Ontario

Airborne Magnetic and Electromagnetic Surveys
Reid-Mahaffy Airborne Geophysical Test Site Survey
Miscellaneous Release – Data (MRD) 55

Geological Setting, Measured and Processed Data, and Derived Products

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Note: All figures are provided as separate images due to their large file sizes.

CREDITS

These surveys are part of the Operation Treasure Hunt geoscience initiative, funded by the Ontario Government.

List of accountabilities and responsibilities:

a) Andy Fyon, Senior Manager, Precambrian Geoscience Section, Ontario Geological Survey (OGS), Ministry of Northern Development and Mines (MNDM) – accountable for the airborne geophysical survey projects, including contract management;
b) Stephen Reford, Vice President, Paterson, Grant & Watson Limited, Toronto, Ontario, OTH Geophysicist under contract to MNDM, responsible for the airborne geophysical survey project management and quality control and quality assurance;
c) Lori Churchill, Project and Results Management Co-ordinator, Precambrian Geoscience Section, Ontario Geological Survey, MNDM – responsible to manage the project-related milestone information;
d) Geological data describing the OTH Test Site: Ontario Geological Survey was responsible to synthesise the interpretations of drill log information provided by Falconbridge Limited EXPLORATION and to select relevant parts of the drill core logs to describe the conductive segments. Ontario Geological Survey and the OTH Geophysicist were jointly responsible for the presentation style of the geological information for the OTH Test Site.

Data Acquisition and data compilation were provided by:

a) Fugro Airborne Surveys, Dighem office, Mississauga, Ontario;
b) Fugro Airborne Surveys, Geoterrex office, Ottawa, Ontario;
c) Fugro Airborne Surveys, High-Sense office, Richmond Hill, Ontario; and
d) Spectrem Air Limited, Johannesburg, South Africa, under sub-contract to Fugro Airborne Surveys, Questor office, Calgary, Alberta.

Source of Geological Data:

Descriptions of drill core were provided by Falconbridge Limited EXPLORATION. The mineral rights for the OTH Test Site is presently held directly, or through joint venture, by Falconbridge Limited EXPLORATION, Timmins, Ontario. MNDM gratefully acknowledges the assistance and co-operation of Falconbridge Limited EXPLORATION, Timmins, Ontario.

DISCLAIMER

for the accuracy of the geological information describing the OTH Test Site, the geological interpretations of the OTH Test Site data by the Ontario Geological Survey, or for the presentation and simplification of the geological information by the Ontario Geological Survey and Paterson, Grant & Watson Limited.

CITATION

Information from this publication may be quoted if credit is given. It is recommended that reference be made in the following form:

Ontario Geological Survey 2000. Airborne magnetic and electromagnetic surveys, Reid-Mahaffy Airborne Geophysical Test Site Survey; Ontario Geological Survey, Miscellaneous Release – Data (MRD)-55.

This digital data release contains the results of 5 airborne geophysical surveys, including magnetic and time-domain (TDEM) or frequency-domain (FDEM) electromagnetic data, collected over the Reid–Mahaffy airborne geophysical test range, as part of the Operation Treasure Hunt program. The following systems were flown:Dighem V - helicopter FDEM (5 frequencies)

* Geotem III - fixed wing TDEM (30 Hz base frequency)
* Geotem III - fixed wing TDEM (90 Hz base frequency)
* High-Sense - helicopter FDEM (5 frequencies)
* Spectrem2000 - fixed wing TDEM (90 Hz base frequency)

The data release consists of the following: 1) 10 tiff figures describing the geophysical profile and grid data in a geological context; 2) digital profile, EM anomalies and grid archives for all 5 systems (Geosoft GDB® and GRD® formats, as well as ASCII formats); and 3) Geotem® halfwave (binary format with reader) and Spectrem2000 fullwave (ASCII format) electromagnetic data.

1) INTRODUCTION

In late 1999, the Ministry of Northern Development and Mines (MNDM) commenced an ambitious program of airborne magnetic and electromagnetic surveys as part of the Operation Treasure Hunt (OTH) geoscience initiative. The project involved four survey contractors, five different electromagnetic systems and more than 105,000 line-km of data acquisition.

Purpose of a Test Site:
Search for Archean bedrock conductors in parts of Ontario have been hindered by conductive overburden, particularly in parts of the Abitibi greenstone belt. In addition, conductors are known to exist at different depths in the bedrock. Resolution of subtle or deeper conductors represents an exploration opportunity especially if these conductors have not been well imaged in the past.

The OTH Test Site served:

a) to demonstrate that each airborne geophysical system was operational;
b) as a calibration site if a new system component was added to a configuration during the OTH survey;
c) verify certain system specifications, for the geological "experiment" contained in the test site.

Use of calibration test sites is standard practice for many Government-funded magnetic and radiometric geophysical surveys, for example those established by the Geological Survey of Canada. No comparable site existed in the public domain for electromagnetic systems. In the past, defined conductors at such Ontario locations as Cavendish Township, Nighthawk Lake and Prosser Township have been used for testing purposes. However, MNDM sought a site with a broader range of electromagnetic responses, at different depths below surface, within a more complex bedrock and surficial geological setting.

After a brief but intense search, a site located in Reid and Mahaffy townships, north of Timmins, Ontario, was selected (Figure 1). It offers good access from the Timmins airport. The site had already been used by Falconbridge Limited to test airborne electromagnetic systems. The mineral claims for the site are held by Falconbridge Limited outright or in joint venture with its partners. Their offer to use this area as a test and calibration site was accepted and is gratefully acknowledged by the Ontario Geological Survey.

The Reid-Mahaffy Airborne Geophysical Test Site offers an array of electromagnetic sources that can be used to evaluate the capabilities of an electromagnetic system, particularly for glaciated Archean granite-greenstone terrains in Canada. These include:

- a variety of typical Abitibi metavolcanic, metasedimentary and intrusive units;
- a broad depth range of discrete bedrock conductors, from near-surface to ~200 m;
- a broad conductance range for discrete bedrock conductors, from weak to strong;

- closely spaced, discrete bedrock conductors, to test lateral resolution; and
- some variation in the conductivity and thickness of the overburden.

Use of the Test Site Data:
The OGS has not used the Test Site results to critically endorse one OTH airborne geophysical system over another. That is an inappropriate use of the Test Site data.
The Test Site data for different systems are directly comparable only where the geological conditions in a survey area are comparable to those of the OTH Test Site. In this regard, the OGS selected each airborne survey provider and their geophysical system based on:

a) the nature of the bedrock and surficial conditions in the survey area;
b) the type of mineralization target anticipated in the survey area;
c) safety considerations (fixed wing vs. helicopter);
d) price – performance considerations;
e) risk management and survey capacity considerations.

Therefore, as at any small site, the responses will not allow for an exhaustive evaluation of a system for all targets, host rock and overburden conditions. However, the site does provide a reasonable comparison of a system's relative strengths and weaknesses for geological conditions similar to those of the Test Site, which should be incorporated in the interpretation of its data.

2) THE TEST FLIGHTS

As part of OTH, each airborne survey system contracted for the project was required to fly a survey over the Reid-Mahaffy Airborne Geophysical Test Site. The systems flown are listed below, with their assigned OTH survey areas:

- Dighem V frequency-domain electromagnetic system, helicopter platform (Garden-Obonga, Vickers);
- Geotem III time-domain electromagnetic system, fixed wing platform, 30 Hz base frequency (Cochrane, Kirkland Lake);
- Geotem III time-domain electromagnetic system, fixed wing platform, 90 Hz base frequency (Temagami);
- High-Sense frequency-domain electromagnetic system, helicopter platform (Schreiber); and
- Spectrem$_{2000}$ time-domain electromagnetic system, fixed wing platform (Matheson).

The flight path map shows the prescribed survey layout (Figure 2). The flight lines are spaced 200 metres apart, the standard for OGS airborne electromagnetic surveys. The direction of flight for each line is specified to simplify the comparison of responses, particularly for electromagnetic systems with asymmetric transmitter-receiver geometry. The flying height was specified as the nominal survey height of the electromagnetic receiver bird for each system, namely 30 m for Dighem V and High-Sense, 70 m for Geotem III and 56 m for Spectrem$_{2000}$.

In addition to flying the flight lines and tie lines as shown, line 40 was selected for two additional tests:

- it was flown in the opposite direction to test the asymmetry of the responses; and
- it was flown at a range of additional heights (50, 75, 100, 125 and 150 m for the helicopter systems, and 75, 100, 125, 150 and 200 m for the fixed wing systems) to test the attenuation in the amplitude and lateral resolution of the electromagnetic responses with increasing height.

The latter test could give a gross estimate of penetration and resolution with depth, although true geology is often not well simulated by a layer of air. In subsequent test surveys, contractors will be required to fly the altitude test in both directions (i.e. N to S and S to N) to test attenuation effects on the asymmetric responses, as well as repeatability of anomaly responses and system noise characteristics.

The specific flight plan is provided below, and could be used for future test surveys. The co-ordinates are specified in the Universal Transverse Mercator projection (zone 17N) and NAD27 datum (NTV2 local datum).

The contractors flew sixteen N-S oriented traverse lines, from 5 400 300 N to 5 405 600 N, as follows:

459 500 E, from N to S (line 10);
459 700 E, from S to N (line 20);
459 900 E, from N to S (line 30);
460 100 E, from S to N (line 40);
460 300 E, from N to S (line 50);
460 500 E, from S to N (line 60);
460 700 E, from N to S (line 70);
460 900 E, from S to N (line 80);
461 100 E, from N to S (line 90);
461 300 E, from S to N (line 100);
461 500 E, from N to S (line 110);
461 700 E, from S to N (line 120);
461 900 E, from N to S (line 130);
462 100 E, from S to N (line 140);
462 300 E, from N to S (line 150); and
462 500 E, from S to N (line 160).

In addition, the contractors flew four E-W oriented tie lines, from 459 500 E to 462 500 E, as follows:

5 400 700 N, from W to E (line 9010);
5 402 200 N, from E to W (line 9020);
5 403 700 N, from W to E (line 9030); and
5 405 200 N, from E to W (line 9040).

This totals 96.8 line-km. The nominal EM bird terrain clearance was 30 m for the helicopter FDEM systems (Dighem V and High-Sense), 70 m for the fixed wing TDEM Geotem III systems, and 56 m for the fixed wing TDEM Spectrem$_{2000}$ system.

In addition, the FDEM systems flew line 40 (460 100 E), from 5 400 300 N to 5 405 600 N, as follows:

N to S, EM bird at 30 m above terrain;
S to N, EM bird at 50 m above terrain;
S to N, EM bird at 75 m above terrain;
S to N, EM bird at 100 m above terrain;
S to N, EM bird at 125 m above terrain; and
S to N, EM bird at 150 m above terrain.

In addition, the TDEM systems flew line 40 (460 100 E), from 5 400 300 N to 5 405 600 N, as follows:

N to S, EM bird at 70 m or 56 m above terrain;
S to N, EM bird at 75 m above terrain;
S to N, EM bird at 100 m above terrain;
S to N, EM bird at 125 m above terrain;
S to N, EM bird at 150 m above terrain; and
S to N, EM bird at 200 m above terrain.

In subsequent test surveys, the five traverses of line 40 flown from S to N at varying altitudes will also be flown from N to S. This brings the survey total to 155.1 line-km.

3) GEOPHYSICAL DATA

Appendices A to E document the content and format of the profile, grid and electromagnetic anomaly archives prepared from each of the five surveys flown over the Reid-Mahaffy Airborne Geophysical Test Site. These products are similar to those prepared for the OTH survey areas. For details on the system parameters, and the data compilation and processing applied for each system, the reader is referred to the corresponding survey reports prepared for the OTH production survey data. They are included on the CD-ROMs as follows:

- Dighem V frequency-domain electromagnetic system – Vickers (thvickers.doc/pdf), Garden-Obonga (thgardenobonga.doc/pdf);
- Geotem III time-domain electromagnetic system, 30 Hz base frequency – Cochrane (thcochrane.doc/pdf), Kirkland Lake (thkirklandlake.doc/pdf);
- Geotem III time-domain electromagnetic system, 90 Hz base frequency – Temagami (thtemagami.doc/pdf);
- High-Sense frequency-domain electromagnetic system – Schreiber (thschreiber.doc/pdf); and
- Spectrem$_{2000}$ time-domain electromagnetic system – Matheson (thmatheson.doc/pdf).

In addition, the "halfwave" data for the two Geotem III surveys and the "fullwave" data for the $Spectrem_{2000}$ survey are provided. These electromagnetic data have been stacked, but not yet windowed to the channels provided in the profile databases. They provide the user with the opportunity to reprocess the data from a near-raw state.

The Geotem III (30 Hz) data archive contains the Keating correlation coefficient (Keating, 1995) data for the test site.

Figures 3 and 4 provide a historical reference for the Reid-Mahaffy Airborne Geophysical Test Site. The magnetic and electromagnetic data were derived from the 1987 OGS survey using the Geotem I time-domain electromagnetic system (Ontario Geological Survey, 1996), which used a 150 Hz base frequency.

4) GEOLOGICAL DATA

The published geology for the area (Figure 1) was extracted from the digital version of Ayer and Trowell (1998). It is located in the Abitibi Subprovince, immediately east of the Mattagami River Fault. The area is underlain by Archean (~2.7 b.y.) mafic to intermediate metavolcanic rocks in the south, and felsic to intermediate metavolcanic rocks in the north, with a roughly an east-west-striking stratigraphy. Narrow horizons of chemical metasedimentary rocks and felsic metavolcanic rocks have been mapped, as well as a mafic to ultramafic intrusive suite to the southeast. North-northwest-striking Proterozoic diabase dykes are evident from the historical aeromagnetic data. Copper and lead-zinc vein/replacement and stratabound, volcanic-hosted massive sulphide (VMS) mineralization occurs in the immediate vicinity. The Kidd Creek VMS deposit occurs to the southeast of the Test Site.

Table 1 was prepared by geologists from the OGS, using diamond drillhole logs provided by Falconbridge Limited. It illustrates the intervals interpreted by the OGS geologists as possible electromagnetic conductors. Falconbridge Limited has interpreted all bedrock conductors in the area to have a near-vertical dip. Figure 5 shows the drillhole collar locations relative to the test site flight plan.

Figures 6 to 10 provide N-S oriented geological sections, derived from the drillholes. The sections are located where fences of holes were available (Figure 5). OGS geologists interpreted the electromagnetic conductors. Table 2 provides excerpts from the drill logs that fully describe these conductors. The location and dip of the drillholes have been projected onto the sections, in some cases from tens of meters away. There is no guarantee that the drillholes have intersected the main source of specific electromagnetic anomalies (e.g. conductor in Figure 10 located by a borehole electromagnetic survey).

Figures 6 to 10 provide the measured electromagnetic responses for the flight-line segments nearest to the corresponding sections. The data segments extend 300 m beyond the north and south ends of each geological section (Figure 5). They illustrate the electromagnetic anomalies associated with each interpreted conductor, and how the responses vary by system. The data are displayed using linear scales, which emphasise the early time/high frequency responses (i.e. due to shallower sources). Users may better appreciate the late time/low frequency responses by referring directly to the digital profile data and using an alternate form of display (e.g. logarithmic scale).

5) CONCLUSIONS

OGS established the airborne geophysical test site in Reid and Mahaffy townships, particularly suited to electromagnetic systems, with the assistance of Falconbridge Limited. The site was flown by five airborne geophysical magnetic and electromagnetic systems as part of the first year of Operation Treasure Hunt. OGS will endeavour to better define the surface and underground geology of the test site as new and historical data are collected and interpreted.

As a courtesy, companies interested in using the OTH Test Site to calibrate their instruments should make prior arrangements with Falconbridge Limited EXPLORATION, Timmins, Ontario.

REFERENCES

Ayer, J.A. and Trowell, N.F. 1998, Geological compilation of the Timmins area, Abitibi greenstone belt; Ontario Geological Survey, Miscellaneous Release – Data (MRD) 36.

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

Ontario Geological Survey, 1996, Timmins area, Ontario airborne magnetic and electromagnetic surveys, processed data and derived products, Archean and Proterozoic “greenstone” belts; ERLIS Dataset CD-ROM 1004, Ontario Geological Survey.

TABLE 1 IS LOCATED ON THE COMPANION CD AS table1.doc

Table 2. Geological description of interpreted electromagnetic conductors.

Conductor	Core Interval	From Surface	Description
NM-73-2-214 (Figure 6)	214-241' (65.2-73.5m)	50.0-56.3m	15% pyrite, 1% sphalerite, minor chalcopyrite. Black shale-andesite tuff (graphite schist - brecciated tuff); strongly fractured graphitic schist zones. Sulphides occur throughout as vuggy nodules and fracture fillings. Pyrite (20%) is concentrated in graphitic black shale sections at 214-222' and 233-237'. 214-223' - reddish brown resinous sphalerite occurs as rims bordering the pyrite nodules and veins (estimated 1% Zn) at 221-222' (estimated 0.3% Cu). 224-229' - brecciated silicified andesite tuff with disseminations and fracture fillings of sulphide and graphitic material. At 225-226' spinifex texture (radiating amphibole crystals). 232-237' - graphitic black shale, mostly pyrite mineralization (20%) as fracture fillings and nodules with blebs of visible chalcopyrite (est. Cu 0.15%); crenulate schistosity. 237-241' - massive graphitic zone with consistent schistosity at 45 degrees. Pyrite 5%.
NM-73-2A-361 (Figure 6)	361-412' (110.0-125.6m) 427-432' (*) (130.1-131.7m)	84.3-96.2m 99.7-100.9m	361-412' - 20% sulphides, Po 15%, Pyrite 3%, Chalcopyrite 0.5%, trace Sph. Mineralised Zone - mixed Black Shale (graphitic-chloritic) and fractured Andesite Tuff; schistosity variable but generally at 40-60 degrees to core axis. 361-368' silicified andesite tuff, moderately hard, grey green, fractured with fracture filling of Po-Cp; 361-362' 30% pyrrhotite as nodules (moderately flattened at 60 degrees to core axis) with associated 0.5% Cu; 362-365' late open fractures at 0-20 degrees to core axis, containing chalcopyrite; 365-368' strongly disseminated Pyrrhotite (10%) and associated Chalcopyrite in siliceous tuff; 368-380' mixed zone andesite tuff and black shale; andesite tuff contains 10% disseminated Pyrrhotite with associated disseminated Chalcopyrite. Black shale sections containing 25% Pyrrhotite with 0.5% Copper occur at 268.5-370.9; 371.5-375 and 377-380'. 380-392' siliceous black shale which contains 50% Pyrrhotite with 1% Chalcopyrite from 382-384', as nodules and fracture filling in a Pyrrhotite rich section which extends from 380-384. From 384-392 pyrite nodule section with minor chalcopyrite. 392-397' andesite tuff (argillic) green, fine-grained, fractured with disseminated pyrrhotite and minor nodules of pyrrhotite (10% Po); schistosity at 50-60 degrees. 397-403' Black shale (graphite schist) schistosity at 50 degrees to core axis. At 399-403' graphite occurs as nodules and disseminations. Nodules of Pyrrhotite are zoned with black shale (chlorite-graphite) at the centre. 403-412' Black shale; sections of argillitic tuff at 403-404' and 406-408'. Strong concentration of pyrrhotite as nodules and veins. From 410-412' 50% Pyrrhotite with 1% chalcopyrite as bands and disseminations. 427-432' - 20% sulphides, Pyrrhotite 15%, Pyrite 5%, minor Chalcopyrite. Black shale (graphite schist) with variable crenulate schistosity at 20-60 degrees to C.A.; sulphides occur as fracture fillings and disseminations.
NM-73-2A-473 (Figure 6)	473-482' (144.2-146.9m)	110.5-112.5m	50% black shale zone with 10% Pyrite-Pyrrhotite occurring as nodules, disseminations and fracture fillings. Associated disseminated and fracture fillings of Chalcopyrite (1%).
NM-73-3-456 (Figure 6)	456-497' (139.0-151.5m)	106.5-116.0m	5% Py. Black shale; black chlorite-graphite sediment with schistosity at 45 degrees to C.A. Pyrite occurs as fine fracture filling and crystal near quartz-calcite veinlets.
RE43-04-142 (Figure 7)	142.3-142.4m	109.0-109.1m	10cm of strongly conductive graphite (80%) at the base of an 80 cm bed of graphitic argillite.
RE43-04-178 (Figure 7)	178.8-182.6m	137.0-139.9m	178.8-179.0m - Graphitic argillite: 20% white grey, quartz-carbonate veins with 5% pyrite, trace chalcopyrite and less than 1% pale brown-red sphalerite overall. 181.2-182.6m – Graphitic argillite: 2-3% pyrite, pyrrhotite in blebs, veinlets; trace chalcopyrite in pyrrhotite.
KV-T2-385	385-393'	89.9-91.8m	Graphitic Tuff - Black, fine grain, minor laminae, no tops - broken core 2" pyrite

(Figure 8)	(117.3-119.8m)		up to 10%.
KV-T2-424 (Figure 8)	424-499' (129.2-152.1m)	99.0-116.5m	Graphitic Slate - medium/fine grain. Fine laminae in places - mainly black. Pyrite common, concentrations of up to 40% over 1-2": 5% overall.
MF13-01-141 (Figure 8)	141.2-142.2m (*) 149.1-183.0m	122.3-123.1m 129.1-158.5m	141.2-142.2m - Graphitic and Carbonaceous Tuff - medium to dark grey, fine grained, minor ash-lapilli size felsic component. Unit made up of alternating graphite and dirty carbonaceous tuff. 5% disseminated and roughly bedded pyrite. 149.1-183.0m - Graphitic and Carbonaceous Argillite - 75% graphite, fine grained, dark grey to black. 25% carbonaceous argillite, medium grey, fine ash. Minor (3%) pyritic beds from 1 to 3 mm. Unit moderate to strongly conductive throughout. 5% pyrite, occurs in beds or as large subround clots up to 2 cm, locally as colloform growths.
UT-RM-4-257 (Figure 8)	257.6-279.6' (78.5-85.2m)	64.3-69.8m	257.6-263' - Graphite-Argillite – Black graphitic sediment, vuggy pyrite 5 - 10%. Casts of black shale, beds broken up (turbidity). 267-269.8' - Graphite - Vuggy grey to black carbonaceous sediment – conductive. 272-279.6' - Graphite-Argillite - Black vuggy carbonaceous sediment – conductive.
UT-RM-4-379 (Figure 8)	379.5-448' (115.7-136.6m)	94.8-111.9m	379.5-380.2' – Graphite - Black graphite with 10-15% pyrite. 383.5-448' - Graphite - Conductor - Black dense graphite with some sections of argillite. Pyrite 3-4% as nodules, and thin 1/8" beds. 404-411' - numerous 1/4 - 1/2" pyrite cubes.
UT-RM-6-238 (Figure 8)	238-360' (72.5-109.7m)	59.4-89.9m	238-243' - Graphite – conductive, Black massive fine-grained graphite, 3-5% pyrite as cubes 1/8" size. 259.4-360' - Graphite - slate - argillite - conductive, black massive graphite initially then occasional, bedding (argillite), pyrite is 5-7%, small folded mass of pyrite at 301 has silica and specks of chalcopyrite. Occasional beds of pyrite 1/4 - 1/2".
RR-RM3-396 (Figure 8)	396.5-452' (120.9-137.8m)	99.0-112.9m	396.5-407.5' – Graphitic tuff: black to grey tuff with 1/8" size white felsic fragments initially in beds but the tuff itself forms fragments and thin beds in a solid graphitic matrix. Pyrite is 25% as fragments in the graphite matrix. The pyrite fragments are mg-fg masses of crystals and crystalline masses. 407.5-424' – Massive graphite: Black fg dense massive graphite with 1/2"-1" nodules (round) of pyrite, with white silica material surrounding 20-25% pyrite. 424-430.5' – Argillite graphite: Graphite grades into bedded graphite units with grey beds of less graphitic (felsic) material. Beds of pyrite 1/2"-1" thick, pyrite 25-30%. 45 degrees to C.A. Graded bedding shows top is to the north. 430.5-439' – Sulphide zone: 70-80% pyrite is 1/2" size nodules with white silica matrix. 5% (then surrounded by graphite 15%). Pyrite looks like clusters of grapes since nodules form 3" wide beds of nodules. 439-452' – Graphite tuff: Grey-black graphitic tuff like 396.5-407.5' with 1/8" white specs of felsic material (fragments?). Pyrite 25-30% in beds 1" and as 1" fragments (sub-rounded). Bedding at 47 degrees.
NM-74-2-205 (Figure 9)	205-216' (62.5-65.8m)	44.2-46.5m	Massive Sulphide; sulphides in silicified matrix of weakly graphitic argillite with some quartz-carbonate laminae; common black gritty mineral (Fe-oxide?). Pyrite 70%; massive bands and lenses Sphalerite 5% as angular fragments up to 1" length and disseminated; Chalcopyrite 1% as irregular patches and streaks, S1 and S2 contorted but generally 45 degrees to C.A. 211-216.5' - graphitic argillite and fine volcanic material; chloritic, silicified zones. Pyrite 20% as laminae and clots and massive sections up to 2" Sphalerite 5% as discrete laminae S1 and S2 45 degrees to C.A.
NM-R74-6-360 (Figure 9)	360-396' (109.7-120.7m)	84.0-92.5m	Pyrrhotite 25% as disseminated pellets irregular clots and veinlets, and massive sections up to 5" Chalcopyrite sparse associated with Pyrrhotite, some veinlets, locally up to 0.5%; Pyrite scattered. 389-396' - Mixed zone, strongly fracture – contorted rock comprising silicified tuff, massive Pyrrhotite, and graphitic, chloritic argillite, some quartz-carbonate veining. Pyrrhotite 25% massive bands and lenses,

			minor Pyrite - Chalcopyrite as irregular patches and streaks.
CW-R1-270 (Figure 10)	270-324' (82.3-98.8m)	67.4-80.9m	270-304' - 10-15% pyrite, slight pyrrhotite as clots and stringers: little graphite. 304-324' - Graphite: slight pyrite, some carbonate: 1st 4" has 75% pyrite.
Borehole conductor (Figure 10)	177 m	131.5m	Drillhole RE54-02 encountered a 6 m interval (174.0 to 180.0m) of weakly graphitic cherty argillite to mudstone. A subsequent borehole electromagnetic survey located a conductor interpreted to lie 5 m below the hole, dipping steeply and with a 120 m depth extent.

Notes:

1) (*) indicates interval too narrow to be shown separately on the geological cross-section.
2) Where the core intervals are given in feet, they reflect the units of the original drill logs, to facilitate comparison.

APPENDIX A

DIGITAL DOCUMENTATION FOR OTH SURVEY 9901 – GEOTEM III 30 HZ

Survey 9901 was carried out using the time-domain Geotem III electromagnetic and magnetic system, mounted on a fixed wing platform. A transmitter base frequency of 30 Hz was used.

Data File Layout

The files for the Reid-Mahaffy Geophysical Test Site Survey 9901 are archived on the first CD in the geotem_30hz subdirectory. The data are broken out in eight forms in separate subdirectories, namely ASCII and binary files of the gridded, profile, electromagnetic anomaly data and kimberlite pipe correlation coefficient data. The content of the ASCII and binary file types is identical. They are provided in both forms to suit the user's available software.

In addition, the halfwave data, halfwave reader program and measured waveform data are archived on the second CD in the geotem_30hz_halfwave subdirectory.

Co-ordinate Systems

The profile, electromagnetic anomaly and Keating coefficient data are provided in four co-ordinate systems:

Universal Transverse Mercator (UTM) projection, Zone 17N, NAD27 datum, NTV2 local datum;
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD83 datum, North American local datum;
Latitude/longitude co-ordinates, NAD27 datum, NTV2 local datum; and
Latitude/longitude co-ordinates, NAD83 datum, North American local datum.

The gridded data are provided in the two UTM co-ordinate systems.

Line Numbering

The line numbering conventions for survey 9901 are as follows:

Flightlines 10, 20 to 160 - 101, 201 to 1601
Tielines 9010 to 9040 - 500101 to 500401
Flightline 40 flown north to south - 12001
Flightline 40 flown at increasing terrain clearance - 12501 to 25001

Gridded Data

The gridded data are provided in two formats, one ASCII and one binary:
*.gxf - ASCII Grid eXchange Format (revision 3.0)
*.grd - Geosoft OASIS montaj binary grid file (no compression)
*.gi - binary file that defines the co-ordinate system for the *.grd file

The grids are summarised as follows:

thrm1mag27.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum)
thrm1mag83.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum)
thrm1magtr27.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum), gridded with geological trend enhancement
thrm1magtr83.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum), gridded with geological trend enhancement
thrm12vd27.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD27 datum)
thrm12vd83.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD83 datum)
thrm1dem27.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD27 datum)
thrm1dem83.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD83 datum)
thrm1con27.grd/.gxf apparent conductance in siemens (UTM co-ordinates, NAD27 datum)
thrm1con83.grd/.gxf apparent conductance in siemens (UTM co-ordinates, NAD83 datum)
thrm1conde27.grd/.gxf de-herringboned apparent conductance in siemens (UTM co-ordinates, NAD27 datum)
thrm1conde83.grd/.gxf de-herringboned apparent conductance in siemens (UTM co-ordinates, NAD83 datum)
thrm1dc27.grd/.gxf decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD27 datum)
thrm1dc83.grd/.gxf decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD83 datum)
thrm1dcde27.grd/.gxf de-herringboned decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD27 datum)
thrm1dcde83.grd/.gxf de-herringboned decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD83 datum)

Profile Data

The profile data are provided in two formats, one ASCII and one binary:
thrm1.xyz - flat ASCII file, sampled at 4 Hz
thrm1mag.xyz - flat ASCII file, sampled at 10 Hz
thrm1.gdb - Geosoft OASIS montaj binary database file (no compression) , sampled at 4 Hz
thrm1mag.gdb - Geosoft OASIS montaj binary database file (no compression) , sampled at 10 Hz

The files thrm1.xyz/.gdb contain the bulk of the data, including the final magnetic channel, sampled at 4 Hz, the acquisition sampling rate of the electromagnetic data. The files thrm1mag.xyz/.gdb contain all of the magnetic and related data, sampled at 10 Hz, the acquisition sampling rate of the magnetic data.

The contents of thrm1.xyz/.gdb (both file types contain the same set of data channels) are summarised as follows:

Channel Name	Description	Units
gps_x_raw	raw GPS X	DDMM.decimal-minutes
gps_y_raw	raw GPS Y	DDMM.decimal-minutes
gps_z_raw	raw GPS Z	metres
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
gps_z_final	differentially corrected GPS Z (NAD83 datum)	metres above sea level
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
radar_raw	raw radar altimeter	metres above terrain
radar_final	corrected radar altimeter	metres above terrain
baro_raw	raw barometric altimeter	metres above sea level
baro_final	corrected barometric altimeter	metres above sea level
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
date	local date	YYYYMMDD
mag_final	IGRF-corrected magnetic field	nanoteslas
height_em	electromagnetic receiver height	metres above terrain
em_x_raw_on	raw (stacked) dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_raw_off	raw (stacked) dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_raw_on	raw (stacked) dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_raw_off	raw (stacked) dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_raw_on	raw (stacked) dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_raw_off	raw (stacked) dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_x_drift_on	drift-corrected dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_drift_off	drift-corrected dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_drift_on	drift-corrected dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_drift_off	drift-corrected dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_drift_on	drift-corrected dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_drift_off	drift-corrected dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_x_final_on	filtered dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_final_off	filtered dB/dT, X-component, off-time (15 channels)	picoteslas per second

em_y_final_on	filtered dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_final_off	filtered dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_final_on	filtered dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_final_off	filtered dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_bx_raw_on	raw (stacked) B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_raw_off	raw (stacked) B-field, X-component, off-time (15 channels)	femtoteslas
em_by_raw_on	raw (stacked) B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_raw_off	raw (stacked) B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_raw_on	raw (stacked) B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_raw_off	raw (stacked) B-field, Z-component, off-time (15 channels)	femtoteslas
em_bx_drift_on	drift-corrected B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_drift_off	drift-corrected B-field, X-component, off-time (15 channels)	femtoteslas
em_by_drift_on	drift-corrected B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_drift_off	drift-corrected B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_drift_on	drift-corrected B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_drift_off	drift-corrected B-field, Z-component, off-time (15 channels)	femtoteslas
em_bx_final_on	filtered B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_final_off	filtered B-field, X-component, off-time (15 channels)	femtoteslas
em_by_final_on	filtered B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_final_off	filtered B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_final_on	filtered B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_final_off	filtered B-field, Z-component, off-time (15 channels)	femtoteslas
power	60 Hz power line monitor	microvolts
primary	electromagnetic primary field	microvolts
tau_x	decay constant (tau) for X-component	microseconds
tau_z	decay constant (tau) for Z-component	microseconds
conductance	apparent conductance of thin sheet model	siemens

In thrm1.xyz, the electromagnetic channel data are provided in individual channels with numerical indices (e.g. em_x_final_on[0] to em_x_final_on[4], and em_x_final_off[0] to em_x_final_off[14]). In thrm1.gdb, the electromagnetic channel data are provided in array channels with five elements (on-time) or 15 elements (off-time).

The contents of thrm1mag.xyz/.gdb (both file types contain the same set of data channels) are summarised as follows:

Channel Name	Description	Units
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
gps_z_final	differentially corrected GPS Z (NAD83 datum)	metres above sea level
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	

line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
date	local date	YYYYMMDD
height_mag	magnetometer height	metres above terrain
mag_base_raw	raw magnetic base station data	nanoteslas
mag_base_final	corrected magnetic base station data	nanoteslas
mag_raw	raw magnetic field	nanoteslas
mag_edit	edited magnetic field	nanoteslas
mag_diurn	diurnally-corrected magnetic field	nanoteslas
igrf	local IGRF field	nanoteslas
mag_igrf	IGRF-corrected magnetic field	nanoteslas
mag_lev	levelled magnetic field	nanoteslas
mag_final	micro-levelled magnetic field	nanoteslas

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:
thrm1anomaly.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm1anomaly.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
em_x_final_on	filtered dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_final_off	filtered dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_final_on	filtered dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_final_off	filtered dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_final_on	filtered dB/dT, Z-component, on-time (5 channels)	picoteslas per second

em_z_final_off	filtered dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_bx_final_on	filtered B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_final_off	filtered B-field, X-component, off-time (15 channels)	femtoteslas
em_by_final_on	filtered B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_final_off	filtered B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_final_on	filtered B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_final_off	filtered B-field, Z-component, off-time (15 channels)	femtoteslas
tau_x	decay constant (tau) for X-component	microseconds
tau_z	decay constant (tau) for Z-component	microseconds
conductance	apparent conductance of thin sheet model	siemens
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_id	unique anomaly identifier	
anomaly_type_letter	anomaly classification	
anomaly_type_no	anomaly classification number	
no_chan	number of off-time channels deflected	
conductance_vert	conductance of vertical plate model	siemens
depth	depth of vertical plate model	metres
heading	direction of flight	degrees
survey_number	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. For example, 1000101007 represents the seventh 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.

The codes for anomaly_type and anomaly_type_number are as follows:

N	1
N?	2
S	3
S?	4
C	5
C?	6

The ? does not question the existence of an anomaly, but denotes some uncertainty as to the most appropriate model.

N: Bedrock (normal) - an anomaly whose response matches that of a bedrock conductor. This anomaly type might include various shapes of conductors: roughly pod-shaped, thin or thick dykes, short strike-length bodies, or conductors sub-parallel to the flight path.

S: Flat lying conductors - generally surficial. Typical geologic anomalies might be conductive overburden, swamps or clay layers. They would not appear to be conductive at depth.

C: Line current - an anomaly with the shape typical of line currents - typically cultural (human sources) such as power lines, train tracks, fences, etc. No anomalies of this type were interpreted for the Reid-Mahaffy Airborne Geophysical Test Site.

Kimberlite Pipe Correlation Coefficients

The Keating kimberlite pipe correlation coefficient data are provided in two formats, one ASCII and one binary:
thrm1kc.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm1kc.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 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 normalised to amplitude	percent
amplitude	peak-to-peak anomaly amplitude within window	nanoteslas

Halfwave Data

The halfwave data is stored in the binary file hwa08119.001. The DOS program read_halfwave.exe is provided to convert this binary file to a flat ASCII file. This utility is run in a standard command line mode, as follows:

```
read_halfwave  input  output
```

The output ASCII file will contain the fiducial and the 384 waveform points for the four components, T, X, Y, and Z, stored in that order. These components are:
T - the amplitude of the primary (transmitted) field;
X - the amplitude of the secondary field as seen by the X coil;
Y - the amplitude of the secondary field as seen by the Y coil; and
Z - the amplitude of the secondary field as seen by the Z coil.

For each of the four components, the following data is stored: primary field, powerline monitor, earth's field monitor and the 384 samples of the waveform. All values are stored as voltages. The format always allows storage of the waveform as 384 points. Depending on the base frequency, if the waveform is not defined by the full 384 points, then the remaining points are simply filled with zeroes. At 30 Hz base frequency, the waveform is defined by 384 points. Each fiducial represents a 0.25 second sample. This is a fifteen-fold stack from the original sampling rate of 30 Hz to the halfwave sampling rate of 4 Hz.

The file pta001.out is an ASCII file containing the electromagnetic system parameters, including the definition of the 20 windows (five on-time and fifteen off-time) derived from the 384-point waveform. It also contains the reference waveform measured during the flight 001.

The window mean delay times (microseconds) for 30 Hz base frequency are:

EM 01: -3906	EM 02: -3169
EM 03: -1975	EM 04: -782
EM 05: -44	EM 06: 195
EM 07: 391	EM 08: 630
EM 09: 911	EM 10: 1215
EM 11: 1541	EM 12: 1931
EM 13: 2409	EM 14: 2995
EM 15: 3733	EM 16: 4665
EM 17: 5837	EM 18: 7313
EM 19: 9136	EM 20: 11306

APPENDIX B

DIGITAL DOCUMENTATION FOR OTH SURVEY 9902 – GEOTEM III 90 HZ

Survey 9902 was carried out using the time-domain Geotem III electromagnetic and magnetic system, mounted on a fixed wing platform. A transmitter base frequency of 90 Hz was used.

Data File Layout

The files for the Reid-Mahaffy Geophysical Test Site Survey 9902 are archived on the first CD in the geotem_90hz subdirectory. The data are broken out in six forms in separate subdirectories, namely ASCII and binary files of the gridded, profile and electromagnetic anomaly data. The content of the ASCII and binary file types is identical. They are provided in both forms to suit the user's available software.

In addition, the halfwave data, halfwave reader program and measured waveform data are archived on the second CD in the geotem_90hz_halfwave subdirectory.

Co-ordinate Systems

The profile and electromagnetic anomaly data are provided in four co-ordinate systems:
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD27 datum, NTV2 local datum;
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD83 datum, North American local datum;
Latitude/longitude co-ordinates, NAD27 datum, NTV2 local datum; and
Latitude/longitude co-ordinates, NAD83 datum, North American local datum.

The gridded data are provided in the two UTM co-ordinate systems.

Line Numbering

The line numbering conventions for survey 9902 are as follows:
Flightlines 10, 20 to 160 - 101, 201 to 1601
Tielines 9010 to 9040 - 500101 to 500401
Flightline 40 flown north to south - 12001
Flightline 40 flown at increasing terrain clearance - 12501 to 25001

Gridded Data

The gridded data are provided in two formats, one ASCII and one binary:
*.gxf - ASCII Grid eXchange Format (revision 3.0)
*.grd - Geosoft OASIS montaj binary grid file (no compression)
*.gi - binary file that defines the co-ordinate system for the *.grd file

Magnetic and digital elevation grids were not prepared for survey 9902, as survey 9901 was measured with the same type of system. However, the magnetic and digital elevation data were fully processed and are incorporated in the profile databases.

The grids are summarised as follows:

thrm2con27.grd/.gxf	apparent conductance in siemens (UTM co-ordinates, NAD27 datum)
thrm2con83.grd/.gxf	apparent conductance in siemens (UTM co-ordinates, NAD83 datum)
thrm2conde27.grd/.gxf	de-herringboned apparent conductance in siemens (UTM co-ordinates, NAD27 datum)
thrm2conde83.grd/.gxf	de-herringboned apparent conductance in siemens (UTM co-ordinates, NAD83 datum)
thrm2dc27.grd/.gxf	decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD27 datum)
thrm2dc83.grd/.gxf	decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD83 datum)
thrm2dcde27.grd/.gxf	de-herringboned decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD27 datum)
thrm2dcde83.grd/.gxf	de-herringboned decay constant (tau) for X-component in microseconds (UTM co-ordinates, NAD83 datum)

Profile Data

The profile data are provided in two formats, one ASCII and one binary:
thrm2.xyz - flat ASCII file, sampled at 4 Hz
thrm2mag.xyz - flat ASCII file, sampled at 10 Hz
thrm2.gdb - Geosoft OASIS montaj binary database file (no compression) , sampled at 4 Hz
thrm2mag.gdb - Geosoft OASIS montaj binary database file (no compression) , sampled at 10 Hz

The files thrm2.xyz/.gdb contain the bulk of the data, including the final magnetic channel, sampled at 4 Hz, the acquisition sampling rate of the electromagnetic data. The files thrm2mag.xyz/.gdb contain all of the magnetic and related data, sampled at 10 Hz, the acquisition sampling rate of the magnetic data.

The contents of thrm2.xyz/.gdb (both file types contain the same set of data channels) are summarised as follows:

Channel Name	Description	Units
gps_x_raw	raw GPS X	DDMM.decimal-minutes
gps_y_raw	raw GPS Y	DDMM.decimal-minutes
gps_z_raw	raw GPS Z	metres
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
gps_z_final	differentially corrected GPS Z (NAD83 datum)	metres above sea level
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
radar_raw	raw radar altimeter	metres above terrain
radar_final	corrected radar altimeter	metres above terrain
baro_raw	raw barometric altimeter	metres above sea level
baro_final	corrected barometric altimeter	metres above sea level
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
date	local date	YYYYMMDD
mag_final	IGRF-corrected magnetic field	nanoteslas
height_em	electromagnetic receiver height	metres above terrain
em_x_raw_on	raw (stacked) dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_raw_off	raw (stacked) dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_raw_on	raw (stacked) dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_raw_off	raw (stacked) dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_raw_on	raw (stacked) dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_raw_off	raw (stacked) dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_x_drift_on	drift-corrected dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_drift_off	drift-corrected dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_drift_on	drift-corrected dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_drift_off	drift-corrected dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_drift_on	drift-corrected dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_drift_off	drift-corrected dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_x_final_on	filtered dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_final_off	filtered dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_final_on	filtered dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_final_off	filtered dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_final_on	filtered dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_final_off	filtered dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_bx_raw_on	raw (stacked) B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_raw_off	raw (stacked) B-field, X-component, off-time (15 channels)	femtoteslas
em_by_raw_on	raw (stacked) B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_raw_off	raw (stacked) B-field, Y-component, off-time (15 channels)	femtoteslas

em_bz_raw_on	raw (stacked) B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_raw_off	raw (stacked) B-field, Z-component, off-time (15 channels)	femtoteslas
em_bx_drift_on	drift-corrected B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_drift_off	drift-corrected B-field, X-component, off-time (15 channels)	femtoteslas
em_by_drift_on	drift-corrected B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_drift_off	drift-corrected B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_drift_on	drift-corrected B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_drift_off	drift-corrected B-field, Z-component, off-time (15 channels)	femtoteslas
em_bx_final_on	filtered B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_final_off	filtered B-field, X-component, off-time (15 channels)	femtoteslas
em_by_final_on	filtered B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_final_off	filtered B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_final_on	filtered B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_final_off	filtered B-field, Z-component, off-time (15 channels)	femtoteslas
power	60 Hz power line monitor	microvolts
primary	electromagnetic primary field	microvolts
tau_x	decay constant (tau) for X-component	microseconds
tau_z	decay constant (tau) for Z-component	microseconds
conductance	apparent conductance of thin sheet model	siemens

In thrm1.xyz, the electromagnetic channel data are provided in individual channels with numerical indices (e.g. em_x_final_on[0] to em_x_final_on[4], and em_x_final_off[0] to em_x_final_off[14]). In thrm1.gdb, the electromagnetic channel data are provided in array channels with five elements (on-time) or 15 elements (off-time).

The contents of thrm2mag.xyz/.gdb (both file types contain the same set of data channels) are summarised as follows:

Channel Name	Description	Units
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
gps_z_final	differentially corrected GPS Z (NAD83 datum)	metres above sea level
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
date	local date	YYYYMMDD
height_mag	magnetometer height	metres above terrain
mag_base_raw	raw magnetic base station data	nanoteslas
mag_base_final	corrected magnetic base station data	nanoteslas

mag_raw	raw magnetic field	nanoteslas
mag_edit	edited magnetic field	nanoteslas
mag_diurn	diurnally-corrected magnetic field	nanoteslas
igrf	local IGRF field	nanoteslas
mag_igrf	IGRF-corrected magnetic field	nanoteslas
mag_lev	levelled magnetic field	nanoteslas
mag_final	micro-levelled magnetic field	nanoteslas

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:
thrm2anomaly.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm2anomaly.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
gps_x_final	differentially corrected GPS X (NAD83 datum)	decimal-degrees
gps_y_final	differentially corrected GPS Y (NAD83 datum)	decimal-degrees
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds after midnight
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
em_x_final_on	filtered dB/dT, X-component, on-time (5 channels)	picoteslas per second
em_x_final_off	filtered dB/dT, X-component, off-time (15 channels)	picoteslas per second
em_y_final_on	filtered dB/dT, Y-component, on-time (5 channels)	picoteslas per second
em_y_final_off	filtered dB/dT, Y-component, off-time (15 channels)	picoteslas per second
em_z_final_on	filtered dB/dT, Z-component, on-time (5 channels)	picoteslas per second
em_z_final_off	filtered dB/dT, Z-component, off-time (15 channels)	picoteslas per second
em_bx_final_on	filtered B-field, X-component, on-time (5 channels)	femtoteslas
em_bx_final_off	filtered B-field, X-component, off-time (15 channels)	femtoteslas
em_by_final_on	filtered B-field, Y-component, on-time (5 channels)	femtoteslas
em_by_final_off	filtered B-field, Y-component, off-time (15 channels)	femtoteslas
em_bz_final_on	filtered B-field, Z-component, on-time (5 channels)	femtoteslas
em_bz_final_off	filtered B-field, Z-component, off-time (15 channels)	femtoteslas
tau_x	decay constant (tau) for X-component	microseconds

tau_z	decay constant (tau) for Z-component	microseconds
conductance	apparent conductance of thin sheet model	siemens
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_id	unique anomaly identifier	
anomaly_type_letter	anomaly classification	
anomaly_type_no	anomaly classification number	
no_chan	number of off-time channels deflected	
conductance_vert	conductance of vertical plate model	siemens
depth	depth of vertical plate model	metres
heading	direction of flight	degrees
survey_number	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. For example, 1000101007 represents the seventh 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.

The codes for anomaly_type and anomaly_type_number are as follows:

N	1
N?	2
S	3
S?	4
C	5
C?	6

The ? does not question the existence of an anomaly, but denotes some uncertainty as to the most appropriate model.

N: Bedrock (normal) - an anomaly whose response matches that of a bedrock conductor. This anomaly type might include various shapes of conductors: roughly pod-shaped, thin or thick dykes, short strike-length bodies, or conductors sub-parallel to the flight path.

S: Flat lying conductors - generally surficial. Typical geologic anomalies might be conductive overburden, swamps or clay layers. They would not appear to be conductive at depth.

C: Line current - an anomaly with the shape typical of line currents - typically cultural (human sources) such as power lines, train tracks, fences, etc. No anomalies of this type were interpreted for the Reid-Mahaffy Airborne Geophysical Test Site.

Halfwave Data

The halfwave data is stored in the binary file hwa18010.065. The DOS program read_halfwave.exe is provided to convert this binary file to a flat ASCII file. This utility is run in a standard command line mode, as follows :

read_halfwave input output

The output ASCII file will contain the fiducial and the 384 waveform points for the four components, T, X, Y, and Z, stored in that order. These components are:
T - the amplitude of the primary (transmitted) field;
X - the amplitude of the secondary field as seen by the X coil;
Y - the amplitude of the secondary field as seen by the Y coil; and
Z - the amplitude of the secondary field as seen by the Z coil.
For each of the four components, the following data is stored: primary field, powerline monitor, earth's field monitor and the 384 samples of the waveform. All values are stored as voltages. The format always allows storage of the waveform as 384 points. Depending on the base frequency, if the waveform is not defined by the full 384 points, then the remaining points are simply filled with zeroes. At 90 Hz base frequency, the waveform is defined by 128 points, padded with 256 trailing zeroes. Each fiducial represents a 0.25 second sample. This is a forty-five-fold stack from the original sampling rate of 90 Hz to the halfwave sampling rate of 4 Hz.

The file pta065.out is an ASCII file containing the electromagnetic system parameters, including the definition of the 20 windows (five on-time and fifteen off-time) derived from the 384-point waveform. It also contains the reference waveform measured during the flight 065.

The window mean delay times (microseconds) for 90 Hz base frequency are:

EM 01: -1888	EM 02: -1475
EM 03: -912	EM 04: -348
EM 05: 44	EM 06: 196
EM 07: 282	EM 08: 369
EM 09: 478	EM 10: 608
EM 11: 760	EM 12: 933
EM 13: 1107	EM 14: 1324
EM 15: 1606	EM 16: 1910
EM 17: 2214	EM 18: 2539
EM 19: 2886	EM 20: 3233

APPENDIX C

DIGITAL DOCUMENTATION FOR OTH SURVEY 9903 – SPECTREM$_{2000}$

Survey 9903 was carried out using the time-domain Spectrem$_{2000}$ electromagnetic and magnetic system, mounted on a fixed wing platform. A transmitter base frequency of 90 Hz was used.

Data File Layout

The files for the Reid-Mahaffy Geophysical Test Site Survey 9903 are archived on the first CD in the spectrem subdirectory. The data are broken out in six forms in separate subdirectories, namely ASCII and binary files of the gridded, profile and electromagnetic anomaly data. The content of the ASCII and binary file types is identical. They are provided in both forms to suit the user's available software.

In addition, the fullwave data are archived on the second CD in the spectrem_fullwave subdirectory.

Co-ordinate Systems

The profile and electromagnetic anomaly data are provided in four co-ordinate systems:
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD27 datum, NTV2 local datum;
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD83 datum, North American local datum;
Latitude/longitude co-ordinates, NAD27 datum, NTV2 local datum; and
Latitude/longitude co-ordinates, NAD83 datum, North American local datum.

The gridded data are provided in the two UTM co-ordinate systems.

Line Numbering

The line numbering conventions for survey 9903 are as follows:
Flightlines 10, 20 to 160 - 11010, 11020 to 11160
Tielines 9010 to 9040 - 19010 to 19040
Flightline 40 flown north to south - 11210
Flightline 40 flown at increasing terrain clearance – 11220 to 11260

Gridded Data

The gridded data are provided in two formats, one ASCII and one binary:
*.gxf - ASCII Grid eXchange Format (revision 3.0)
*.grd - Geosoft OASIS montaj binary grid file (no compression)
*.gi - binary file that defines the co-ordinate system for the *.grd file

Magnetic and digital elevation grids were not prepared for survey 9902, as survey 9901 was measured with the same type of system. However, the magnetic and digital elevation data were fully processed and are incorporated in the profile databases.

The grids are summarised as follows:

thrm3mag27.grd/.gxf	IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum)
thrm3mag83.grd/.gxf	IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum)
thrm32vd27.grd/.gxf	second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD27 datum)
thrm32vd83.grd/.gxf	second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD83 datum)
thrm3dem27.grd/.gxf	digital elevation model in metres above sea level (UTM co-ordinates, NAD27 datum)
thrm3dem83.grd/.gxf	digital elevation model in metres above sea level (UTM co-ordinates, NAD83 datum)
thrm3conx27.grd/.gxf	X-component apparent conductivity in siemens per metre (UTM co-ordinates, NAD27 datum)
thrm3conx83.grd/.gxf	X-component apparent conductivity in siemens per metre (UTM co-ordinates, NAD83 datum)
thrm3conz27.grd/.gxf	Z-component apparent conductivity in siemens per metre (UTM co-ordinates, NAD27 datum)
thrm3conz83.grd/.gxf	Z-component apparent conductivity in siemens per metre (UTM co-ordinates, NAD83 datum)
thrm3dcx27.grd/.gxf	X-component decay constant (tau) in microseconds (UTM co-ordinates, NAD27 datum)
thrm3dcx83.grd/.gxf	X-component decay constant (tau) in microseconds (UTM co-ordinates, NAD83 datum)
thrm3dcz27.grd/.gxf	Z-component decay constant (tau) in microseconds (UTM co-ordinates, NAD27 datum)
thrm3dcz83.grd/.gxf	Z-component decay constant (tau) in microseconds (UTM co-ordinates, NAD83 datum)

Profile Data

The profile data are provided in two formats, one ASCII and one binary:
thrm3.xyz - flat ASCII file
thrm3.gdb - Geosoft OASIS montaj binary database file (no compression)

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

Channel Name	Description	Units
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
lon_nad83	longitude using NAD83 datum	decimal-degrees
lat_nad83	latitude using NAD83 datum	decimal-degrees
gps_z_asl_nad27	GPS Z (NAD27 datum)	metres above sea level
gps_z_asl_nad83	GPS Z (NAD83 datum)	metres above sea level
radar_raw	raw radar altimeter	metres above terrain
radar_final	corrected radar altimeter	metres above terrain
laser_final	corrected laser altimeter	metres above terrain
baro_raw	raw barometric altimeter	millibars
baro_final	corrected barometric altimeter	metres above sea level
dem	digital elevation model	metres above sea level
fiducial	fiducial	
flight	flight number	
line_no	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
height_mag	magnetometer height	metres above terrain
mag_base_final	corrected magnetic base station data	nanoteslas
mag_raw	raw magnetic field	nanoteslas
mag_edit	edited magnetic field	nanoteslas
mag_diurn	diurnally-corrected magnetic field	nanoteslas
igrf	local IGRF field	nanoteslas
mag_igrf	IGRF-corrected magnetic field	nanoteslas
mag_lev	levelled magnetic field	nanoteslas
mag_final	micro-levelled magnetic field	nanoteslas
height_em	electromagnetic receiver height	metres above terrain
em_x_raw	raw (stacked) step response, X-component, on-time (7 channels)	parts per two thousand of the primary field
em_z_raw	raw (stacked) step response, Z-component, on-time (7 channels)	parts per two thousand of the primary field
em_x_final	filtered step response, X-component, on-time (7 channels)	parts per two thousand of the primary field
em_z_final	filtered step response, Z-component, on-time (7 channels)	parts per two thousand of the primary field
tau_x	decay constant (tau) for X-component	microseconds
tau_z	decay constant (tau) for Z-component	microseconds
conductivity_x	apparent conductivity for X-component	millisiemens per metre
conductivity_z	apparent conductivity for Z-component	millisiemens per metre

In thrm3.xyz, the electromagnetic channel data are provided in individual channels with numerical indices (e.g. em_x_final[0] to em_x_final[6]). In thrm3.gdb, the electromagnetic channel data are provided in array channels with seven elements.

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:
thrm3anomaly.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm3anomaly.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
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	
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
em_x2_final	filtered dB/dT, X-component, channel 2	parts per two thousand of the primary field
em_x6_final	filtered dB/dT, X-component, channel 6	parts per two thousand of the primary field
em_z2_final	filtered dB/dT, Z-component, channel 2	parts per two thousand of the primary field
em_z6_final	filtered dB/dT, Z-component, channel 6	parts per two thousand of the primary field
tau_x	decay constant (tau) for X-component	microseconds
tau_z	decay constant (tau) for Z-component	microseconds
conductivity_x	apparent conductivity for X-component	millisiemens per metre
conductivity_z	apparent conductivity for Z-component	millisiemens per metre
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_id	unique anomaly identifier	
anomaly_type_letter	anomaly classification	
anomaly_type_number	anomaly classification number	
anomaly_grade_letter	grade A (best) to D (worst)	
anomaly_grade_number	grade 1 (best) to 4 (worst)	
conductance	conductance of dipping plate model	siemens
depth	depth of dipping plate model	metres

dip	dip of dipping plate model	degrees
dip_direction	dip direction of dipping plate model	degrees
heading	direction of flight	degrees
survey_number	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. For example, 1000101007 represents the seventh 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.

The codes for anomaly_type and anomaly_type_number are as follows:

N 1

N: Geological (not cultural) - an anomaly whose response matches that of a geological conductor.

Fullwave Data

The fullwave data are stored in ASCII files named line_number .stk (e.g. 19040.stk for line 19040). On the CD, these files have been zipped into spectrem_fullwave.zip to save space.

Each ASCII file contains five columns of data: the fiducial and the four measured electromagnetic components Tx, X, Y, and Z, stored in that order. These components are:
Tx - the amplitude of the primary (transmitted) field
X - the amplitude of the secondary field as seen by the X coil
Y - the amplitude of the secondary field as seen by the Y coil
Z - the amplitude of the secondary field as seen by the Z coil

These components are stored in digitiser units, where 1 digitiser unit is approximately 0.477 microvolts.

Each fiducial contains a 256-point waveform (i.e. fiducial value repeats 256 times). Each fiducial represents a 0.2 second sample. This is an eighteen-fold stack from the original sampling rate of 90 Hz to the fullwave sampling rate of 5 Hz.

The windowing of the fullwave data to eight channels, after transformation to the step response, is defined as follows:

Window 1: sample 2	1 sample wide
Window 2: samples 3 to 4	2 samples wide
Window 3: samples 5 to 8	4 samples wide
Window 4: samples 9 to 16	8 samples wide
Window 5: samples 17 to 32	16 samples wide
Window 6: samples 33 to 64	32 samples wide

Window 7: samples 65 to 128 64 samples wide
Window 8: samples 129 to 256 128 samples wide

Window 8 is then used to normalise the step response for windows 1 to 7, as a means of removing the transmitter-receiver coupling changes of the primary field measured at the receiver.

APPENDIX D

DIGITAL DOCUMENTATION FOR OTH SURVEY 9904 – HIGH-SENSE

Survey 9904 was carried out using the frequency-domain High-Sense electromagnetic and magnetic system, mounted on a helicopter platform. It incorporated two magnetometers, separated vertically by 15 m.

Data File Layout

The files for the Reid-Mahaffy Geophysical Test Site Survey 9904 are archived on the first CD in the high-sense subdirectory. The data are broken out in six forms in separate subdirectories, namely ASCII and binary files of the gridded, profile and electromagnetic anomaly data. The content of the ASCII and binary file types is identical. They are provided in both forms to suit the user's available software.

Co-ordinate Systems

The profile and electromagnetic anomaly data are provided in four co-ordinate systems:
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD27 datum, NTV2 local datum;
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD83 datum, North American local datum;
Latitude/longitude co-ordinates, NAD27 datum, NTV2 local datum; and
Latitude/longitude co-ordinates, NAD83 datum, North American local datum.

The gridded data are provided in the two UTM co-ordinate systems.

Line Numbering

The line numbering conventions for survey 9904 are as follows:
Flightlines 10, 20 to 160 - 10, 20 to 160
Tielines 9010 to 9040 - 9010 to 9040
Flightline 40 flown north to south - 1040
Flightline 40 flown at increasing terrain clearance - 2040 to 6040

Gridded Data

The gridded data are provided in two formats, one ASCII and one binary:
*.gxf - ASCII Grid eXchange Format (revision 3.0)
*.grd - Geosoft OASIS montaj binary grid file (no compression)

*.gi - binary file that defines the co-ordinate system for the *.grd file

The grids are summarised as follows:

thrm4magl27.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum), measured by the lower magnetometer
thrm4magl83.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum) , measured by the lower magnetometer
thrm4magu27.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum), measured by the upper magnetometer
thrm4magu83.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum), measured by the upper magnetometer
thrm42vgrad27.grd/.gxf vertical magnetic gradient in nanoteslas per metre (UTM co-ordinates, NAD27 datum), measured between the upper and lower magnetometers
thrm42vgrad83.grd/.gxf vertical magnetic gradient in nanoteslas per metre (UTM co-ordinates, NAD83 datum), measured between the upper and lower magnetometers
thrm42vdl27.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD27 datum), measured by the lower magnetometer
thrm42vdl83.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per \metre-squared (UTM co-ordinates, NAD83 datum), measured by the lower magnetometer
thrm42vdu27.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD27 datum), measured by the upper magnetometer
thrm42vdu83.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD83 datum), measured by the upper magnetometer
thrm4dem27.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD27 datum)
thrm4dem83.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD83 datum)
thrm4reslow27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 852 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm4reslow83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 852 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)
thrm4resmid27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 4740 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm4resmid83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 4740 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)
thrm4reshigh27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 35110 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm4reshigh83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 35110 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)

Profile Data

The profile data are provided in two formats, one ASCII and one binary:
thrm4.xyz - flat ASCII file
thrm4.gdb - Geosoft OASIS montaj binary database file (no compression)

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

Channel Name	Description	Units
gps_x_raw	raw GPS X	metres
gps_y_raw	raw GPS Y	metres
gps_z_raw	raw GPS Z	metres
gps_base_x	GPS base station X	decimal-degrees
gps_base_y	GPS base station Y	decimal-degrees
gps_base_z	GPS base station Z	metres
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
z_nad27	GPS height using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
z_nad83	GPS height using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
lon_nad83	longitude using NAD83 datum	decimal-degrees
lat_nad83	latitude using NAD83 datum	decimal-degrees
gps_z_asl	GPS Z (height)	metres above sea level
radar_raw	raw radar altimeter	metres above terrain
radar_final	corrected radar altimeter	metres above terrain
baro_raw	raw barometric altimeter	metres above sea level
baro_final	corrected barometric altimeter	metres above sea level
dem	digital elevation model	metres above sea level
fiducial	fiducial	
flight	flight number	
line_no	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
mag_base_raw	raw magnetic base station data	nanoteslas
mag_base_final	corrected magnetic base station data	nanoteslas
umag_raw	raw magnetic field (upper magnetometer)	nanoteslas
umag_edit	edited magnetic field (upper magnetometer)	nanoteslas
u_igrf	local IGRF field (upper magnetometer)	nanoteslas
umag_igrf	IGRF-corrected magnetic field (upper magnetometer)	nanoteslas
umag_igrf_diurn	diurnally-corrected magnetic field (upper magnetometer)	nanoteslas
umag_lev	levelled magnetic field (upper magnetometer)	nanoteslas
umag_final	micro-levelled magnetic field (upper magnetometer)	nanoteslas
lmag_raw	raw magnetic field (lower magnetometer)	nanoteslas
lmag_edit	edited magnetic field (lower magnetometer)	nanoteslas
l_igrf	local IGRF field (lower magnetometer)	nanoteslas
lmag_igrf	IGRF-corrected magnetic field (lower magnetometer)	nanoteslas
lmag_igrf_diurn	diurnally-corrected magnetic field (lower magnetometer)	nanoteslas
lmag_lev	levelled magnetic field (lower magnetometer)	nanoteslas
lmag_final	micro-levelled magnetic field (lower magnetometer)	nanoteslas
vg_raw	raw vertical magnetic gradient (measured between upper and lower magnetometers)	nanoteslas per metre

vg_edit	edited vertical magnetic gradient	nanoteslas per metre
vg_lev	levelled vertical magnetic gradient	nanoteslas per metre
vg_final	micro-levelled vertical magnetic gradient	nanoteslas per metre
height_umag	upper magnetometer height	metres above terrain
height_lmag_em	lower magnetometer and electromagnetic receiver height	metres above terrain
cxi_925_raw	raw coaxial inphase at 925 Hz	parts per million
cxq_925_raw	raw coaxial quadrature at 925 Hz	parts per million
cpi_852_raw	raw coplanar inphase at 852 Hz	parts per million
cpq_852_raw	raw coplanar quadrature at 852 Hz	parts per million
cxi_4396_raw	raw coaxial inphase at 4396 Hz	parts per million
cxq_4396_raw	raw coaxial quadrature at 4396 Hz	parts per million
cpi_4740_raw	raw coplanar inphase at 4740 Hz	parts per million
cpq_4740_raw	raw coplanar quadrature at 4740 Hz	parts per million
cpi_35110_raw	raw coplanar inphase at 35110 Hz	parts per million
cpq_35110_raw	raw coplanar quadrature at 35110 Hz	parts per million
cxi_925_filt	filtered coaxial inphase at 925 Hz	parts per million
cxq_925_filt	filtered coaxial quadrature at 925 Hz	parts per million
cpi_852_filt	filtered coplanar inphase at 852 Hz	parts per million
cpq_852_filt	filtered coplanar quadrature at 852 Hz	parts per million
cxi_4396_filt	filtered coaxial inphase at 4396 Hz	parts per million
cxq_4396_filt	filtered coaxial quadrature at 4396 Hz	parts per million
cpi_4740_filt	filtered coplanar inphase at 4740 Hz	parts per million
cpq_4740_filt	filtered coplanar quadrature at 4740 Hz	parts per million
cpi_35110_filt	filtered coplanar inphase at 35110 Hz	parts per million
cpq_35110_filt	filtered coplanar quadrature at 35110 Hz	parts per million
cxi_925_lev	levelled coaxial inphase at 925 Hz	parts per million
cxq_925_lev	levelled coaxial quadrature at 925 Hz	parts per million
cpi_852_lev	levelled coplanar inphase at 852 Hz	parts per million
cpq_852_lev	levelled coplanar quadrature at 852 Hz	parts per million
cxi_4396_lev	levelled coaxial inphase at 4396 Hz	parts per million
cxq_4396_lev	levelled coaxial quadrature at 4396 Hz	parts per million
cpi_4740_lev	levelled coplanar inphase at 4740 Hz	parts per million
cpq_4740_lev	levelled coplanar quadrature at 4740 Hz	parts per million
cpi_35110_lev	levelled coplanar inphase at 35110 Hz	parts per million
cpq_35110_lev	levelled coplanar quadrature at 35110 Hz	parts per million
power	60 Hz power line monitor	
ares_852	apparent resistivity for coplanar transmitter-receiver coil pair - 852 Hz	ohm-metres
ares_4740	apparent resistivity for coplanar transmitter-receiver coil pair - 4740 Hz	ohm-metres
ares_35110	apparent resistivity for coplanar transmitter-receiver coil pair - 35110 Hz	ohm-metres
ares_852_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 852 Hz	metres
ares_4740_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 4740 Hz	metres
ares_35110_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 35110 Hz	metres

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:
thrm4anomaly.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm4anomaly.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
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	
flight	flight number	
line_no	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
cxi_925_final	levelled coaxial inphase at 925 Hz	parts per million
cxq_925_final	levelled coaxial quadrature at 925 Hz	parts per million
cpi_852_final	levelled coplanar inphase at 852 Hz	parts per million
cpq_852_final	levelled coplanar quadrature at 852 Hz	parts per million
cxi_4396_final	levelled coaxial inphase at 4396 Hz	parts per million
cxq_4396_final	levelled coaxial quadrature at 4396 Hz	parts per million
cpi_4740_final	levelled coplanar inphase at 4740 Hz	parts per million
cpq_4740_final	levelled coplanar quadrature at 4740 Hz	parts per million
cpi_35110_final	levelled coplanar inphase at 35110 Hz	parts per million
cpq_35110_final	levelled coplanar quadrature at 35110 Hz	parts per million
ares_852	apparent resistivity for coplanar transmitter-receiver coil pair - 852 Hz	ohm-metres
ares_4740	apparent resistivity for coplanar transmitter-receiver coil pair - 4740 Hz	ohm-metres
ares_35110	apparent resistivity for coplanar transmitter-receiver coil pair - 35110 Hz	ohm-metres
ares_852_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 852 Hz	metres
ares_4740_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 4740 Hz	metres
ares_35110_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 35110 Hz	metres
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_id	unique anomaly identifier	
anomaly_type	anomaly classification	
anomaly_type_no	anomaly classification number	

vert_sheet_conductance	conductance of vertical plate model	siemens
vert_sheet_depth	depth of vertical plate model	metres
heading	direction of flight	degrees
survey_number	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. For example, 1000101007 represents the seventh 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.

The codes for anomaly_type and anomaly_type_number are as follows:

B	1
S	4

B: Bedrock - an anomaly whose response matches that of a bedrock conductor, but not thin and/or near vertical. This anomaly type might include other shapes of conductors: roughly pod-shaped, thick dykes, short strike-length bodies, or conductors sub-parallel to the flight path.

S: Flat lying conductors - generally surficial. Typical geologic anomalies might be conductive overburden, swamps or clay layers. They would not appear to be conductive at depth.

APPENDIX E

DIGITAL DOCUMENTATION FOR OTH SURVEY 9905 – DIGHEM V

Survey 9905 was carried out using the frequency-domain Dighem V electromagnetic and magnetic system, mounted on a helicopter platform.

Data File Layout

The files for the Reid-Mahaffy Geophysical Test Site Survey 9905 are archived on the first CD in the dighem subdirectory. The data are broken out in six forms in separate subdirectories, namely ASCII and binary files of the gridded, profile and electromagnetic anomaly data. The content of the ASCII and binary file types is identical. They are provided in both forms to suit the user's available software.

Co-ordinate Systems

The profile and electromagnetic anomaly data are provided in four co-ordinate systems:
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD27 datum, NTV2 local datum;
Universal Transverse Mercator (UTM) projection, Zone 17N, NAD83 datum, North American local datum;
Latitude/longitude co-ordinates, NAD27 datum, NTV2 local datum; and
Latitude/longitude co-ordinates, NAD83 datum, North American local datum.

The gridded data are provided in the two UTM co-ordinate systems.

Line Numbering

The line numbering conventions for survey 9905 are as follows:
Flightlines 10, 20 to 160 - 10011, 10021 to 10161
Tielines 9010 to 9040 - 19010 to 19040
Flightline 40 flown north to south - 10042
Flightline 40 flown at increasing terrain clearance - 10043 to 10047

Gridded Data

The gridded data are provided in two formats, one ASCII and one binary:
*.gxf - ASCII Grid eXchange Format (revision 3.0)
*.grd - Geosoft OASIS montaj binary grid file (no compression)
*.gi - binary file that defines the co-ordinate system for the *.grd file

The grids are summarised as follows:

thrm5mag27.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD27 datum)
thrm5mag83.grd/.gxf IGRF-corrected magnetic field in nanoteslas (UTM co-ordinates, NAD83 datum)
thrm52vd27.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD27 datum)
thrm52vd83.grd/.gxf second vertical derivative of the IGRF-corrected magnetic field in nanoteslas per metre-squared (UTM co-ordinates, NAD83 datum)
thrm5dem27.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD27 datum)
thrm5dem83.grd/.gxf digital elevation model in metres above sea level (UTM co-ordinates, NAD83 datum)
thrm5reslow27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 868 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm5reslow83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 868 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)
thrm5resmid27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 7025 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm5resmid83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 7025 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)
thrm5reshigh27.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 56374 Hz in ohm-metres (UTM co-ordinates, NAD27 datum)
thrm5reshigh83.grd/.gxf apparent resistivity for coplanar transmitter-receiver coil pair - 56374 Hz in ohm-metres (UTM co-ordinates, NAD83 datum)

Profile Data

The profile data are provided in two formats, one ASCII and one binary:
thrm5.xyz - flat ASCII file
thrm5.gdb - Geosoft OASIS montaj binary database file (no compression)

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

Channel Name	Description	Units
gps_x_raw	raw GPS X using WGS84 datum	metres
gps_y_raw	raw GPS Y using WGS84 datum	metres
gps_z_raw	raw GPS Z using WGS84 datum	metres
gps_x_final	differentially corrected GPS X using WGS84 datum	metres
gps_y_final	differentially corrected GPS Y using WGS84 datum	metres
gps_z_final	differentially corrected GPS Z using WGS84 datum	metres
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
lon_nad83	longitude using NAD83 datum	decimal-degrees

lat_nad83	latitude using NAD83 datum	decimal-degrees
gps_z_asl	GPS Z (height)	metres above sea level
radar_raw	raw radar altimeter	metres above terrain
radar_final	corrected radar altimeter	metres above terrain
dem	digital elevation model	metres above sea level
fiducial	fiducial	seconds
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
mag_base_final	corrected magnetic base station data	nanoteslas
mag_raw	raw magnetic field	nanoteslas
mag_edit	edited magnetic field	nanoteslas
igrf	local IGRF field	nanoteslas
mag_diurn	diurnally-corrected magnetic field	nanoteslas
mag_lev	micro-levelled magnetic field	nanoteslas
mag_final	residual magnetic field (IGRF-corrected)	nanoteslas
height_em	electromagnetic receiver height	metres above terrain
cxi_1068_raw	raw coaxial inphase at 1068 Hz	parts per million
cxq_1068_raw	raw coaxial quadrature at 1068 Hz	parts per million
cpi_868_raw	raw coplanar inphase at 868 Hz	parts per million
cpq_868_raw	raw coplanar quadrature at 868 Hz	parts per million
cxi_4820_raw	raw coaxial inphase at 4820 Hz	parts per million
cxq_4820_raw	raw coaxial quadrature at 4820 Hz	parts per million
cpi_7025_raw	raw coplanar inphase at 7025 Hz	parts per million
cpq_7025_raw	raw coplanar quadrature at 7025 Hz	parts per million
cpi_56374_raw	raw coplanar inphase at 56374 Hz	parts per million
cpq_56374_raw	raw coplanar quadrature at 56374 Hz	parts per million
cxi_1068_filt	filtered coaxial inphase at 1068 Hz	parts per million
cxq_1068_filt	filtered coaxial quadrature at 1068 Hz	parts per million
cpi_868_filt	filtered coplanar inphase at 868 Hz	parts per million
cpq_868_filt	filtered coplanar quadrature at 868 Hz	parts per million
cxi_4820_filt	filtered coaxial inphase at 4820 Hz	parts per million
cxq_4820_filt	filtered coaxial quadrature at 4820 Hz	parts per million
cpi_7025_filt	filtered coplanar inphase at 7025 Hz	parts per million
cpq_7025_filt	filtered coplanar quadrature at 7025 Hz	parts per million
cpi_56374_filt	filtered coplanar inphase at 56374 Hz	parts per million
cpq_56374_filt	filtered coplanar quadrature at 56374 Hz	parts per million
cxi_1068_final	levelled coaxial inphase at 1068 Hz	parts per million
cxq_1068_final	levelled coaxial quadrature at 1068 Hz	parts per million
cpi_868_final	levelled coplanar inphase at 868 Hz	parts per million
cpq_868_final	levelled coplanar quadrature at 868 Hz	parts per million
cxi_4820_final	levelled coaxial inphase at 4820 Hz	parts per million
cxq_4820_final	levelled coaxial quadrature at 4820 Hz	parts per million
cpi_7025_final	levelled coplanar inphase at 7025 Hz	parts per million
cpq_7025_final	levelled coplanar quadrature at 7025 Hz	parts per million
cpi_56374_final	levelled coplanar inphase at 56374 Hz	parts per million

cpq_56374_final	levelled coplanar quadrature at 56374 Hz	parts per million
power	60 Hz power line monitor	millivolts
ares_868	apparent resistivity for coplanar transmitter-receiver coil pair - 868 Hz	ohm-metres
ares_7025	apparent resistivity for coplanar transmitter-receiver coil pair - 7025 Hz	ohm-metres
ares_56374	apparent resistivity for coplanar transmitter-receiver coil pair - 56374 Hz	ohm-metres
ares_868_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 868 Hz	metres
ares_7025_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 7025 Hz	metres
ares_56374_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 56374 Hz	metres

Electromagnetic Anomaly Data

The electromagnetic anomaly data are provided in two formats, one ASCII and one binary:
thrm5anomaly.csv – ASCII comma-delimited format (Microsoft Excel file)
thrm5anomaly.gdb – Geosoft OASIS montaj binary database file

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

Channel Name	Description	Units
x_nad27	easting in UTM co-ordinates using NAD27 datum	metres
y_nad27	northing in UTM co-ordinates using NAD27 datum	metres
x_nad83	easting in UTM co-ordinates using NAD83 datum	metres
y_nad83	northing in UTM co-ordinates using NAD83 datum	metres
lon_nad27	longitude using NAD27 datum	decimal-degrees
lat_nad27	latitude using NAD27 datum	decimal-degrees
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	
flight	flight number	
line_number	full flightline number (flightline and part numbers)	
line	flightline number	
line_part	flightline part number	
time_utc	UTC time	seconds
time_local	local time	seconds after midnight
date	local date	YYYYMMDD
cxi_1068_final	levelled coaxial inphase at 1068 Hz	parts per million
cxq_1068_final	levelled coaxial quadrature at 1068 Hz	parts per million
cpi_868_final	levelled coplanar inphase at 868 Hz	parts per million
cpq_868_final	levelled coplanar quadrature at 868 Hz	parts per million
cxi_4820_final	levelled coaxial inphase at 4820 Hz	parts per million
cxq_4820_final	levelled coaxial quadrature at 4820 Hz	parts per million
cpi_7025_final	levelled coplanar inphase at 7025 Hz	parts per million
cpq_7025_final	levelled coplanar quadrature at 7025 Hz	parts per million
cpi_56374_final	levelled coplanar inphase at 56374 Hz	parts per million
cpq_56374_final	levelled coplanar quadrature at 56374 Hz	parts per million
ares_868	apparent resistivity for coplanar transmitter-receiver coil pair - 868 Hz	ohm-metres
ares_7025	apparent resistivity for coplanar transmitter-receiver coil pair - 7025 Hz	ohm-metres

ares_56374	apparent resistivity for coplanar transmitter-receiver coil pair - 56374 Hz	ohm-metres
ares_868_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 868 Hz	metres
ares_7025_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 7025 Hz	metres
ares_56374_dep	apparent depth calculated from coplanar transmitter-receiver coil pair - 56374 Hz	metres
height_em	electromagnetic receiver height	metres above terrain
anomaly_no	nth anomaly along the survey line	
anomaly_id	unique anomaly identifier	
anomaly_type	anomaly classification	
anomaly_type_no	anomaly classification number	
mag_correlation	magnetic correlation	nanoteslas
vert_sheet_conductance	conductance of vertical plate model	siemens
vert_sheet_depth	depth of vertical plate model	metres
hor_sheet_conductance	conductance of horizontal plate model	siemens
hor_sheet_depth	depth of horizontal plate model	metres
heading	direction of flight	degrees
survey_number	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. For example, 1000101007 represents the seventh 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.

The codes for anomaly_type and anomaly_type_number are as follows:

B	1
B?	2
D	3
S	5
S?	6
L	7

The ? does not question the existence of an anomaly, but denotes some uncertainty as to the most appropriate model.

B: Bedrock - an anomaly whose response matches that of a bedrock conductor, but not thin and/or near vertical. This anomaly type might include other shapes of conductors: roughly pod-shaped, thick dykes, short strike-length bodies, or conductors sub-parallel to the flight path.

D: Dyke - an anomaly whose shape matches that of a steeply dipping thin dyke-like conductor. The thickness appears to be less than about 3m. These are commonly conductors in steeply-dipping geology, but may also be conductive shear zones.

S: Flat lying conductors - generally surficial. Typical geologic anomalies might be conductive overburden, swamps or clay layers. They would not appear to be conductive at depth.

L: Line current - an anomaly with the shape typical of line currents - typically cultural (human sources) such as power lines, train tracks, fences, etc. No anomalies of this type were interpreted for the Reid-Mahaffy Airborne Geophysical Test Site.