MAGPIE RIVER – MISSINAIBI LAKE AREA

Ontario Airborne Geophysical Surveys
Magnetic and Electromagnetic Data
Geophysical Data Set 1237

Ontario Geological Survey
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- Geotech Limited, Aurora, Ontario – data acquisition and data compilation.

DISCLAIMER

To enable the rapid dissemination of information, this digital data has not received a technical edit. Every possible effort has been made to ensure the accuracy of the information provided; however, the Ontario Ministry of Northern Development, Mines and Forestry does not assume any liability or responsibility for errors that may occur. Users may wish to verify critical information.

CITATION

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1 INTRODUCTION

As part of an on-going program to acquire high-quality, high-resolution airborne geophysical data across the province of Ontario, the Ontario Ministry of Northern Development, Mines and Forestry (MNDMF) does, from time to time, issue Requests For Data (RFD) in order to purchase existing proprietary data held by mining companies. Purchase of existing data complements new surveys commissioned by the MNDMF.

The purchase of data is attractive due to the low cost of acquisition relative to flying new surveys. The money used to purchase the data can be reinvested in exploration. The data are assessed for quality prior to purchase and are reprocessed to meet the common formats and standards of other Ontario geophysical data. Once reprocessed these data are then made public.

Ranking and valuation of submitted airborne geophysical survey data sets were based on the following criteria:

- date of survey – recent surveys were favoured over older surveys because of improved acquisition technology, greater data density and improved final products.
- survey method – magnetometer surveys, without supplementary radiometrics or VLF, were given the lowest rating in this category; AEM and magnetometer were given the highest; the objective was to acquire data that complements what is already available in the public domain, with emphasis on exploration rather than mapping.
- location of area
    - data sets occurring within areas already surveyed or scheduled for survey were only selected if they added significantly to the acquired data sets,
    - proximity or coincidence of the survey block with areas having restricted land use designations affected the value assigned to that survey,
    - consideration was given to data sets that were collected in remote areas where logistical costs are very high.
- line spacing – detailed surveys were normally accorded a higher rating than reconnaissance surveys.
- quality of data – data quality, processed products, and adherence to correct survey specifications had to be up to normal industry standards.
- survey size – data sets comprising less than 1000 line-km were selected only if they fell in very strategic locations.
- other criteria – factors such as apparent mineral significance, previous exploration activity and land availability were also considered in making the final selection.

2 SURVEY LOCATION AND SPECIFICATIONS

This report describes a compilation of four helicopter-borne geophysical surveys located near Wawa, Ontario, carried out on behalf Golden Chalice Resources Ltd. and Chalice Diamond Corp. The surveys were flown during the period March 2006 to February 2008 by Geotech Ltd., Aurora, Ontario. Each survey employed Geotech's VTEM time domain electromagnetic system in conjunction with a high-sensitivity cesium vapour magnetometer. Details of the systems particular to each survey follow.

The surveys are comprised of five individual blocks, all flown in a north-south orientation at 75 m line spacing. Total survey coverage was 16,834 line-km. The index map below (Figure 1) shows the location of the survey areas. The original surveys have been numbered 1 to 4. Table 1, below, summarizes the basic survey details for each block.

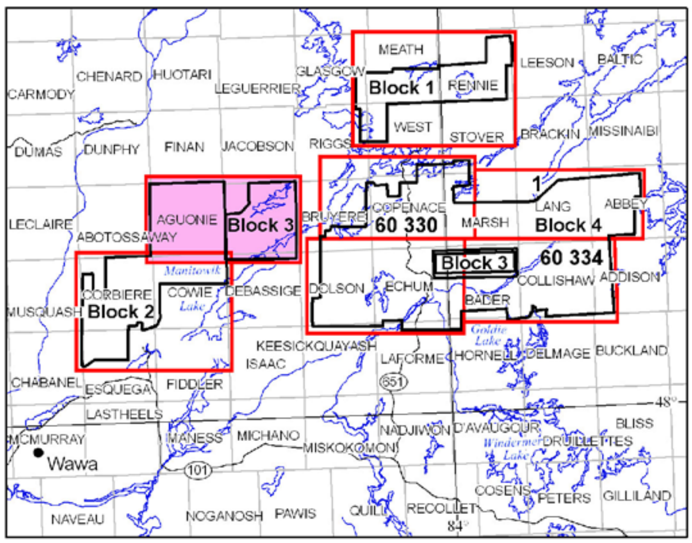

Figure 1 – Survey index map.

The table below summarizes some details for the individual survey blocks. Specific details of the geophysical systems used, and logistics are particular to each survey and will be discussed individually.

Company Name	Survey Name	New Block Name	Mag Alt. (metres)	EM Alt. (metres)	Year
Chalice Diamond Corp.	Rennie	Magpie_1	48	48	2007
Chalice Diamond Corp.	Aguonie-Cowie-Esquega	Magpie_2	60	35	2008
Golden Chalice Resources	Bird	Magpie_3a	40	40	2006
Golden Chalice Resources	Bader	Magpie_3b	40	40	2006
Chalice Diamond Corp.	Chapleau Main	Magpie_4	60	35	2007

Table 1 – Basic survey details.

3 AIRCRAFT, EQUIPMENT AND PERSONNEL

Aircraft

Survey 1

Helicopter:	Astar B2
Registration:	C-GWOW
Owner-Operator:	Expedition Helicopters

Survey 2 and Survey 4

Helicopter:	Astar B2
Registration:	C-FXFU
Owner-Operator:	Gateway Helicopters Ltd.

Survey 3

Helicopter:	Astar B2
Registration:	C-FLTA
Owner-Operator:	Gateway Helicopters Ltd.

Installation of the geophysical and ancillary equipment was carried out by Geotech Ltd.

Magnetometer

The VTEM systems included a Geometrics optically pumped cesium vapour magnetometer contained in a towed bird. For surveys 1 and 3, the magnetometer was towed at the same altitude as the EM system (see Figure 2a). For surveys 2 and 4, the bird was towed 15 metres below the helicopter (see Figure 2b). The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds.

EM System

The VTEM system uses a superimposed dipole configuration with the receiver located within the transmitter loop. The system was towed 42 metres below the helicopter (see figures 2a and 2b). Table 2 on the following page summarizes system configuration details for the specific surveys. The transmitter axis is vertical (Z). The receiver has a single vertical axis. The transmitter current waveform was trapezoid-shaped, repeated with reversing polarity, at a base frequency of 30 Hz. The receiver measures the secondary field at intervals after the termination of the transmitter current pulse (see Figure 3).

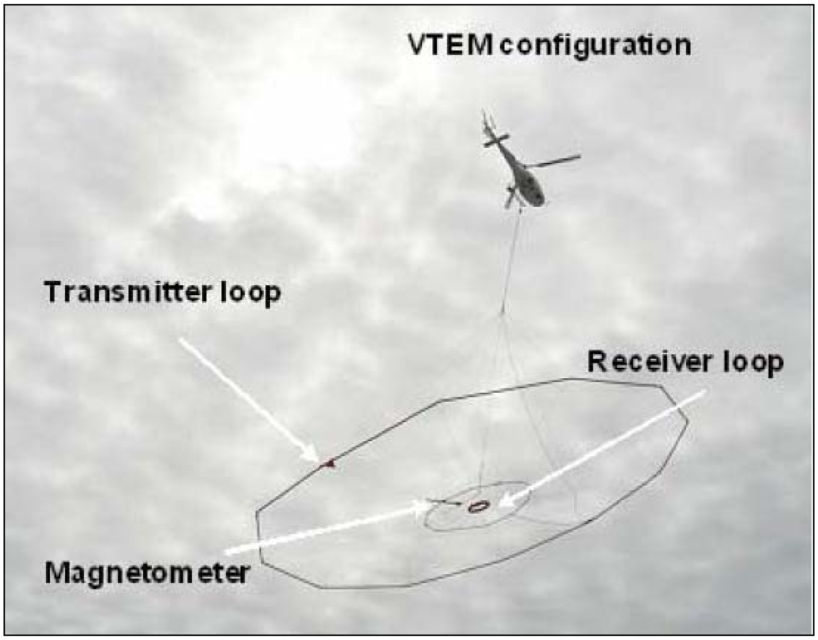

Figure 2a – VTEM system used in surveys 1 and 3.

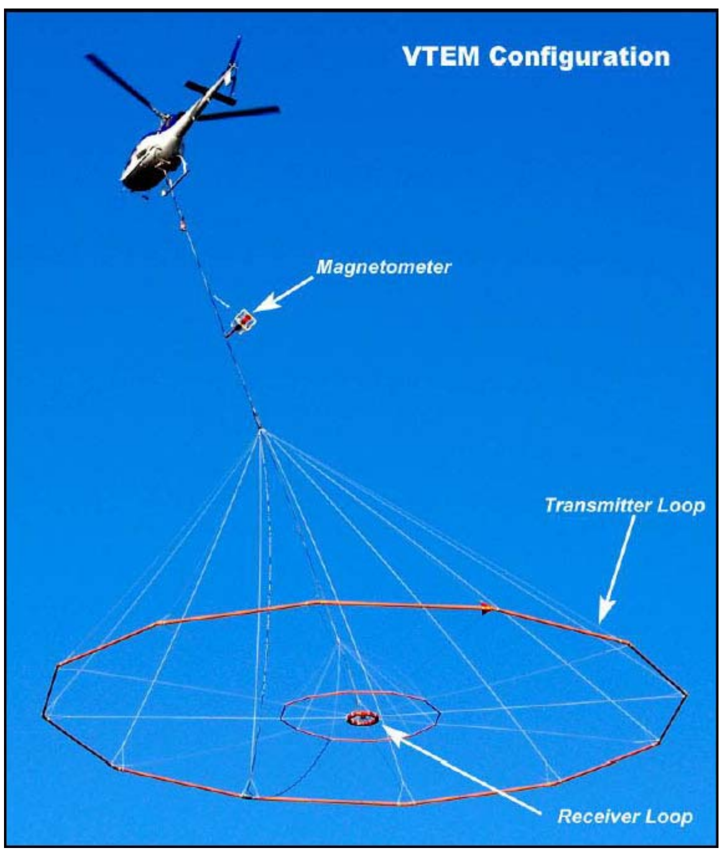

Figure 2b – VTEM system used in surveys 2 and 4.

Parameter	Survey 1	Survey 2	Survey 3	Survey 4F
Transmitter Diameter (m)	26	26	26	26
Number of Turns	4	4	4	4
Peak Current (Amp)	212	199	193	229
Receiver Diameter (m)	1.2	1.2	1.2	1.1
Number of Turns	100	100	100	60
Effective Area (m^2)	113	113	113	57

Table 2 – System configuration details.

Figure 3, below, shows the VTEM current waveform for the 30 Hz system, with locations of the receiver coil sample windows in the first half-cycle. The current in the transmitter coil generates the primary field. This field will induce a voltage in the receiver coil that is a function of the time rate of change of the primary field (i.e. dB/dt). Figure 4, on the following page, shows the voltage response to the primary field in the receiver coil.

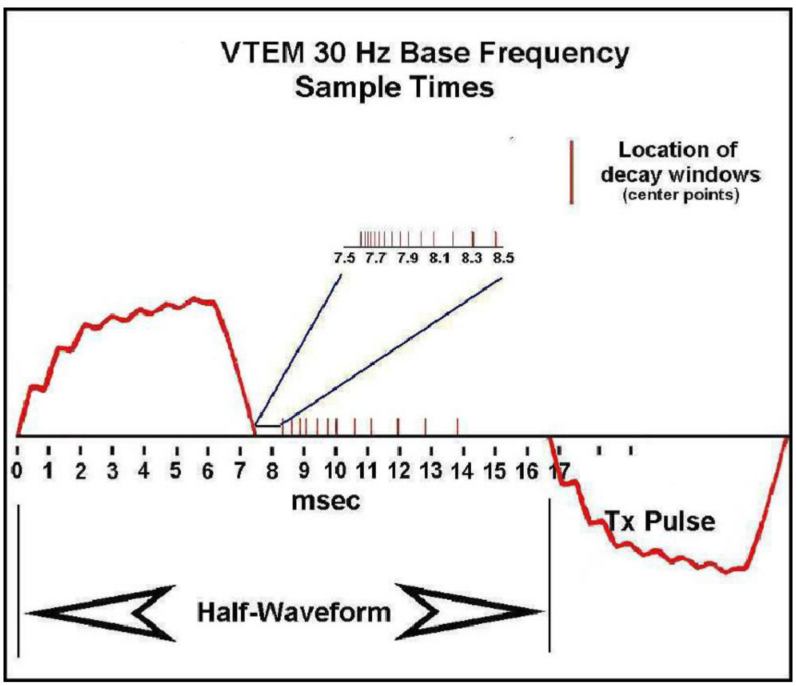

Figure 3 – VTEM current waveform and off-time recording scheme.

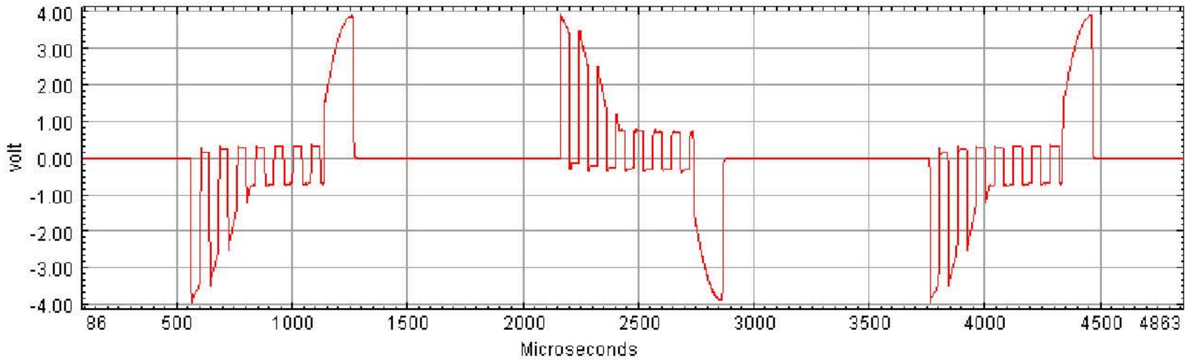

Figure 4 – Voltage response to waveform in receiver coil.

Sample Time Windows

The following three tables (Table 3a, Table 3b and Table 3c) summarize the off-time receiver recording window times for the various VTEM surveys.

Array Index	Time (μs)	Start (μs)	End(μs)	Width(μs)
0	130	120	140	20
1	150	140	160	20
2	170	160	180	20
3	190	180	205	25
4	220	205	240	35
5	260	240	280	40
6	300	280	325	45
7	350	325	380	55
8	410	380	445	65
9	480	445	525	80
10	570	525	625	100
11	680	625	745	120
12	810	745	885	140
13	960	885	1045	160
14	1130	1045	1235	190
15	1340	1235	1470	235
16	1600	1470	1750	280
17	1900	1750	2070	320
18	2240	2070	2450	380
19	2660	2450	2920	470
20	3180	2920	3480	560
21	3780	3480	4120	640
22	4460	4120	4880	760
23	5300	4880	5820	940
24	6340	5820	6860	1040

Table 3a—VTEM receiver recording times – survey 1.

Array Index	Time (μs)	Start (μs)	End(μs)	Width(μs)
0	120	110	131	21
1	141	131	154	24
2	167	154	183	29
3	198	183	216	34
4	234	216	258	42
5	281	258	310	53
6	339	310	373	63
7	406	373	445	73
8	484	445	529	84
9	573	529	628	99
10	682	628	750	123
11	818	750	896	146
12	974	896	1063	167
13	1151	1063	1261	198
14	1370	1261	1506	245
15	1641	1506	1797	292
16	1953	1797	2130	333
17	2307	2130	2526	396
18	2745	2526	3016	490
19	3286	3016	3599	583
20	3911	3599	4266	667
21	4620	4266	5058	792
22	5495	5058	6037	979
23	6578	6037	7203	1167

Table 3b—VTEM receiver recording times – surveys 2 and 4.

Array Index	Time (μs)	Start (μs)	End(μs)	Width(μs)
0	130	120	140	20
1	150	140	160	20
2	170	160	180	20
3	190	180	205	25
4	220	205	240	35
5	260	240	280	40
6	300	280	325	45
7	350	325	380	55
8	410	380	445	65
9	480	445	525	80
10	570	525	625	100
11	680	625	745	120
12	810	745	885	140
13	960	885	1045	160
14	1130	1045	1235	190
15	1340	1235	1470	235
16	1600	1470	1750	280
17	1900	1750	2070	320
18	2240	2070	2450	380
19	2660	2450	2920	470
20	3180	2920	3480	560
21	3780	3480	4120	640
22	4460	4120	4880	760
23	5300	4880	5820	940
24	6340	5820	6860	1040
25	7520	6860	8220	1360

Table 3c—VTEM receiver recording times – survey 3.

Radar Altimeter

A Terra TRA 3000/TRI 40 radar altimeter was used on all VTEM surveys to record terrain clearance. The antenna was mounted beneath the bubble of the helicopter cockpit.

GPS Navigation System

All of the surveys used a proprietary Geotech PC based navigation system, with a screen display and controls in front of the pilot. The antenna was mounted on the helicopter tail.

Digital Acquisition System

The Geotech data acquisition system recorded the digital survey data on an internal compact flash card. Data are displayed on an LCD screen as traces to allow the operator to monitor the integrity of the system. Data sampling intervals are summarized in Table 4 below.

Data Type	Sample Rate
TDEM	0.1 Sec
Magnetometer	0.1 Sec
GPS	0.2 Sec
Radar Altimeter	0.2 Sec

Table 4 – Data sampling rates.

Base Station

Each survey utilized a combination magnetometer and GPS base station. A Geometrics cesium vapour magnetometer recorded magnetic field, together with GPS time, on a computer at a 1 Hz sample rate.

Personnel

The following lists summarize the personnel involved in the various VTEM surveys.

Survey 1

Field

Field Operations Manager:	Shawn Grant
Crew Chief:	Colin Lennox / Les Moschuk
Operator:	Paul Taylor
Pilot:	Alex Parra
Mechanic:	Evin Huisson

Office

Data Processing:	Harish Kumar
Data Processing / Reporting:	Richard Gürtler / Harish Kumar

Survey 2

<u>Field</u>

Field Operations Manager:	Shawn Grant
Crew Chief / Operator:	Adrian Samarsag
Operator:	Roberto Tito
Pilot:	Brad MacRae
Mechanic:	Andrew MacGregor

<u>Office</u>

Project Manager / QC Geophysicist:	Harish Kumar
Data Processing / Reporting:	Marta Orta

Survey 3

<u>Field</u>

Geophysicist:	Brian Parsons
Operators:	Roberto Tito / Vlad Kutuzov / Grant Hendricks
System Support Engineer:	Juri Arbuzov
Pilots:	Germain Ratte / Michel Frigon
Mechanics:	Dan Pratt / Bruce Keen

<u>Office</u>

Data Processing:	Andrei Bagrianski
Data Processing / Reporting:	Harish Kumar / Shawn Grant

Survey 4

<u>Field</u>

Field Operations Manager:	Shawn Grant
Crew Chief / Operators:	Peter Ionica / Jonathan Lkimczak
Operator:	Paul Taylor
Pilots / Mechanics:	Dick Arnold / Jocelyn V. / Brad MacRae

<u>Office</u>

Project Manager / QC Geophysicist:	Harish Kumar
Data Processing / Reporting:	Marta Orta

4 CONTRACTOR DATA PROCESSING

Flight Path

The flight path, recorded by the acquisition program as WGS 84 latitude/longitude, was converted into the UTM coordinate system (UTM Zone 16N) in Oasis Montaj.

Electromagnetic Data

A three stage digital filtering process was used to reject major sferic events and to reduce system noise. Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. Smoothing or stacking will reduce their amplitude but leave a broader residual response that can be confused with geological phenomena. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events. The filter used was a 16 point non-linear filter.

The signal to noise ratio was further improved by the application of a low pass linear digital filter. This filter has zero phase shift which prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 1 second or 20 metres. This filter is a symmetrical 1 sec linear filter.

Magnetic Data

The processing of the magnetic data involved the correction for diurnal variations by using the digitally recorded ground base station magnetic values. The base station magnetometer data were edited and merged into the Geosoft GDB database on a daily basis. The aeromagnetic data were corrected for diurnal variations by subtracting the observed magnetic base station deviations.

Tie line levelling was carried out by adjusting intersection points along traverse lines.

5 FINAL DATA COMPILATION AND PROCESSING

Base Maps

Base maps of the survey area were supplied by the Ontario Ministry of Northern Development, Mines and Forestry.

Projection Description

Datum:	NAD83 (Canada)
Ellipsoid:	GRS80
Projection:	UTM Zone 16N (CM=87° W)
False Northing:	0 m
False Easting:	500,000 m
Scale factor:	0.9996

Magnetic Microlevelling

Microlevelling is the process of removing residual flight line noise that remains after conventional levelling using control lines. It has become increasingly important as the resolution of aeromagnetic surveys has improved and the requirement of interpreting subtle geophysical anomalies has increased.

To isolate and remove this noise, the following procedure was employed. An elliptical reject filter, aligned with the flight lines, was first applied to the levelled total magnetic field grid. This filter removes features with a long wavelength in the flight line direction, but a short wavelength in the transverse direction. While removing the unwanted residual levelling errors, it also significantly distorts higher amplitude anomalies.

In order to minimize the effect on real anomalies, the flight path was 'threaded' through the filtered grid and a database profile channel was created from the grid. The difference between the control line levelled magnetic profile and this filtered profile was calculated. The difference profile was clipped to the amplitude of the observed noise in the grid. A half cosine roll-off filter was then applied to this channel and a final correction profile was derived with wavelengths longer than one kilometre. This microlevel correction profile was applied to the levelled magnetic profile and a final magnetic profile channel was created.

GSC Levelling

The final step in the magnetic processing was to level the dataset to the 200 m Ontario Master grid, which has been compiled and levelled to the 812.8 metre magnetic datum from the Geological Survey of Canada. The levelling process must retain all the detail of the newer low-altitude survey and only make corrections on the order of 10 km or more. To accomplish this, a variation on a method developed by Paterson, Grant and Watson (Reford, S.W. et al. 1990) was used. The procedure was as follows:

The final total magnetic data were gridded at a 200 m cell size and upward continued to a height of 305 metres, to match the nominal terrain clearance of the Ontario master grid. The difference between the upward continued grid and the Ontario master grid was calculated. An FFT 2-D low-pass filter was applied to a grid of the difference, which retained wavelengths longer than 10 km. This filtered grid was re-gridded at a 20 m cell size and the flight path was threaded through the grid to create a correction profile. This long wavelength correction profile was subtracted from the final magnetic channel to create a GSC levelled (mag_gsclevel) channel.

The levelled magnetic profile data were gridded, for each database, using a bi-cubic spline.

Second Vertical Derivative Grids

The second vertical derivative of the total magnetic field was computed to enhance small and weak near-surface anomalies and as an aid to delineate the contacts of the lithologies having contrasting susceptibilities. The location of contacts or boundaries is usually traced by the zero contour of the second vertical derivative map.

The calculation was done in the frequency domain by combining the transfer function of the second vertical derivative and a half cosine roll-off filter with a 100 m cut-off wavelength to minimize grid aliasing effects in the total magnetic field, which are emphasized by the second vertical derivative.

Keating Correlation Coefficients

Possible kimberlite targets are identified from the residual magnetic intensity data, based on the identification of roughly circular anomalies. This procedure is automated by using a known pattern recognition technique (Keating 1995), which consists of computing, over a moving window, a first-order regression between a vertical cylinder model anomaly and the gridded magnetic data. Only the results where the absolute value of the correlation coefficient is above a threshold of 75% were retained. On the magnetic maps, the results are depicted as circular symbols, scaled to reflect the correlation value. The most favourable targets are those that exhibit a cluster of high amplitude solutions. Correlation coefficients with a negative value correspond to reversely magnetised sources.

The cylinder model parameters are as follows:

Cylinder diameter: 200 m
Cylinder length: infinite
Overburden thickness: 3 m
Magnetic inclination: 74° N
Magnetic declination: 8° W
Magnetization scale factor: 100
Model window size: 10 x 10 cells (400 m x 400 m)
Model window grid cell size: 40 m

It is important to be aware that other magnetic sources may correlate well with the vertical cylinder model, whereas some kimberlite pipes of irregular geometry may not. The user should study the magnetic anomaly that corresponds with the Keating symbols, to determine whether it does resemble a kimberlite pipe signature, reflects some other type of source or even noise in the data e.g. boudinage (beading) effect of the bi-cubic spline gridding. All available geological information should be incorporated in kimberlite pipe target selection.

Decay Constant Calculation

The theoretical decay constant of a uniform half-space is given by the following exponential:

$$B = Ae^{-t/\tau}$$

Where **B** is the secondary field amplitude, **A** is the time=0 amplitude, **t** is the time and **τ** is the decay constant (tau). A large conductive body will have a large tau and thus the signal will decay slowly. A small poor conductor will have a small tau and thus decay quickly. See Figure 6a below.

The voltage in the receiver coil is a function of dB/dt, which behaves in a similar way:

$$dB/dt = (-A/ \tau)\, e^{-t/\tau}$$

See Figure 6b.

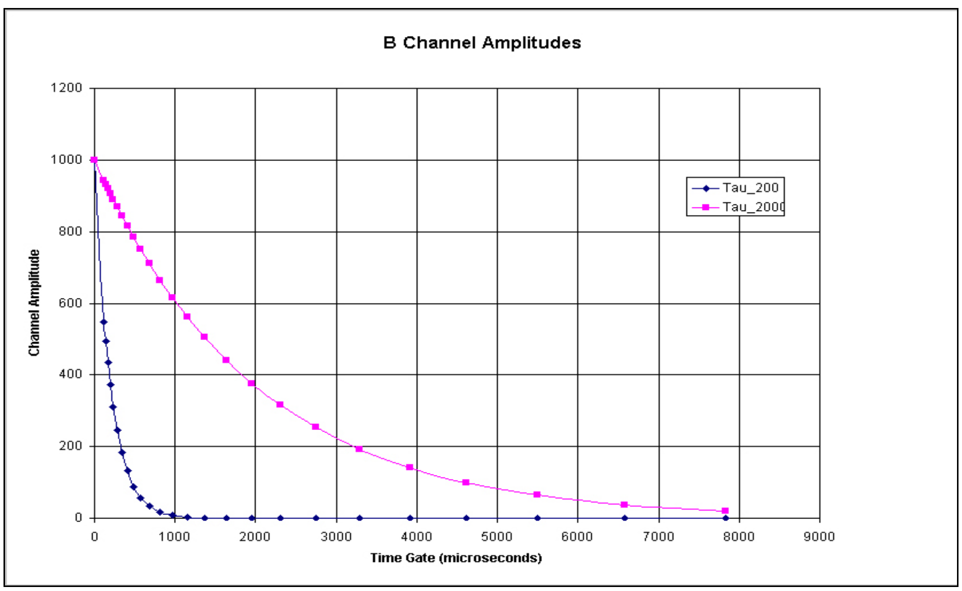

Figure 6a – B field decay with two different time constants.

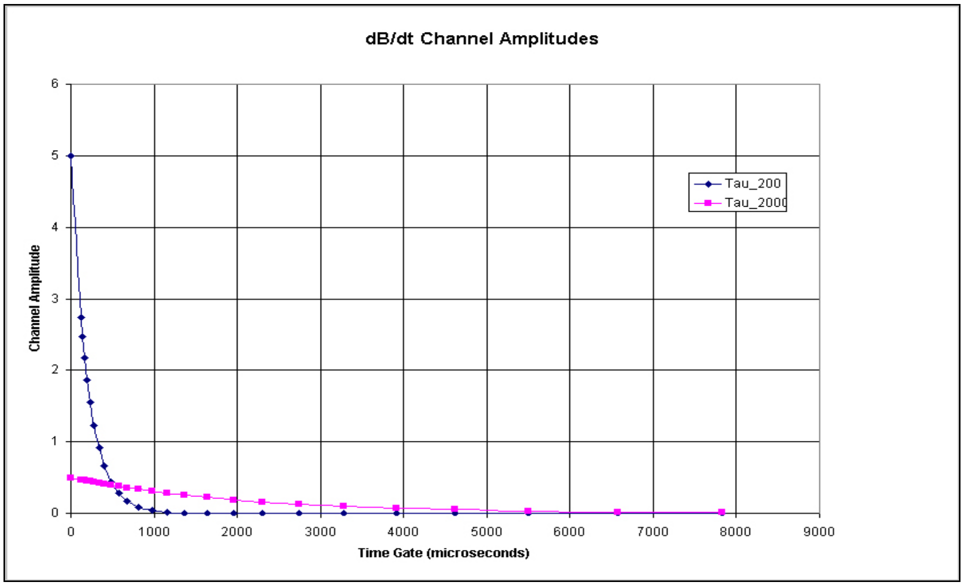

Figure 6b – dB/dt field decay with two different time constants.

The time constant, Tau can be calculated using any two channels in the dB/dt decay.

Tau = - (t1-t2) / log (Amplitude1/Amplitude2)

The actual signal measured by a time domain EM system, surveying a non-uniform geological setting, is a sum of exponentials. A time constant calculated using early channels would predominantly reflect the shorter time constants and one based on late channels would predominantly reflect the longer time constants.

A value for Tau was calculated by analysis of all of the dB/dt time gates with emphasis given to later channels and larger values. The tau profile was smoothed using a twenty-one point Hanning filter. The data were gridded for each survey database using a bi-cubic spline.

Grid Merge

Once the gridding was completed, the individual grids were combined. Before merging, the magnetic grids were downward or upward continued to a common altitude of 40 m. Contiguous and overlapping grids were joined together using the Geosoft *Gridstch* routine. This grid-joining tool defines a suture line that bisects any area of overlap between two grids and unneeded 'cut-off' sections of each grid are discarded. Any mismatch in gridded values along the suture line were adjusted and the correction applied was smoothly transitioned into the corrected grid to provide a seamless join. Stand-alone grids were simply added to the compilation using Gridbool.

The second vertical derivative grids and decay constant grids were merged in the same fashion.

The EM Anomaly Selection

The EM profile data were analysed on a line by line basis and conductive anomalies were noted. Based on the shape of the profile response, each anomaly has been classified as thin (N) or thick (K). A thin, vertically orientated source produces a double peak anomaly in the z-component response, with a diminished or null response over the axis of the conductor. This response will be skewed if the body is dipping. A thick source will show a single peak response. The anomalies have been further classified by the associated decay constant.

The power line monitor channel was used to flag anomalies as likely cultural in origin.

6 FINAL PRODUCTS

The following products are included in the compilation:

Map products at 1:20,000

- Colour residual magnetic field grid with contours, plotted along with EM anomalies on a planimetric base
- Shaded colour image of the second vertical derivative of the magnetics and Keating kimberlite coefficient anomalies on a planimetric base
- Colour decay constant grid with contours and EM anomalies on a planimetric base

Profile databases

- Database with EM and magnetics sampled at 10 samples/sec in both Geosoft® GDB and ASCII format

Waveform databases

- Database with EM response in the receiver of the transmitter pulse Geosoft® GDB format

EM anomaly databases

- EM anomaly databases in both Geosoft® GDB and ASCII CSV format

Kimberlite coefficient database

- Keating kimberlite coefficient anomaly databases in both Geosoft® GDB and ASCII CSV format

Data grids

Data grids, in both Geosoft® GRD and GXF formats, gridded from coordinates in UTM Zone 16N, NAD83 datum, of the following parameters:

- GSC levelled magnetic field
- Second vertical derivative of the GSC levelled magnetic field
- EM decay constant

GeoTIFF images:

- Colour residual magnetic field grid with contours, plotted along with EM anomalies on a planimetric base
- Shaded colour image of the second vertical derivative of the magnetics and Keating kimberlite coefficient anomalies on a planimetric base
- Colour decay constant with contours and EM anomalies on a planimetric base

DXF vector files

- Flight path
- EM anomaly symbols
- Keating kimberlite coefficient anomalies
- Residual magnetic field contours
- Decay constant contours

Project report

- Provided in both Microsoft® Word and Adobe® PDF formats

REFERENCES

Keating, P.B. 1995. A simple technique to identify magnetic anomalies due to kimberlite pipes; Exploration and Mining Geology, v.4, no.2, p.121-125.

Kumar, H. 2006. Report on a helicopter-borne VTEM geophysical survey, Chapleau project; unpublished report for Golden Chalice Resources Ltd.

Kumar, H. 2007. Report on a helicopter-borne VTEM geophysical survey, Rennie Block; unpublished report for Chalice Diamond Corp.

Ontario Geological Survey 1999. Single master gravity and aeromagnetic data for Ontario; Ontario Geological Survey, Geophysical Data Set 1036.

Orta, M. 2008. Report on a helicopter-borne VTEM geophysical survey, Aguonie-Cowie-Corbiere-Esquega townships; unpublished report for Chalice Diamond Corp.

Orta, M. 2008. Report on a helicopter-borne VTEM geophysical survey, Chapleau Main Block Chapleau diamond project; unpublished report for Chalice Diamond Corp.

Reford, S.W., Gupta, V.K., Paterson, N.R., Kwan, K.C.H. and Macleod, I.N. 1990. Ontario master aeromagnetic grid: A blueprint for detailed compilation of magnetic data on a regional scale; *in* Expanded Abstracts, Society of Exploration Geophysicists, 60th Annual International Meeting, San Francisco, v.1, p.617-619.

APPENDIX A PROFILE ARCHIVE DEFINITION

Survey 1237 was carried out using the time-domain VTEM electromagnetic and magnetic systems mounted on a helicopter platform.

Data File Layout

The files for the Magpie River Geophysical Survey 1237 are archived on DVDs. The content of the ASCII and Geosoft® binary file types are identical. They are provided in both forms to suit the user's available software. The survey data are divided as follows:

- ASCII (GXF) grids
  - total (residual) field magnetics
  - second vertical derivative of the total field magnetics
  - decay constant
- EM anomaly databases (ASCII CSV format)
- Keating correlation (kimberlite) database (ASCII CSV format)
- DXF files:
  - flight path
  - EM anomalies
  - Keating correlation (kimberlite) anomalies
  - total field magnetic contours
  - decay constant contours
- GEOTIFF images
  - colour total field magnetics with base map
  - colour shaded relief of second vertical derivative with base map
  - colour decay constant with base map
- Geosoft® Binary (GRD) grids
  - total (residual) field magnetics
  - second vertical derivative of the total field magnetics
  - decay constant
- EM anomaly databases (Geosoft® GDB format)
- Keating correlation (kimberlite) database (Geosoft® GDB format)
- Waveform databases (Geosoft® GDB format)
- ASCII Profile data
  - Profile databases of electromagnetic and magnetic data (10 Hz sampling) in ASCII (XYZ) format
- Binary Profile data
  - Profile databases of electromagnetic and magnetic data (10 Hz sampling) in Geosoft® GDB format
- Survey report (Microsoft® Word and Adobe® PDF formats)

Coordinate Systems

The profile, electromagnetic anomaly and Keating coefficient data are provided in two coordinate systems:

- Universal Transverse Mercator (UTM) projection, Zone 16N, NAD83 datum, Canada local datum
- Latitude/longitude coordinates, NAD83 datum, Canada local datum

The gridded data are provided in one UTM coordinate system:

- Universal Transverse Mercator (UTM) projection, Zone 16N, NAD83 datum, Canada local datum

Profile Data

The profile data are provided in two formats, one ASCII and one binary:

ASCII

- ASCII files of electromagnetic and magnetic data, sampled at 10 Hz

Magpie_m.xyz – Where **m** is a sequential numerical reference.

Binary

- Geosoft® OASIS montaj binary database file (no compression) of electromagnetic and magnetic data, sampled at 10 Hz

Magpie_m.gdb – Where **m** is a sequential numerical reference.

The contents of the databases csv/gdb are summarized as follows:

Channel Name	Description	Units
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad83	longitude using NAD83 datum	decimal-degrees
lat_nad83	latitude using NAD83 datum	decimal-degrees
radar_final	corrected radar altimeter	metres above terrain
gps_z_final	differentially corrected GPS Z (NAD83 datum)	metres above sea level
dem	digital elevation model	metres above sea level
fiducial	fiducial	
flight	flight number	
line	flightline number	
time_gps	GPS time	seconds
mag_base_final	corrected magnetic base station data	nanoteslas
mag_ raw	raw magnetic data	nanoteslas
mag_diurn	diurnally corrected magnetic data	nanoteslas
mag_lev	levelled magnetic field	nanoteslas
mag_final	micro-levelled magnetic field	nanoteslas
mag_gsclevel	GSC levelled magnetic field	nanoteslas
height_em	electromagnetic receiver height	metres above sea level
em_z_final	processed off-time dB/dt profile response	$pV/A/m^4$
em_z_B_field	processed off-time B field profile response	$pV*ms/A/m^4$
power	60 Hz power line monitor	microvolts
tau_z	decay constant (tau) for Z-component	microseconds

APPENDIX B ANOMALY ARCHIVE DEFINITION

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:

Both file types contain the same set of data channels, summarized as follows:

Channel Name	Description	Units
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad83	longitude using NAD83 datum	decimal-degrees
lat_nad83	latitude using NAD83 datum	decimal-degrees
dem	digital elevation model	metres above sea level
fiducial	fiducial	
line	flightline number	
time_gps	GPS time	seconds
em_z_final	final dB/dT, Z-component, off-time	$pV/A/m^4$
tau_z	decay constant (tau) for Z-component	microseconds
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_no_let	nth anomaly along the survey line (alpha)	
anomaly_id	unique anomaly identifier	
anomaly_type_let	anomaly classification Thin = N Thick = K	
heading	direction of flight	degrees
survey_no	survey number	

The unique anomaly identifier (anomaly_id) is a ten digit integer in the format 1LLLLLLAAA where 'LLLLLL' holds the line number (and leading zeroes pad short line numbers to six digits). The 'AAA' represents the numeric anomaly identifier (anomaly_no) for that line padded with leading zeroes to three digits. The leading 1 indicates that the anomaly was identified as likely having a normal or surficial source. For example, 1000101007 represents the seventh anomaly on Line 101. Anomalies identified as likely having a cultural source do not include the leading 1, and take the format LLLLLLAAA. For example, 101007 represents the seventh cultural anomaly on Line 101. When combined with the survey number (survey_no), the anomaly identifier provides an electromagnetic anomaly number unique to all surveys archived by the Ontario Geological Survey.

APPENDIX C KEATING CORRELATION ARCHIVE DEFINITION

Kimberlite Pipe Correlation Coefficients

The Keating kimberlite pipe correlation coefficient data are provided in two formats; ASCII and binary.

Both file types contain the same set of data channels, summarized as follows:

Channel Name	Description	Units
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad83	longitude using NAD83 datum	decimal-degrees
lat_nad83	latitude using NAD83 datum	decimal-degrees
corr_coeff	correlation coefficient	percent x 10
pos_coeff	positive correlation coefficient	percent
neg_coeff	negative correlation coefficient	percent
norm_error	standard error normalized to amplitude	percent
amplitude	peak-to-peak anomaly amplitude within window	nanoteslas

APPENDIX D GRID ARCHIVE DEFINITION

Gridded Data

The gridded data are provided in two formats, one ASCII (gxf) and one binary (grd)

The grids are summarized as follows:

- All grids are NAD83 UTM Zone 16N, with a grid cell size of 20 m x 20 m.

MAMAG83.grd/.gxf – GSC Levelled Residual Magnetic Intensity
MA2VD83.grd/.gxf – Second Vertical Derivative of Residual Magnetic Intensity
MADCZ83.grd/.gxf – Decay Constant

APPENDIX E GEOTIFF AND VECTOR ARCHIVE DEFINITION

GeoTIFF Images

Geographically referenced colour images, incorporating a base map, are provided in GeoTIFF format for use in GIS applications:

MMMAG83_a.TIF – GSC Levelled Residual Magnetic Intensity
MM2VD83_a.TIF – Second Vertical Derivative of GSC Levelled Residual Magnetic Intensity
MMDCZ83_a.TIF – Decay Constant

Where **a** is a sequential numerical reference within the survey.

Vector Archives

Vector line work from the maps is provided in DXF ASCII format using the following naming convention:

MAPATH83.DXF – flight path of the survey area
MAANOM83.DXF – electromagnetic anomalies
MAKC83.DXF – Keating correlation targets
MAMAG83.DXF – contours of the residual magnetic intensity in nanoteslas
MADC83.DXF – contours of the decay constant (micro-seconds)