Ø1Ø

A GEOTEM® EM AND MAGNETIC SURVEY OVER SHEPPARD AND McCARTHY TOWNSHIPS, ONTARIO FOR TECK CORPORATION

Distribution:

4 - Teck Corporation, North Bay, Ontario

1 - CGI Controlled Geophysics Inc., Mississauga, Ontario

File: 6039

May, 1991

S1146852
S1146853
S1146854
S1146855
S1146856
S1146857
S1146858
S1146859
S1146860
S1146861
S1146862
S1146863
S1146864
S1145865
S1146866
S1146867
S1146868
S1146869
S1146870
S1146871
S1146872
S1146873
S1146874
S1146875
S1146876
S1146877
S1146878
S1146879
S1146880
S1146881
S1146882
S1146883
S1146884
S1146885
S1146886
S1146887
S1146888
S1146889
S1146890
S1146891
S1146892
S1146893
S1146894
S1146895
S1146896
S1146897
S1146898
S1146899
S1146900
S1146901
S1146902
S1146903
S1146904
S1146905
S1146906
S1146907
S1146908
S1146909
S1146910
S1146911
S1146912
S1146913
S1146914
S1146915
S1146916
S1146917
S1146918
S1146919
S1146920
S1146921
S1146922
S1146923
S1146924
S1146925
S1146926
S1146927
S1146928
S1146929
S1146930
S1146931
S1146932
S1146933
S1146934
S1146935
S1146936
S1146937
S1146938
S1146939
S1146940
S1146941
S1146942
S1146943

Emerald Lake - 233 Mining Claims

S1094987	S1146758	S1146805
S1094988	S1146759	S1146806
S1094989	S1146760	S1146807
S1094990	S1146761	S1146808
S1094991	S1146762	S1146809
S1094992	S1146763	S1146810
S1094993	S1146764	S1145811
S1094994	S1146765	S1146812
S1094995	S1146766	S1146813
S1094996	S1146767	S1146814
S1094997	S1146768	S1146815
S1094998	S1146769	S1146816
S1094999	S1146770	S1146817
S1095000	S1146771	S1146818
S1095001	S1146772	S1146819
S1095002	S1146773	S1146820
S1095003	S1146774	S1146821
S1095004	S1146775	S1146822
S1095005	S1146776	S1146823
S1095006	S1146777	S1146824
S1095007	S1146778	S1146825
S1095008	S1146779	S1146826
S1095009	S1146780	S1146827
S1095010	S1146781	S1146828
S1095011	S1146782	S1146829
S1095012	S1146783	S1146830
S1095013	S1146784	S1146831
S1095014	S1146785	S1146832
S1095015	S1146786	S1146833
S1095016	S1146787	S1146834
S1095017	S1146788	S1146835
S1095018	S1146789	S1146836
S1095019	S1146790	S1146837
S1146744	S1146791	S1146838
S1146745	S1146792	S1146839
S1146746	S1146793	S1146840
S1146747	S1146794	S1146841
S1146748	S1145795	S1146842
S1146749	S1146796	S1146843
S1146750	S1146797	S1146844
S1146751	S1146798	S1146845
S1146752	S1146799	S1146846
S1146753	S1146800	S1146847
S1146754	S1146801	S1146848
S1146755	S1146802	S1146849
S1146756	S1146803	S1146850
S1146757	S1146804	S1146851

EXECUTIVE SUMMARY

During the period November 13, 1990 to January 12, 1991 a combined airborne magnetic and GEOTEM® EM survey was carried out by CGI Controlled Geophysics Inc. for Teck Corporation over portions of Sheppard and McCarthy Townships approximately 40 km northeast of the airport of Sudbury, Ontario.

The objectives of the survey were to map in detail the magnetic and electromagnetic responses to obtain an improved geological interpretation, to identify deeply buried targets of potential economic value, and to relate the new information to that obtained from prior geological and geophysical surveys located in the same area. Including tie-lines, a total of approximately 275 line kilometres were flown.

The geophysical parameters measured during flight were total magnetic field (at 1 sample per second) and 12 electromagnetic channels representing the GEOTEM® transient response (at 6 samples per second). Data compilation carried consisted of flight path recovery, electromagnetic data processing, preparation and plotting of total magnetic field data, and calculation of first vertical magnetic derivative.

As interpretation aids, maps of selected processed GEOTEM® channels were plotted in plan profile format to show all EM responses in the survey area. The total magnetic field was contoured in blackline and presented on a clear base.

This report presents a logistical account of the survey, describes the products produced, and provides some interpretation notes about the results. A program of data processing will be neccessary to enhance the weak responses from deep sources and a detailed program of ground geophysics is recommended to pinpoint targets before drilling, especially in areas where complex structures appear to be present and conductor axes were not uniquely resolvable.

41116NW0064 2.14181 SHEPPARD

010C

TABLE OF C

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This report describes the execution and results of a combined GEOTEM® EM and magnetic survey carried out by CGI Controlled Geophysics Inc. from November 13, 1990 to January 12, 1991.

The survey instrumentation and layout were chosen to maximize the ability to detect deeply buried conductors of potential economic value and to use the electromagnetic data in a mapping mode to compliment the magnetic data mapping abilities. The EM mapping is achieved by examining the conductivity distribution in the area as maps of apparent time constant as derived from the *OUTPUT* processing technique developed by C. Vaughan.

The data were acquired via a sub-contract to Geoterrex Ltd. of Ottawa, Ontario who were also responsible for flight path recovery and levelling of the total magnetic field. Blackline contour plotting of the magnetic field was carried out by Controlled Geophysics. The electromagnetic data were processed and presented by Controlled Geophysics.

This report presents the logistics of the survey and interpretation notes on the results, along with supporting map products and recommendations for follow-up.

2. SURVEY AREA DESCRIPTION

The survey area is located in portions of Sheppard and McCarthy Townships approximately 40 km northeast of the airport of Sudbury, Ontario (See Figure 1), and is encompassed within the following geographic co-ordinates:

LONGITUDE	LATITUDE
081° 24' W	46° 49' N
081° 28' W	46° 56' N

The co-ordinates used on the maps are expressed in metres north of the Equator and east of a false easting located 500,000 metres west of 81° W longitude for the local UTM grid zone 41I. The UTM limits enclosing the project are:

EASTING (m)	NORTHING (m)
540,000	5,184,000
545,000	5,197,000

The survey area has glacial moraine and glaciofluvial terraines and is quite rugged, with topographic relief occasionally exceeding 350 feet from lake surface to hill top. There is very little wetlands terrain, but numerous lakes. Cultural sources are minimal. The bedrock geology consists primarily of Huronian age Cobalt Group rocks and late intrusive dikes. The survey covers a portion of the Temagami magnetic anomaly which is believed to have a source depth of several kilometres.

3. FIELD WORK

3.1 Survey Specifications

The survey specifications were set based on a detailed knowledge of the GEOTEM® system, the project objectives, and some *a priori* knowledge of the regional geological setting.

The nominal line spacing of 200 metres and line direction of $0^{o}/180^{o}$ were chosen to map the property in sufficient detail to resolve the anticipated structures. A series of tie-lines oriented $90^{o}/270^{o}$ were also specified.

The flying specifications in Table 1 were commensurate with current standards except for a tightening of the navigation specification to cover altitude as well as horizontal positioning. See Section 4.4 for a description of the GEOTEM® system configuration.

3.2 Survey Operations

The survey operations are described in the Geoterrex Limited *Logistics and Processing Report* in Appendix A of this report. A Controlled Geophysics geophysicist visited the survey base of operations in Sudbury to monitor survey performance and data quality. The flight logs are presented in Appendix B of this report.

4. DATA COMPILATION, PROCESSING, AND PRESENTATION

The following covers the preparation and presentation of the products listed in Table 2. Each product has been presented on one map sheet at a scale of 1:20,000.

4.1 Flight Path

The flight path recovery (described in Appendix A) was carried out by the airborne sub-contractor using Doppler and Global Positioning System (GPS) data to assist visual navigation. The final flight path has been presented in one sheet on a clear base at a scale of 1:20,000. Each line is labelled and annotated with fiducial ticks every 100 fids (10 seconds) and fiducial labels every 500 fids (50 seconds). The direction of traverse is indicated by an arrow at the beginning and end of each line. On all maps, a network of registration cross-hairs has been plotted at 1,000 m intervals.

4.2 Total Magnetic Field Preparation and Presentation

The total magnetic field measured during the survey was corrected for diurnal variations and levelled by the airborne sub-contractor. See Appendix A for details. These data were delivered to Controlled Geophysics as both a final grid archive and a line archive. The total magnetic field grid was then contoured at 10 nT (gamma) intervals and presented as blackline contours on a clear base at 1:20,000. The digital grid was imaged, including shadowing, with RTI-CAD on a workstation.

4.3 Electromagnetic Data Preparation and Presentation

The raw GEOTEM® data were compiled and processed at Controlled Geophysics during early 1991. Before any presentation or *OUTPUT* processing could be carried out, the data needed to be processed to remove noise from known non-geological sources. This section describes each of these procedures.

Figure 2 presents the principles of operation of the GEOTEM® system. When a conductor is nearby, the receiver measures a transient waveform produced by the decay of the induced secondary field from that conductor. During flight, a set of channel amplitudes measured in a number of time slices through the transient are plotted vs time on analogue chart records. The amplitude of the response grows as the aircraft approaches the conductor and returns to zero or background levels as the aircraft departs. The detailed manner in which the amplitudes vary in the interim (including possible zero crossovers and nulls) provide source type and geometry information. In the GEOTEM® system, a set of channel amplitudes are recorded six times per second corresponding to roughly one transient every 10 metres.

In the GEOTEM® receiver there are 20 channels available to represent the transient waveform. Twelve of these are positioned at equal time intervals throughout the off-time to obtain a true representation of the transient waveform. The other eight channels are used to monitor the GEOTEM® response throughout the on-time. Additional channels record the primary field at the towed bird and the power line noise. The position and widths for the channels are summarized in Table 3.

The raw GEOTEM® data were loaded from 9-track tape and plotted on large scale plots showing selected channel amplitude profiles. The high rate of sampling in the raw GEOTEM® data permits spherics to be edited by statistical means, thus preserving the fidelity of the ground responses. The GEOTEM® data are calibrated during flight and require no post-survey calibration. Channel levelling errors due to a small amount of system drift must be trapped and adjusted before *OUTPUT* processing.

Levelling has been carried out using a combination of statistical means and the end-of-flight calibration sequences that appear on the raw analogue charts. The end-of-flight base levels were measured and subtracted by applying a linear correction to each EM channel across the duration of the flight. Where non-linear drifts were present, the same type of levelling was carried out using shorter, linear drift segments.

The statistical characteristics of the levelled EM data were then examined using a histogram of amplitude occurrences computed for each channel. The results for a representative portion of the survey are presented in Figure 3. The range of amplitudes available in the histograms is -12.5 to +237.5 ppm with a resolution of 0.25 ppm. Each histogram contains the same area so that amplitudes falling within a close range of 0 will appear narrow and peaked while channels with more variability in amplitude produce broad, flat histograms. Where a number of amplitudes are counted above 237.5 or below -12.5 ppm, these counts are collectively plotted at their respective limits, producing a single spike there.

The key elements of the histograms are summarized in Table 4 where the absolute minimum and maximum value for each channel are presented along with the histogram peak amplitude and the first and second standard deviations above and below the peak. The peak amplitude provides the average amplitude in that channel, which for late channels is usually the zero or base level. For early channels it is the average ground response in that channel. Levelling errors appear as a shift of the distribution from zero and/or a break in the monotonic decrease of average channel amplitude expected from early through late time and/or a general broadening of the histogram. The standard deviations in the late time channels provides an estimate of the measured noise level in the data which is more quantitative than values based on an "eyeballed" noise level from analogue chart.

The 1.5 second time constant filter used for display during flight is adequate for the real-time analogues, but not for processing and interpretation as it phase-shifts the anomalies and degrades important anomaly nulls and zero crossings. For post-flight processing and presentation, adaptive spike rejection and a symmetric low-pass filter was used to reduce noise while preserving the anomaly peak shapes and locations.

Levelled and filtered original GEOTEM® Channels 2 and 5 have been plotted in plan profile at 1:20,000 scale and 100 ppm/cm vertical scale. The EM data lag has been removed.

4.4 *OUTPUT* EM Processing and Presentation

The filtered and levelled GEOTEM® data can be further processed using Controlled Geophysics' *OUTPUT* program, which generates apparent time constant and initial amplitude from a transient measurement. Every point in the survey consists of a sampled transient yielding 12 channel amplitudes. The measured GEOTEM® transient resembles an exponential decay function with a characteristic initial amplitude and time constant. An exponential decay model is determined from each transient in the survey using a weighted least squares algorithm. Figure 4 presents the channel amplitudes plotted as symbols with the fitted exponential running smoothly through them.

The parameters generated by the *OUTPUT* program are the initial amplitude of the exponential decay in ppm, the time constant of the exponential in microseconds (μs), and the normalized error in fit of the exponential to the measured EM channels, called Fit Index. The Fit Index is a function of how closely the fitted data match the observed and a function of the number of channels used for that fit. The closer the fitted transient matches the measured data and the more channels used, the larger the Fit Index value will be, to a maximum of 100.

In general the depth and orientation of a conductor affects the initial amplitude of the anomalous response while the conductivity and spatial extent of the conductor is proportional to the apparent time constant. The transient recorded from an ideal conductor, such as a well-connected deposit of massive sulphides at shallow depth would exhibit a strong initial amplitude and a slow decay because of its large apparent time constant value. The manner in which the initial amplitude changes along the line indicates the general shape of the body that is producing the response (i.e., a thin plate, a horizontal ribbon, or a sphere) and its orientation and depth.

The transient recorded from a surficial conductor, such as a lake bottom or swamp would exhibit a very high initial amplitude, because of its relatively close proximity to the AEM system, and a rapid decay because of its much smaller apparent time constant value. For areas of extensive continuous cover, the observed time constant may not vary much while the initial amplitude changes as the aircraft and/or towed bird change geometry. This phenomena produces "false" anomalies on traditional interpretation maps and chart records, but not on *OUTPUT* maps that key on time constant variations. Time constant can vary even when no anomaly peak is observed, as when a survey is flown sub-parallel to conductor strike or when bedrock conductor responses are embedded within larger surficial responses. These targets may be overlooked during standard compilation procedures that place emphasis upon anomaly peaks.

Where data are noisy or of low amplitude or where the transient decays very quickly, only the first few channels are reliable to fit an exponential to. Normally, a minimum number of 3 channels is specified to obtain a reliable fit. In more resistive portions of the survey, the minimum number of channels may not be available, so *OUTPUT* reports no fits there.

In lieu of initial amplitude, a PseudoChannel amplitude is often used on the maps and analogue chart records. The PseudoChannel presentation is a useful format to express the transient information. 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 GEOTEM® time gate represents a fixed delay time following the transmitter shut-off, one can use the same delay time to compute a corresponding PseudoChannel using the formula:

$$P_i = A_o e^{-t_i/c}$$

where
- P_i is the PseudoChannel i amplitude,
- A_o is the fitted initial amplitude,
- t_i is the specified Channel i delay time,
- c is the fitted time constant.

Selecting a small delay time t will result in large PseudoChannel amplitudes for all responses in the survey. Using a large delay time produces a map where only the most conductive responses have any appreciable amplitude.

On *OUTPUT* PseudoChannel maps the processed data are presented in a shaded plan profile format where the height of the profile at each location is the PseudoChannel amplitude and the colour is its time constant. The smallest time constants are given cool colours and the longest are given warm colours. All data above a specified Fit Index are presented and the EM lag is applied.

5. INTERPRETATION OF RESULTS

5.1 Introduction

The following geophysical interpretation of the survey results reflects the biases of the interpreter. It was prepared based on the products of the survey and a limited knowledge of the geological setting. The interpretation may be refined through the addition of ground control and modelling.

In general, an optimum bedrock conductor should have a large time constant and a strong initial amplitude. The anomaly profile will show a fairly narrow cross-section (a few hundred metres peak half width amplitude) if it is caused by a discrete, steeply-dipping bedrock conductor such as a graphitic horizon or by massive sulphides. Anomaly half-width normally broadens with increased depth of source. Broader anomalies can be caused by regional changes in basement lithology or widespread flat-lying conductors including swamps, lake-bottom 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 often readily identified by a signal in the power line monitor (HYDR on the chart records) or by visually inspecting the photomosaics and videotapes 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 strike and may give no response at all when the survey is flown sub-parallel to them. The GEOTEM® system employs synchronous detection to reject 60 Hz (and harmonics) signals, but DC power sources cannot be rejected using that principle because they have a wideband frequency content. Where EM anomalies coincide with power line monitor response and exhibit a high degree of correlation with magnetics, but show no visual evidence on the ground, they are treated as possible geological conductors since active power lines can induce current flow in geological conductors.

Weaker conductors with short time constants are often good targets for precious metal exploration, especially where they have good correlation with favourable magnetic or geological models. Sometimes, such responses are similar in character to surficial responses of finite extent such as a narrow stream bed. In situations where an above average time constant is consistently detected (i.e., 150 μs vs 100 μs) within a widespread area of conductive cover, there may be an underlying bedrock conductor. It might also indicate a thickening of the surficial conducting layer, since a thicker layer supports a larger induced eddy current pattern which would produce a larger apparent time constant. Magnetic data are normally used to corroborate the authentic bedrock responses.

To be sure of catching even the subtle responses, the interpretation was carried out with reference to the air analogue charts, *OUTPUT* derived time constants, contoured maps of total magnetic field and the photomosaics of the terrain.

Using the EM data in plan profile and magnetic total field map, conductor axes were interpreted and sketched in. Where an axis was not obvious for a conductive area, the area was outlined. A solid line indicates a definite axis while a dashed line implies tentative line-to-line correlation and/or uncertainty in location. Where possible, interpreted geological contacts and structures are indicated.

The location of the top of the conductor in relation to the anomaly symbol depends on the anomaly shape and the flight direction. The profiles in Figure 5 are those that would be seen from flying over a thin plate-like body in opposite 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 rules were used to position the axes. Where the anomalies are all attributed to a conductive overburden response, a long dashed line has been used to encircle the area. Where a bedrock conductor has been interpreted within such an area, the axis is drawn as well. The *OUTPUT* information allows variation of conductivity along strike to be monitored.

Passive cultural conductors, such as fence lines and railway tracks, often produce a real-looking anomalies with no evidence of culture in the power line monitor on the analogue chart. These responses have generally been included on the EM maps where their source is readily apparent from the photomosaic base. Active cultural conductors, such as power lines, show activity in the power line channel. These have not been picked on the interpretation map.

The individual anomalous trends and areas are discussed in the following sections. Related ones are discussed together. In some cases, estimates of dip and depth are provided. Note that all anomalies discussed are recommended for follow up with ground geophysics unless specifically noted otherwise.

5.2 The Geophysical Response over the Survey Area

The area exhibits a wealth of magnetic responses, but only limited electromagnetic response. The following are some general observations.

The Temagami magnetic high anomaly has produced a background response ranging from 58,800 nT in the south to over 63,000 nT in the northeast. Superimposed upon the regional gradient are several smaller scale magnetic responses including two WNW trending linear highs spanning the survey which are probably late intrusive diabase dikes and a complex region of magnetic high (approximately 300 nT above the background) response, which spans the two dikes in a nearly north-south direction and continues north of the pair. A good bipolar magnetic reponse with peak-to-trough reponse of 260 nT runs from Line 36302 at fiducial 532600 to Line 35801 at fiducial 335700. Northwest of this magnetic feature, the strongest electromagnetic responses occur. Situated on Lines 35301 through 35801 at a Northing of 5,192,000 metres, they are broad and have Channel 2 amplitude peaks between 10 and 40 ppm.

The background electromagnetic response in the survey is essentially nil. Most of the EM responses exhibit broad profile shape and very low amplitude, suggesting that the sources are deep.

6. CONCLUSIONS AND RECOMMENDATIONS

The combined airborne GEOTEM® electromagnetic and magnetic survey in the survey area has detected many magnetically-defined structures and several weak EM responses within a resistive background. A detailed program of ground geophysics is recommended to pinpoint targets before drilling, especially in areas where complex structures appear to be present and conductor axes were not uniquely resolvable.

Additional useful products which could be generated include contours of first and second vertical magnetic derivatives, colour versions of all magnetic products and *OUTPUT* PseudoChannel maps. Any further evaluation of the conductors using the survey products would best be carried out by overlaying the interpretation maps on *OUTPUT* PseudoChannel maps and colour magnetic products, especially the calculated magnetic first vertical derivative. Image analysis of the EM and magnetic data should also form the basis for continued study of the area. As more information becomes available, a detailed program of modelling and interpretation can be carried out to refine the present interpretation.

Respectfully submitted,
CGI *Controlled* Geophysics Inc.

Chris Vaughan
Chief Geophysicist

Glenn Boustead, P.Eng.
Geophysicist

Qual 2.6114

STATEMENT OF QUALIFICATIONS

I, Glenn Boustead, Geophysicist with CGI Controlled Geophysics Inc. operating at Suite 31, 400 Matheson Blvd. East, Mississauga, Ontario do hereby certify that:

1. I am a geophysicist.

2. I graduated from the University of Toronto in 1983 with a B.A.Sc. in Engineering Science (Geophysics option).

3. I have been actively engaged in geophysical exploration since 1983.

4. I am an active member of several professional societies involved with mining geophysics.

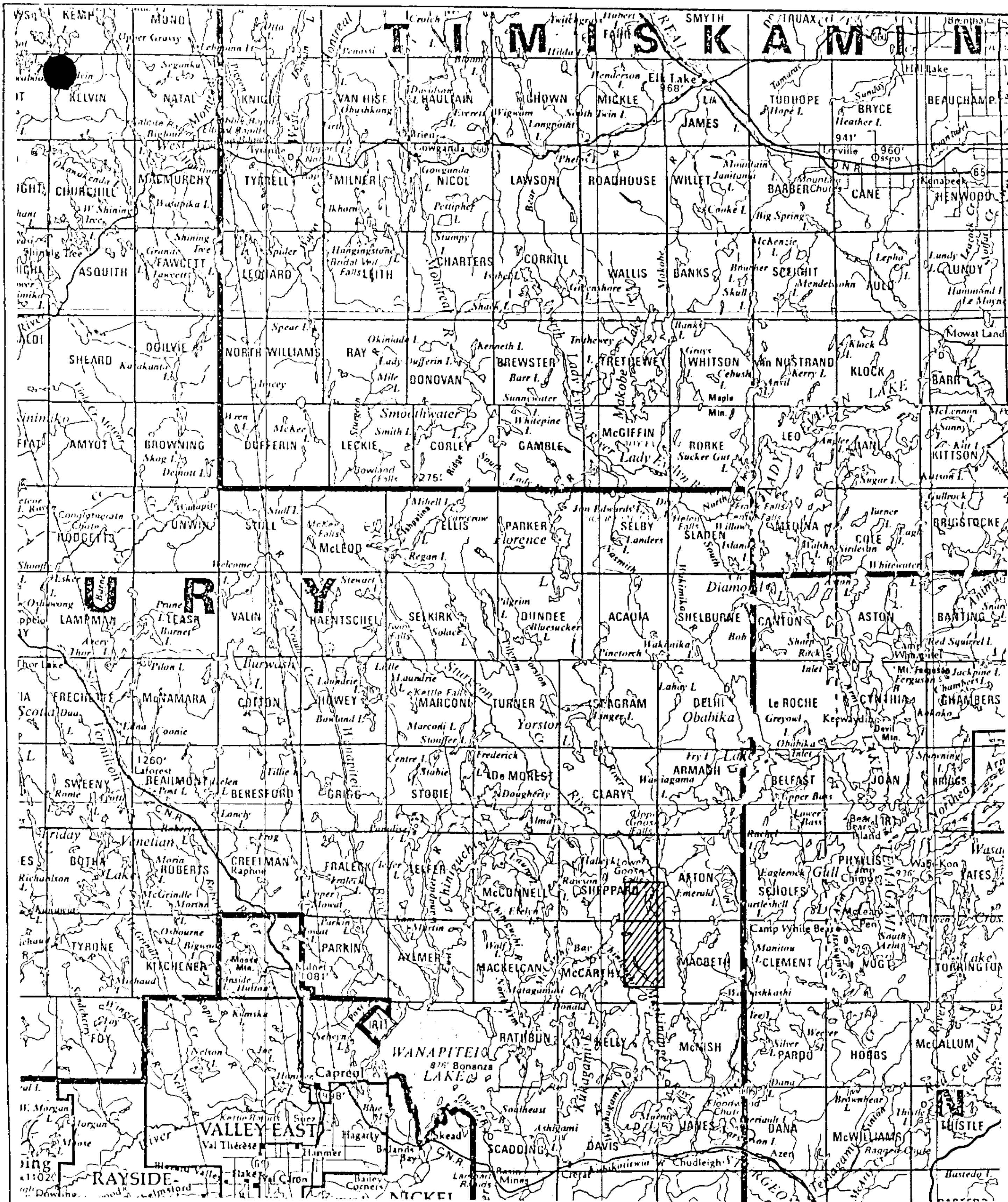
5. I was personally involved in the interpretation of the geophysical data in this report.

6. I have no interest, direct, or indirect, in the property described nor do I hold securities in Teck Corporation.

CGI *Controlled* Geophysics Inc.

Glenn Boustead, P.Eng.
Geophysicist

Qual 2. 6114

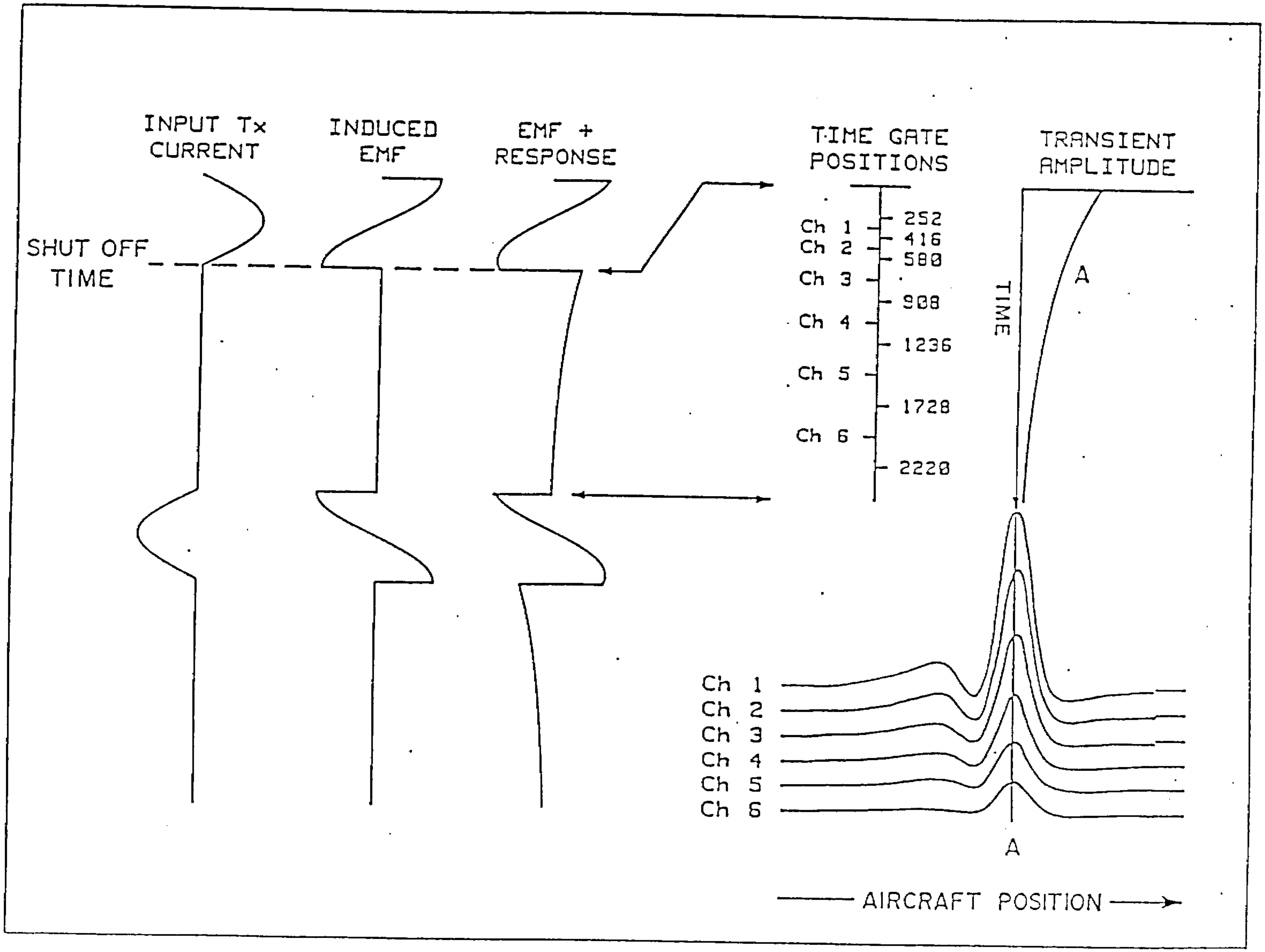


CONTROLLED GEOPHYSICS

Survey Area Location Map

Figure 1

Job 6039



CONTROLLED GEOPHYSICS

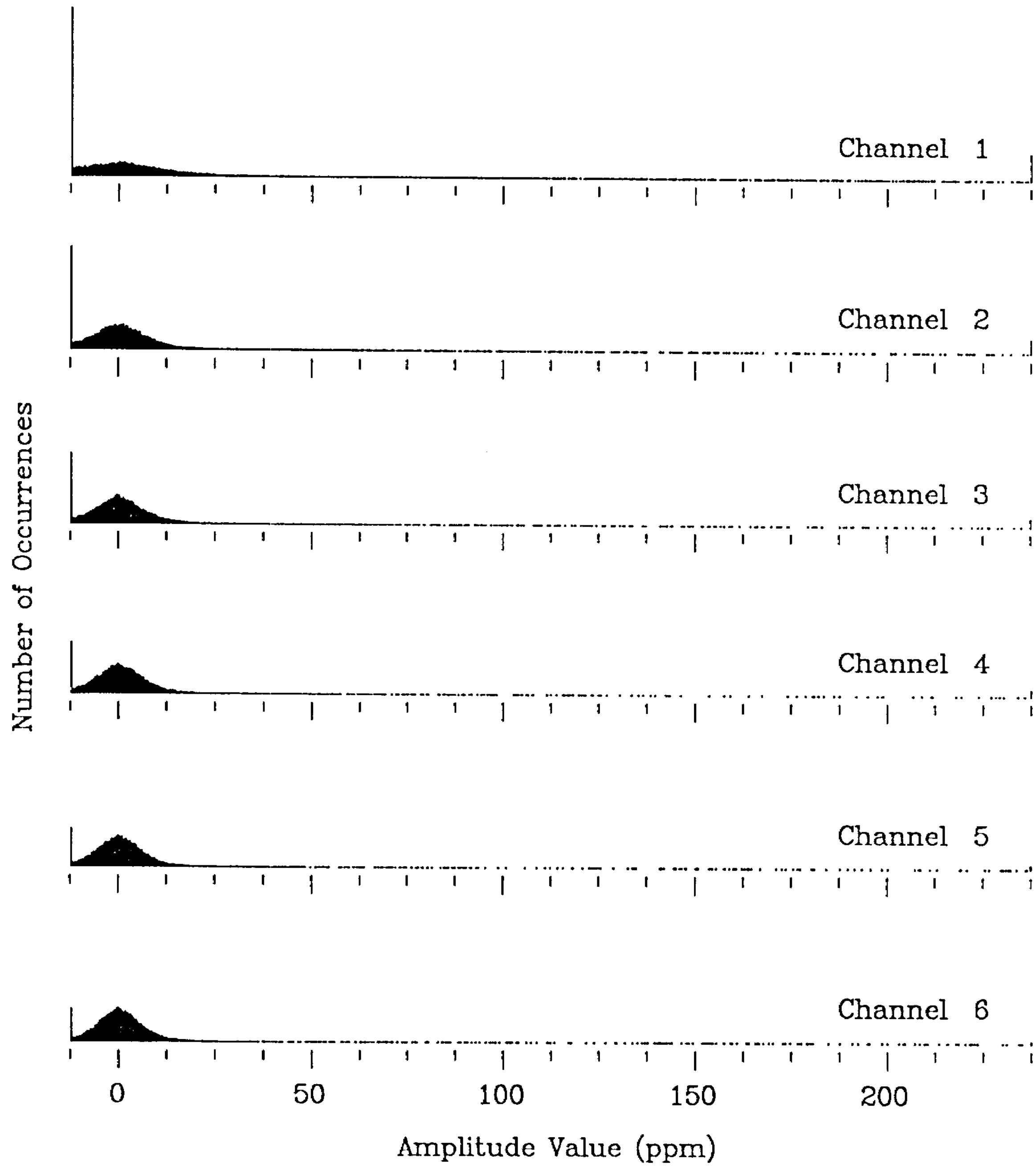
GEOTEM® Principles of Operation

Figure 2

Job 6039

EM CHANNEL HISTOGRAM ANALYSIS

File Name : J6039M2_FL_1.N02
Start Record : 1
End Record : 40401
Resolution : 0 ppm
Accept : <LINE<9999999

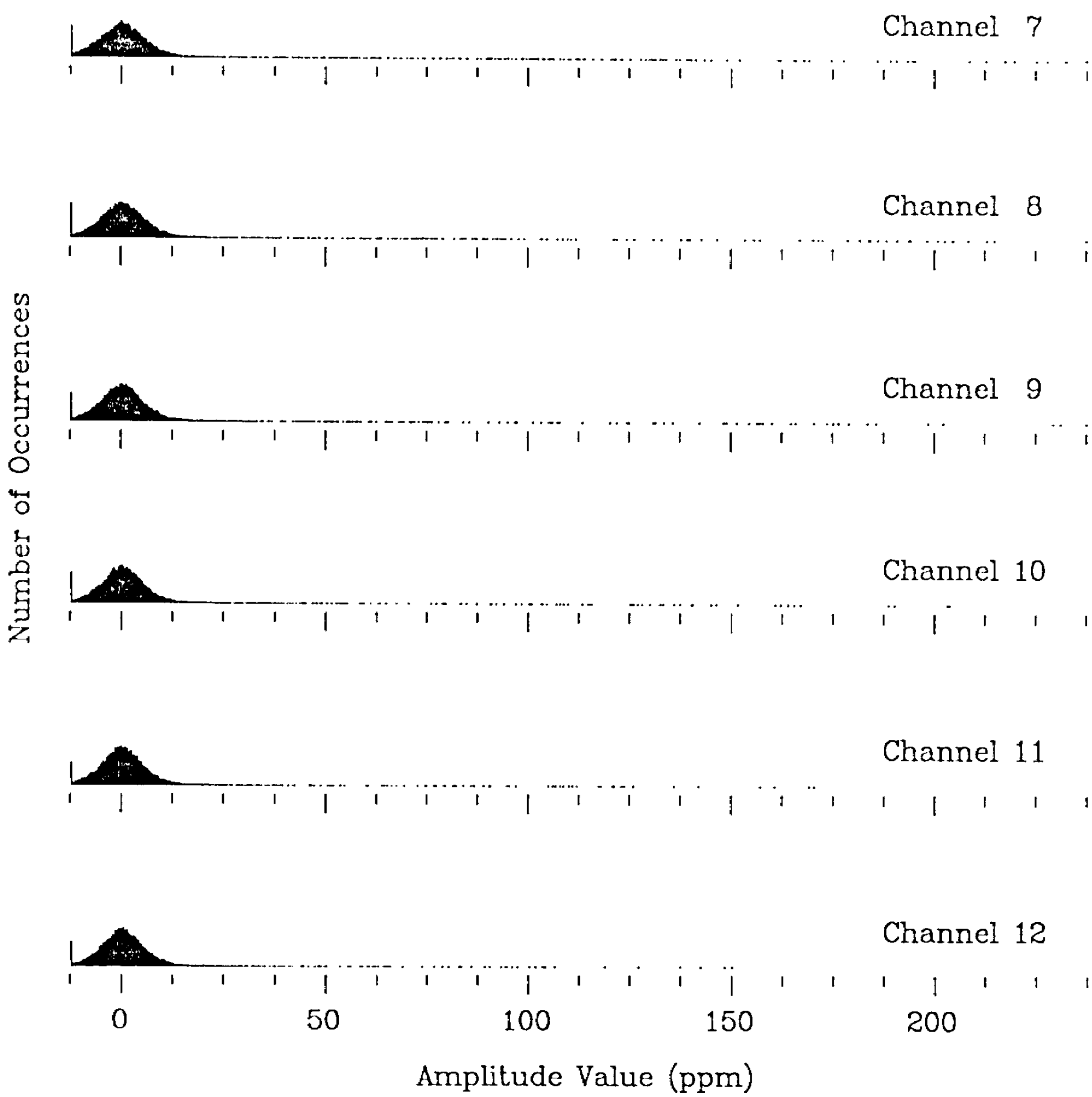


N.B. Equal area under all histograms. Blanks signify no occurrences.

CONTROLLED GEOPHYSICS	**GEOTEM® Channels 1 through 6 Histograms**	
	Figure 3a	**Job 6039**

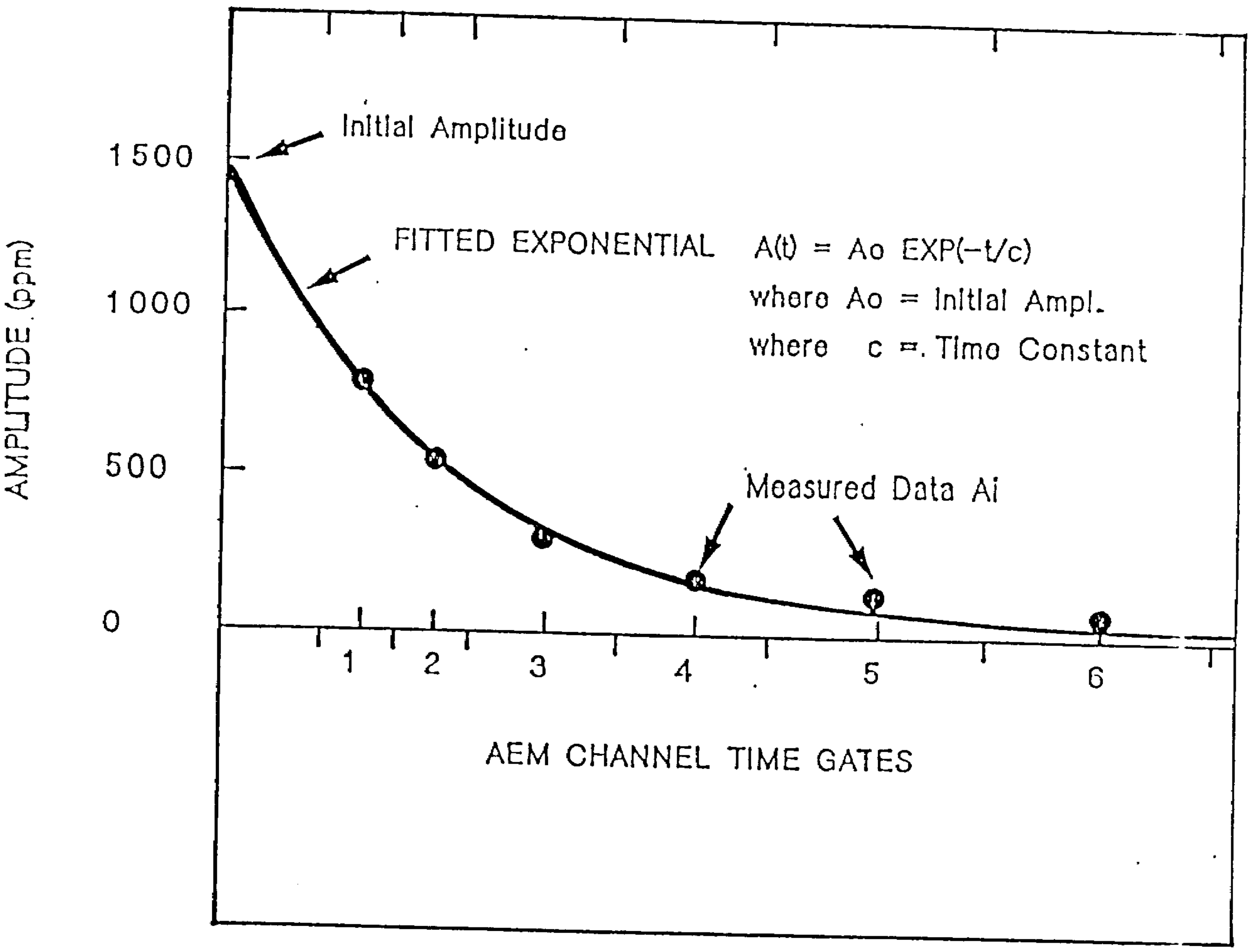
EM CHANNEL HISTOGRAM ANALYSIS

File Name : J6039M2_FL_7.N02
Start Record : 1
End Record : 40401
Resolution : 0 ppm
Accept : <LINE<9999999

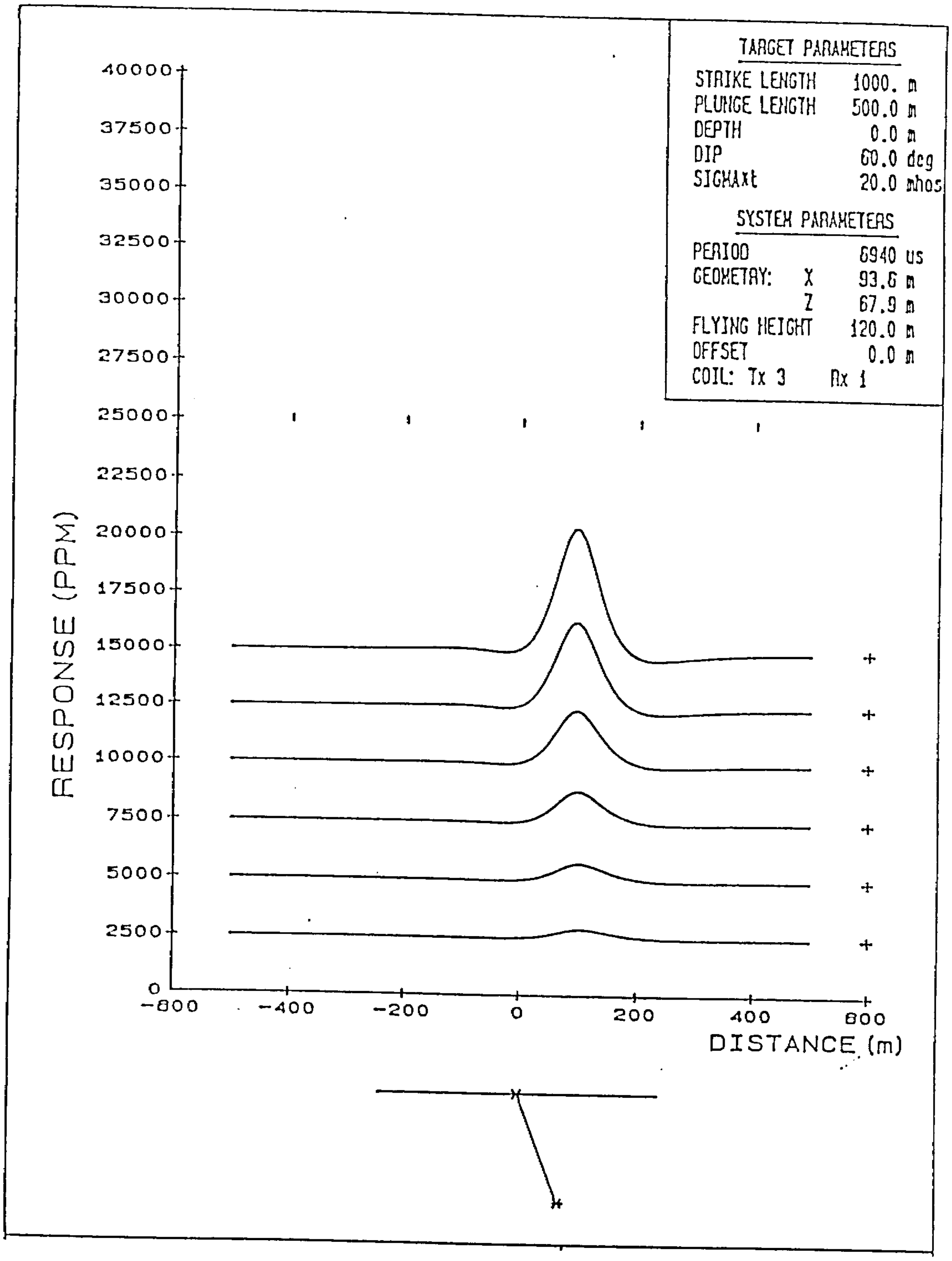


N.B. Equal area under all histograms. Blanks signify no occurrences.

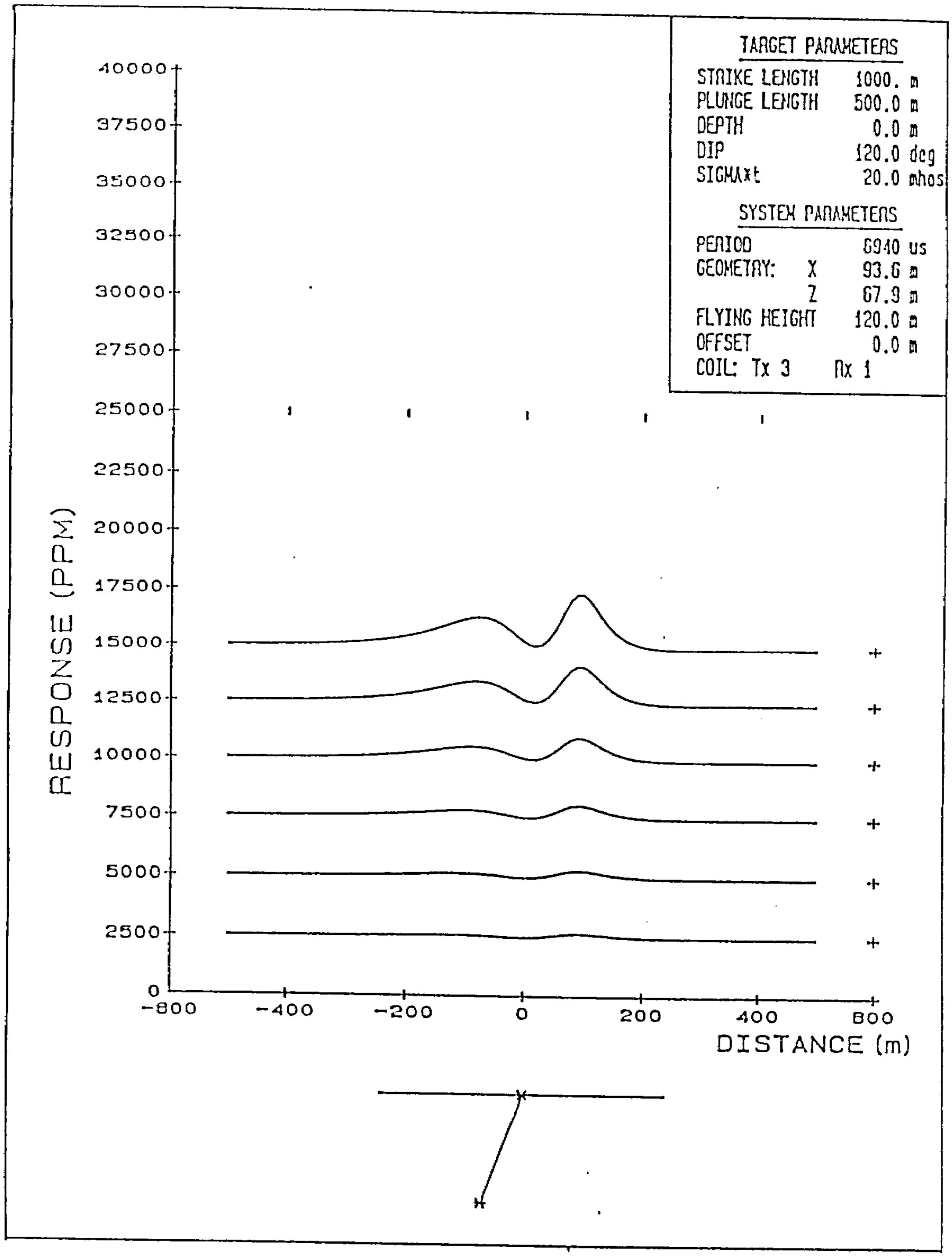
CONTROLLED GEOPHYSICS	GEOTEM® Channels 7 through 12 Histograms	
	Figure 3b	Job 6039



CONTROLLED GEOPHYSICS	*OUTPUT* Processing Principles	
	Figure 4	Job 6039



CONTROLLED GEOPHYSICS	Thin PLATE Anomaly Observed Flying Down Dip of 60°	
	Figure 5a	Job 6039



CONTROLLED GEOPHYSICS	Thin PLATE Anomaly Observed Flying Up Dip of 60^0	
	Figure 5b	Job 6039

Table 1 - Survey Flying Specifications

Line Spacing	200 m nominal
Line Direction	N $0^o/180^o$ E
Horizontal Tolerance	must not exceed 150% of nominal line spacing for a distance along line of 1.5 km and must never exceed 200% of line spacing.
Altitude	120 m nominal
Vertical Tolerance	must not exceed 140 m for a distance along line of 1.5 km or more and must never exceed 160 m.
Speed	120 knots (220 km/hr, 61 m/s)
EM Noise Level	must not exceed 20 ppm in the late channels after application of a 1.5 second time constant filter and spherics must not be too frequent to prevent their effect from being removed.
Calibration Sequences	minimum of 2 calibrations for flights under 2 hours duration and minimum of 3 calibrations for flights over 2 hours duration.
Magnetic Noise Level	must not exceed 1.0 nT over a distance along line of 3 km or more.
Diurnal Noise Level	must not exceed 10 nT during a 2 minute chord

Table 2 - Project Deliverables

- Flight path on clear base, *mylar plus prints*
- Blackline contours of Total Magnetic Field with flight path on clear base, *mylar plus prints*
- Levelled GEOTEM® Channels 2 and 5 as plan profiles with flight path on clear base, *mylar plus prints*
- Data processing and interpretation report including sub-contractor's survey logistics report.

N.B. Unless otherwise noted, all map products cover the survey area in one map sheet at a scale of 1:20,000.

Table 3 - GEOTEM® EM Receiver Window Positions

Window	Start (μs)	End (μs)	Centre (μs)	Width (μs)
1	312	468	**390**	156
2	469	625	**547**	156
3	625	781	**703**	156
4	781	937	**859**	156
5	937	1,093	**1,015**	156
6	1,094	1,250	**1,172**	156
7	1,250	1,406	**1,328**	156
8	1,406	1,562	**1,484**	156
9	1,562	1,718	**1,640**	156
10	1,719	1,875	**1,797**	156
11	1,875	2,031	**1,953**	156
12	2,031	2,187	**2,109**	156

N.B. At base operating frequency of 150 Hz, group delay of approximately 100 μs and pulse length of 1,042 μs yields 2,187 μs of off-time.

Table 4 - Levelled GEOTEM® Channel Histogram Analysis

Chn #	Min Value	2 SD Below	1 SD Below	Peak Amplitude	1 SD Above	2 SD Above	Max Value
1	-229	>-12.25	>-12.25	0.75	17.75	141.75	5,007
2	-123	>-12.25	-7.00	0.50	9.00	47.25	2,297
3	-71	>-12.25	-6.25	0.25	8.00	28.25	1,341
4	-68	>-12.25	-6.00	0.25	7.25	21.75	837
5	-43	-12.00	-5.50	0.25	6.50	17.50	612
6	-31	-11.50	-5.25	0.25	6.50	15.75	473
7	-28	-11.25	-5.50	0.25	6.00	14.50	372
8	-68	-11.50	-5.00	0.25	5.75	13.75	301
9	-47	-11.00	-5.00	0.25	5.50	13.25	247
10	-39	-11.00	-5.00	0.25	5.50	12.75	204
11	-41	-10.50	-4.75	0.25	5.50	12.50	171
12	-35	-10.75	-4.75	0.25	5.50	12.00	150

N.B. All values expressed in ppm. Width refers to the span between the two standard deviations (SD).

Appendix A - Geoterrex Ltd. *Logistics and Processing Report*

LOGISTICS AND PROCESSING REPORT

of the

AIRBORNE GEOTEM® ELECTROMAGNETIC AND MAGNETIC SURVEY

SUDBURY, ONTARIO

for

CGI CONTROLLED GEOPHYSICS INC.

GEOTERREX LTD.
PROJECT NO. 619
FEBRUARY 1991

geoterrex ltd.

TABLE OF CONTENTS

geoterrex ltd.

I. INTRODUCTION

During the period 12 November, 1990 to 12 January, 1991 a combined airborne magnetic and GEOTEM® electromagnetic survey was flown for CGI CONTROLLED GEOPHYSICS INC. by GEOTERREX Limited. In all, 275 kilometres of survey lines were flown over a survey block northeast of Sudbury, Ontario (see Figure 1).

The survey area was outlined to generally map the Archean volcanics and metasediments present over this edge of the Canadian Shield. These rocks are associated with numerous mineralization occurrences. The magnetic and electromagnetic responses mapped over these volcanics and surrounding rocks yield important structural, textural and compositional information which will be useful in most exploration applications.

The data were compiled and processed in Ottawa by GEOTERREX Limited and are presented as a flight path map, a photomosaic base map, a total magnetic intensity contour map, and digital archive tapes.

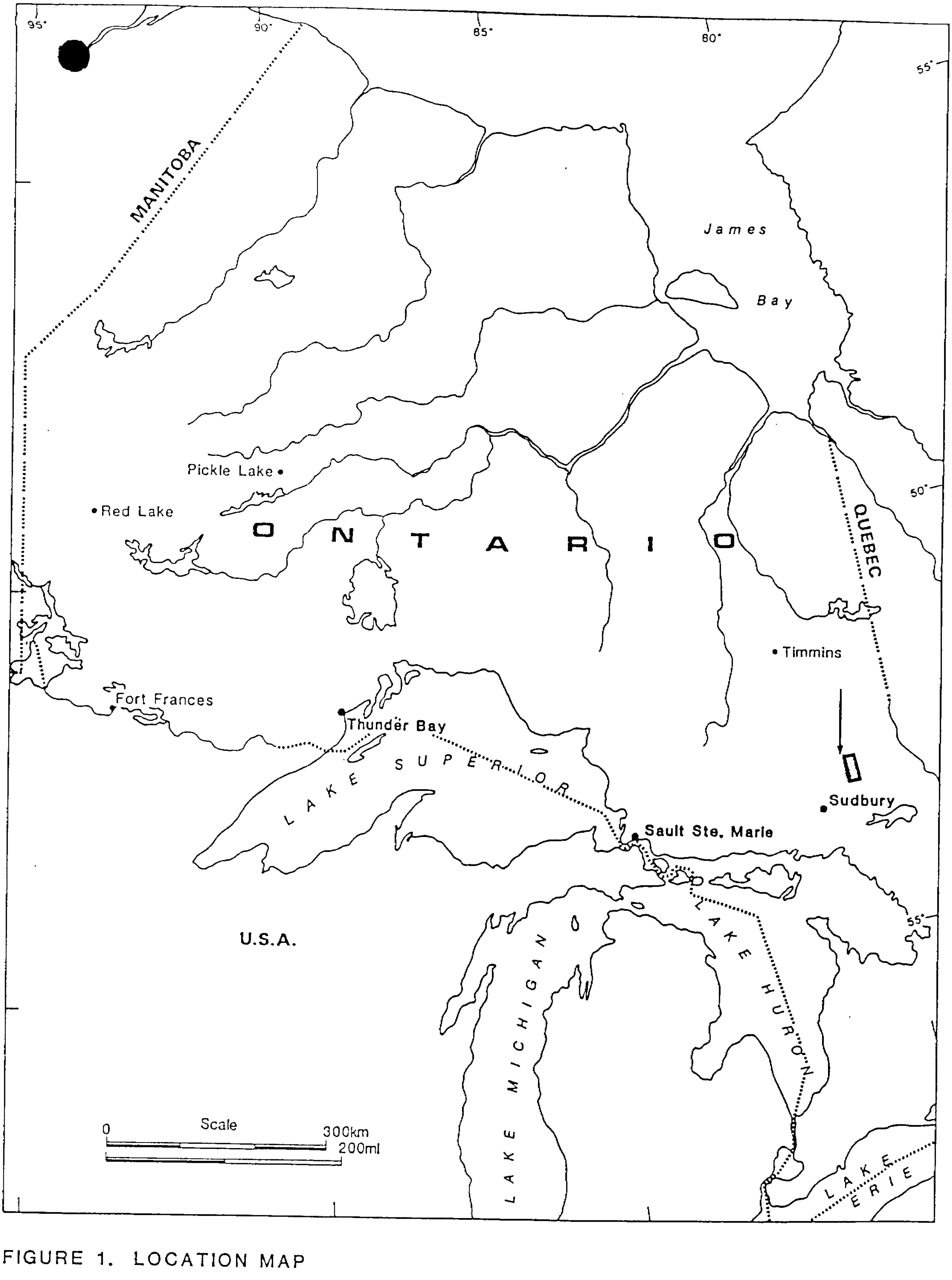


FIGURE 1. LOCATION MAP

II. SURVEY OPERATIONS

1. Location of the Survey Area

The survey block is located northeast of Sudbury. It is hereafter referred to as the Sudbury project.

2. Flight Line Directions

The area was covered with N-S oriented flight lines, at a nominal spacing of 200 m. A total of 275 km of data were collected.

3. Flight Altitude

The survey was flown at a height of 120 m 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 in a towed bird at the end of a 135-m cable) at approximately 64 m above the ground.

4. Navigation

The navigation was primarily visual, using airphoto mosaics at a scale of 1:20,000, prepared by GEOTERREX Limited. The navigation was aided by the GPS satellite and Doppler navigation systems.

5. 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/h, 61 m/s).

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 description of the gate settings used for this survey may be seen in Table 1.

- MADACS Digital Acquisition System: Combining an Interdata 6/16 16-bit microprocessor and a Digi-Data 1640, 9-track, 800 bpi tape drive. The following information was recorded digitally:

  - 20 GEOTEM® EM channels
  - Magnetic total field
  - Barometric altitude
  - 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
  - 7 GPS fields: lat., long., elevation, acquired time, universal time, satellite time, standard deviation.

TABLE 1 **GEOTEM® Gate Description**

Gate	Center	Width
1	393 µsec	156 µsec
2	549	156
3	705	156
4	862	156
5	1018	156
6	1174	156
7	1330	156
8	1487	156
9	1643	156
10	1799	156
11	1955	156
12	2112	156
13-20	Used for diagnostic purposes.	
Note: All times shown are in microseconds after termination of the transmitter current.		

- Magnetometer: Scintrex cesium vapour, single-cell, split-beam magnetometer, 0.1 nT sensitivity, 1 s sample rate, mounted in a stinger on the tail of the aircraft.

- Altimeters: - Radar altimeter: King KRA405
  - Barometric altimeter: Rosemount AVH8

- Tracking Camera: Panasonic V.H.S. video with 4.2 mm lens mounted vertically, recording in NTSC mode, with fiducial marks every second.

- Analog Recorder: RMS-GR-33A-1 heat-sensitive graphic recorder, displaying the following information on a 32-cm wide chart, running at a speed of 9 cm/min:

  - 12 GEOTEM® EM channels (low-pass filtered with a 1.5-second time constant in real time) at a vertical scale of 200 ppm/cm for the first 10 cm, 400 ppm for the next 10 cm, and 800 ppm to the top of the chart.

  - Channels 3 and 12 are also plotted, without the filter, at vertical scales of 400 ppm/cm and 200 ppm/cm respectively.

  - The magnetic total field at vertical scales of 50 and 500 nT/cm.

  - The radar altitude at a vertical scale of 50 feet/cm.

  - The barometric altitude at a vertical scale of 24 millibars/cm increasing downward.

  - The primary EM field monitor at a vertical scale of 240,000 ppm/cm.

  - 60 Hz powerline monitor at a vertical scale of 150,000 microvolts/cm.

  - Fourth difference of the total magnetic field at a vertical scale of 10 nT/cm.

  - Time (fiducial) markers, ticked every 2 seconds and labelled every 20 seconds.

- Absolute values of the magnetic total field and both altimeters are printed every 40 seconds.

6. Ground Computer Installation

- Compaq III microcomputer with a 40 Mb hard disk and Dell 310 micro-computer with a 110 Mb hard disc using GMAPS software developed by GEOTERREX Ltd.

- Digi-Data, 9-track 1600-bpi tape drive, model 1649.

- Zeta plotter, model Zeta 8A.

- Epson LX-800 printer.

- Gentian table top digitizer.

7. Diurnal Variation Monitor Equipment

- A Scintrex single-cell, split-beam, cesium vapour magnetometer measuring the total magnetic field at 0.1 nT sensitivity with a 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.

- A Seiko heat sensitive analogue recorder, displaying the total magnetic field at 2.9 nT/cm on 7-cm chart paper, run at 1.45 min/cm.

The base station was set up in Sudbury.

8. Pre-Survey Tests

a) Figure of Merit

The aircraft is put through a series of pitches (± 5°) yaws, (± 5°) and rolls (± 10°), 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.

The results of the Figure of Merit obtained in June of 1990 are presented in Table 2.

TABLE 2 FIGURE OF MERIT RESULTS (with GEOTEM system on)

Direction	Manoeuvre	Noise (nT)
East	Pitches	0.30
East	Rolls	0.15
East	Yaws	0.20
North	Pitches	0.40
North	Rolls	0.15
North	Yaws	0.15
West	Pitches	0.50
West	Rolls	0.15
West	Yaws	0.15
South	Pitches	0.40
South	Rolls	0.15
South	Yaws	0.15
Total Figure Of Merit		= 2.85 nT
Average noise per manoeuvre		= 0.24 nT

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 $t_1 > t_0$. Furthermore, because of electronic delays, the reading performed at time t_1 will be recorded on the magnetic tape at time $t_2 > t_1$. 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 s (equal to 4 EM sample intervals)

- GEOTEM EM = 4.1 s (equal to 25 EM samples)

These lag values were taken into account at the processing stage by shifting the digital values correspondingly back in time.

c) Altitude Calibration

The calibration of the radar altimeter is factory-set so as to display the aircraft's height above ground in feet. No further calibration is required. The linearity of the instrument output onto the analog chart was confirmed in September, 1989, by flying at heights of 300, 400, 500, 600 and 750 m.

d) Magnetic Cloverleaf Test

A cloverleaf test was flown in June 1990 to verify the heading differences of the magnetometer. The test consisted of flying in the four cardinal directions over a common point on the ground and examining the differences in the magnetic readings (normalized to a common datum). Table 3 gives the results of the test.

TABLE 3 CLOVERLEAF RESULTS JUNE 1990

Direction	Radar Altimeter	Diurnal	Air mag.	Air mag. corrected for diurnal and altitude (@1nT/100′)
West	457′	60237.49 nT	60470.85 nT	233.36 nT
South	366′	60239.39 nT	60474.10 nT	234.71 nT
East	405′	60240.08 nT	60471.75 nT	231.67 nT
North	395′	60239.45 nT	60470.60 nT	231.15 nT
Difference North-South = 3.56 nT				
Difference East-West = 1.69 nT				
Difference Average North South - Average East West = 0.67 nT				

e) 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 automatic internal calibration to parts per million and therefore, pre-survey calibrations are not required (see Appendix A). However, a compensation is required because of the residual signal after the transmitter pulse. This residual results from a number of sources which include transmitter imperfection, aircraft response and receiver bandwidth limitations. Compensation is carried out at the beginning and end of each flight and after 2 hours into any flight exceeding 2 hours. The EM signal is measured at flying heights well above the point where the ground response can be detected. The observed response can then be attributed to deviations of the system from ideal. This allows measurement of the peak transmitter amplitude, A^0_p, and the residual signal at off-time observation window n, A^0_n. Window n is assumed to be located at time t_n after the transmitter turn off time. A^0_p and A^0_n are averaged over 1 to 100 seconds depending on the particular survey design and ambient noise conditions. The resulting values of A^0_p and A^0_n are saved in the digital receiver for compensation of survey data. The compensation process is applied as follows. The instantaneous peak primary received field, A^i_p, is measured for data stack, i. The signal in window or gate n is measured for each data stack i to be A^i_n. The compensated value of A^i_n denoted as W^i_n is expressed as follows:

$$W^i_n = A^i_n - \left(\frac{A^i_p}{A^o_p}\right) A^o_n$$

9. Survey Specifications

Lines were reflown if any of the following limits were exceeded.

a) Navigation

Flight line spacing cannot exceed the nominal line spacing (200 m) by more than 50% for more than 1.5 km.

b) Altitude

Altitude must not exceed ± 20 m of the prescribed 120 m terrain clearance for more than 1.5 km, and never exceed 160 m, unless required for safety.

c) EM Noise Level

Noise level must not exceed ± 20 ppm, as monitored on the late channels of the analog, with a 1.5-second time constant over a distance of 3 km or more; and atmospheric disturbances must not become so frequent that their distortion of the signal cannot be accurately removed.

d) Magnetic Noise Level

Noise level must not exceed ± 0.5 nT over a distance exceeding 3 km. This is monitored on the analog fourth difference trace where 0.5 nT noise will be expanded to 5.0 nT.

e) Diurnal Conditions

Magnetic storms were defined as exceeding 10 nT departures over a 2-minute chord, during which time survey flying would be halted.

10. Field Operations

The following GEOTERREX personnel acted as the primary field operation crew:

R. Smith	Project Manager, Dataman
K. Ireland	Dataman
S. Hay	Pilot
A. Capyk	Co-Pilot
J. Trepanier	Engineer
A. Proulx	Electronics Technician

In addition, the following GEOTERREX personnel acted as supplementary or replacement field operation crew:

B. Byerley	Geophysicist
C. Ivimey	Engineer
M. Nash	Engineer
F. Corriveau	Electronics Technician
M. Carson	Senior Management

The crew was based in Sudbury, with production from 12 November, 1990 to 12 January, 1991.

III. DATA PROCESSING

1. Flight Path Recovery

The flight path was recovered in the field by identifying points on the video tracking film and on the photomosaics, at a scale of 1:20,000. 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 flight path was automatically plotted at a scale of 1:20,000. The flight path coordinates were recovered in UTM metres, using the Clarke 1866 Spheroid projection with a central meridian of 81°W, a false easting of 500,000, a false northing of 0 and a scale factor of 0.9996.

Both the Doppler and GPS flight paths were also recovered in the field and merged with the visual flight path by updating to the picked points, thus gaining more accurate positioning between the picked points, as well as an additional quality check on the accuracy of the picked points.

2. Magnetic Data Processing

a) Editing of Air Data

After reformatting the field tapes, the flights were broken into individual lines and the total magnetic intensity, radar altimeter and time fiducials were verified for continuity and validity by generating a statistical listing of maximum, minimum, mean, standard deviation, and variance. 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 defects as spikes or missing values were automatically corrected by the program or simply flagged and corrected manually when outside the limits of the program.

b) Editing of Diurnal Records

The ground station analogs were initially examined to identify cultural disturbances such as anomalies created by passing vehicles. Once identified, these disturbances were removed from the digital data by fitting a curve to the data based on the best polynomial fit (via the use of a graphics terminal).

The digital data were then verified and edited in the same manner as the airborne data. That is, the data were first examined for busts or gaps using the statistical analysis. It was then edited using the same fourth difference routine as used on the air data, with any bad values corrected down to the same thresholds.

c) Smoothing Data

The digital values from both the ground station and airborne magnetometer were smoothed by applying a triangular convolution, with an amplitude threshold of 0.75 nT.

The digital radar altimeter readings were also smoothed by the same triangular convolution, with an amplitude threshold of 10 feet.

The triangular filters above were set to smooth noise events of less than 4 samples in width.

d) Subtraction of the Diurnal Field

The degree to which the diurnal signal was being seen on the airborne records was carefully examined. The short period diurnal events were not seen in the air records. Thus, only the long period diurnal events were removed from the airborne magnetics; this improves the levelling of the data prior to contouring. A triangular filter removed all diurnal events shorter than approximately 50 seconds.

To maintain the recorded airborne magnetic values in their proper regional range, the mean diurnal value of 58,120 nT was added back to the air data after subtraction.

e) Interpolation of the Data

The magnetic data, which were originally recorded at the rate of 1 sample per second, were then expanded to 6 samples per second by interpolating a fourth-order polynomial curve between sample points. This was done to allow merging the magnetic data with the electromagnetic data, which was originally recorded at 6 samples per second.

f) Correction for Lag

The magnetic digital values were shifted back in time by 0.67 s (corresponding to 4 EM samples), to make them coincide with their true positions over the ground.

g) Total Intensity Contour Map

The magnetic data used as input to the contours were the total intensity after editing of bad values and noise filtering.

In order to contour the magnetometer data, the values from the lines and tie-lines were levelled together. This was done automatically by comparing the values of the total field at the intersection of each line and tie-line. The differences were analyzed and a compensation was calculated at each intersection in order to provide a pattern of smoothly varying adjustments along each line and tie-line. Erratic differences, implying an error in the intersection location, were carefully checked and corrected.

The values were then sorted and gridded along an 50 m grid, which at the map scale of 1:20,000 is equal to 2.5 mm. A triangular convolution was then applied to the gridded values to smooth the contours. The gridded values were then automatically contoured using the following intervals:

Sudbury Project: 10 nT

3. GEOTEM® Electromagnetic Data

After reformatting the field tapes, the data were verified and edited to produce files representing continuous EM coverage of the area flown. Statistics were generated (minima, maxima, mean, standard deviation and variance) on a line-by-line basis for each channel of the raw data recorded in order to verify the data content and check for any irregularities. To facilitate interpretation, a lag of 4.1 seconds (25 digital samples) was then applied to the data in order to line-up the EM anomaly peaks from one line to the next.

4. Products

a) Base Map

A photomosaic base was produced

b) Flight Path Map

A flight path map was produced, superimposed on the matching photomosaic basemap

c) Contour Map

A total intensity magnetic contour map was produced on a clear base, at the following scale and contour interval: 1:20,000 with a 10 nT interval.

3. GEOTEM® Electromagnetic Data

After reformatting the field tapes, the data were verified and edited to produce files representing continuous EM coverage of the area flown. Statistics were generated (minima, maxima, mean, standard deviation and variance) on a line-by-line basis for each channel of the raw data recorded in order to verify the data content and check for any irregularities. To facilitate interpretation, a lag of 4.1 seconds (25 digital samples) was then applied to the data in order to line-up the EM anomaly peaks from one line to the next.

4. Products

a) Base Map

A photomosaic base was produced

b) Flight Path Map

A flight path map was produced, superimposed on the matching photomosaic basemap

c) Contour Map

A total intensity magnetic contour map was produced on a clear base, at the following scale and contour interval: 1:10,000 with a 5 nT interval.

d) Archive Tape

The archive includes magnetic, altimeter, position, and electromagnetic data from profile, plus the gridded magnetic data. A full format description is included with the tapes and in Appendix A.

RESPECTFULLY SUBMITTED

Ron Lyall, Processor

Gord Roberts, Processor

Brian Schacht, Geophysicist

Appendix B - Flight Logs

MILES /

geoterrex limited
OTTAWA

GEOTEM - SPECTRO - DIGITAL

JOB NUMBER : 619 DATE : 26 NOVEMBER 1990 FLIGHT NUMBER : 25

OPERATIONS BASE: SUDBURY AREA NAME :

PILOT : A.C. CO-PILOT : S.M. OPERATOR : F.C.

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

— ANALOG SCALES —

		FULL SCALE
GEOTEM SLOW TIME CONSTANT :	ppm/cm	cm
FAST TIME CONSTANT :	ppm/cm	cm
TOTAL FIELD :	mv/cm	cm
MAG FINE :	γ / cm	cm
COARSE :	γ / cm	cm

BIRD SIGNAL : 5.2 VOLTS volts

RADAR ALT : m / cm

BARO ALT : m / cm

		FULL SCALE
SPECTRO TOTAL :	Cts / cm	cm
K 40 :	Cts / cm	cm
UR :	Cts / cm	cm
TH :	Cts / cm	cm

PRE AMP SIGNAL :

— POST FLIGHT COMMENTS —

TOTAL FLIGHT TIME : 3.4 ON LINE :

MILES / KMS FLOWN : MILES / KMS ACCEPTED :

FLIGHT COMMENTS

WEATHER : CLEAR [illegible] -4°C

ATMOSPHERICS :

NAVIGATION :

WIND : 5-8 KNT. CALM mph

LINE No	PART	DIR.	FID START	FID END		FLT# 25 COMMENTS 222.9	MILES / KMS
			50340	50400		Mod 2	
			50480	50550		Back	
366	1	S	51219	51560	51260 / 51455	NB - TL703	.020
366	2	S	51830	52144	51802 / 52132	TL703 - SB	
365	1	N	52237	52752	52262 / 52701	/	
364	~~1~~	S	52888	53100	X	NB - TL704	
364	~~2~~	S	53549	53700	X	TL704 - TL703	
364	31	N	54175	54655	54330 / 54614	~~[illegible]~~ - SB - NB. Scrub S. BDY -	[illegible] 702
363	1	S	55047	55567	55105 / 55396	SCRUB 702 - S. BDY	[illegible]
362	1	N	56335	56840	56348 / 56788		
			57020	57080	X	Back 3xFFFF END 25-1	
			57260	57320	X	mod 2 START 25-2	
			57540	57580	X	Back	
361	1	S	58313	58347	58361 / 58836		.040
360	1	N	58926	59405	58091 / 59395		
359	1	S	59804	60308	59825 / 60297		
			60430	60480		Back	
			60510	60580		Mod 2	
						3xFFFF	

geoterrex limited
OTTAWA

GEOTEM - SPECTRO - DIGITAL

JOB NUMBER : 619 DATE : DECEMBER 1990. FLIGHT NUMBER : 35

OPERATIONS BASE: SUDBURY AREA NAME :

PILOT : S.H. CO-PILOT : S.H. OPERATOR : F.S.

			FID START	FID END	FILEMARK BEGIN	CHECK(✓) END
TAPE NUMBER : (Digital)	①	35-1				
	②					
	③					
	④					
FILM NUMBER :	①					
	②					
	③					

— ANALOG SCALES —

			FULL SCALE
GEOTEM	SLOW TIME CONSTANT :	ppm/cm	cm
	FAST TIME CONSTANT :	ppm/cm	cm
	TOTAL FIELD :	mv/cm	cm
MAG	FINE :	γ / cm	cm
	COARSE :	γ / cm	cm

BIRD SIGNAL : volts

RADAR ALT : m / cm

BARO ALT : m / cm

			FULL SCALE
SPECTRO	TOTAL :	Cts / cm	cm
	K 40 :	Cts / cm	cm
	UR :	Cts / cm	cm
	TH :	Cts / cm	cm

PRE AMP SIGNAL :

— POST FLIGHT COMMENTS —

TOTAL FLIGHT TIME : 2.7 ON LINE :

MILES / KMS FLOWN : MILES / KMS ACCEPTED :

FLIGHT COMMENTS

WEATHER : Mod 2 ALTITUDE -3°c SURVEY ALTITUDE -10°c

ATMOSPHERICS : SNOW ICE

NAVIGATION :

WIND : ... ... mph

LINE No	PART	DIR.	FID START	FID END		FLT# 35 COMMENTS 228.4	MILES / KMS
			32840	32900	X	Mod2	
			32980	33071	X	Back (TEMP DIFFERENCE of 10C)	
358	1	N	33362	33859	33389 / 33853		c20
357	1	S	33965	34500	33981 / 34490		
356	1	N	34588	35090	34620 / 35081		
355	1	S	35172	35745	35206 / 35733		c20
354	1	N	35861	36379	35908 / 36372	S[illegible] TURBULENCE	c30
			36520	36560	X	Back CMAG 5000 FMAG 5000	
			36590	36660	X	Mode	
			37000	37060	X	Mod2	
			37140	37230	X	Back	
353	1	S	37897	38510	37924 / 38489	[illegible] SNOW HIGH WINDS	c90
352	1	N	38594	39094	38630 / 39027		
351	1	S	39510	40130	39563 / 40114		
350	1	N			X	[illegible] ICE ON CABLE	
						low clouds, 0 visibility	
			40180	40320		Back	
			40395	40460		Mod2	
						FFFF×3	

geoterrex limited
OTTAWA

GEOTEM - SPECTRO - DIGITAL

JOB NUMBER : 619 DATE : 7 JANUARY 1991 FLIGHT NUMBER : 51

OPERATIONS BASE : SUDBURY AREA NAME :

PILOT : SM CO-PILOT : SH OPERATOR : RC

				FILEMARK CHECK(V)	
TAPE NUMBER : (Digital) ①	51-1	FID START	FID END		
②	51-2				
③					
④					
				BEGIN	END
FILM NUMBER : ①					
②					
③					

— ANALOG SCALES —

		FULL SCALE
GEOTEM SLOW TIME CONSTANT :	ppm/cm	cm
FAST TIME CONSTANT :	ppm/cm	cm
TOTAL FIELD :	mv/cm	cm
MAG FINE :	ϐ / cm	cm
COARSE :	ϐ / cm	cm
BIRD SIGNAL : 6.0	volts	

RADAR ALT : m / cm
BARO ALT : m / cm

		FULL SCALE
SPECTRO TOTAL :	Cts / cm	cm
K 40 :	Cts / cm	cm
UR :	Cts / cm	cm
TH :	Cts / cm	cm

PRE AMP SIGNAL :

— POST FLIGHT COMMENTS —

TOTAL FLIGHT TIME : 4.2 ON LINE :

MILES / KMS FLOWN : MILES / KMS ACCEPTED :

FLIGHT COMMENTS

WEATHER : CLEAR ICE CRYSTAL -22°C

ATMOSPHERICS : HAZE

NAVIGATION :

WIND : 10KM mph

LINE No	PART	DIR.	FID START	FID END		FLT# 51 COMMENTS 350.3	MILES / KMS
			32780	32740	X	Mod2	
			32400	32480	X	Back Ice Crystal HAZE	
350	1	S	33183	33741	33242 / 33726		020
349	1	N	33820	34441	33872 / 34435		
348	1	S	34679	35195	34689 / 35180	OPEN water	
347	1	N	35280	35900	35325 / 35895		
346	1	S	35993	36537	36016 / 36515		020
			37320	37380	X	Mod2	
			37470	37580	X	Back	
345	1	N	37826	38448	37878 / 38439	[illegible]	040
344	1	S	38630	39087	38658 / 39072		
343	1	N	39175	39777	39218 / 39770	GPSHIFT WILL NOT RUN ON	this
342	1	S	39874	40417	39889 / 40406	PART - ALSO BIG SHIFTS SEEN ON CASA - SAT MOVEMENT?	
341	1	N	40512	41116	40553 / 41108	FFFFx3 ENDS1-1	040
~~340~~			42660	42720	X	Mod5 LeDT Start 51-2	
			42820	42880	X	Back	
340	1	S	43263	43827	43290 / 43811	43343	060
339	1	N	43920	44600	X	Scrub NOISE Ice Crystals	
			44640	44700	X	Back	
			44760	44820	X	mod2 3x FFFF	

geoterrex limited
OTTAWA

GEOTEM - SPECTRO - DIGITAL

JOB NUMBER : 619 DATE : Jan 10/91 FLIGHT NUMBER : 50

OPERATIONS BASE : Sudbury AREA NAME :

PILOT : D.C. CO-PILOT : S.H. OPERATOR : M.P. Glen

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

— ANALOG SCALES —

			FULL SCALE
GEOTEM	SLOW TIME CONSTANT :	ppm/cm	cm
	FAST TIME CONSTANT :	ppm/cm	cm
	TOTAL FIELD :	mv/cm	cm
MAG	FINE :	γ / cm	cm
	COARSE :	γ / cm	cm
BIRD	SIGNAL :	volts	

RADAR ALT : m / cm
BARO ALT : m / cm

			FULL SCALE
SPECTRO	TOTAL :	Cts / cm	cm
	K 40 :	Cts / cm	cm
	UR :	Cts / cm	cm
	TH :	Cts / cm	cm

PRE AMP SIGNAL :

— POST FLIGHT COMMENTS —

TOTAL FLIGHT TIME : 4.5 ON LINE :

MILES / KMS FLOWN : MILES / KMS ACCEPTED :

FLIGHT COMMENTS

WEATHER : Clear -25

ATMOSPHERICS : Mod.

NAVIGATION :

WIND : 5-11 mph

LINE No	PART	DIR.	FID START	FID END		FLT# ~~56~~ 57 COMMENTS 146.3	MILES / KMS
Mod	2		45780	45805	x		
Back			45936	45960	x	DOPPLER [illegible] u/s	AT TIMES
4011	1	S	46156	46290	46155 / 46273	704 → 703	020
4101	1	N	46414	46570	46438 / 46564	704 → NB	
399	3	S	46640	46~~975~~ 835	46648 / 46939	703	
399	4	S	47117	47276	47132 / 47261	PU 703	
397	~~3~~	N	47354	X	X	SB	
397	3	N	47540	48010	47572 / 48003	(about [illegible])	
383	2	S	48462	48600	48468 / 48576	704	
383	3	S	48747	49110	48766 / 49095	PU 704	
387	2	N	49~~373~~ 375	49920	49400 / 49842	GPSHFT NOT RUN ON	020
Back			50161	50189	X	PART 020 END OF FILE ENCOUNTERED?	
Mod	2		50222	50255	X		
~~Back~~			50432	50458	X		
Mod	2		50432	50458	X	—	
Back			50540	50560	X	DOPPLER IN/OUT [illegible]	
384	2	N	50915	51042	50956 / 51014	SB	050
376	2	N	51237	51410	51294 / 51404	704	
367	2	S	51712	52185	51717 / 52172		
366	3	N	52260	52766	52302 / 52755	end 571	050
363	2	S	52970	53470	52980 / 53442	St 572	060
359	2	N	53555	54078	53593 / 54070	702	
364	2	S	54603	54834	54605 / 54814		
339	2	N	54951	55484	54974 / 55479		
325	3	S	55750	55896	55764 / 55884	703	

LINE No	PART	DIR.	FID START	FID END		FLT # 57 COMMENTS	MILES / KMS
324	2	S	55944	56088	55976 / 56074	701	
334	2	N	56~~147~~340	56458	56335 / 56441	SB 701	
321	1	N	56710	57274	56751 / 57267		
320	1	S	57345	57585	57373 / 57865		060
Back			57997	58020	X		
Mod 2			58052	58097	X		
Back.			58196	58215	X	Not on tape.	
319	1	N	58600 554	59144	58630 / 59130		080
318	1	S	59220	59765	59245 / 59743		
317	1	N	59831	60370	59867 / 60356		080
Back			60432	60465	X		
Mod 2			60497	60526	X		
FFFF							

Ministry of Northern Development and Mines
Ontario

W 8170.00055

15800

41116NW0064 2.14181 SHEPPARD

900

Mining Act

Report of Work
(Geophysical, Geological and Geochemical S

Type of Survey(s): Geophysical - Em & Mag	Mining Division: Sudbury	Township or Area: McCarthy & Sheppard
Recorded Holder(s): Teck Exploration Ltd. 2.14181		Prospector's Licence No.: A32498
Address: P.O. Box 170, Suite 7000, 1 First Canadian Place, Toronto, M5X 1G9		Telephone No.: 416-862-7102
Survey Company: Geonics - Controlled Geophysics		
Name and Address of Author (of Geo-Technical Report): K. Thorsen, 2189 Algonquin Avenue, North Bay, P1B 4Z3		Date of Survey (from & to): 10 01 91 (Day Mo Yr) 20 01 91 (Day Mo Yr)

Credits Requested per Each Claim in Columns at right

		Days per Claim
Special Provisions For first survey: Enter 40 days (This includes line cutting). For each additional survey using the same grid: Enter 20 days (for each)	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Other	
	Geological	
	Geochemical	
Man Days Complete reverse side and enter total(s) here	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Other	
	Geological	
	Geochemical	
Airborne Credits Note: Special provisions credits do not apply to Airborne Surveys	Electromagnetic	20.79
	Magnetometer	20.79
	Other	

Total miles flown over claim(s): 121.13

Date: Apr 17/91 Recorded Holder or Agent (Signature): [signature]

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Number	Mining Claim Prefix	Number	Mining Claim Prefix	Number
		See	Attached List		

RECEIVED
SEP 19 1991
MINING LANDS SECTION

Total number of mining claims covered by this report of work: 233

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in this Report of Work, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying: K. Thorsen, 2189 Algonquin Avenue, North Bay, Ontario, P1B 4Z3

Telephone No: 705-474-5500 Date: Apr 17/91 Certified By (Signature): [signature]

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
9,688.14	Apr. 19, 1991	[signature]
	Date Approved as Recorded: Sept. 20 1991.	Provincial Manager, Mining Lands: [signature]

Received Stamp:
SUDBURY MINING DIV.
RECEIVED
APR 19 1991
2:25
A.M. P.M.
7,8,9,10,11,12,1,2,3,4,5,6

1362 (89/06)

Emerald Lake - 233 Mining Claims

S1094987
S1094988
S1094989
S1094990
S1094991
S1094992
S1094993
S1094994
S1094995
S1094996
S1094997
S1094998
S1094999
S1095000
S1095001
S1095002
S1095003
S1095004
S1095005
S1095006
S1095007
S1095008
S1095009
S1095010
S1095011
S1095012
S1095013
S1095014
S1095015
S1095016
S1095017
S1095018
S1095019
S1146744
S1146745
S1146746
S1146747
S1146748
S1146749
S1146750
S1146751
S1146752
S1146753
S1146754
S1146755
S1146756
S1146757

S1146758
S1146759
S1146760
S1146761
S1146762
S1146763
S1146764
S1146765
S1146766
S1146767
S1146768
S1146769
S1146770
S1146771
S1146772
S1146773
S1146774
S1146775
S1146776
S1146777
S1146778
S1146779
S1146780
S1146781
S1146782
S1146783
S1146784
S1146785
S1146786
S1146787
S1146788
S1146789
S1146790
S1146791
S1146792
S1146793
S1146794
S1145795
S1146796
S1146797
S1146798
S1146799
S1146800
S1146801
S1146802
S1146803
S1146804

S1146805
S1146806
S1146807
S1146808
S1146809
S1146810
S1145811
S1146812
S1146813
S1146814
S1146815
S1146816
S1146817
S1146818
S1146819
S1146820
S1146821
S1146822
S1146823
S1146824
S1146825
S1146826
S1146827
S1146828
S1146829
S1146830
S1146831
S1146832
S1146833
S1146834
S1146835
S1146836
S1146837
S1146838
S1146839
S1146840
S1146841
S1146842
S1146843
S1146844
S1146845
S1146846
S1146847
S1146848
S1146849
S1146850
S1146851

S1146852✓
S1146853✓
S1146854✓
S1146855✓
S1146856✓
S1146857✓
S1146858✓
S1146859✓
S1146860✓
S1146861✓
S1146862✓
S1146863✓
S1146864✓
S1145865✓
S1146866✓
S1146867✓
S1146868✓
S1146869✓
S1146870✓
S1146871✓
S1146872✓
S1146873✓
S1146874✓
S1146875✓
S1146876✓
S1146877✓
S1146878✓
S1146879✓
S1146880✓
S1146881✓
S1146882✓
S1146883✓
S1146884✓
S1146885✓
S1146886✓
S1146887✓
S1146888✓
S1146889✓
S1146890✓
S1146891✓
S1146892✓
S1146893✓
S1146894✓
S1146895✓
S1146896✓
S1146897✓
S1146898✓
S1146899✓
S1146900✓
S1146901✓

S1146992 – should be "S1146902"
S1146903✓
S1146904✓
S1146905✓
S1146906✓
S1146907✓
S1146908✓
S1146909✓
S1146910✓
S1146911✓
S1146912✓
S1146913✓
S1146914✓
S1146915✓
S1146916✓
S1146917✓
S1146918✓
S1146919✓
S1146920✓
S1146921✓
S1146922✓
S1146923✓
S1146924✓
S1146925✓
S1146926✓
S1146927✓
S1146928✓
S1146929✓
S1146930✓
S1146931✓
S1146932✓
S1146933✓
S1146934✓
S1146935✓
S1146936✓
S1146937✓
S1146938✓
S1146939✓
S1146940✓
S1146941✓
S1146942✓
S1146943✓

S1146852
S1146853
S1146854
S1146855
S1146856
S1146857
S1146858
S1146859
S1146860
S1146861
S1146862
S1146863
S1146864
S1145865
S1146866
S1146867
S1146868
S1146869
S1146870
S1146871
S1146872
S1146873
S1146874
S1146875
S1146876
S1146877
S1146878
S1146879
S1146880
S1146881
S1146882
S1146883
S1146884
S1146885
S1146886
S1146887
S1146888
S1146889
S1146890
S1146891
S1146892
S1146893
S1146894
S1146895
S1146896
S1146897
S1146898
S1146899
S1146900
S1146901

S1146902
S1146903
S1146904
S1146905
S1146906
S1146907
S1146908
S1146909
S1146910
S1146911
S1146912
S1146913
S1146914
S1146915
S1146916
S1146917
S1146918
S1146919
S1146920
S1146921
S1146922
S1146923
S1146924
S1146925
S1146926
S1146927
S1146928
S1146929
S1146930
S1146931
S1146932
S1146933
S1146934
S1146935
S1146936
S1146937
S1146938
S1146939
S1146940
S1146941
S1146942
S1146943

TECK EXPLORATIONS LIMITED

April 30, 1991

VIA FACSIMILE (705) 670-7323

OFFICE OF THE MINING RECORDER
MINISTRY OF NORTHERN DEVELOPMENT & MINES
2nd floor
159 Cedar Street
Sudbury, Ontario
P3E 6A5

Dear Sirs:

RE: MCCARTHY AND SHEPPARD TOWNSHIP CLAIMS

A work report dated April 17, 1991 (copy attached) for airborne credits covering 233 claims has recently been submitted to your office.

In reviewing the list of claims attached, it has come to my attention that one of the claim numbers was typed incorrectly. The claim number shown as "S1146992" should be "[redacted]. It would be appreciated if you could correct your copy.

Thank you.

Yours truly,

TECK EXPLORATION LTD.

Karen L. Dunfee

(Mrs.) Karen L. Dunfee
Land Officer

KLD:cat
Encls.

cc: Ken Thorsen (via fax)

1199 WEST HASTINGS STREET VANCOUVER B.C. V6E 2K5 TEL (604) 687-1117 TELEX 04-507709 FAX (604) 687-6100

Ministry of Northern Development and Mines

Ontario

Geophysical-Geological-Geochemical Technical Data Statement

2.14181

TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT
FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT
TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

Type of Survey(s) Geophysical - EM and Mag

Township or Area McCarthy and Sheppard Twps.

Claim Holder(s) Teck Exploration Ltd.

Survey Company GEOTEM - Controlled Geophysics

Author of Report Chris Vaughn, Glenn Boustead

Address of Author Ste. 31, 400 Matheson Blvd. Mississauga Ontario

Covering Dates of Survey 10-01-91 to 20-01-91 (linecutting to office)

Total Miles of Line Cut N/A

SPECIAL PROVISIONS CREDITS REQUESTED

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

	DAYS per claim
Geophysical	
–Electromagnetic	
–Magnetometer	
–Radiometric	
–Other	
Geological	
Geochemical	

AIRBORNE CREDITS (Special provision credits do not apply to airborne surveys)

Magnetometer 20.79 Electromagnetic 20.79 Radiometric ______ (enter days per claim)

DATE: June 11/91 SIGNATURE: ______ Author of Report or Agent

MINING CLAIMS TRAVERSED
List numerically

(prefix)	(number)
SEE ATTACHED LIST	

If space insufficient, attach list

TOTAL CLAIMS ______

OFFICE USE ONLY

Res. Geol. ______ Qualifications [redacted]

Previous Surveys

File No.	Type	Date	Claim Holder

937 (85/12)

GEOPHYSICAL TECHNICAL DATA

GROUND SURVEYS If more than one survey, specify data for each type of survey

Number of Stations ______ Number of Readings ______

Station interval ______ Line spacing ______

Profile scale ______

Contour interval ______

MAGNETIC

Instrument ______

Accuracy – Scale constant ______

Diurnal correction method ______

Base Station check-in interval (hours) ______

Base Station location and value ______

ELECTROMAGNETIC

Instrument ______

Coil configuration ______

Coil separation ______

Accuracy ______

Method: ☐ Fixed transmitter ☐ Shoot back ☐ In line ☐ Parallel line

Frequency ______ (specify V.L.F. station)

Parameters measured ______

GRAVITY

Instrument ______

Scale constant ______

Corrections made ______

Base station value and location ______

Elevation accuracy ______

INDUCED POLARIZATION
RESISTIVITY

Instrument ______

Method ☐ Time Domain ☐ Frequency Domain

Parameters – On time ______ Frequency ______

– Off time ______ Range ______

– Delay time ______

– Integration time ______

Power ______

Electrode array ______

Electrode spacing ______

Type of electrode ______

SELF POTENTIAL

Instrument ______ Range ______

Survey Method ______

Corrections made ______

RADIOMETRIC

Instrument ______

Values measured ______

Energy windows (levels) ______

Height of instrument ______ Background Count ______

Size of detector ______

Overburden ______
(type, depth – include outcrop map)

OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)

Type of survey ______

Instrument ______

Accuracy ______

Parameters measured ______

Additional information (for understanding results) ______

AIRBORNE SURVEYS

Type of survey(s) Magnetics and GEOTEM - EM

Instrument(s) GEOTEM Electromagnetic system, Scintrex cesium vapour magnetometer
(specify for each type of survey)

Accuracy EM - ± 20 ppm Magnetometer ± 0.1nT
(specify for each type of survey)

Aircraft used CASA C212-200 twin turbo prop STOC aircraft

Sensor altitude 120 m

Navigation and flight path recovery method Air photo mosaics, GPS satellite, Doppler

Aircraft altitude 160 m Line Spacing 200 m

Miles flown over total area 165.0 miles Over claims only 121.3 miles

GEOCHEMICAL SURVEY – PROCEDURE RECORD

Numbers of claims from which samples taken ____________________

Total Number of Samples ____________________

Type of Sample ____________________
(Nature of Material)

Average Sample Weight ____________________

Method of Collection ____________________

Soil Horizon Sampled ____________________

Horizon Development ____________________

Sample Depth ____________________

Terrain ____________________

Drainage Development ____________________

Estimated Range of Overburden Thickness ____________________

SAMPLE PREPARATION
(Includes drying, screening, crushing, ashing)

Mesh size of fraction used for analysis ____________________

General ____________________

ANALYTICAL METHODS

Values expressed in: per cent ☐ p. p. m. ☐ p. p. b. ☐

Cu, Pb, Zn, Ni, Co, Ag, Mo, As,-(circle)

Others ____________________

Field Analysis (____________________ tests)

Extraction Method ____________________

Analytical Method ____________________

Reagents Used ____________________

Field Laboratory Analysis

No. (____________________ tests)

Extraction Method ____________________

Analytical Method ____________________

Reagents Used ____________________

Commercial Laboratory (____________________ tests)

Name of Laboratory ____________________

Extraction Method ____________________

Analytical Method ____________________

Reagents Used ____________________

General ____________________

TECK EXPLORATION LTD.

2189 Algonquin Avenue
North Bay, Ontario
P1B 4Z3

Telephone 705-474-5500
Fax 705-474-4053

June 11, 1991

2.14181

Office of the Mining Recorder
Ministry of Northern Development and Mines
2nd floor - 159 Cedar Street
Sudbury, Ontario
P3E 6A5

Dear Sir:

Please find enclosed 2 copies of a report on an Airborne Survey completed in McCarthy and Sheppard Townships and 2 copies of a Technical Data Statement. The Reports of Work were submitted for these claims on April 17, 1991.

Yours truly,

Ken Thorsen
District Manager

Encl.

KT-0686/ec

cc: P. Dillon
K. Dunfee

SUDBURY
MINING DIV.
RECEIVED
1991
A.M. P.M.
7 8 9 10 11 12 1 2 3 4 5 6

Ontario

Ministry of Natural Resources

Ministry of Northern Development and Mines

IN SERVICE FEBRUARY 10, 1989

INDEX TO LAND DISPOSITION

PLAN

G-4082

TOWNSHIP

McCARTHY

M.N.R. ADMINISTRATIVE DISTRICT

SUDBURY

MINING DIVISION

SUDBURY

LAND TITLES/REGISTRY DIVISION

SUDBURY

Scale 1:20 000

Contour Interval 10 Metres

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M+S - Mining and Surface Rights

Description | Order No. | Date | Disposition | File

DATE OF ISSUE
SEP 04 1990
SUDBURY
MINING RECORDER'S OFFICE

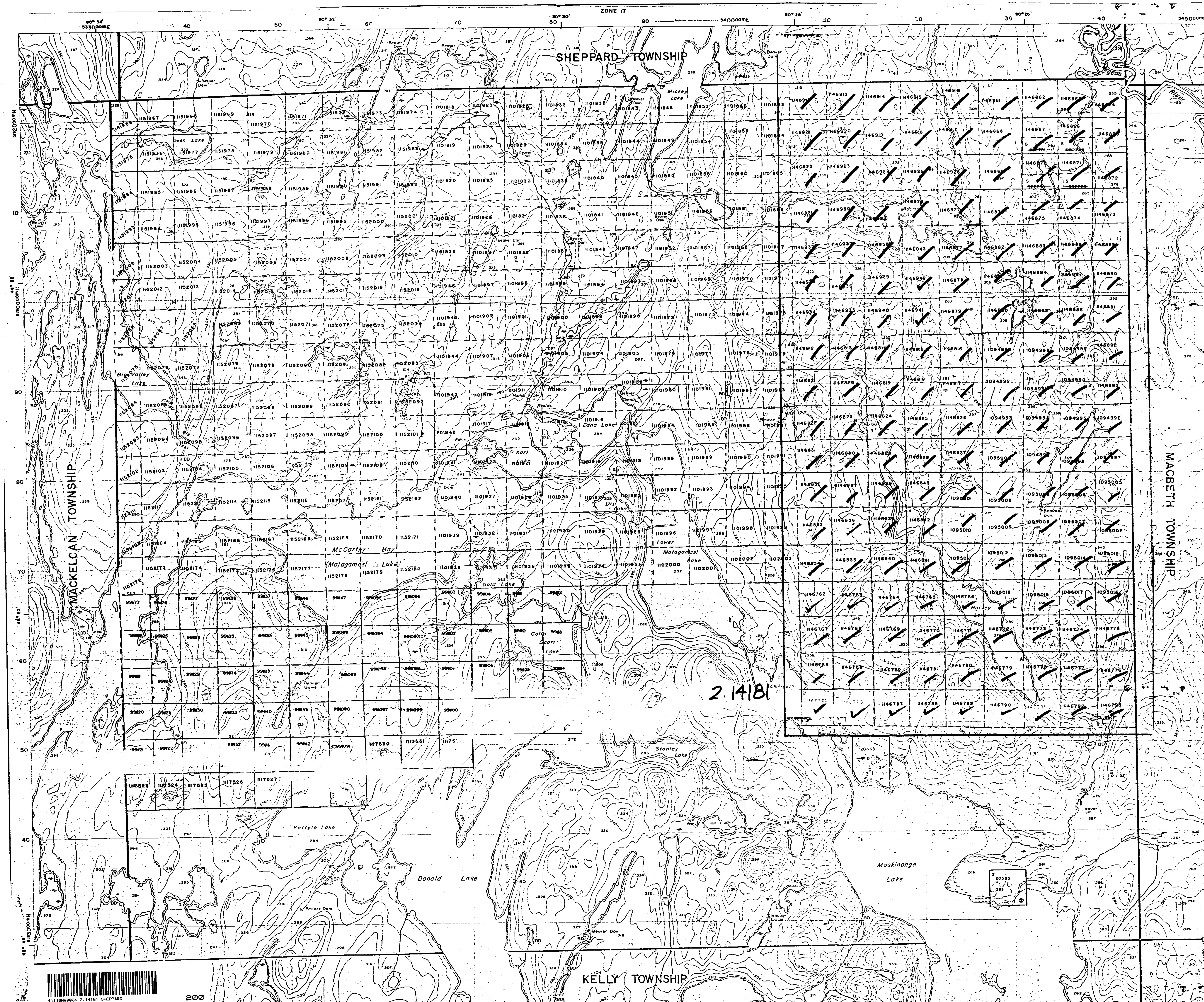
SYMBOLS

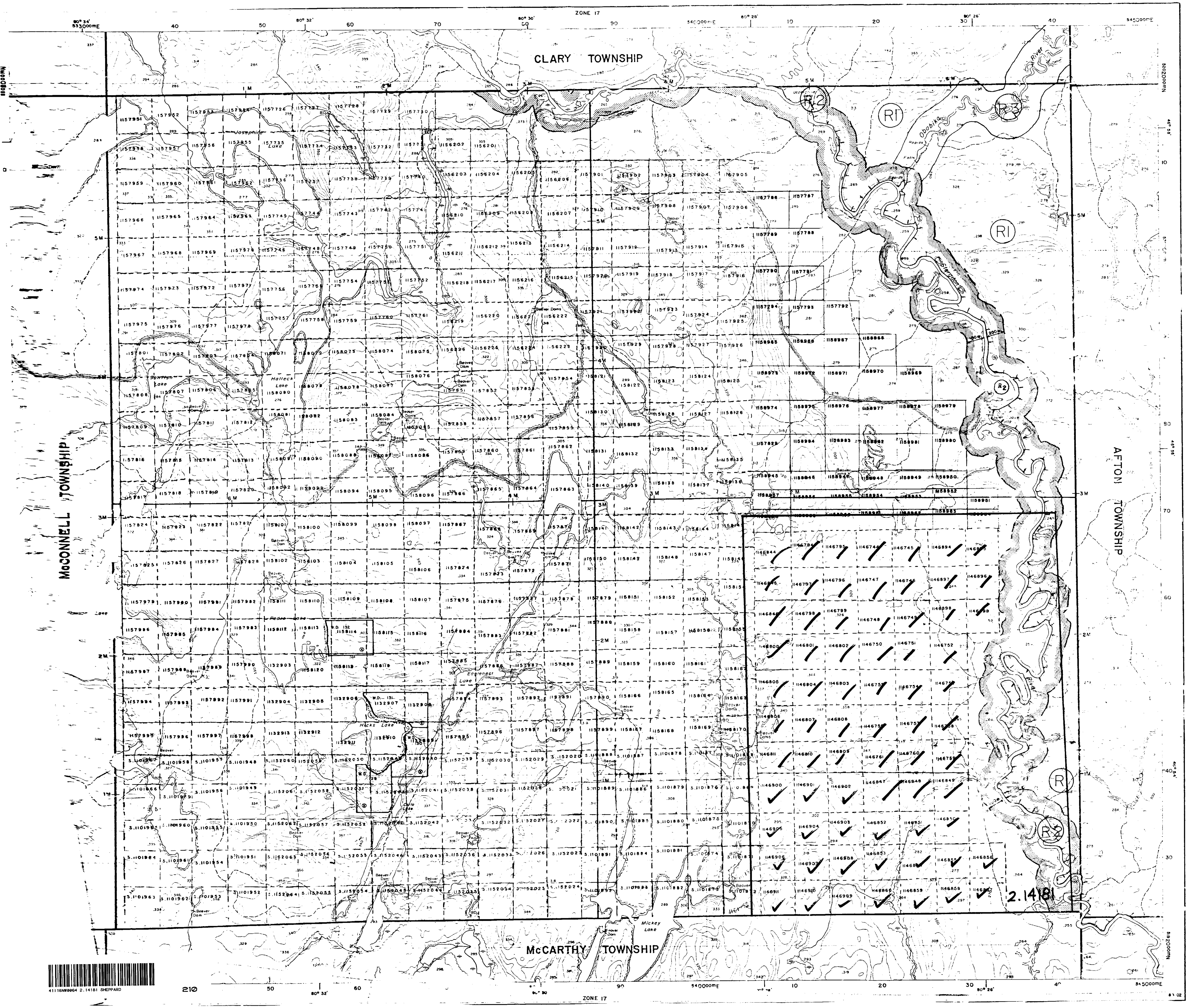
Boundary
Right-of-way: road
railway
utility
Reservation
Cliff, Pit, Pile
Contour
Interpolated
Approximate
Depression
Control point (horizontal)
Flooded land
Mine head frame
Pipeline (above ground)
Railway: single track
double track
abandoned
Road: highway, county, township
access
trail, bush
Shoreline (original)
Wooded area

DISPOSITION OF CROWN LANDS

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
Cancelled
Reservation
Sand & Gravel

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON





Ministry of Natural Resources
Ministry of Northern Development and Mines
Ontario

INDEX TO LAND DISPOSITION

PLAN
G-4104
TOWNSHIP
SHEPPARD

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

Scale 1:20 000

SYMBOLS

Boundary
Township, Meridian, Baseline
Road allowance; surveyed
shoreline
Lot/Concession; surveyed
unsurveyed
Parcel; surveyed
unsurveyed
Right-of-way; road
way
utility
Reservation
Cliff, Pit, Pile
Contour
interpolated
Approximate
Depression
Control point (horizontal)
Flooded land
Mine
Pipeline (above ground)
Railway; single track
double track
abandoned
Road; highway, county, township

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M + S - Mining and Surface Rights

	Order No.	Date	Disposition
SEC. 36/80	R.1/82	1/05/82	M+S
PARK RESERVE			

(R2) STURGEON RIVER PROVINCIAL PARK — ONTARIO REGULATION NO.256/1, MAY 8, 1989 SCHEDULE NO.230

(R3) OBABIKA RIVER PROVINCIAL PARK — ONTARIO REGULATION NO.256/1, MAY 8, 1989 SCHEDULE 225

REOPENED by order G.M. DI/90 NER effective April 3/1990 at 7:00 AM E.S.T.

NOTE:
"THIS MAP SHOWS THE APPROXIMATE LOCATION OF THE BOUNDARIES OF THE AREA WHICH IS THE SUBJECT OF CURRENT LITIGATION. THE EXACT LOCATION WILL BE SHOWN FOLLOWING CONFIRMATION BY THE PARTIES TO THE ACTION"

DATE OF ISSUE
AUG 3 1 1993
SUDBURY
RECORDER'S OFFICE

DISPOSITION OF CROWN LANDS

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
Cancelled
Reservation
Sand & Gravel

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

Map base and land disposition drafting by Surveys and Mapping Branch, Ministry of Natural Resources.

The disposition of land, location of lot fabric and parcel boundaries on this index was compiled for administrative purposes only.

210

Scale 1:20000

500 0 500 1000 1500 (metres)

1000 0 1000 2000 3000 4000 5000 6000 (feet)

Total Magnetic Field

mean sensor elevation 120m

Contour Intervals (nanoTeslas)

10

50

250

1000

Sheet 1 of 1

Teck Exploration Ltd.

Total Magnetic Field Contours

Cesium Magnetometer – [nT]

Sudbury Area

Ontario

2.14181

Data Compiled and Plotted by

CONTROLLED GEOPHYSICS

CGI Controlled Geophysics Inc.

Geoterrex Limited GEOTEM Survey

CGI Project 6039 – April 1991 – NTS 41I/P

41I15NW0064 2.14181 SHEPPARD

220

Scale 1:20000

(metres)

(feet)

GEOTEM EM Profiles

Channel 2 – 0.549ms
Channel 5 – 1.018ms

Sheet 1 of 1

Teck Exploration Ltd.

GEOTEM EM Profiles
Channels 2 and 5 – 100 ppm/cm
Sudbury Area
Ontario

2.14181

Data Compiled and Plotted by

CONTROLLED GEOPHYSICS

CGI Controlled Geophysics Inc.

Geoterrex Limited GEOTEM Survey
CGI Project 6039 – April 1991 – NTS 41I/P

41I16NW0054 2.14181 SHEPPARD

230

Scale 1:20000

500 0 500 1000 1500 (metres)

1000 0 1000 2000 3000 4000 5000 6000 (feet)

Flight Path
(video recovery assisted by Doppler and GPS)

Sheet 1 of 1

Teck Exploration Ltd.

Flight Path

Sudbury Area
Ontario

2.14181

Data Compiled and Plotted by

CONTROLLED GEOPHYSICS

CGI Controlled Geophysics Inc.

Geoterrex Limited GEOTEM Survey
CGI Project 6039 – April 1991 – NTS 41I/P

41I15NW0064 2.14181 SHEPPARD

240