11:38:54	120	59267.8
11:41:33	130	59252.4
11:44:12	140	59206.0
11:51:14	150	59321.2
11:54: 9	160	59801.2
11:56:44	170	59606.4
12: 2:28	180	59326.0
12: 5:17	190	59320.0
12: 8:10	200	59340.2
12:10:45	210	59315.6
12:13:16	220	59392.0
12:15:49	230	59410.6
12:18:23	240	59453.2
12:21:30	250	59481.8
12:24:12	260	59442.0



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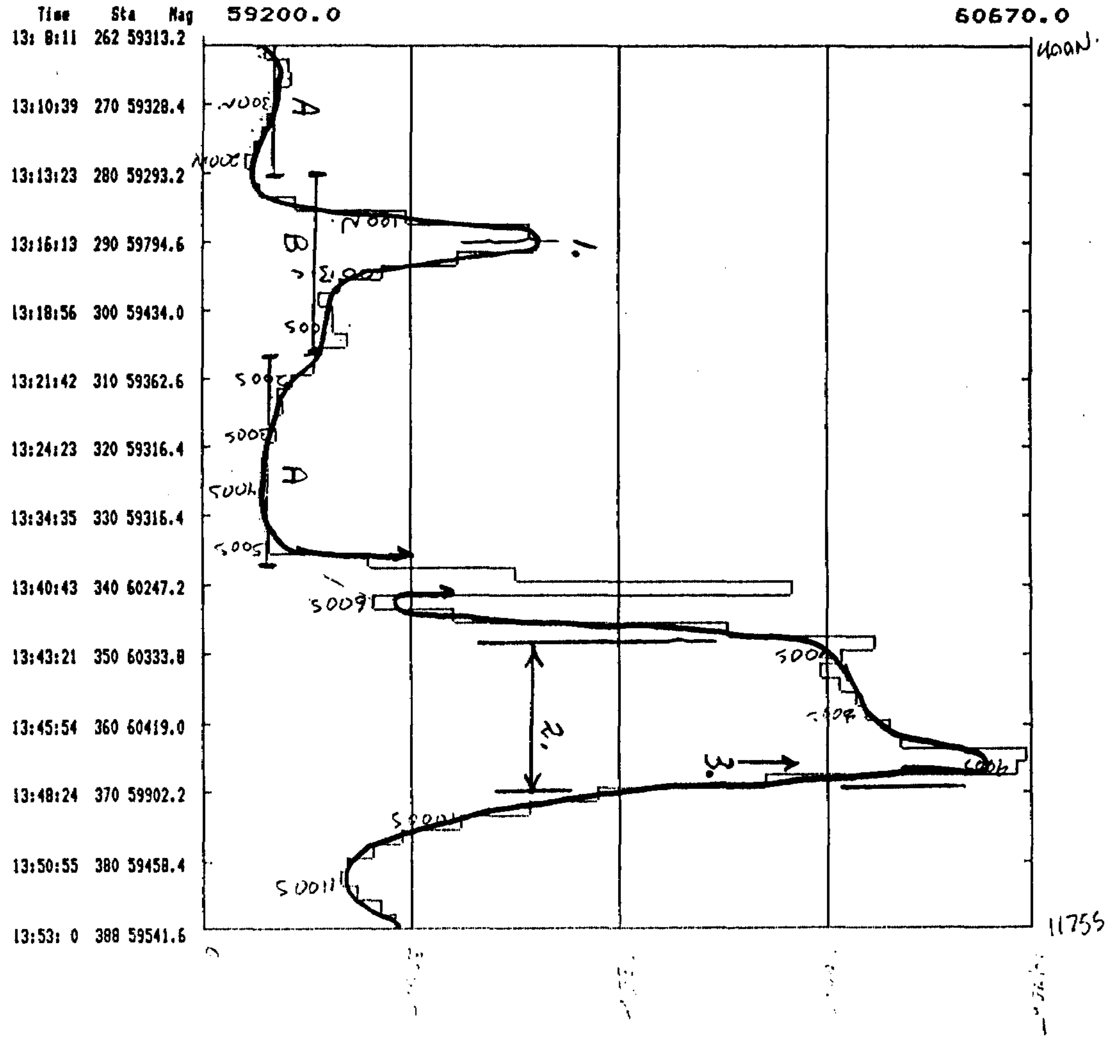
LINE NUMBER 6 E

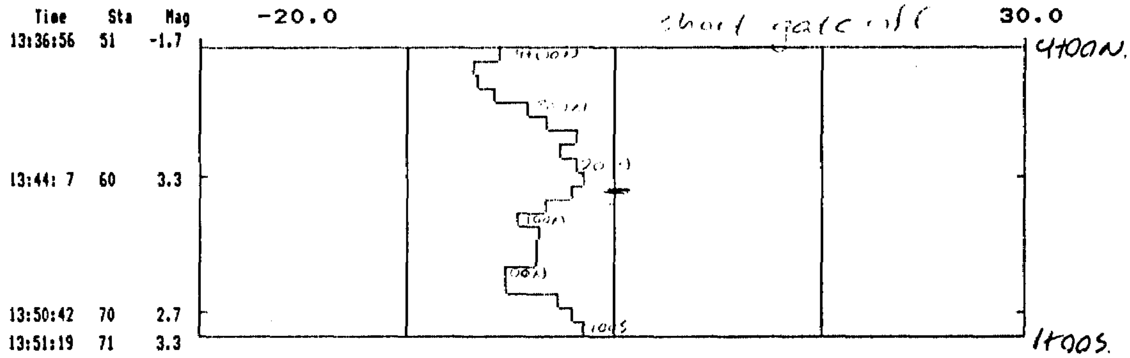


A,B ..Rock Units (based on mag. level)
1....Bedrock Anomaly.
2....Wide magnetic rock unit.
3....Boundary anomaly to 2 above.

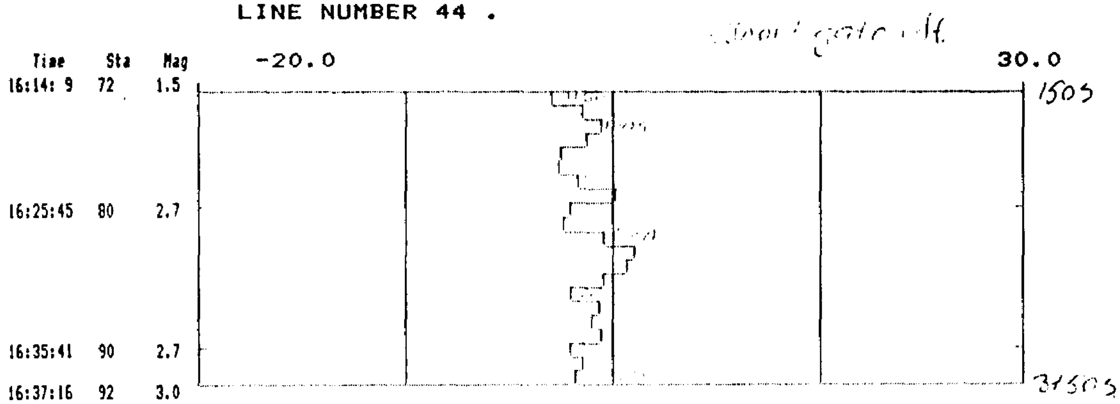
PROVINCE OF MANITOBA
C. D. ANDERSON
Mar. 24/88
REGISTERED ENGINEER

(H)

DATA FILE b:g3a.fld .
LINE NUMBER 521 . (52)

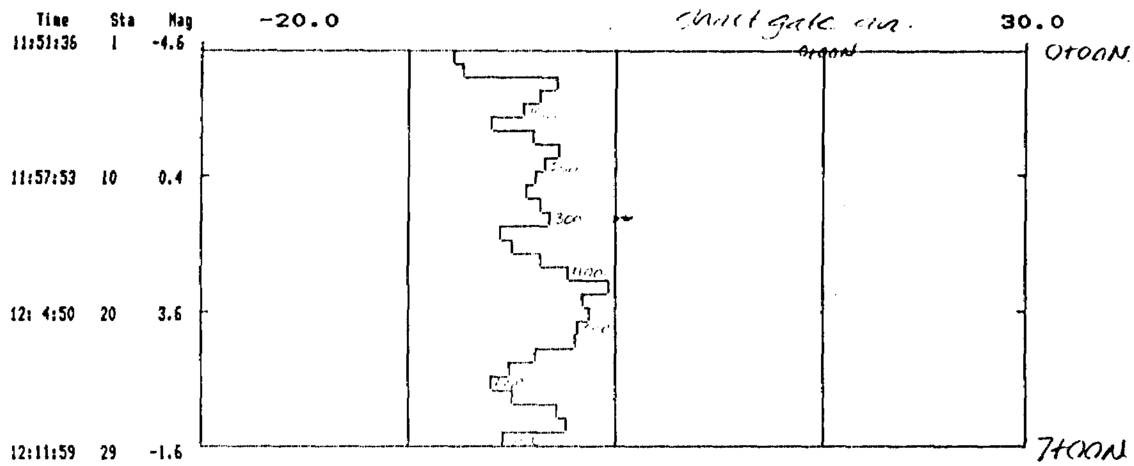


DATA FILE b:g3a.fld .
LINE NUMBER 44 .

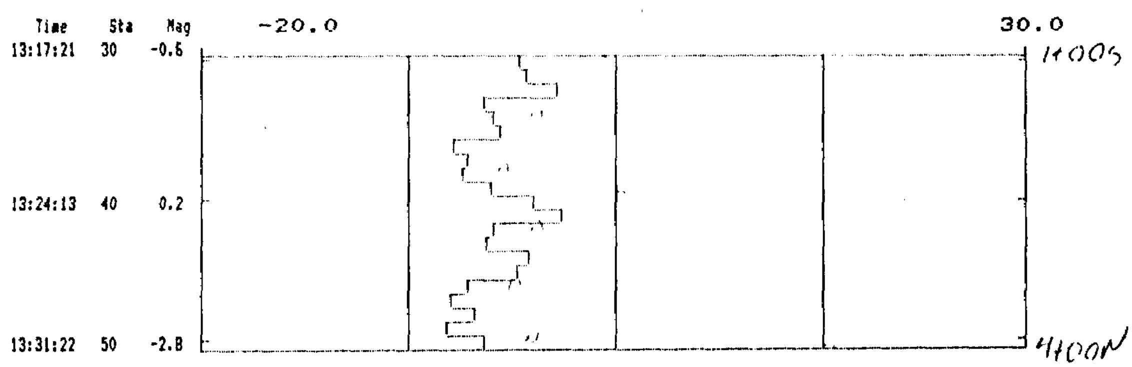


(35807) 1442
45000 2554
3800

DATA FILE b:g3a.fld .
LINE NUMBER 58 .



DATA FILE b:g3a.fld .
LINE NUMBER 52 .



52E11SE9016 2.11159 SNOWSHOE BAY (SHOAL

900

Ontario

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

880 Bay Street
3rd Floor
Toronto, Ontario
M5S 1Z8

(416) 965-4888

February 7, 1989

Your File: W8801-113
Our File : 2.11159

Mining Recorder
Ministry of Northern Development and Mines
808 Robertson Street
Box 5200
Kenora, Ontario
P9N 3X9

Dear Sir:

RE: Notice of Intent dated January 23, 1989
Geophysical (Electromagnetic & Magnetometer) Survey
on Mining Claims K 978356 et al in the Areas of
Shoal Lake, Moosin Bay and Snowshoe Bay

The assessment work credits, as listed with the above-mentioned Notice of Intent, have been approved as of the above date.

Please inform the recorded holder of these mining claims and so indicate on your records.

Yours sincerely,

W.R. Cowan
Provincial Manager, Mining Lands
Mines & Minerals Division

Encls:

DK:sc

cc: Mr. J. Brown
17 Barton Avenue
Winnipeg, Manitoba
R2M 1E8

cc: Mr. G.H. Ferguson
Mining & Lands Commissioner
Toronto, Ontario

cc: Resident Geologist
Kenora, Ontario

Ministry of Northern Development and Mines
Ontario

Technical Assessment Work Credits

File	
2.11159	
Date: January 23, 1989	Mining Recorder's Report of Work No. W8801-113

Recorded Holder: J. Brown

~~Township or~~ Area: Shoal Lake, Moosin Bay, Snowshoe Bay

Type of survey and number of Assessment days credit per claim	Mining Claims Assessed
Geophysical	K-978354 to 98 inclusive 978400-01 1018455 to 64 inclusive 1018466 to 71 inclusive
Electromagnetic 40 days	
Magnetometer ____ days	
Radiometric ____ days	
Induced polarization ____ days	
Other ____ days	
Section 77 (19) See "Mining Claims Assessed" column	
Geological ____ days	
Geochemical ____ days	
Man days ☐ Airborne ☐	
Special provision ☒ Ground ☒	
☐ Credits have been reduced because of partial coverage of claims.	
☐ Credits have been reduced because of corrections to work dates and figures of applicant.	

Special credits under section 77 (16) for the following mining claims

20 days Electromagnetic

K-978399
1018465

No credits have been allowed for the following mining claims

☐ not sufficiently covered by the survey ☐ insufficient technical data filed

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical - 80; Geologocal - 40; Geochemical - 40; Section 77(19) - 60.

828 (85/12)

Ministry of Northern Development and Mines
Ontario

Technical Assessment Work Credits

File
2.11159

Date	Mining Recorder's Report of Work No.
January 23, 1989	W8801-113

Recorded Holder
J. Brown

~~Township or~~ **Area**
Shoal Lake, Moosin Bay, Snowshoe Bay

Type of survey and number of Assessment days credit per claim	Mining Claims Assessed
Geophysical	K-978356 to 95 inclusive 1018455 to 59 inclusive 1018465 to 70 inclusive
Electromagnetic 8 days	
Magnetometer 8 days	
Radiometric ______ days	
Induced polarization ______ days	
Other ______ days	
Section 77 (19) See "Mining Claims Assessed" column	
Geological ______ days	
Geochemical ______ days	
Man days ☐ Airborne ☒	
Special provision ☐ Ground ☐	
☒ Credits have been reduced because of partial coverage of claims.	
☐ Credits have been reduced because of corrections to work dates and figures of applicant.	

Special credits under section 77 (16) for the following mining claims

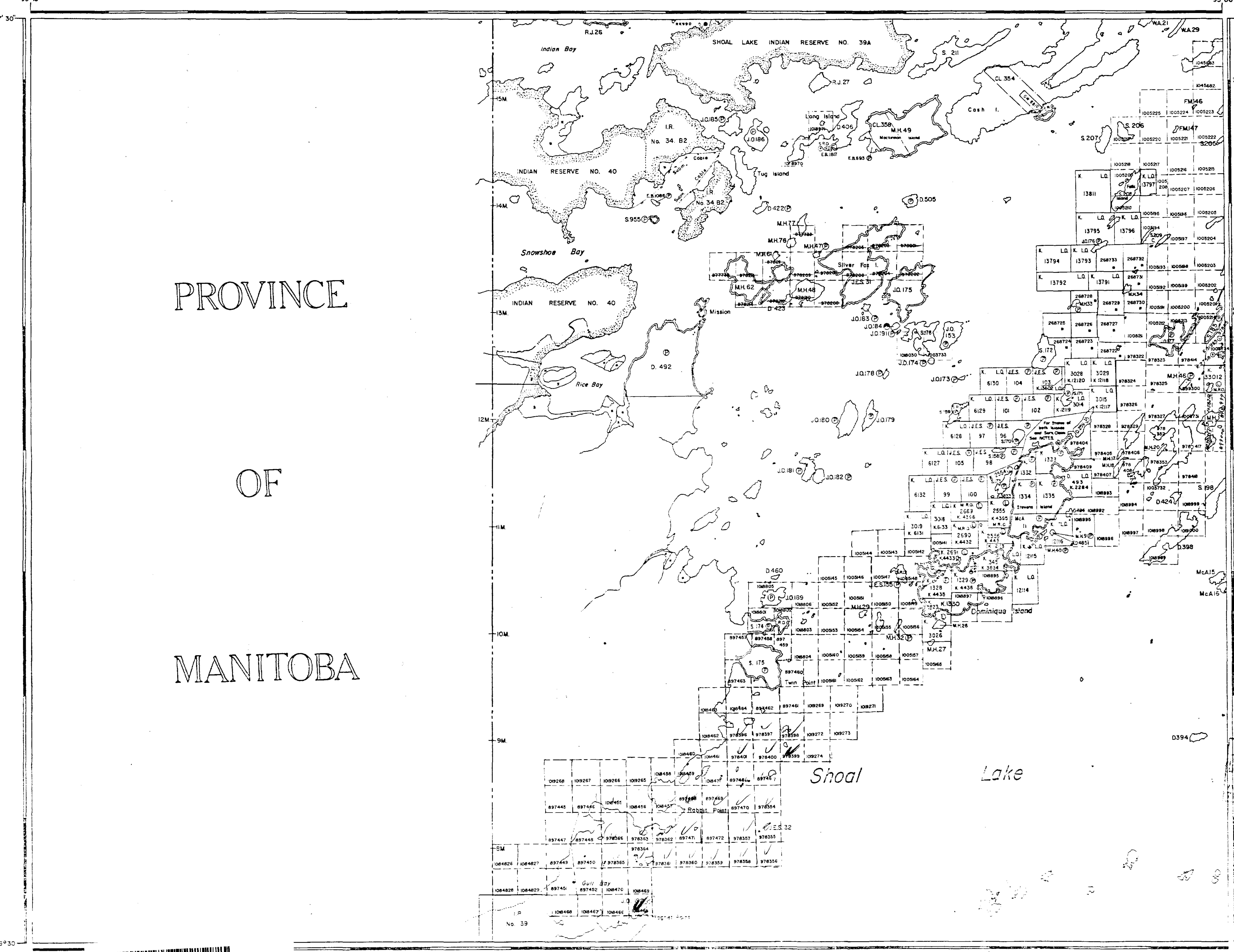
No credits have been allowed for the following mining claims

☒ not sufficiently covered by the survey ☐ insufficient technical data filed

K-978354-55
978396 to 401 inclusive
1018460 to 64 inclusive
1018471

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical - 80; Geologocal - 40; Geochemical - 40; Section 77(19) - 60.

EWART TP. and INDIAN BAY G-2623



LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES:
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC.
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON-PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	Ⓟ or ●
" , SURFACE RIGHTS ONLY	
" , MINING RIGHTS ONLY	
LEASE, SURFACE & MINING RIGHTS	Ⓛ or ■
" , SURFACE RIGHTS ONLY	S.R.O. or
" , MINING RIGHTS ONLY	
LICENCE OF OCCUPATION	L.O. or ▼
ORDER-IN-COUNCIL	OC
RESERVATION	
CANCELLED	
SAND & GRAVEL	

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

REFERENCES

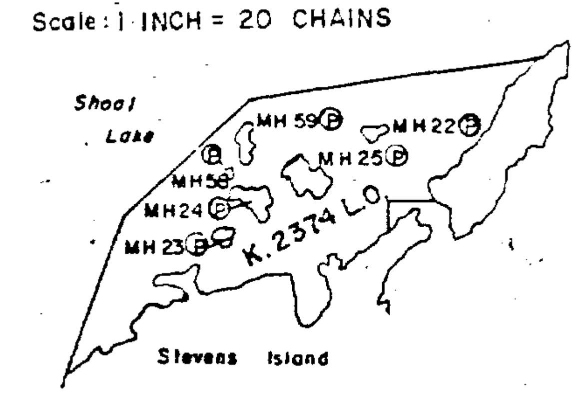
AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File

Flooding rights reserved up to 1064' above sea level.

Scale: 1 INCH = 20 CHAINS



SCALE: 1 INCH = 40 CHAINS

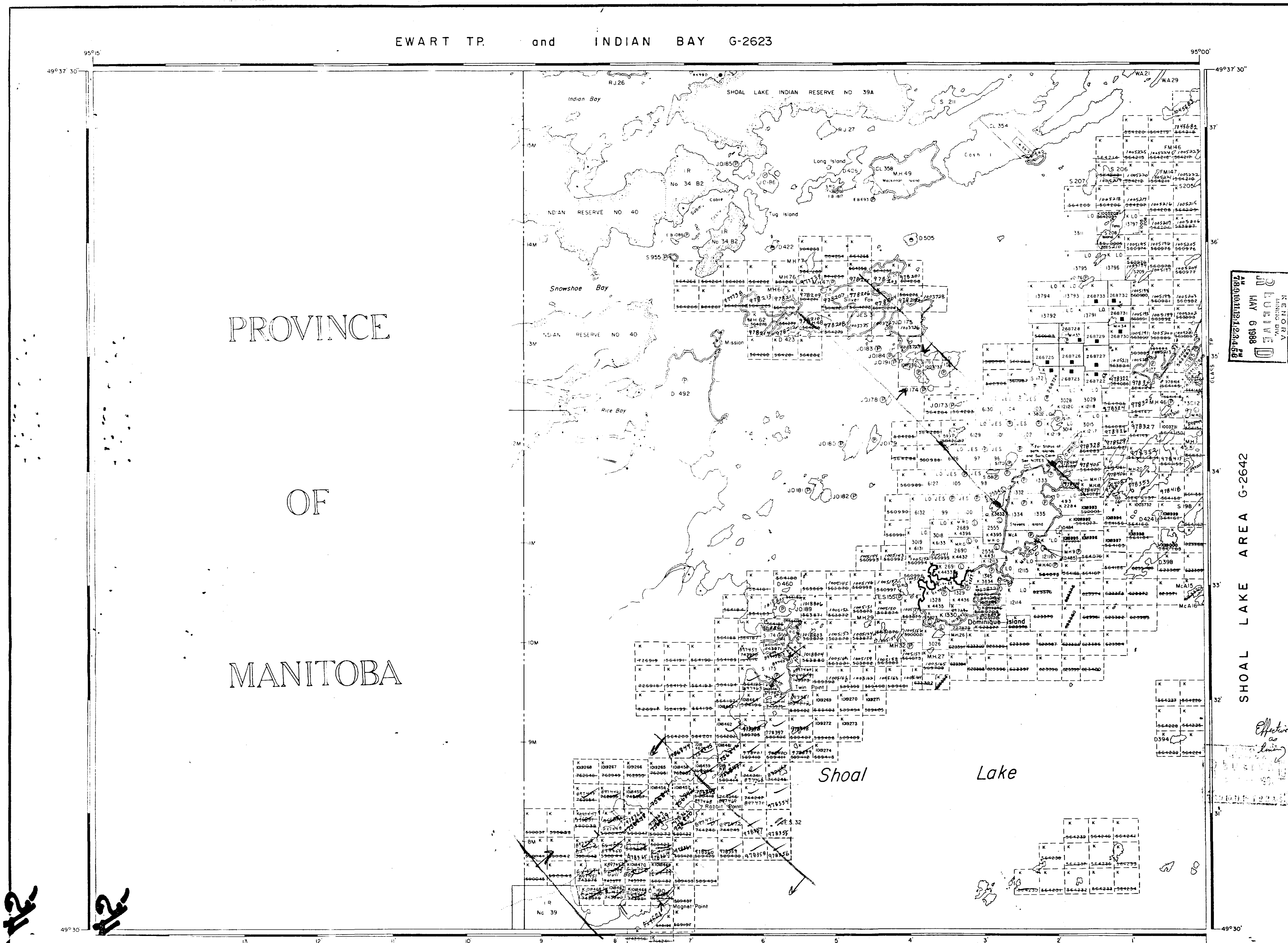
AREA
SNOWSHOE BAY
SHOAL LAKE

M.N.R. ADMINISTRATIVE DISTRICT
KENORA
MINING DIVISION
KENORA
LAND TITLES / REGISTRY DIVISION
KENORA

Ministry of Natural Resources
Ontario
Land Management Branch

Date FEBRUARY, 1984.
Number G-2645

200



LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES:
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC.
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	
" , SURFACE RIGHTS ONLY	
" , MINING RIGHTS ONLY	
LEASE, SURFACE & MINING RIGHTS	
" , SURFACE RIGHTS ONLY	S.R.O.
" , MINING RIGHTS ONLY	
LICENCE OF OCCUPATION	L.O.
ORDER-IN-COUNCIL	OC
RESERVATION	
CANCELLED	
SAND & GRAVEL	

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1.

REFERENCES

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description Order No. Date Disposition File
J0184 Mining rights only open for staking June 01/86

Flooding rights reserved up to 1064' above sea level.

Scale: 1 INCH = 20 CHAINS

SCALE: 1 INCH = 40 CHAINS

Effective as ...

AREA
SNOWSHOE BAY
SHOAL LAKE

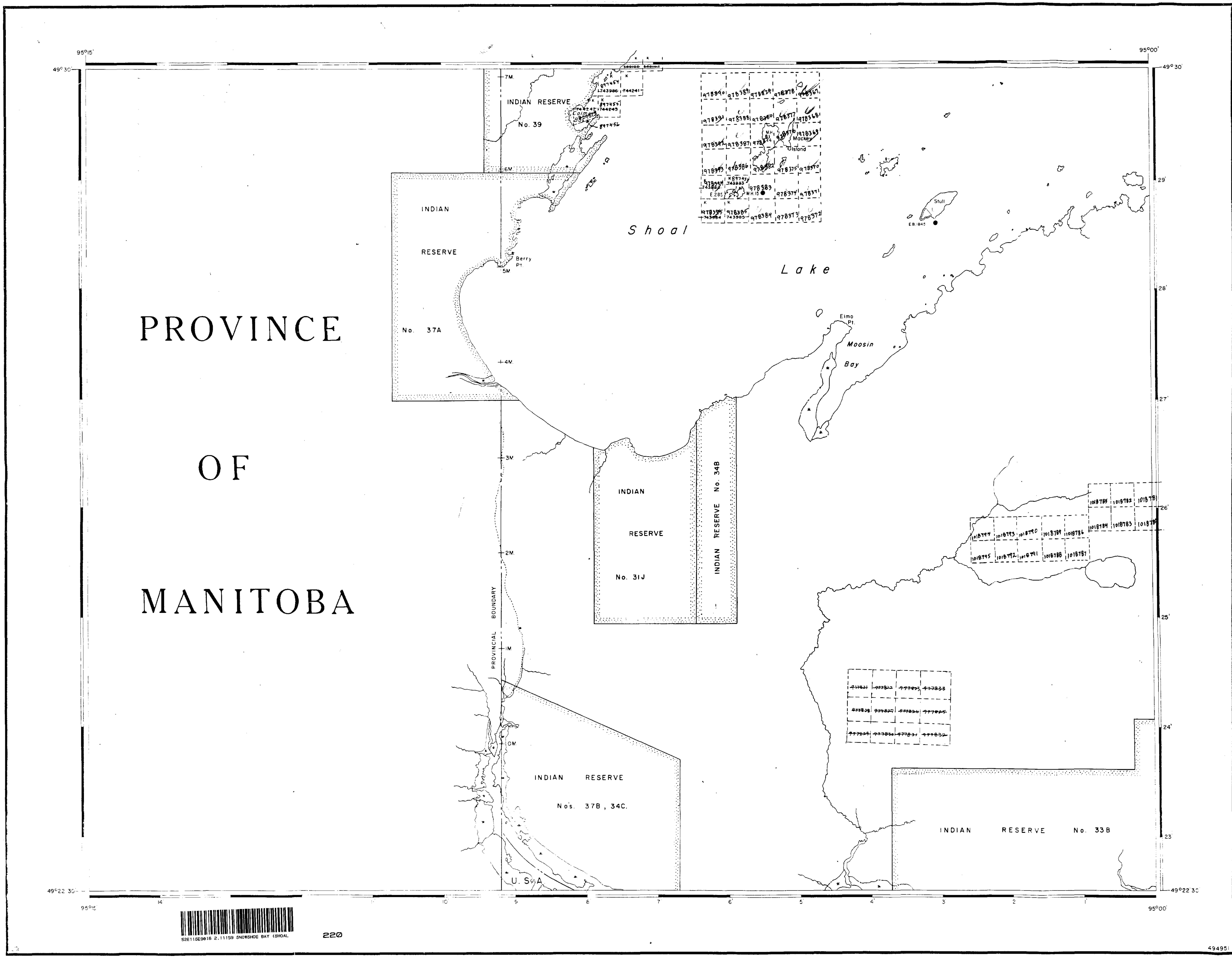
M.N.R. ADMINISTRATIVE DISTRICT
KENORA
MINING DIVISION 2.11159
KENORA
LAND TITLES / REGISTRY DIVISION
KENORA

Ontario Ministry of Natural Resources Land Management Branch

Date FEBRUARY, 1984 Number G-2645

M-2704

495951



LEGEND

HIGHWAY AND ROUTE No.	
OTHER ROADS	
TRAILS	
SURVEYED LINES:	
TOWNSHIPS, BASE LINES, ETC.	
LOTS, MINING CLAIMS, PARCELS, ETC.	
UNSURVEYED LINES:	
LOT LINES	
PARCEL BOUNDARY	
MINING CLAIMS ETC.	
RAILWAY AND RIGHT OF WAY	
UTILITY LINES	
NON-PERENNIAL STREAM	
FLOODING OR FLOODING RIGHTS	
SUBDIVISION OR COMPOSITE PLAN	
RESERVATIONS	
ORIGINAL SHORELINE	
MARSH OR MUSKEG	
MINES	
TRAVERSE MONUMENT	

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◓
" , MINING RIGHTS ONLY	◒
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	⬒
" , MINING RIGHTS ONLY	⬓
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	
CANCELLED	
SAND & GRAVEL	

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

REFERENCES

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File

Effective as line

SCALE: 1 INCH = 40 CHAINS

FEET 0 1000 2000 4000 6000 8000
METRES 0 200 1000 (1 KM) 2000 (2 KM)

AREA
MOOSIN BAY
SHOAL LAKE

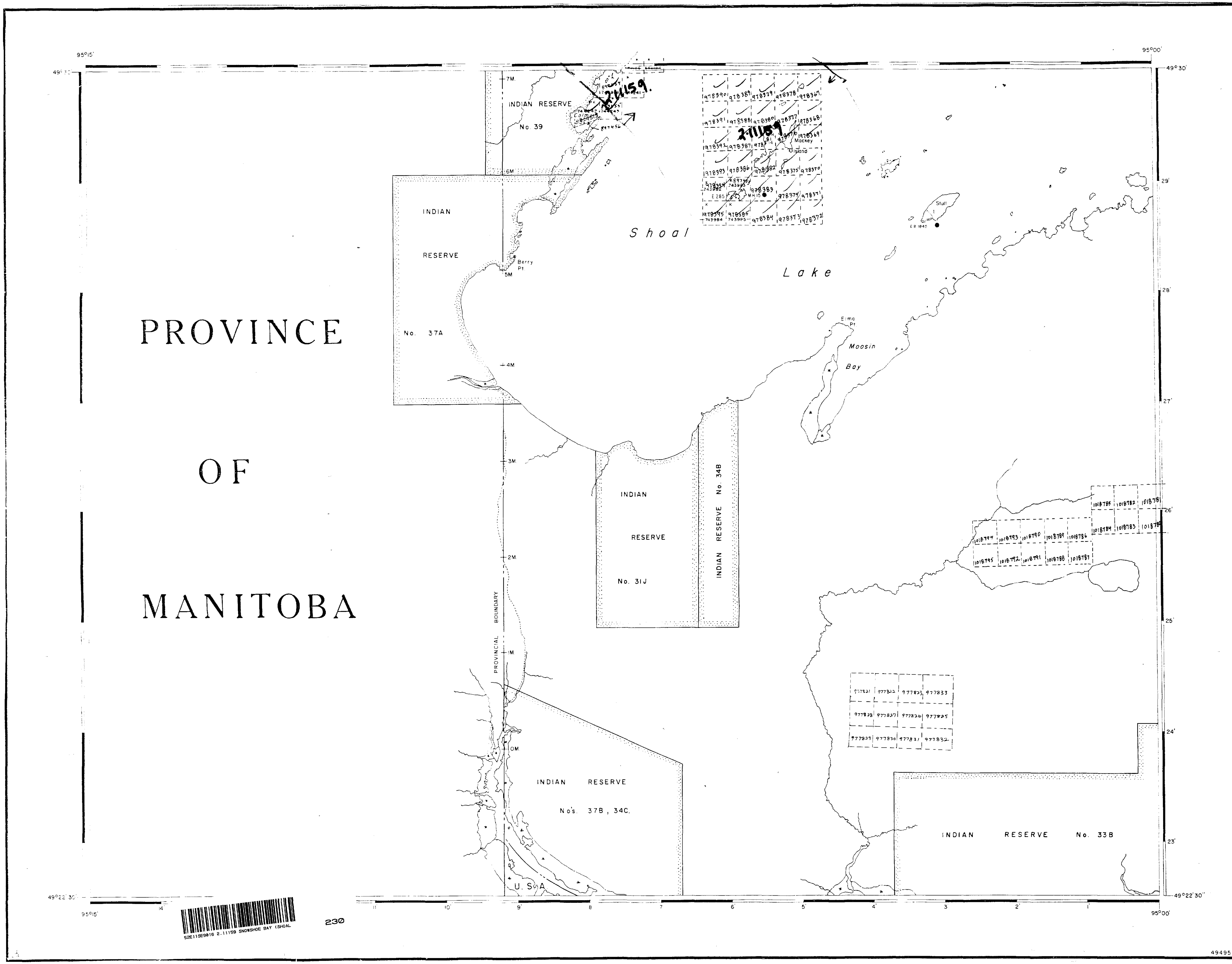
M.N.R. ADMINISTRATIVE DISTRICT
KENORA
MINING DIVISION
KENORA
LAND TITLES / REGISTRY DIVISION
KENORA

Ontario Ministry of Natural Resources — Land Management Branch

Date FEBRUARY, 1984. Number G-2633

M-2687

52E11SE9016 2.11159 SNOWSHOE BAY (SHOAL 220



LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC
LOTS, MINING CLAIMS, PARCELS, ETC
UNSURVEYED LINES
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON-PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	
" , MINING RIGHTS ONLY	
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	
" , MINING RIGHTS ONLY	
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	
CANCELLED	
SAND & GRAVEL	

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

REFERENCES

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File

SCALE: 1 INCH = 40 CHAINS

AREA
MOOSIN BAY
SHOAL LAKE

M.N.R. ADMINISTRATIVE DISTRICT
KENORA
MINING DIVISION 2.11159
KENORA
LAND TITLES / REGISTRY DIVISION
KENORA

Ministry of Natural Resources
Ontario
Land Management Branch

Date FEBRUARY, 1984.
Number G-2633
M-2687

TOTAL MAGNETIC FIELD

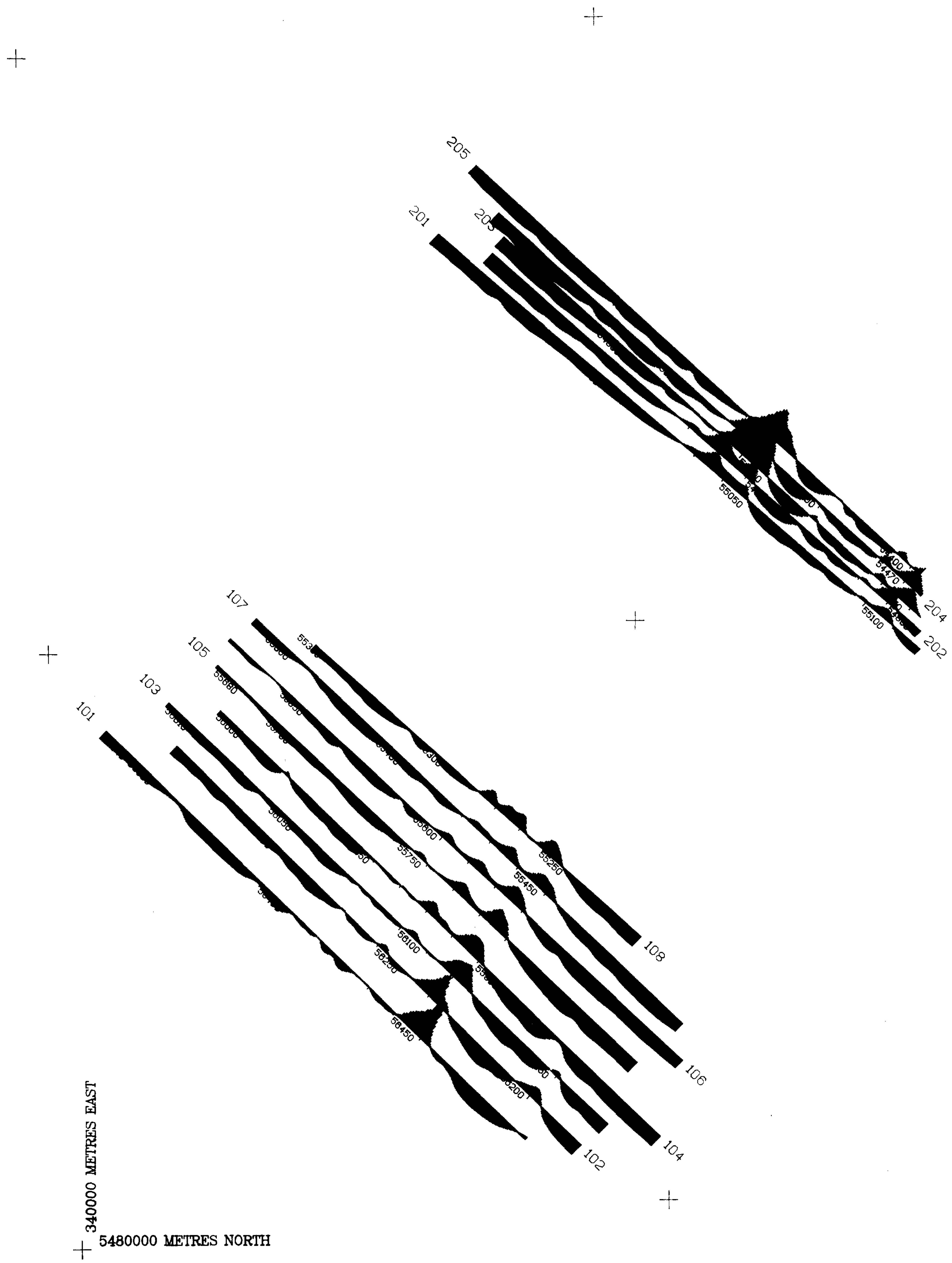
Scale 1 : 50000

0 3000 m

6000 nT

0

Flight Direction NW <-> SE



N

– TOTAL MAGNETIC FIELD –

60,000 nT BACKGROUND SUBTRACTED

ALMADEN RESOURCES CORP.

Michaelson Claims, Ontario

Job # 5062 Sheet 1 of 1 Jan, 1988

Data Compiled and Plotted by

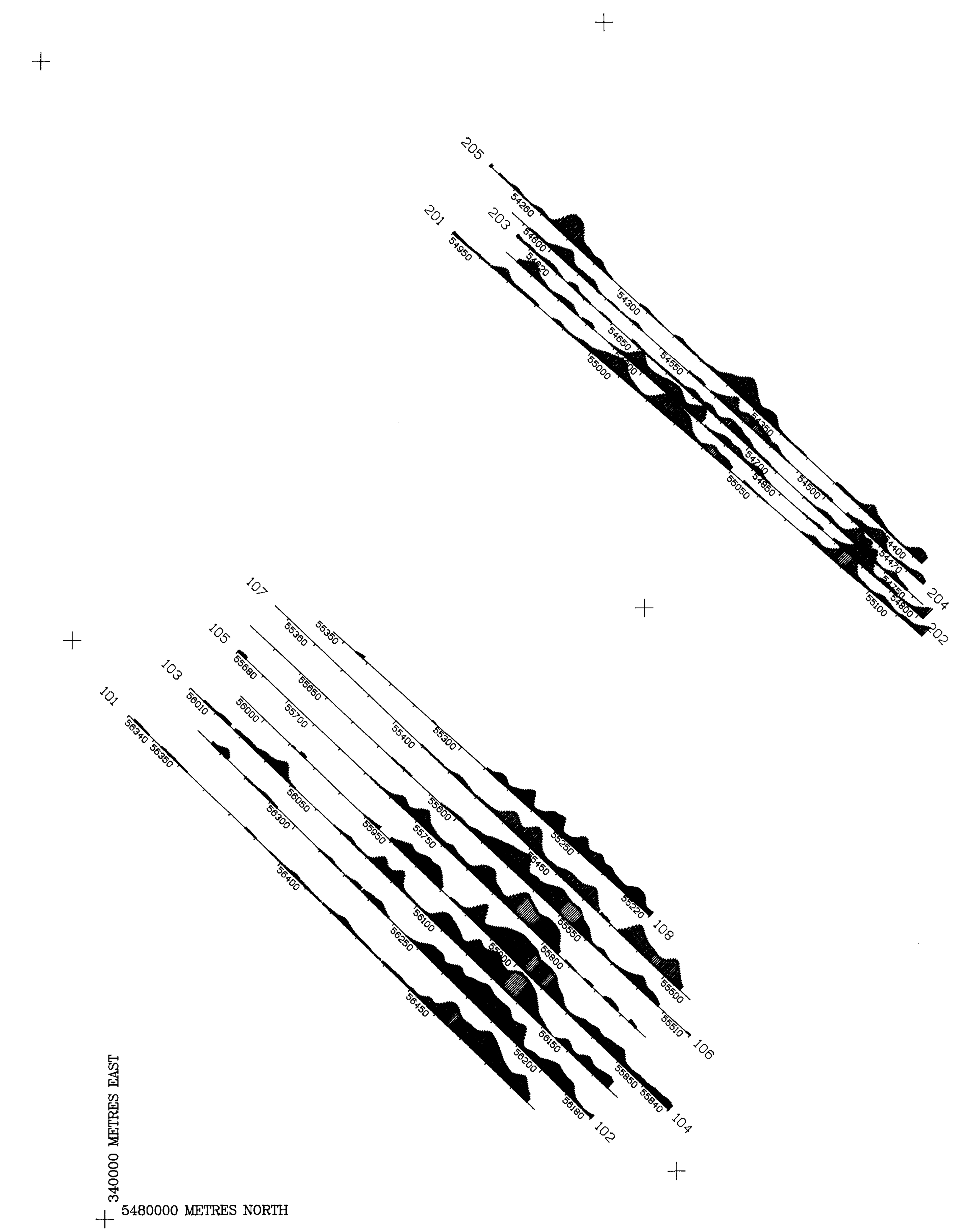
A³ A–CUBED INC.

5566 Tomken Road (416) 624-8878
Mississauga, Ont. Telex 06-965537
Canada L4W 1P4 A-CUBED MSGA

240

2.11159

PSEUDO-CHANNEL 1



Scale 1 : 50000

0 3000 m

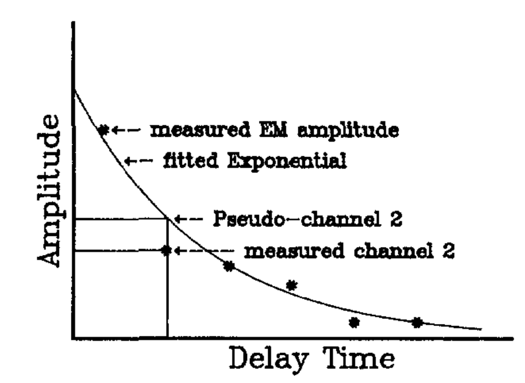
300000 ppm

0

Fit Quality > 60%
Minimum Width 3 pts
Flight Direction NW <-> SE
Data Lag 4.0 s

TIME CONSTANT KEY
(microseconds)
0 – 250
250 – 300
300 – 5000

DEFINITION OF PSEUDO CHANNEL



– ELECTROMAGNETIC PROFILES –
PSEUDO CHANNEL 1 (0.273 ms Delay Time)

ALMADEN RESOURCES CORP.

Michaelson Claims, Ontario

Job # 5062 Sheet 1 of 1 Dec, 1987

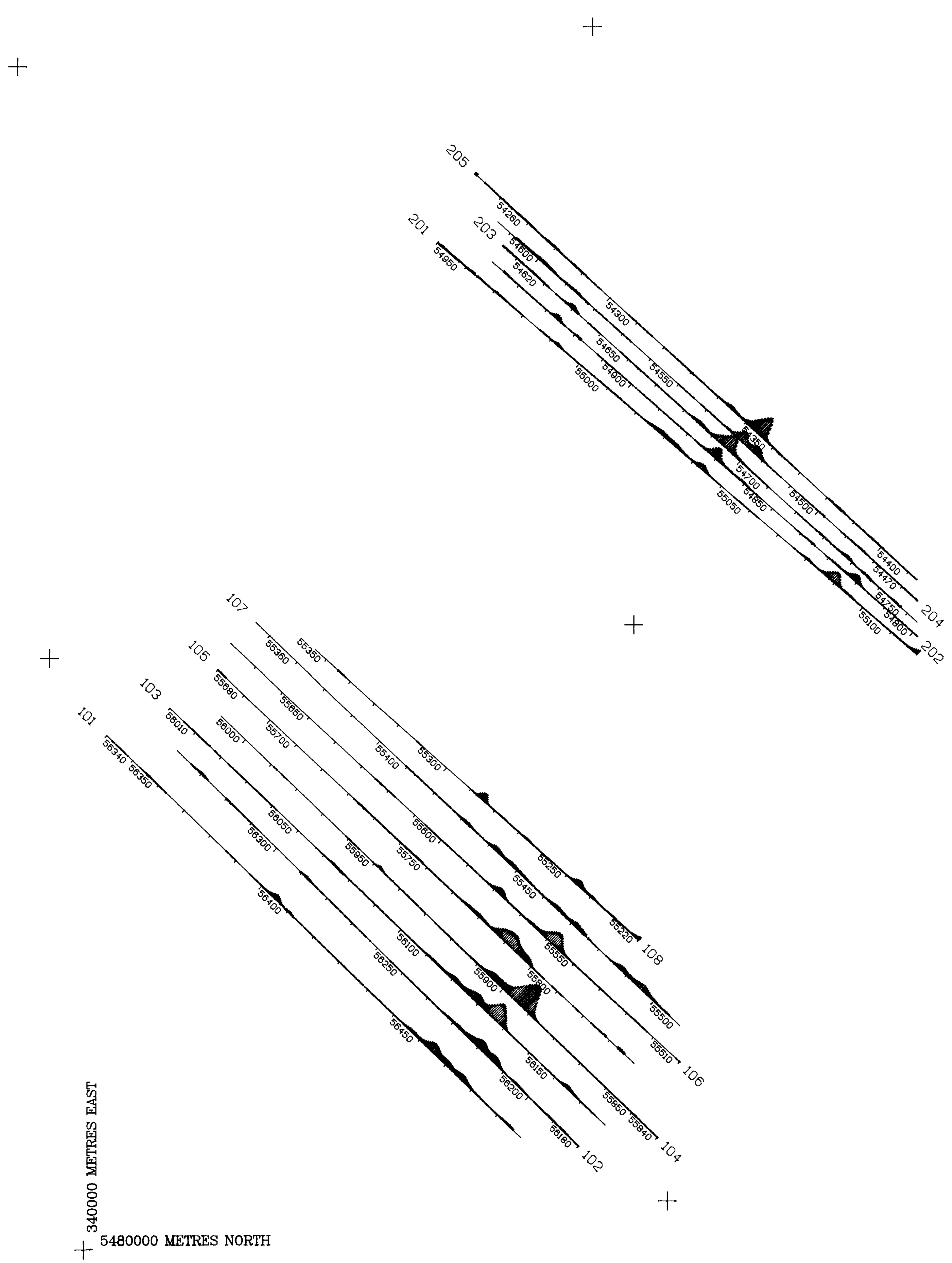
Data Compiled and Plotted by

A-CUBED INC.
5566 Tomken Road (416) 624-8876
Mississauga, Ont. Telex 06-965537
Canada L4W 1P4 A-CUBED MSGA

250

2.11159

PSEUDO-CHANNEL 8



Scale 1 : 50000

0 3000 m

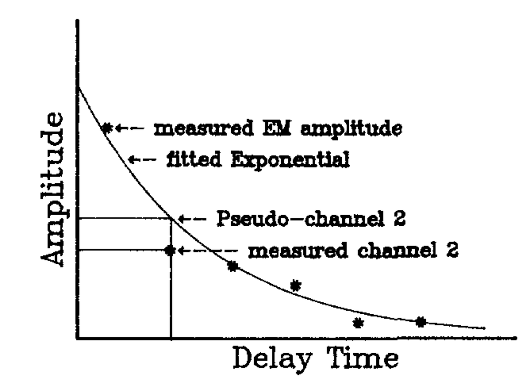
6000 ppm

0

Fit Quality > 60%
Minimum Width 3 pts
Flight Direction NW <--> SE
Data Lag 4.0 s

TIME CONSTANT KEY
(microseconds)
0 – 250
250 – 300
300 – 5000

DEFINITION OF PSEUDO CHANNEL



– ELECTROMAGNETIC PROFILES –
PSEUDO CHANNEL 8 (1.458 ms Delay Time)

ALMADEN RESOURCES CORP.

Michaelson Claims, Ontario

Job # 5062 Sheet 1 of 1 Dec, 1987

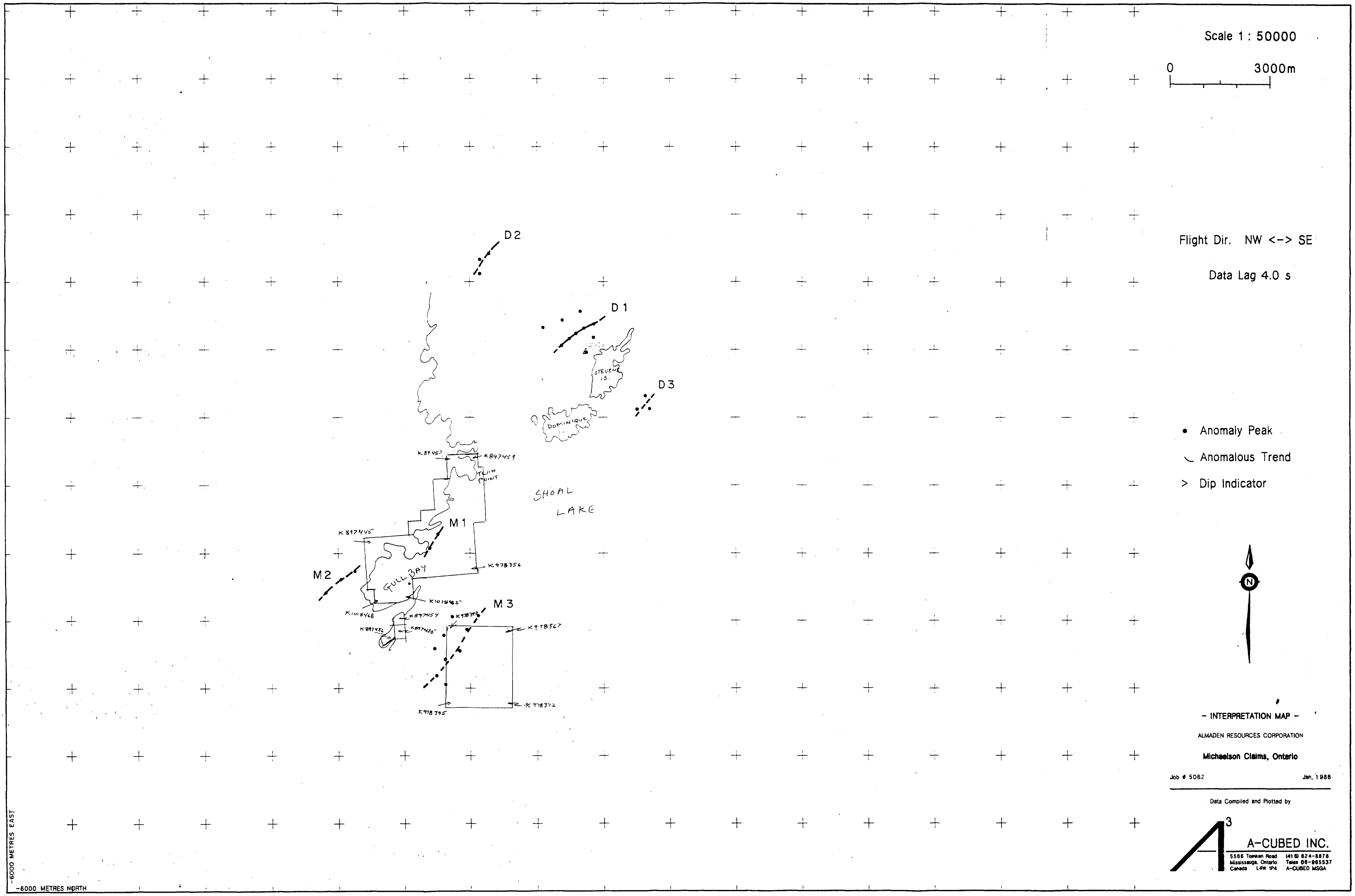
Data Compiled and Plotted by

A-CUBED INC.
5566 Tomken Road (416) 624-8878
Mississauga, Ont. Telex 06-985537
Canada L4W 1P4 A-CUBED MSGA

52E11SE9816 2.11159 SNOWSHOE BAY ISHOAL

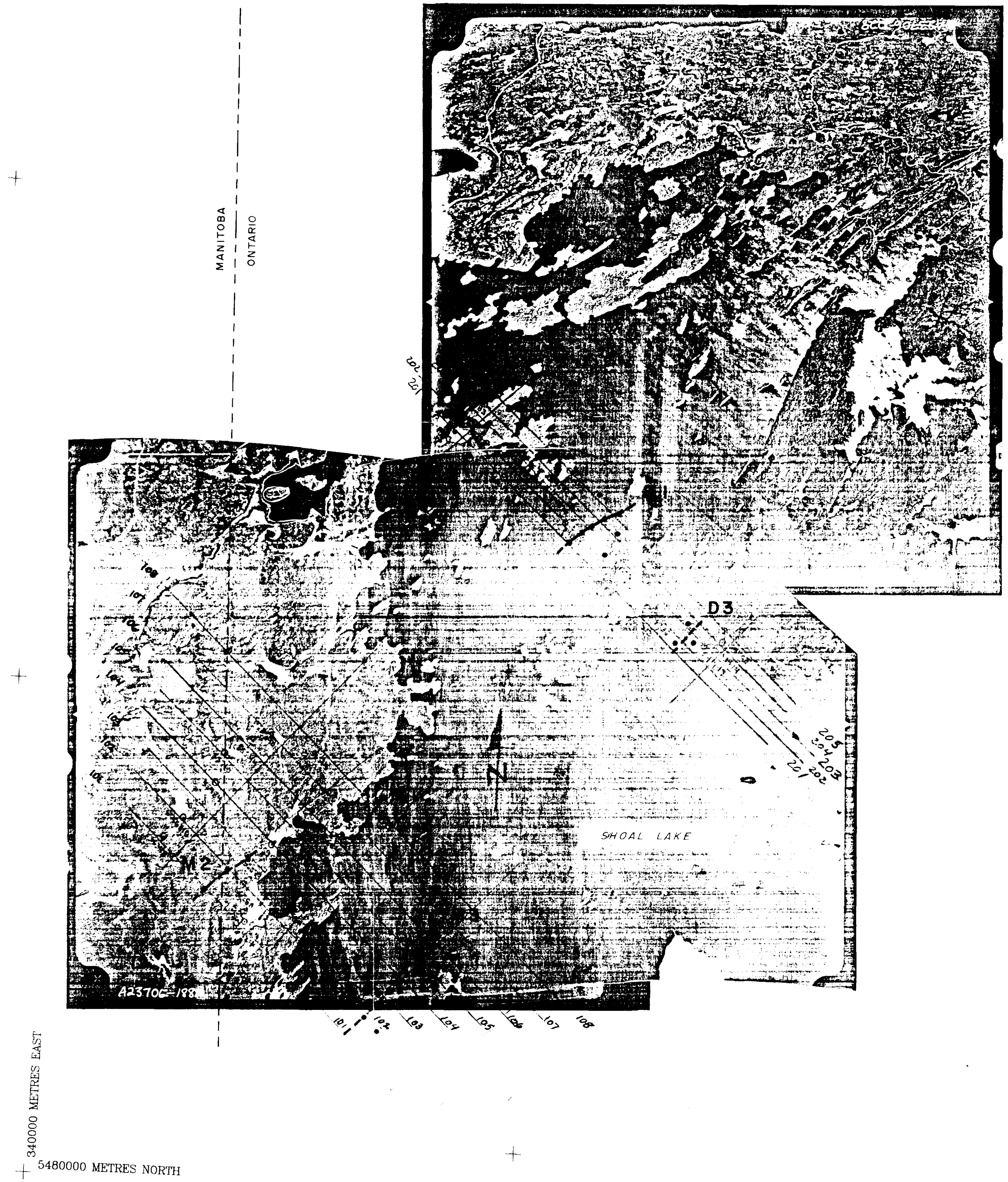
260

2.11159


Scale 1 : 50000
0
3000m
Flight Dir. NW <-> SE
Data Lag 4.0 s
Anomaly Peak
Anomalous Trend
> Dip Indicator
D2
D1
D3
STEVENS IS.
DOMINIQUE
K89457
K897459
TWIN POINT
SHOAL LAKE
M1
K897445
M2
GULL BAY
K978356
K1018465
K1018468
M3
K897454
K978398
K978367
K897456
K897450
K978395
K978372
-6000 METRES EAST
-6000 METRES NORTH
- INTERPRETATION MAP -
ALMADEN RESOURCES CORPORATION
Michaelson Claims, Ontario
Job # 5062
Jan, 1988
Data Compiled and Plotted by
A-CUBED INC.
5566 Tomken Road
Mississauga, Ontario
Canada L4W 1P4
(416) 624-8878
Telex 06-965537
A-CUBED MSGA

2.11159

INTERPRETATION



Scale 1 : 50000

0 3000 m

Flight Direction NW <-> SE
Data Lag 0.0 s

● Anomaly Peak

Anomalous Trend

Dip Indicator

N

– INTERPRETATION MAP –

ALMADEN RESOURCES CORPORATION

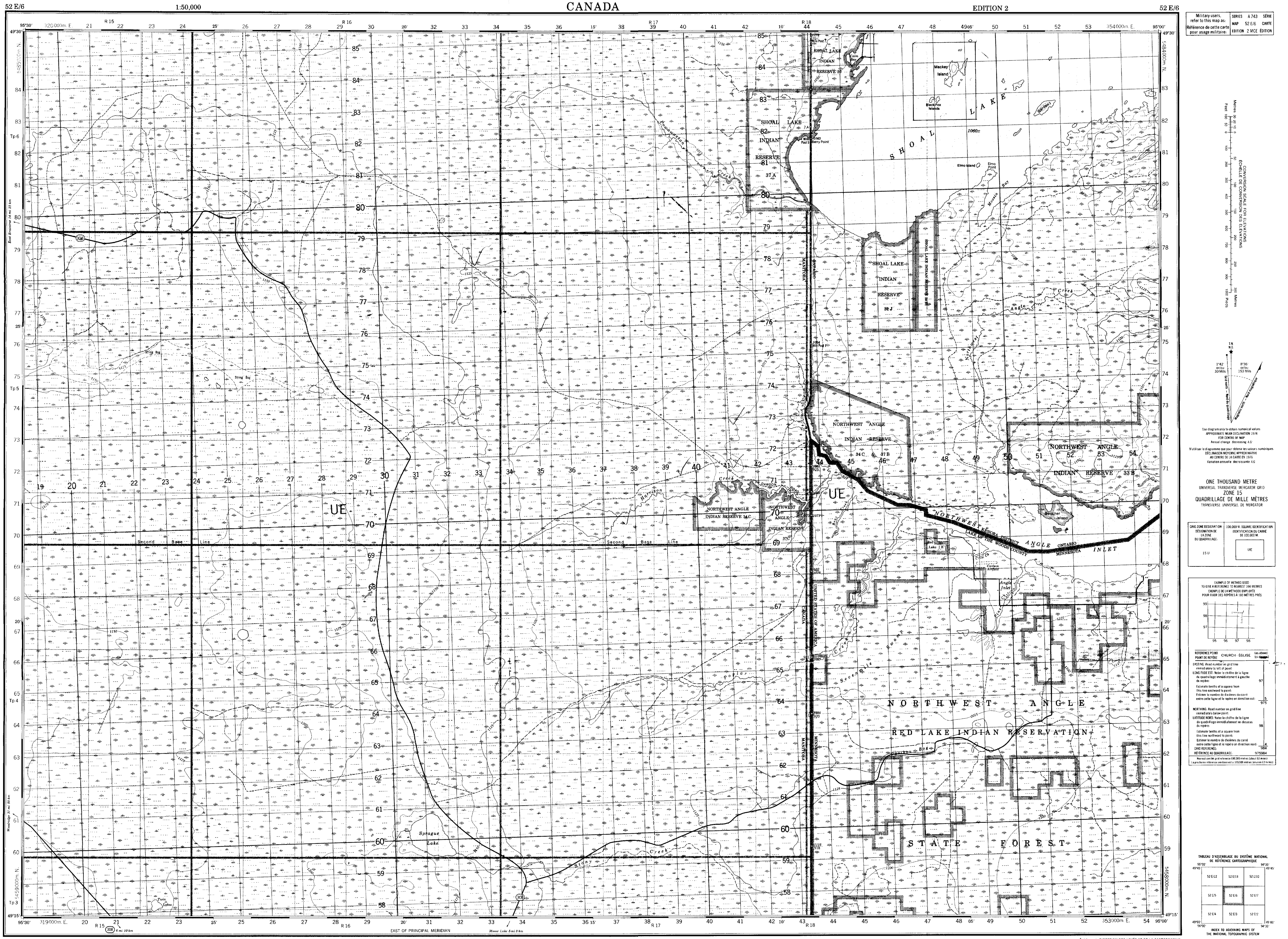
Michaelson Claims, Ontario

Job # 5062 Jan, 1988

Data Compiled and Plotted by

A-CUBED INC.

5566 Tomken Road (416) 624-8878
Mississauga, Ont. Telex 06-965537
Canada L4W 1P4 A-CUBED MSGA



Produced by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Updated from aerial photographs taken in 1974. Culture check 1975. Information current as of 1975. USA portion copied in part from maps (1967) supplied by the United States Geological Survey.

BERRY POINT

CANADA - UNITED STATES OF AMERICA

Roads:	Routes:
loose or stabilized surface, all weather	gravier aggloméré, toute saison
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues hors classe
cart track	de terre
trail, cut line or portage	sentier, percée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE — POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

Scale 1:50,000 Échelle

CONTOUR INTERVAL 50 FEET
AUXILIARY CONTOUR INTERVAL 25 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

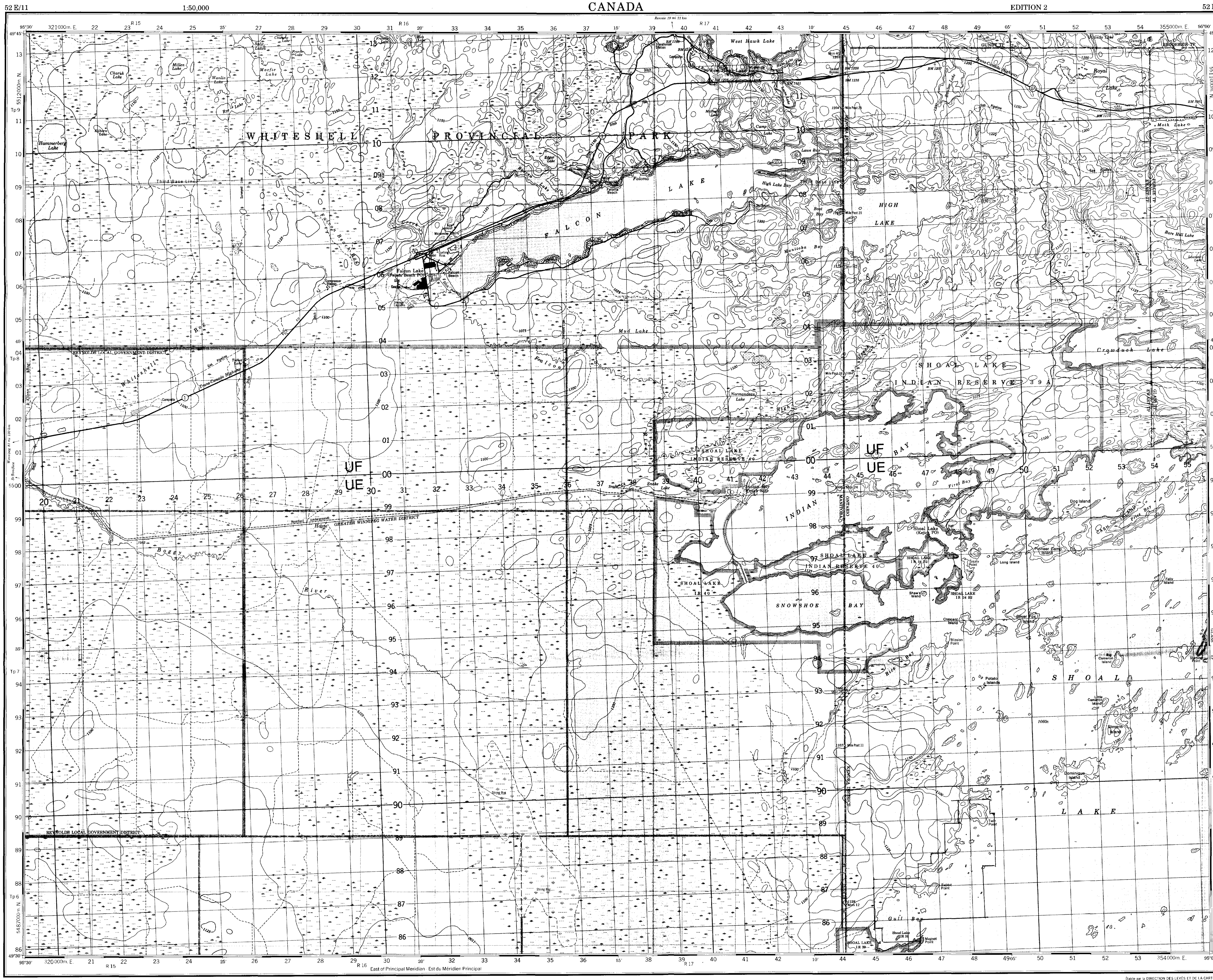
ÉQUIDISTANCE DES COURBES 50 PIEDS
ÉQUIDISTANCE DES COURBES AUXILIAIRES 25 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

Établie par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à l'aide de photographies aériennes prises en 1974. Vérification des ouvrages en 1975. Renseignements à jour en 1975. Partie américaine reproduite en partie d'après des cartes (1967) fournies par le Geological Survey des États-Unis.

Ces cartes sont en vente au Bureau des Cartes du Canada, ministère de l'Énergie, des Mines et des Ressources, Ottawa, ou chez le vendeur le plus près.

BERRY POINT
52 E/6
EDITION 2

52 E/11 1:50,000 CANADA EDITION 2 52 E/11



Produced by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Updated from aerial photographs taken in 1974. Culture check 1975. Information current as of 1975.

Roads:	Routes:
hard surface, all weather	pavée, toute saison — dual highway / 2 chaussées séparées; more than 2 lanes / plus de 2 voies
hard surface, all weather	pavée, toute saison — 2 lanes / 2 voies; less than 2 lanes / moins de 2 voies
loose or stabilized surface, all weather	gravier aggloméré, toute saison — 2 lanes or more / 2 voies ou plus; less than 2 lanes / moins de 2 voies
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues hors classe
cart track	de terre
trail, cut line or portage	sentier, percée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE — POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

FALCON LAKE
MANITOBA-ONTARIO

Scale 1:50,000 Échelle

CONTOUR INTERVAL 50 FEET
AUXILIARY CONTOUR INTERVAL 25 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
ÉQUIDISTANCE DES COURBES AUXILIAIRES 25 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

Établie par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à l'aide de photographies aériennes prises en 1974. Vérification des ouvrages en 1975. Renseignements à jour en 1975.

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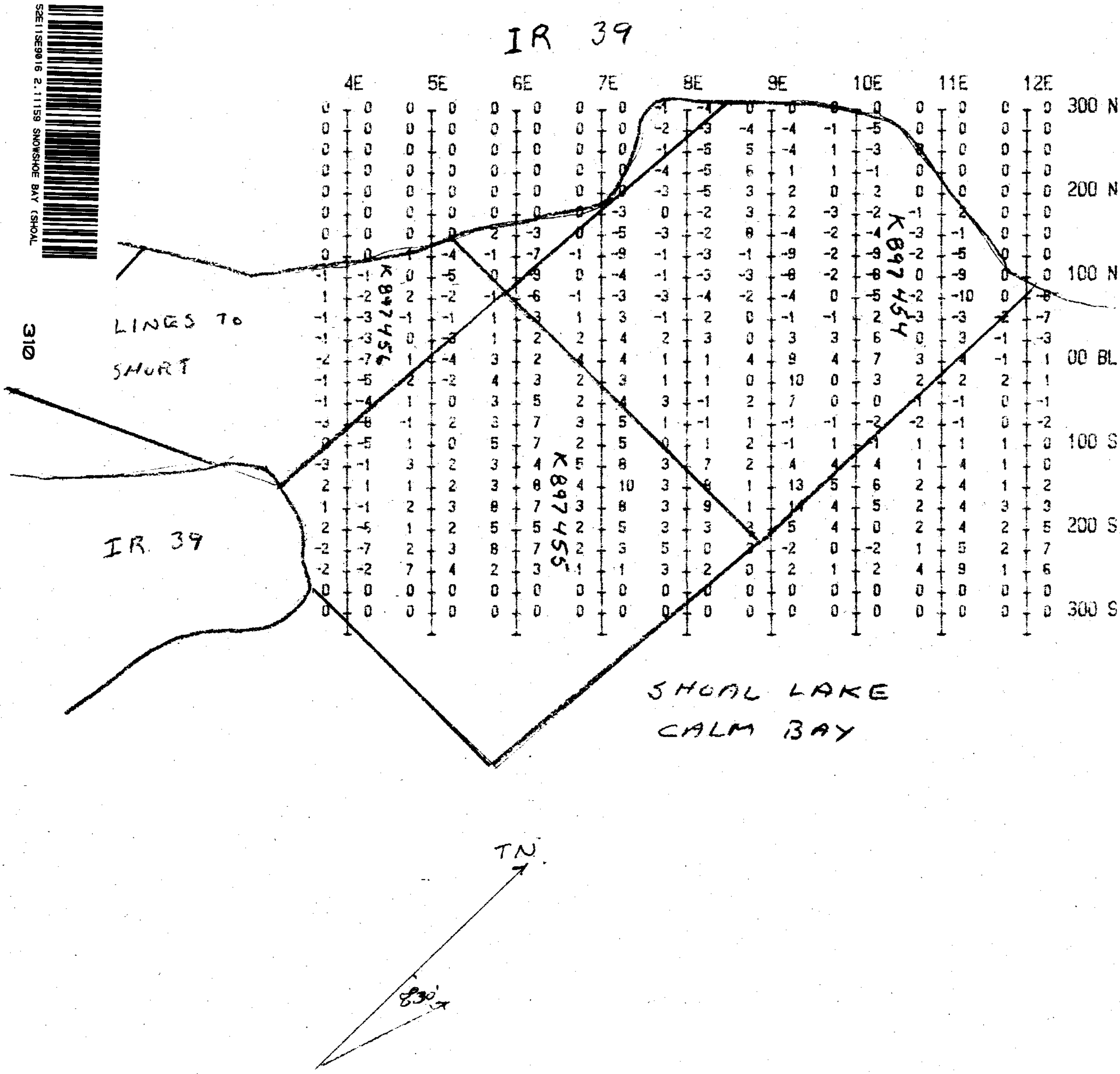
FALCON LAKE
52 E/11
EDITION 2



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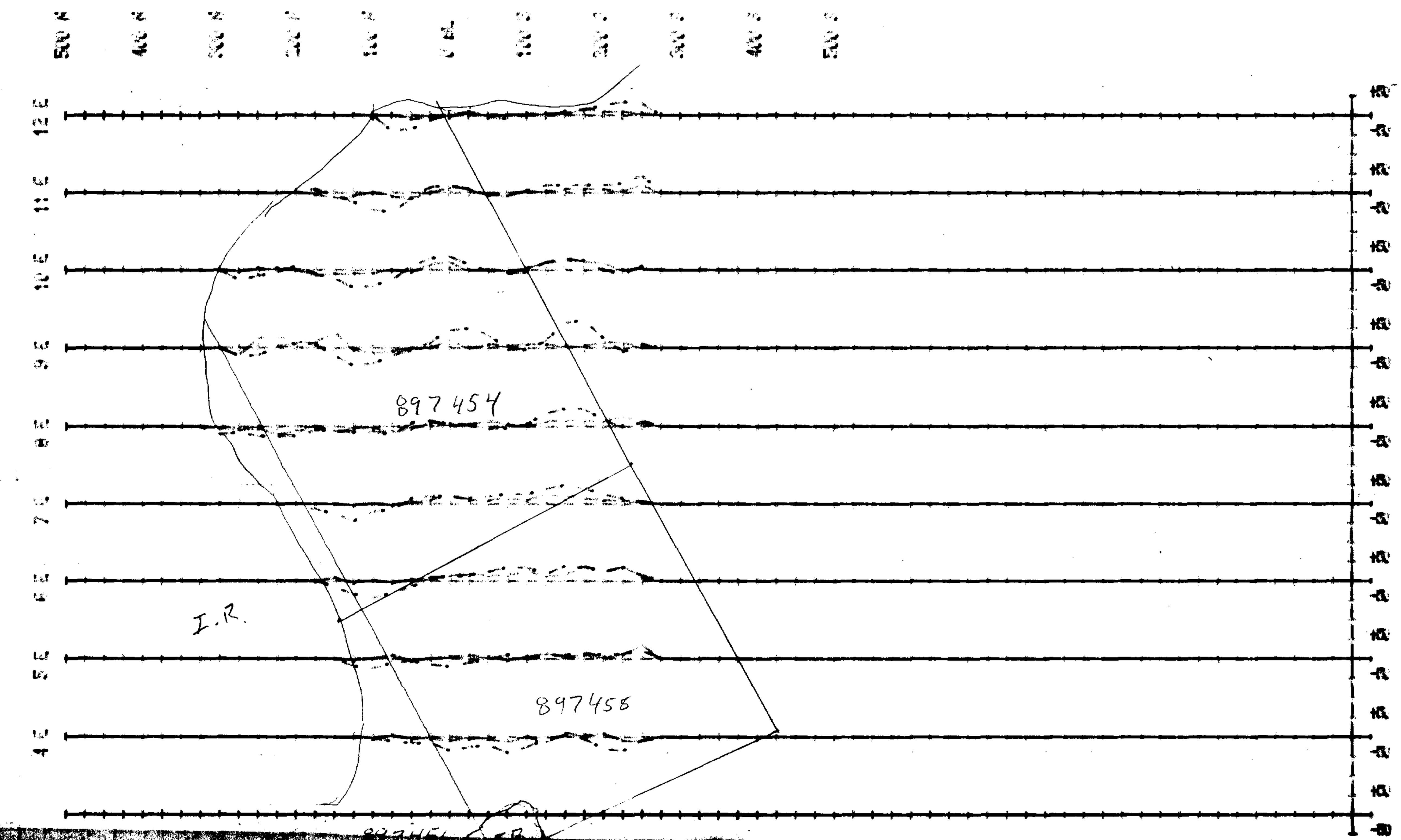
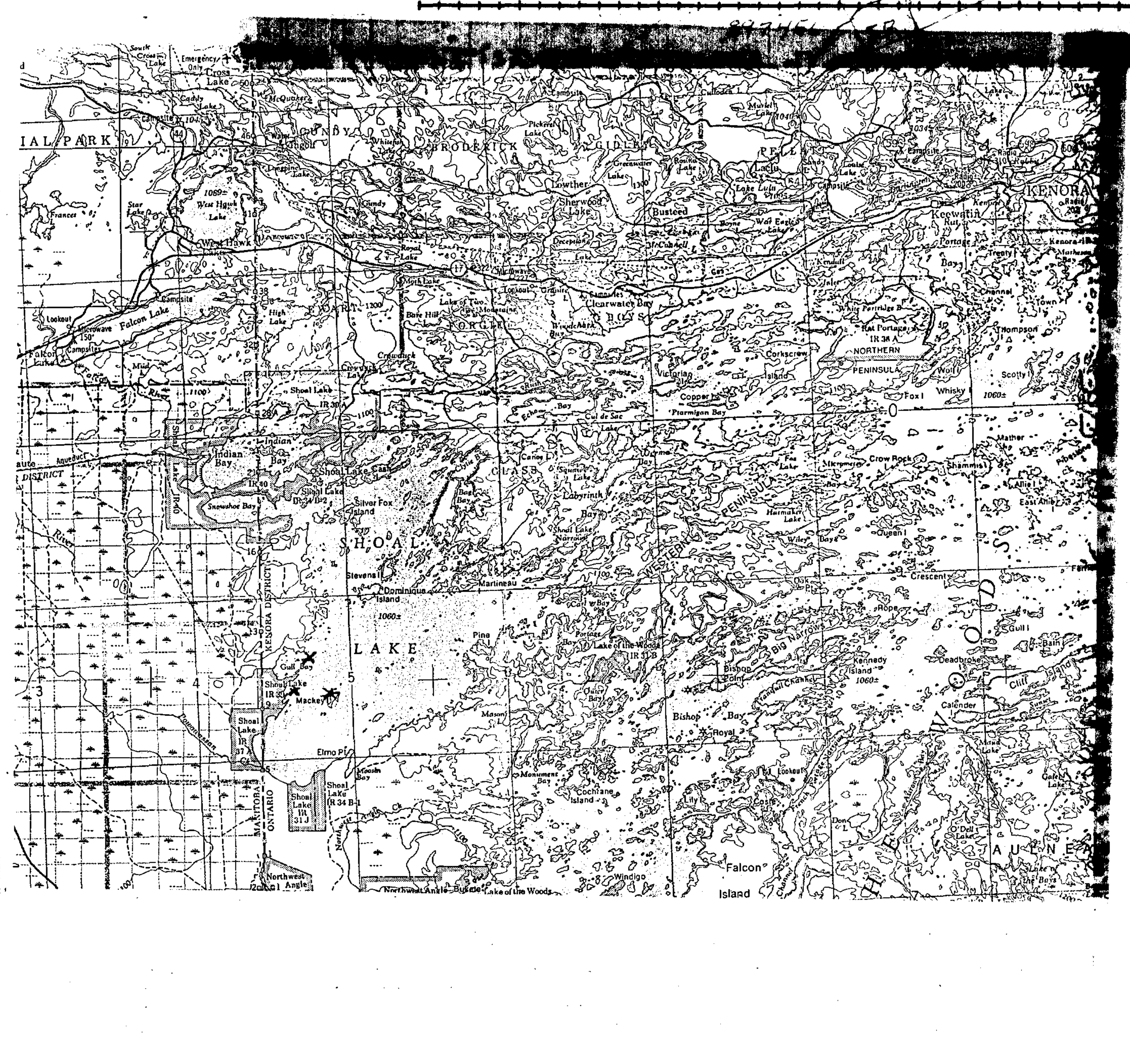
310

2,11159





EXPLANATION

MAXMIN II + EM PROFILE MAP

CALM BAY - SHOAL LAKE ONT.

GRID 'C'

FREQUENCY = 444 HZ.
INPHASE
OUT-OF-PHASE

Date Sept. 20 1988

Prepared by J.BROWN

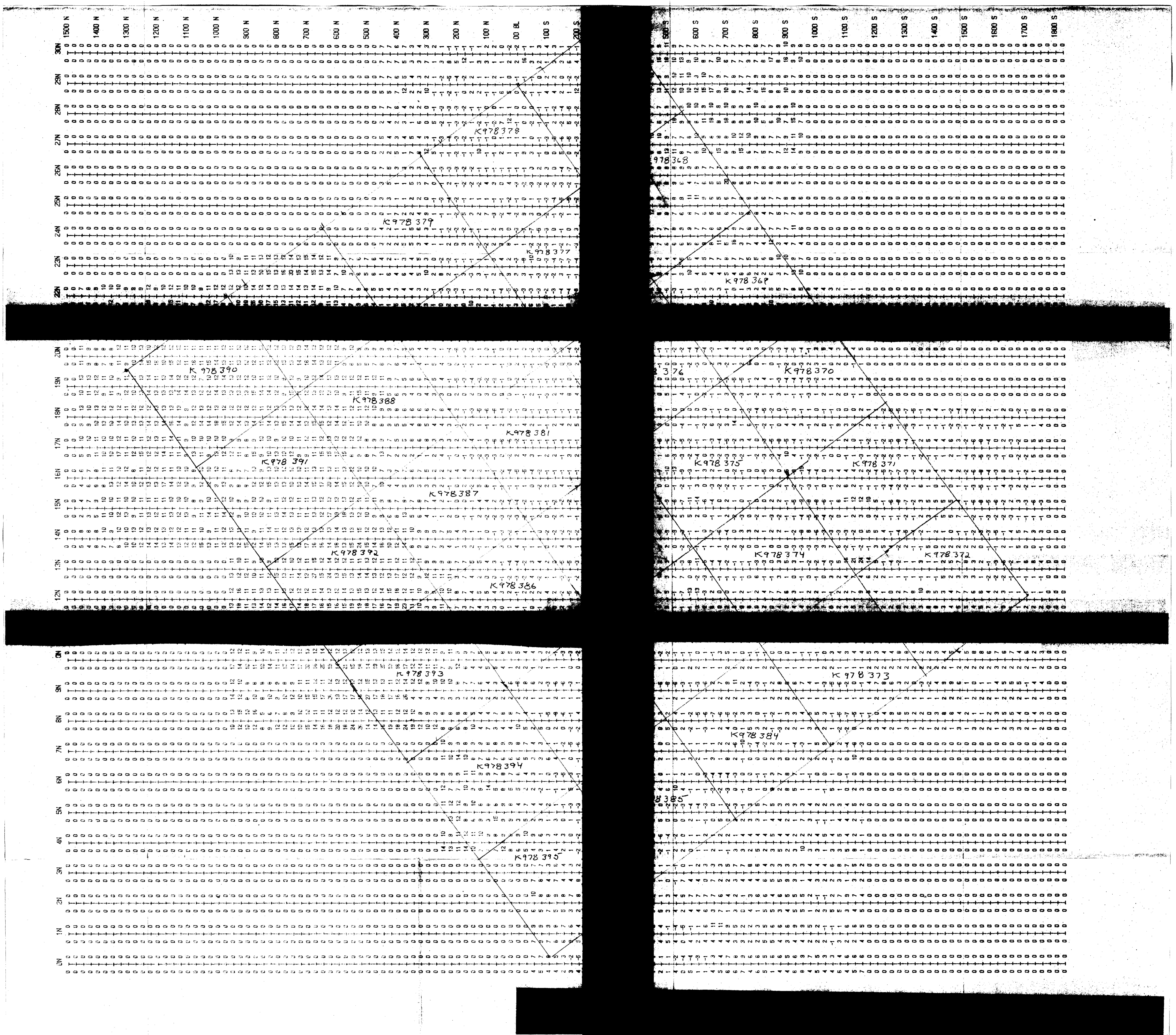
Scale 1 : 5000

100m 0 100m

2.11159

52E11SE9016 2.11159 SNOWSHOE BAY (SHOAL

320



GRID E

DATA PLAN MAP
MAX-MIN II PLUS EM SURVEY
MACKAY ISLAND - SHOAL LAKE ONTARIO

FREQUENCY = 444 HZ. COIL SEP 100 m
SCALE 1:5000

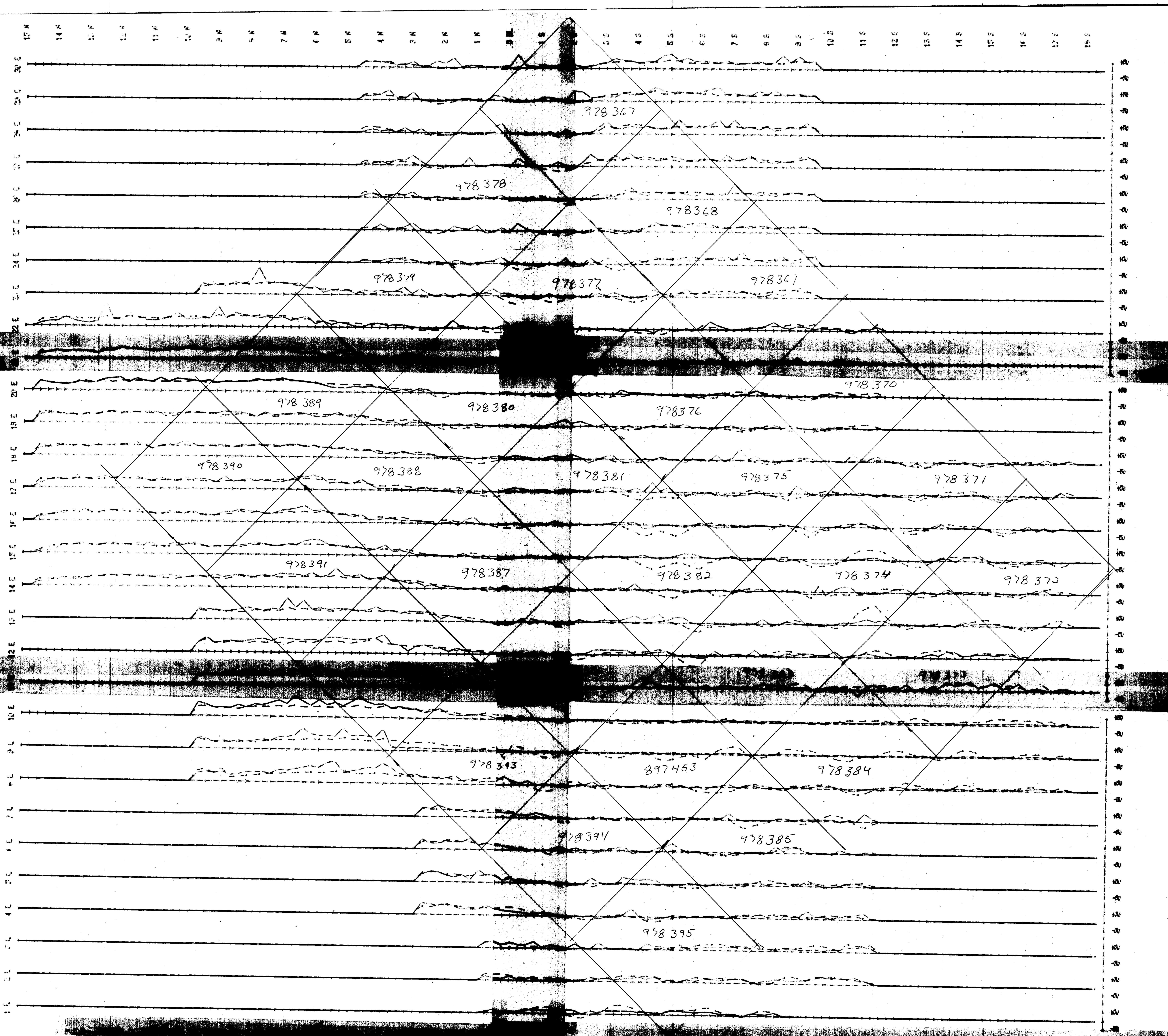
OUT OF PHASE
IN PHASE

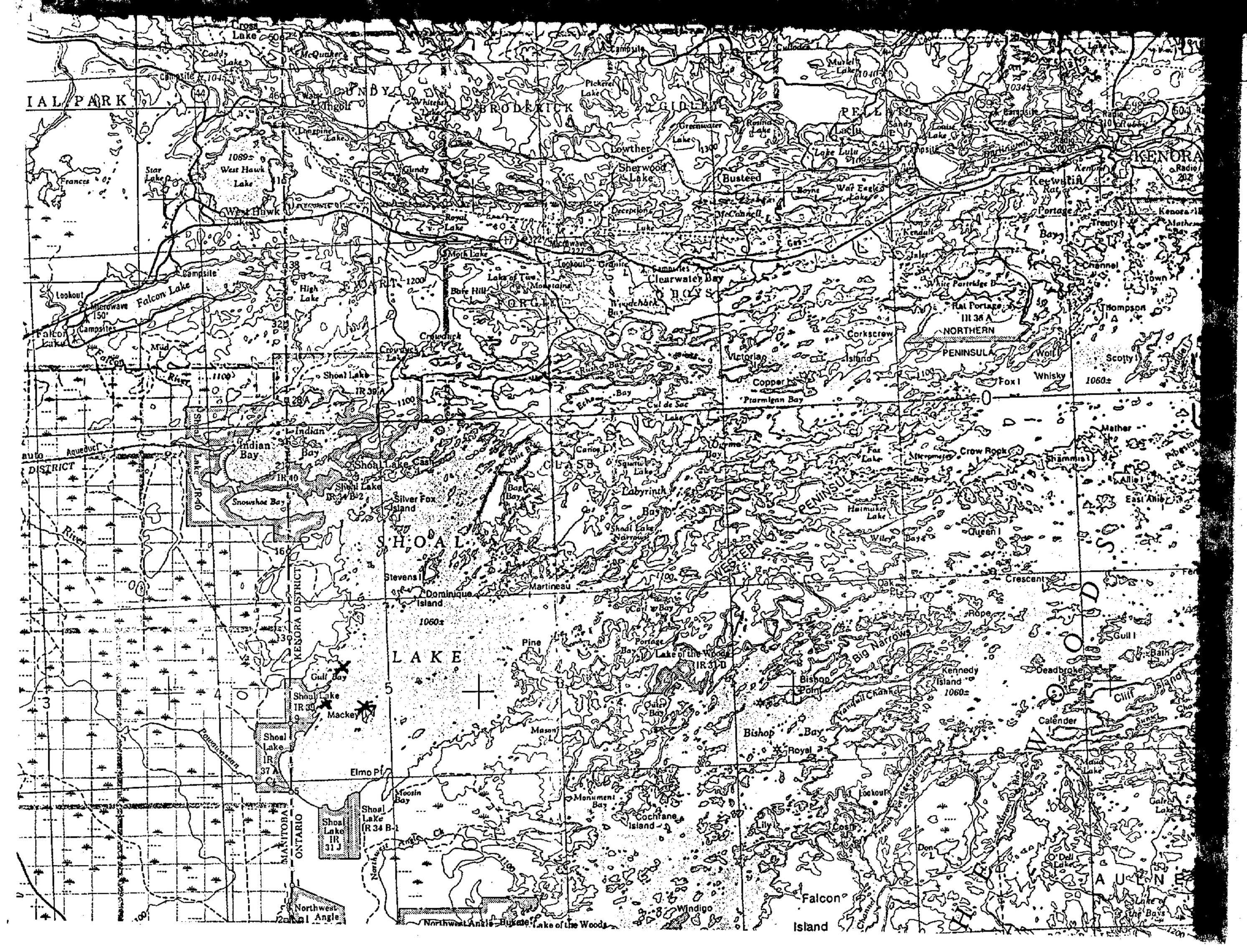
DATE JULY 18 1988
PREPARED BY J. BROWN

2.11159

52E11SE0018 2.11159 SNOWSHOE BAY (SHOAL

330





EXPLANATION

MAXMIN II + EM PROFILE MAP

MACKAY ISLAND - SHOAL LAKE ONT.

GRID ' E '

FREQUENCY = 444 HZ.
INPHASE
OUT-OF-PHASE

Date Sept. 20 1988

Prepared by J. BROWN

Scale 1 : 5000

100m 0 100m

52E11SE9016 2.11159 SNOWSHOE BAY (SHOAL

340

2.11159


2000N 1900N 1800N 1700N 1600N 1500N 1400N 1300N 1200N 1100N 1000N 900N 800N 700N 600N 500N 400N 300N
0BL 100S 200S 300S 400S 500S 600S 700S 800S 900S 1000S 1100S 1200S 1300S
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K1018467
GULL BAY
SHOAL LAKE
TN

2.11159

350

EXPLANATION
MAXMIN II + EM PROFILE MAP
GULL BAY - SHOAL LAKE ONT.
GRID 'G'
FREQUENCY = 444 HZ.
INPHASE
OUT-OF-PHASE
Date Sept. 20 1988
Prepared By J.BROWN
Scale 1 : 5000
100m 0 100m
PATENT
SHOAL LAKE
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