ASSESSMENT REPORT ON
AIRBORNE GEOPHYSICS ON 36 CLAIMS

BORDEN LAKE PROJECT

COCHRANE, BORDEN, MCNAUGHT & GALLAGHER TOWNSHIPS
PORCUPINE DISTRICT, ONTARIO

Submitted to:
PROVINCIAL RECORDING OFFICE
Ministry of Northern Development and Mines and Forestry
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INTRODUCTION

Between January 5 and January 20 2011, Probe Mines Limited contracted Geotech Ltd. to carry out a second helicopter-borne geophysical survey on the Borden Lake Project.

A surface gold showing is present on the Borden Lake Project and has been identified over an area 150 metres long by up to 45 metres wide, hosted by a highly altered and metamorphosed suite of rocks within the volcano-sedimentary horizon. Grab samples from selected outcrop returned values of up to 3.4 g/t gold, and the property is considered to have excellent potential to host a low-grade, bulk tonnage-type of gold deposit. Limited exploration work investigating the base metal potential of the volcanic horizon was previously undertaken by Noranda. Sulphide mineralized felsic fragmental units were identified which returned anomalous base metal concentrations, suggesting good potential for hosting volcanogenic massive sulphide ("VMS") deposits.

In July 2010, a drill program was completed to test the extent of the surface showing. Results indicated that there is excellent potential to host a low-grade, bulk tonnage gold deposit on the property. Additional drilling on the property has continued to illustrate this potential. Previous assessment for the first stage drilling was filed under work report W1060.02610 in November 2010. An initial Geotech VTEM survey was flown in late April-early May 2010 and assessment for this was filed under work report W1160.00098 in January 2011.

The project is located in NTS Sheet 41O14, in Borden, Cochrane, McNaught & Gallagher Townships, approximately 9 km east-northeast of the town of Chapleau, Ontario.

All maps coordinates are UTM Nad 83, Zone 17. All costs are in Canadian dollars.

LOCATION AND ACCESS

The Borden Lake project is located in the Borden Lake area of the 1:50,000 NTS topographic sheet 41O/14, approximately 160 km southwest of the city of Timmins and 9 km east-northeast of the town of Chapleau, Ontario (Figure 1). Access to the property is via Highway 101.

The current report details work applicable to 36 claims, the numbers being: 4252996; 4252997; 4240489; 4240490; 4255237; 4255238; 1234887; 4242553; 4242554; 4242555; 4242557; 4242558; 4242559; 4242560; 4249706; 4249707; 4249708; 4249709; 4249710; 4249711; 4249712; 4249713; 4256762; 4259801; 4259802; 4259803; 4259804; 4259805; 4260523; 4260525; 4260527; 4260536; 4252987; 4227868; 4260524; 4256763, all located in Borden, Cochrane, McNaught and GallagherTownships of the Porcupine District. Claim information is displayed in Table 1.

Total assessment required to keep the claims in good standing is $100,000. Five of these claims (4252996; 4252997; 4240489; 4240490; 4252987) have had work filed on them previously in work report W1160.00098. One of these claims (4227868) has had work filed on it previously in work report W1060.02610.

The amount of credits applied from the work completed as detailed in this report is $67,839 and is being used towards keeping all the claims in good standing.

Probe Mines has entered into an option agreement with M. Tremblay and J. Robert on certain of these claims, and has the right to acquire 100% according to the terms of the agreement. The agent's letter was submitted with the previous assessment reports mentioned above and is on file at the MNDMF.

GEOLOGY

The Borden Lake Project is located in the Superior Province of Northern Ontario. The Superior Province is divided into numerous Subprovinces, bounded by linear faults and characterized by differing lithologies, structural/tectonic conditions, ages and metamorphic conditions. The Subprovinces are divided into 4 categories: Volcano-plutonic; Metasedimentary; Gneissic/plutonic; and High-grade gneissic (Thurston, 1991). The rocks range in age from 3.5Ga to less than 2.76 Ga and form an east-west trending pattern of alternating terranes.

Regionally (Figure 2), the Kapuskasing Structural Zone (KSZ), an elongate north to northeast trending structure, transects the Wawa Subprovince to the west, and the Abitibi Subprovince to the east. The KSZ is approximately 500km long, extending from James Bay at its northeast end to the east shore of Lake Superior at its southwest end. Typically the KSZ is represented by high metamorphic grade granulite and amphibolite facies paragneiss, tonalitic gneisses and anorthosite-suite gneisses occurring along a moderate northwest dipping crustal scale thrust fault believed to have resulted from an early Proterozoic event (Percival and McGrath 1986).

The Wawa and Abitibi Subprovinces, which abut the KSZ, are volcano-plutonic terranes comprising low metamorphic grade metavolcanic-metasedimentary belts. They contain lithologically diverse metavolcanic rocks with various intrusive suites and to a lesser extent chemical and clastic metasedimentary rocks. The individual greenstone belts within the subprovinces have been intruded, deformed and truncated by felsic batholiths. The east trending Abitibi and Swayze greenstone belts of the

Claim#	District	Claim Due Date	Assessment Period		Township	G-Plan	NTS	Units	Assess Required	Assess Applied Previously	Total Required Now	Total Reserve
			From	To								
4252996	POR	26-Apr-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	10	$4,000.00	$3,745	$255.00	
4252997	POR	26-Apr-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	15	$6,000.00	$4,958	$1,042.00	
4240489	POR	6-May-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	6	$2,400.00	$2,557	$2,243.00	
4240490	POR	6-May-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	6	$2,400.00	$2,647	$2,153.00	
4255237	POR	27-May-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	6	$2,400.00			
4255238	POR	27-May-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
1234887	POR	13-Sep-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	7	$2,800.00			
4242553	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	16	$6,400.00			
4242554	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	14	$5,600.00			
4242555	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	16	$6,400.00			
4242557	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	6	$2,400.00			
4242558	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	2	$800.00			
4242559	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4242560	POR	13-Sep-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	16	$6,400.00			
4249706	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4249707	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4249708	POR	13-Sep-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	2	$800.00			
4249709	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4249710	POR	13-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4249711	POR	22-Sep-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4249712	POR	22-Sep-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	8	$3,200.00			
4249713	POR	22-Sep-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	6	$2,400.00			
4256762	POR	30-Nov-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
4259801	POR	30-Nov-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	11	$4,400.00			
4259802	POR	30-Nov-12	January-05-11	January-20-2011	BORDEN	G-1056	41O14	8	$3,200.00			
4259803	POR	30-Nov-12	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	12	$4,800.00			
4259804	POR	30-Nov-12	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	12	$4,800.00			
4259805	POR	15-Dec-12	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	1	$400.00			
4260523	POR	15-Dec-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	1	$400.00			
4260525	POR	15-Dec-12	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	4	$1,600.00			
4260527	POR	15-Dec-12	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	4	$1,600.00			
4260536	POR	10-Jan-13	January-05-11	January-20-2011	MCNAUGHT	G-1178	41O14	5	$2,000.00			
4252987	POR	26-Feb-13	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00	$1,682	$1,518	
4227868	POR	10-Nov-15	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	15	$6,000.00	$30,000		$75,808
4260524	POR	30-Nov-12	January-05-11	January-20-2011	GALLAGHER	M-0823	41O14	1	$400.00			
4256763	POR	30-Nov-12	January-05-11	January-20-2011	COCHRANE	G-1085	41O14	4	$1,600.00			
									$100,000.00			

Table 1 – Claim Information

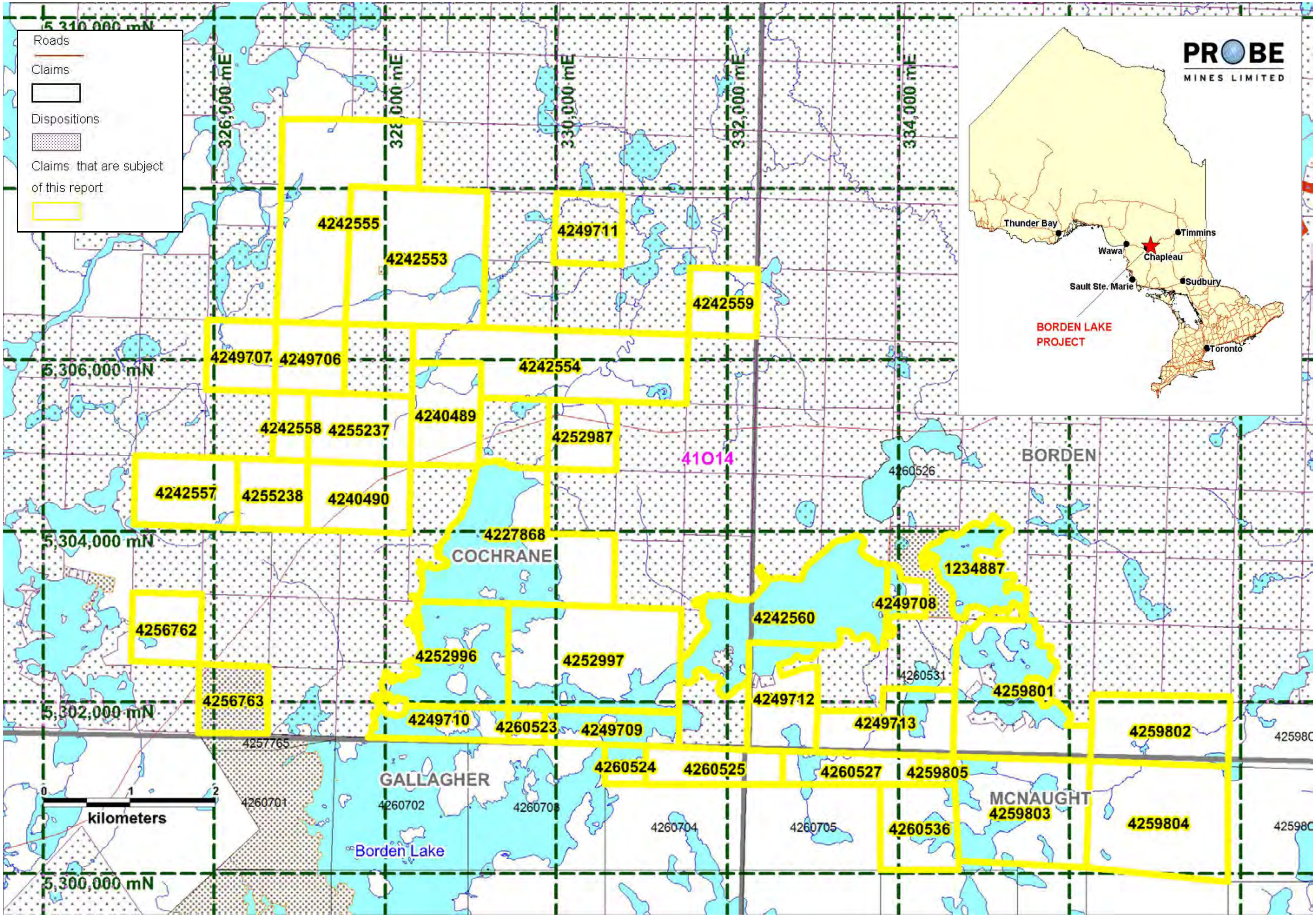


Figure 1- Location of the Borden Lake Project

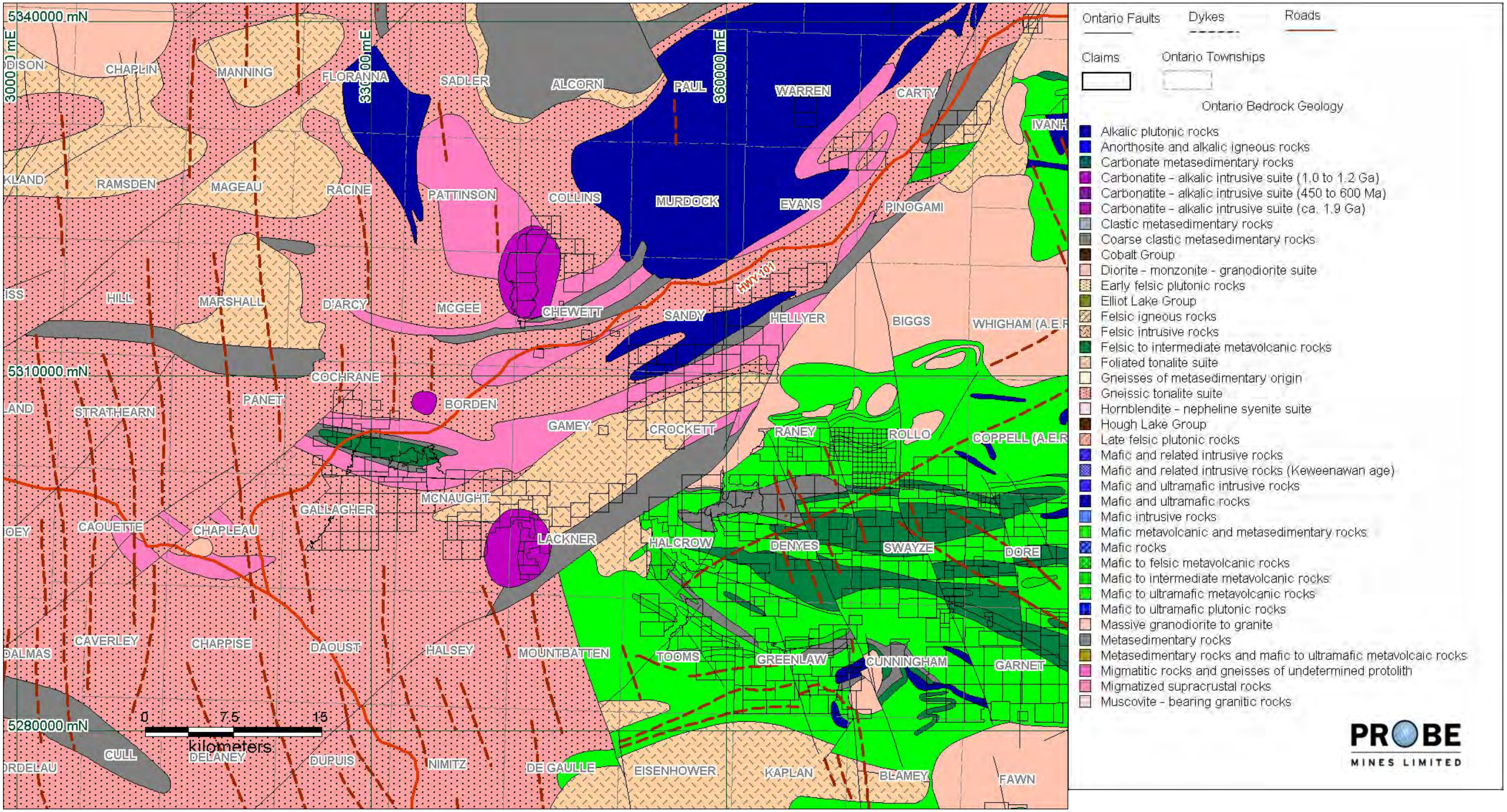


Figure 2 – General Geology of the Borden Lake Area

Abitibi subprovince have historically been explored and mined for a variety of commodities; while the Wawa subprovince hosts the east-trending Wawa greenstone belt and the Mishibishu greenstone belt where much exploration and mining has occurred.

Several alkalic rocks such as carbonatite complexes along with lamprophyric dykes intruded along the KSZ, approximately 1022 to 1141 Ma ago. The carbonatite occurrences appear to display close spatial relationships with major northeast-striking shear zones. Proximal to the project area, on the northern side of the KSZ, three (3) such complexes are known to occur. These include the Borden Township carbonatite complex, the Nemegosenda Lake alkalic complex, and the Lackner Lake alkalic complex.

LOCAL GEOLOGY

The Borden Lake greenstone belt is in Borden and Cochrane Townships. It is a west trending belt of supracrustal rocks, approximately 3 km wide, that includes mafic to ultramafic gneiss, pillow basalt, felsic metavolcanic rocks, felsic porphyries and tonalites which are overlain by a +30 m thick suite of Timiskaming-aged clastic metasediments (Moser 1989, Moser 1994, Moser 2008, Percival 2008). The metasediments comprise greywackes, arkose, arenite, quartz pebble conglomerate and polymictic cobble conglomerate, metamorphosed to upper amphibolites facies. Gneissic fabrics are evident and the rocks appear to have been affected by regional deformation. Several episodes of deformation are reflected in the structural imprint of the rocks, with the last deformation being related to the development of the KSZ.

PREVIOUS WORK

Prior to Probe Mines commencing work, minimal previous work was completed on the property. In the early to mid 1980s Noranda Exploration Co. Ltd. carried out an exploration program in the west-northwest section of the project area. The program consisted of geological mapping and geophysical surveys including magnetic and Max-min EM. A drill program was also conducted. AFRIs 41O14SW1003, 41O14SW0003 and 41O14SW0004 detail the results of this work.

Various assessment reports were also filed by M. Tremblay in the early 1990s. Work included VLF surveys, soil geochemical sampling and overburden stripping. The AFRIs that detail the work completed include 41O14SW9179, 41O14SW9180, 41O14SW9184, 41O14SW9200, 41O15NE0001 and 41O14SW0001.

In July 2010, Probe Mines completed a diamond drill program comprising eight holes and totaling 790m on claim number 4227868. An assessment report on the drilling was filed in November 2010 under work report W1060.02610. Results indicated that there is excellent potential to host a low-grade, bulk tonnage gold deposit on the property.

An initial Geotech VTEM survey was flown by Probe Mines in late April-early May 2010 and assessment for this was filed under work report W1160.00098 in January 2011.

AIRBORNE GEOPHYSICAL SURVEY – VTEM II

Between January 5 and January 20 2011, Geotech Ltd. carried out a second helicopter-borne time domain electromagnetic and aeromagnetic survey for Probe Mines Limited over the Borden Lake Project situated near Chapleau, Ontario, Canada. A total of 1373.2 line-km of geophysical data were acquired during the survey on the Borden Lake Block. The area covered by the survey and the flight lines are shown in Figure 3. The survey coverage for the claims that are the subject of this report is detailed in Table 2.

A Geotech report detailing the specifics of the airborne survey is attached in Appendix I. Maps illustrating the results of the survey are contained in Appendix II.

Table 2 – Survey Coverage of Claims (in this Report)

	Claim	Total Line Km
1	4252996	15.57
2	4252997	22.40
3	4240489	10.40
4	4240490	10.80
5	4255237	10.80
6	4255238	8.00
7	1234887	7.90
8	4242553	27.20
9	4242554	25.50
10	4242555	28.00
11	4242557	10.80
12	4242558	4.40
13	4242559	7.20
14	4242560	22.51
15	4249706	8.00
16	4249707	7.20
17	4249708	2.44
18	4249709	4.40
19	4249710	6.80
20	4249711	7.20
21	4249712	11.18
22	4249713	10.34
23	4256762	6.40
24	4259801	18.54
25	4259802	13.60
26	4259803	24.20
27	4259804	22.72
28	4259805	2.00
29	4260523	1.60
30	4260525	8.00
31	4260527	8.00
32	4260536	9.80
33	4252987	7.20
34	4227868	29.25
35	4260524	4.65
36	4256763	8.00

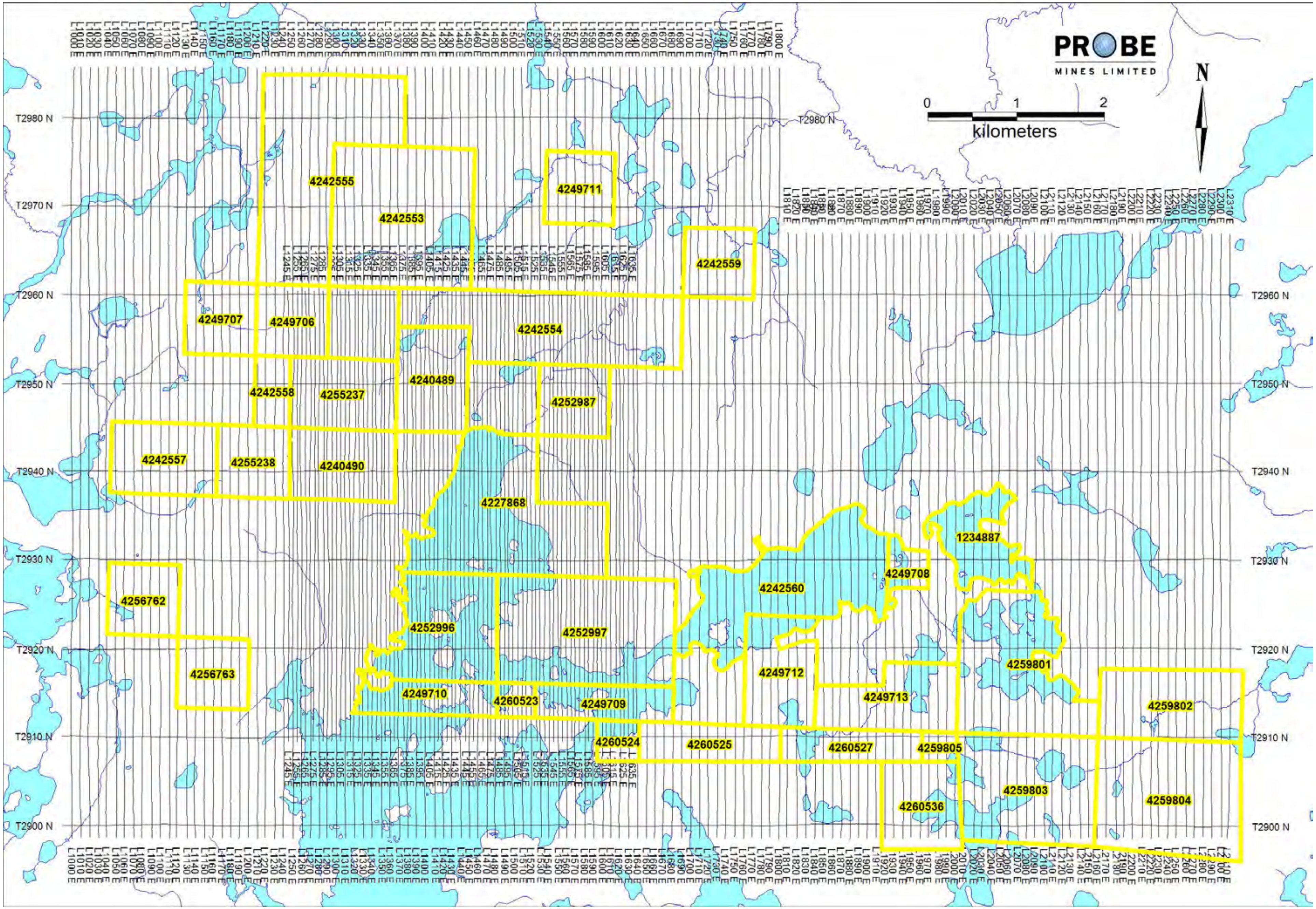


Figure 3 – Flight lines of the 2011 Airborne Survey and Location of Claims (in yellow) that are the subject of this report (flight lines for 2010 survey are shown as well)

RECOMMENDATIONS

The geophysical results indicate that there are numerous anomalies present within the survey area that warrant further exploration. As such Probe Mines is filing assessment credits to keep the claims in good standing and plans to continue performing work on the property.

REFERENCES

Moser, D. E. 1989. Preliminary Map, Geology of the Wawa Gneiss Terrane Adjacent to the Kapuskasing Structural Zone near Chapleau, Ontario; Geological Survey of Canada Open File Map 2056, scale 1:50 000.

Moser, D.E. 1994. The geology and structure of the mid-crustal Wawa gneiss domain – a key to understanding tectonic variation with depth and time in the late Archean Abitibi-Wawa Orogen. Canadian Journal of Earth Sciences, 31: p. 1064-1080.

Moser, D.E, Bowman, J.R., Wooden, J., Valley, J.W., Mazdab, F. and Kita, N. 2008. Creation of a continent recorded in zircon zoning. Geology 36: p. 239-242.

Ontario Geological Survey 1991a. Bedrock geology of Ontario, north sheet; Ontario Geological Survey, Map 2543, scale 1:1 000 000.

Ontario Geological Survey 2001. Results of modern alluvium sampling, Chapleau area,
northeastern Ontario: Operation Treasure Hunt—Kapuskasing Structural Zone;
Ontario Geological Survey, Open File Report 6063, 164p.

Percival, J.A. and West, G.F. 1994. The Kapuskasing uplift: a geological and geophysical synthesis; Canadian Journal of Earth Sciences, v.31, p.1256-1286.

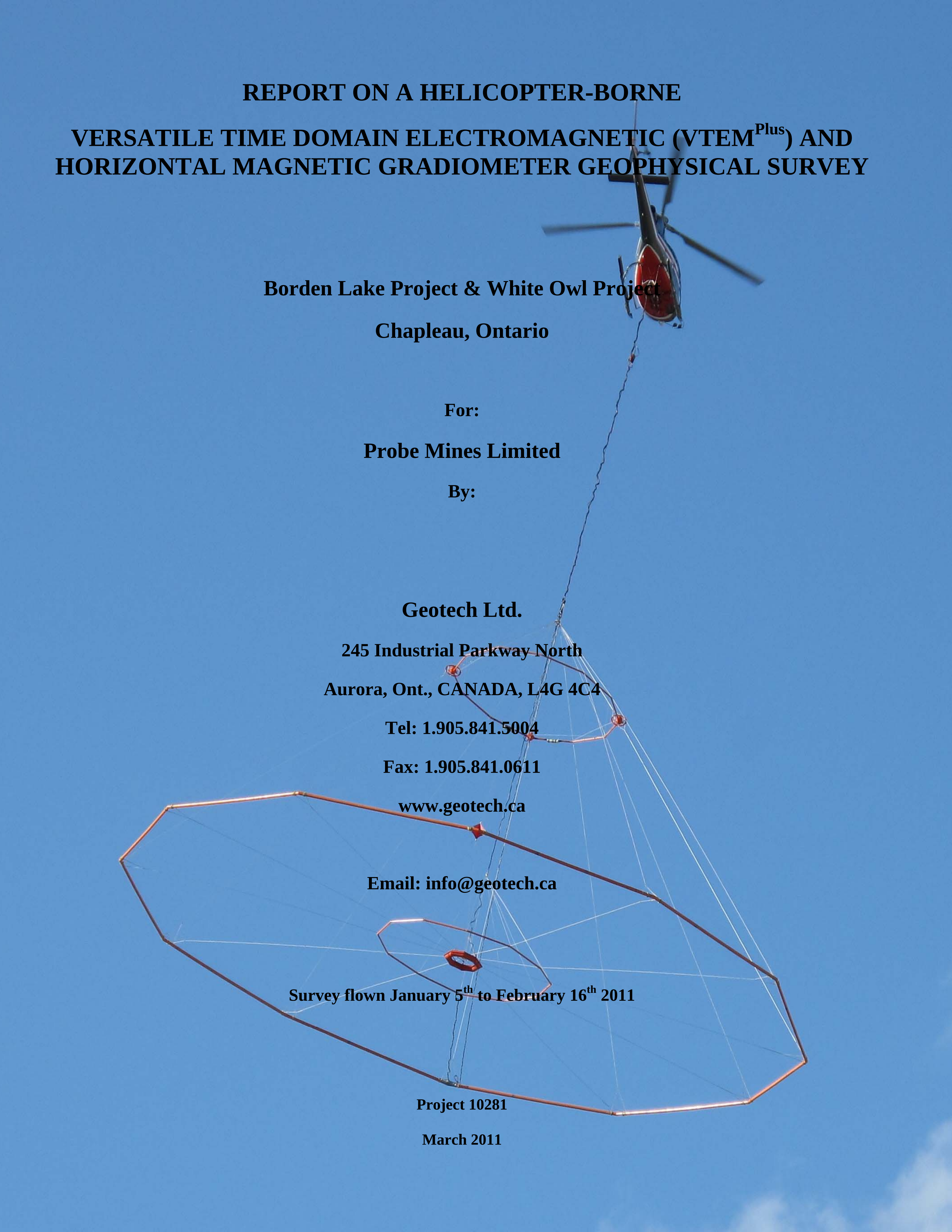
Percival, J. A. and McGrath, P.H. 1986. Deep crustal structure and tectonic history of the northern Kapuskasing uplift of Ontario: an integrated petrological–geophysical study; Tectonics, v.5, no.4, p.553-572.

Percival, J. 2008. Field Guide to the Kapuskasing Uplift, Chapleau-Foleyet Transect: A window on the deep crust, in Geological Society of America Field Forum ―Late Archean Crust: Magmatism and Tectonics of the Abitibi Subprovince, Canadian Shield" p. 46-76.

Thurston, P.C., 1991, Archean geology of Ontario: Introduction, in Geology of Ontario,
Ontario Geological Survey, Special Volume 4, Part l, p.73-78

APPENDIX I

Helicopter Borne Time Domain
Electromagnetic and Aeromagetic Survey
by Geotech Ltd.



REPORT ON A HELICOPTER-BORNE

VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM^{Plus}) AND HORIZONTAL MAGNETIC GRADIOMETER GEOPHYSICAL SURVEY

Borden Lake Project & White Owl Project

Chapleau, Ontario

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Survey flown January 5th to February 16th 2011

Project 10281

March 2011

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REPORT ON A HELICOPTER-BORNE VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM^{Plus}) and HORIZONTAL MAGNETIC GRADIOMETER SURVEY

Borden Lake & White Owl Projects
Chapleau, Ontario

Executive Summary

Durning January 5th to February 16th, 2011 Geotech Ltd. carried out a helicopter-borne geophysical survey over the Borden Lake & White Owl Projects situated about 4 km east of Chapleau in Ontario, Canada.

Principal geophysical sensors included a versatile time domain electromagnetic (VTEM^{Plus}) system, and horizontal magnetic gradiometer consisting of two cesium magnetometers. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 3063.7 line-kilometres were flown.

In-field data quality assurance and preliminary processing were carried out on a daily basis during the acquisition phase. Preliminary and final data processing, including generation of final digital data and map products were undertaken from the office of Geotech Ltd. in Aurora, Ontario.

The processed survey results are presented as the following maps:

- Electromagnetic stacked profiles of the B-Field Z Component
- Electormagnetic stacked profiles of the dB/dt Z Components
- Colour grids of a B-Field Z Component Channel
- Calculated Verical Gradient of TMI (CVG)
- EM Time-constant B-Field Z Component (Tau)
- EM Time-constant dB/dt Z Component (Tau)
- Total Magnetic Intensity (TMI)
- Total Horizontal Gradient of TMI (TotalHGrad)
- Tilt Derivative of TMI

Digital data includes all electromagnetic and magnetic products, plus ancillary data including the waveform.

The survey report describes the procedures for data acquisition, processing, final image presentation and the specifications for the digital data set.

1. INTRODUCTION

1.1 General Considerations

Geotech Ltd. performed a helicopter-borne geophysical survey over the Broden Lake & White Owl Projects located about 4 km east of Chapleau in Ontario, Canada (Figure 1 & 2).

David Palmer represented Probe Mines Limited during the data acquisition and data processing phases of this project.

The geophysical surveys consisted of helicopter borne EM using the versatile time-domain electromagnetic (VTEM^{Plus}) system with Z and X component measurements and horizontal magnetic gradiometer using two cesium magnetometers. A total of 3063.7 line-km of geophysical data were acquired during the survey.

The crew was based out of Chapleau, Ontario (Figure 2) for the acquisition phase of the survey. Survey flying started on January 5th and was completed on February 16th, 2010.

Data quality control and quality assurance, and preliminary data processing were carried out on a daily basis during the acquisition phase of the project. Final data processing followed immediately after the end of the survey. Final reporting, data presentation and archiving were completed from the Aurora office of Geotech Ltd. in March 2011.

Figure 1 - Property Location

1.2 Survey and System Specifications

The blocks are located approximately 4 kilometres east of Chapleau, Ontario (Figure 2).

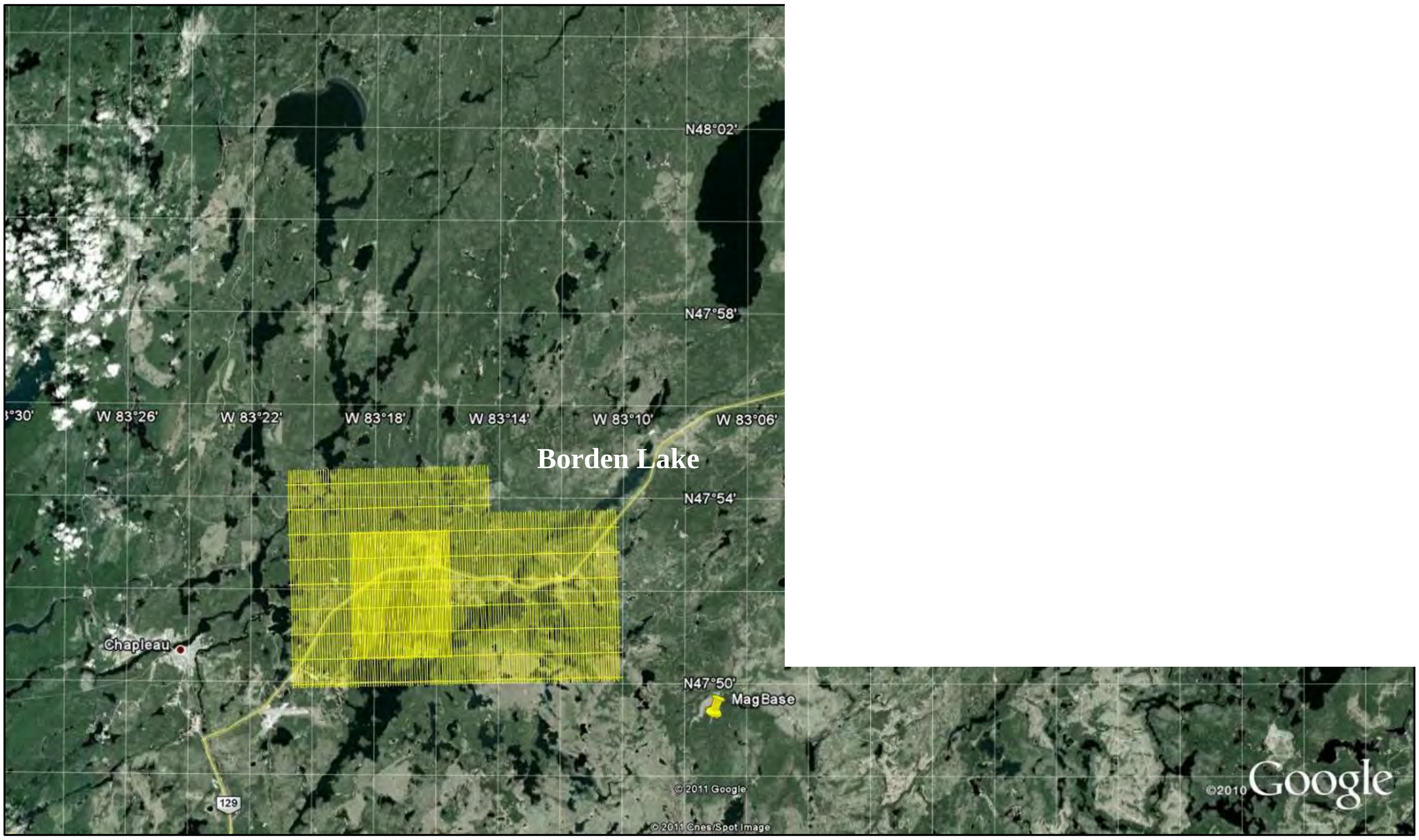

Figure 2 – The survey area location on Google Earth

Both blocks were flown in north to south (N 0° E azimuth) direction with traverse line spacing of 100 metres as depicted in Figure 3. Tie lines were flown perpendicular to the traverse lines at a spacing of 1000 metres (N 90° E azimuth).For more detailed information on the flight spacing and direction see Table 1.

1.3 Topographic Relief and Cultural Features

Topographically, the blocks exhibit a shallow relief with an elevation ranging from 406 to 493 metres above mean sea level over an area of 256 square kilometres (Figure 3 & 4). There are numerous rivers and streams running through the survey area which connect various lakes and wetlands. The most notable lake is Borden Lake which is located along the southern edge of the Borden Lake Project. There are visible signs of culture throughout both blocks, such as roads, trails and buildings, most which are located southwest of the Borden Lake Project.

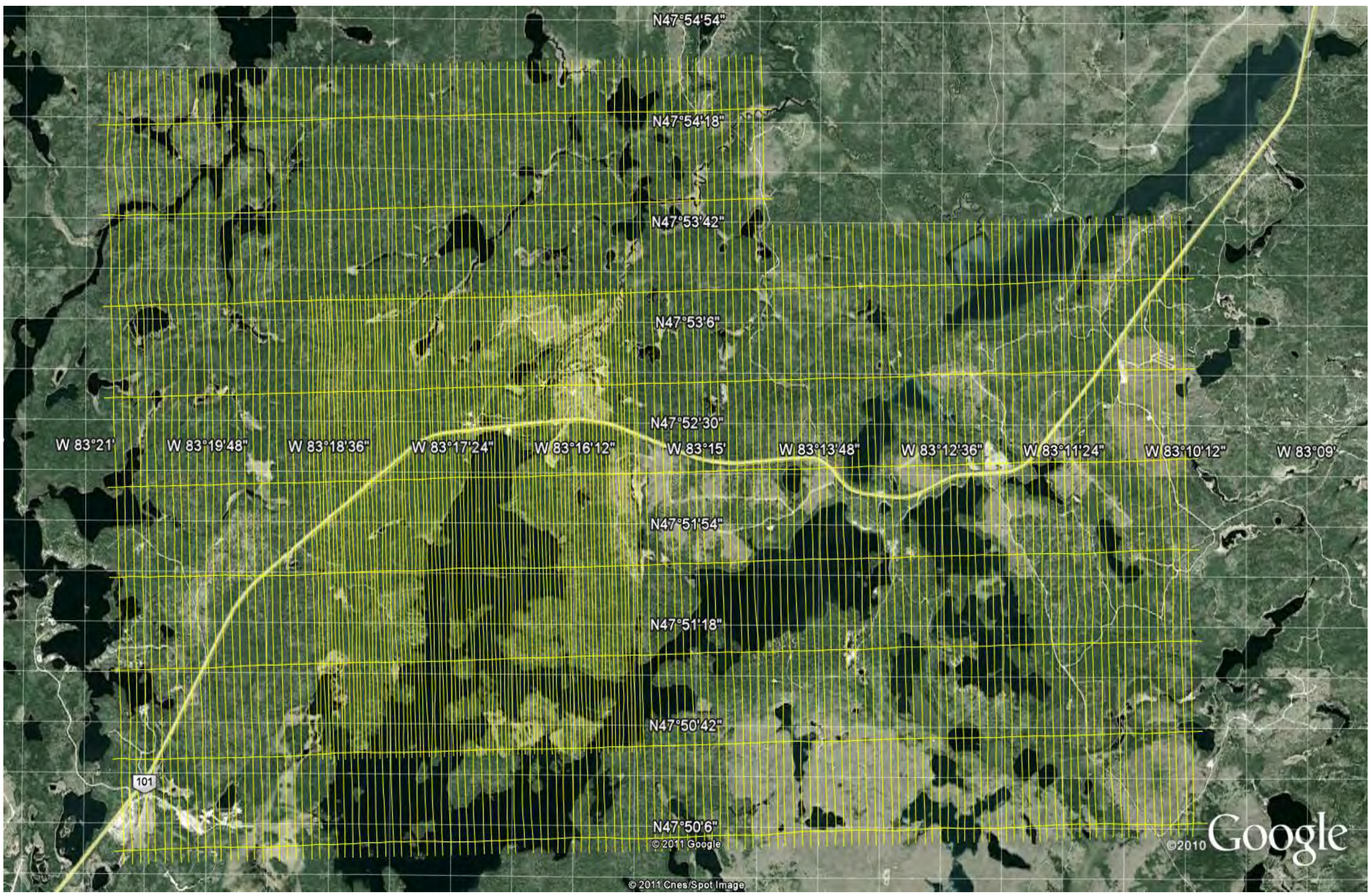

Figure 3 – Borden Lake Flight path over a Google Earth Image.

2. DATA ACQUISITION

2.1 Survey Area

The survey block (see Figure 3 & 4 and Appendix A) and general flight specifications are as follows:

Table 1 - Survey Specifications

Survey block	Traverse Line spacing (m)	Area (Km^2)	Planned[1] Line-km	Actual Line-km	Flight direction	Line numbers
Borden Lake	Traverse: 100	104	1240.9	1263.2	N 0° E / N 180° E	L1000-L2310
	Tie: 1000		108.5	110	N 90° E / N 270° E	T2900-T2980

Survey block boundaries co-ordinates are provided in Appendix B.

2.2 Survey Operations

Survey operations were based out of Chapleau in Ontario from January 5th to February 16th, 2010. The following table shows the timing of the flying.

[1] Note: Actual Line kilometres represent the total line kilometres in the final database. These line-km normally exceed the Planned line-km, as indicated in the survey NAV files.

Table 2 - Survey schedule

Date	Flight #	Block	Crew location	Comments
5-Jan-11			Chapleau, ON	System assembly started
6-Jan-11			Chapleau, ON	System assembly completed and testing done
7-Jan-11	1		Chapleau, ON	Ground/ air testing completed
8-Jan-11	2	Borden Lake	Chapleau, ON	70km flown limited production due to weather
9-Jan-11			Chapleau, ON	No production due to weather
10-Jan-11			Chapleau, ON	No production due to technical issues
11-Jan-11			Chapleau, ON	No production due to technical issues
12-Jan-11			Chapleau, ON	No production due to technical issues
13-Jan-11	3	Borden Lake	Chapleau, ON	143km flown
14-Jan-11	4,5	Borden Lake	Chapleau, ON	396km flown
15-Jan-11			Chapleau, ON	No production due to weather
16-Jan-11	6,7	Borden Lake	Chapleau, ON	374km flown
17-Jan-11			Chapleau, ON	No production due to weather
18-Jan-11			Chapleau, ON	No production due to weather
19-Jan-11	8	Borden Lake	Chapleau, ON	160km flown
20-Jan-11	9,10	Borden Lake	Chapleau, ON	225km flown

2.3 Flight Specifications

During the survey the helicopter was maintained at a mean altitude of 77 metres above the ground with a nominal survey speed of 80 km/hour. This allowed for a nominal EM bird terrain clearance of 42 metres and a horizontal gradiometer bird magnetic clearance of 52 metres.

The on board operator was responsible for monitoring the system integrity. He also maintained a detailed flight log during the survey, tracking the times of the flight as well as any unusual geophysical or topographic features.

On return of the aircrew to the base camp the survey data was transferred from a compact flash card (PCMCIA) to the data processing computer. The data were then uploaded via ftp to the Geotech office in Aurora for daily quality assurance and quality control by qualified personnel.

2.4 Aircraft and Equipment

2.4.1 Survey Aircraft

The survey was flown using a Eurocopter Aerospatiale (Astar) 350 B3 helicopter, registration C-GEOZ. The helicopter is owned and operated by Geotech Aviation Ltd. Installation of the geophysical and ancillary equipment was carried out by a Geotech Ltd crew.

2.4.2 Electromagnetic System

The electromagnetic system was a Geotech Time Domain EM (VTEM) system. The configuration is as indicated in Figure .

The VTEM Receiver and transmitter coils were in concentric-coplanar and Z-direction oriented configeration. The receiver system for the project also included a coincident-coaxial X-direction coil to measure the in-line dB/dt and calculate B-Field responses. The EM bird was towed at a mean distance of 35 metres below the aircraft as shown in Figure 5 and Figure 7. The receiver decay recording scheme is shown diagrammatically in Figure 6.

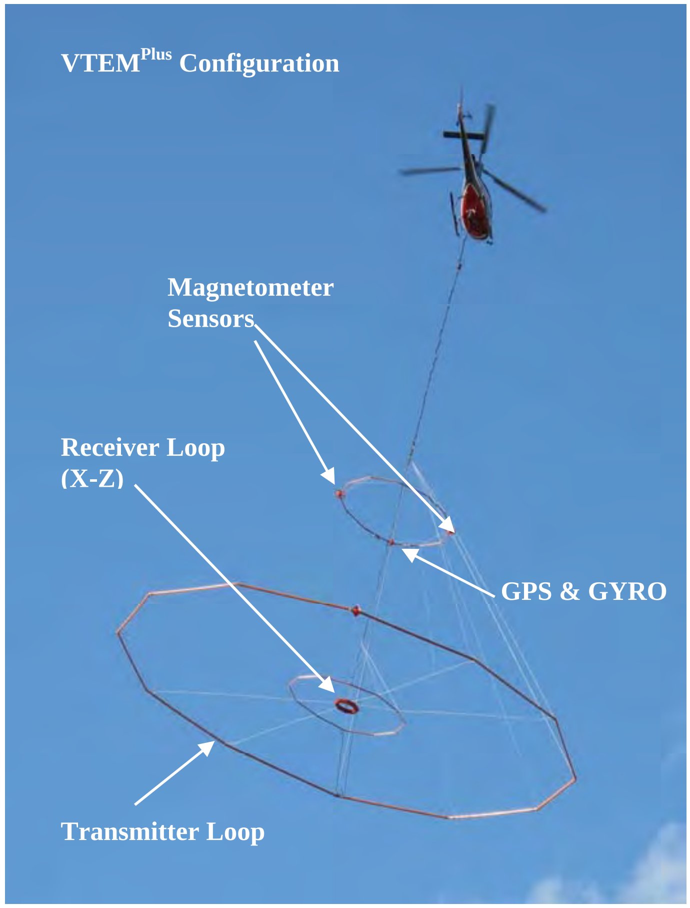

Figure 5 - VTEM[Plus] Configuration, with magnetometer.

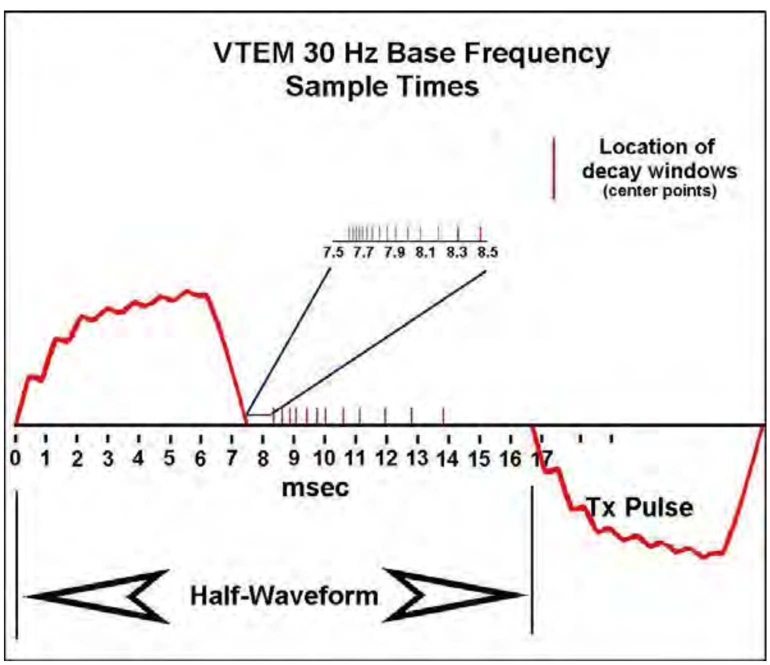

Figure 6 - VTEM Waveform & Sample Times

The VTEM decay sampling scheme is shown in Table 3 below. Thirty-two time measurement gates were used for the final data processing in the range from 96 to 7036 μ sec.

Table 3 - Decay Sampling Scheme

VTEM Decay Sampling Scheme				
Index	**Middle**	**Start**	**End**	**Window**
	Microseconds			
14	96	90	103	13
15	110	103	118	15
16	126	118	136	18
17	145	136	156	20
18	167	156	179	23
19	192	179	206	27
20	220	206	236	30
21	253	236	271	35
22	290	271	312	40
23	333	312	358	46
24	383	358	411	53
25	440	411	472	61
26	505	472	543	70
27	580	543	623	81
28	667	623	716	93
29	766	716	823	107
30	880	823	945	122
31	1,010	945	1,086	141
32	1,161	1,086	1,247	161
33	1,333	1,247	1,432	185
34	1,531	1,432	1,646	214
35	1,760	1,646	1,891	245
36	2,021	1,891	2,172	281
37	2,323	2,172	2,495	323
38	2,667	2,495	2,865	370
39	3,063	2,865	3,292	427
40	3,521	3,292	3,781	490
41	4,042	3,781	4,341	560
42	4,641	4,341	4,987	646
43	5,333	4,987	5,729	742
44	6,125	5,729	6,581	852
45	7,036	6,581	7,560	979

VTEM system parameters:

Transmitter Section

- Transmitter coil diameter: 26 m
- Number of turns: 4
- Transmitter base frequency: 30 Hz
- Peak current: 188 A
- Pulse width: 7.13 ms
- Duty cycle: 42 %
- Wave form shape: trapezoid
- Peak dipole moment: 399,258 nIA
- Nominal EM Bird terrain clearance: 42 metres above the ground
- Effective coil area: 2123 m^2

Receiver Section

X-Coil

- X Coil diameter: 0.32 m
- Number of turns: 245
- Effective coil area: 19.69 m^2

Z-Coil

- Z-Coil coil diameter: 1.2 m
- Number of turns: 100
- Effective coil area: 113.04 m^2

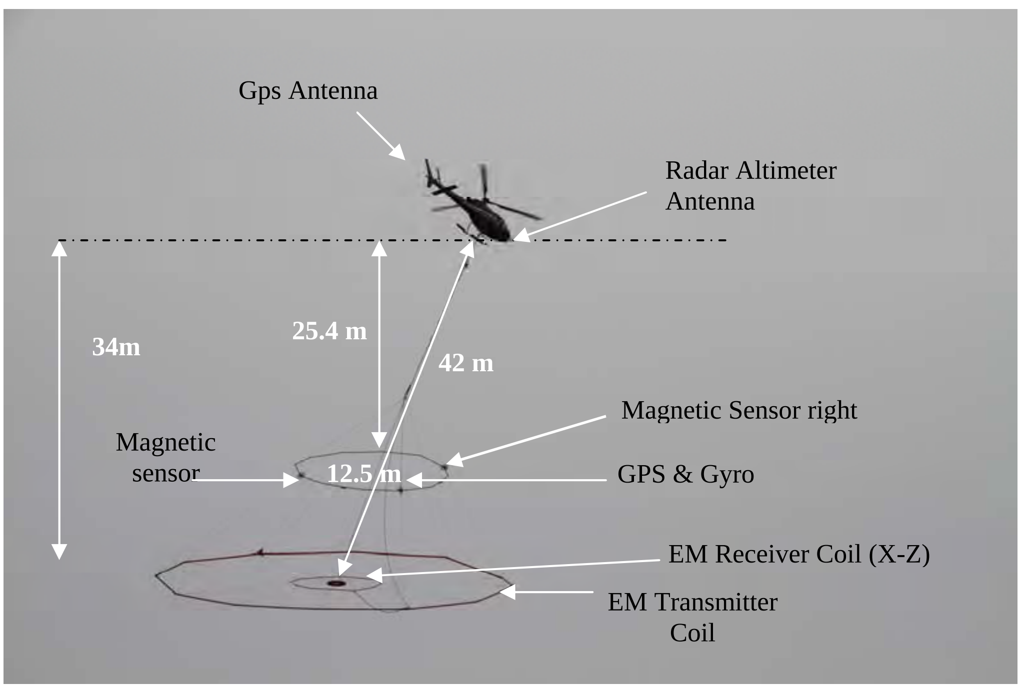

Figure 7 - VTEM^{Plus} System Configuration

2.4.3 Horizontal Magnetic Gradiometer

The horizontal magnetic gradiometer consists of two Geometrics split-beam field magnetic sensors with a sampling interval of 0.1 seconds. These sensors are mounted 12.5 metres apart on a separate bird, 10 metres above the EM bird. A GPS antenna and Gyro is installed to accurately record the tilt and position of the horizontal magnetic gradiometer bird.

2.4.4 Radar Altimeter

A Terra TRA 3000/TRI 40 radar altimeter was used to record terrain clearance. The antenna was mounted beneath the bubble of the helicopter cockpit (Figure 7).

2.4.5 GPS Navigation System

The navigation system used was a Geotech PC104 based navigation system utilizing a NovAtel's CDGPS (Canada-Wide Differential Global Positioning System Correction Service) enable OEM4-G2-3151W GPS receiver, Geotech navigate software, a full screen display with controls in front of the pilot to direct the flight and an NovAtel GPS antenna mounted on the helicopter tail (Figure 7). As many as 11 GPS and two CDGPS satellites may be monitored at any one time. The positional accuracy or circular error probability (CEP) is 1.8 m, with CDGPS active, it is 1.0 m. The co-ordinates of the block were set-up prior to the survey and the information was fed into the airborne navigation system.

2.4.6 Digital Acquisition System

A Geotech data acquisition system recorded the digital survey data on an internal compact flash card. Data is displayed on an LCD screen as traces to allow the operator to monitor the integrity of the system. The data type and sampling interval as provided in Table 4.

Table 4 - Acquisition Sampling Rates

DATA TYPE	SAMPLING
TDEM	0.1 sec
Magnetometer	0.1 sec
GPS Position	0.2 sec
Radar Altimeter	0.2 sec

2.5 Base Station

A combined magnetometer/GPS base station was utilized on this project. A Geometrics Cesium vapour magnetometer was used as a magnetic sensor with a sensitivity of 0.001 nT. The base station was recording the magnetic field together with the GPS time at 1 Hz on a base station computer.

The base station magnetometer sensor was installed behind the maintenance garage at the airport (47º49.1290 N, 83º 21.6425 W); away from electric transmission lines and moving ferrous objects such as motor vehicles. The base station data were backed-up to the data processing computer at the end of each survey day.

3. PERSONNEL

The following Geotech Ltd. personnel were involved in the project.

Field:

Project Manager:	Darren Tuck (Office)
Data QC:	Neil Fiset (Office)
Crew chief:	Gavin Boege
Operator:	Joseph Florjancic

The survey pilot and the mechanical engineer were employed directly by the helicopter operator – Geotech Aviation.

Pilot:	Claude Noel
Mechanical Engineer:	Nathan Shirey

Office:

Preliminary Data Processing:	Neil Fiset
Final Data Processing:	Karl Kwan
Final Data QC:	Timothy Eadie
Reporting/Mapping:	Corrie Laver

Data acquisition phase was carried out under the supervision of Andrei Bagrianski, P. Geo, Chief Operating Officer. Processing phase was carried out under the supervision of Harish Kumar, P.Geo, Assistant Manager of Data Processing. The interpretation phase was under the supervision of Alexander Prikhodko, P. Geo.The customer relations were looked after by Paolo Berardelli.

4. DATA PROCESSING AND PRESENTATION

Data compilation and processing were carried out by the application of Geosoft OASIS Montaj and programs proprietary to Geotech Ltd.

4.1 Flight Path

The flight path, recorded by the acquisition program as WGS 84 latitude/longitude, was converted into the NAD83 Datum, UTM Zone 17 North coordinate system in Oasis Montaj.

The flight path was drawn using linear interpolation between x, y positions from the navigation system. Positions are updated every second and expressed as UTM easting's (x) and UTM northing's (y).

4.2 Electromagnetic Data

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

The signal to noise ratio was further improved by the application of a low pass linear digital filter. This filter has zero phase shift which prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 1 second or 15 metres. This filter is a symmetrical 1 sec linear filter.

The results are presented as stacked profiles of EM voltages for the time gates, in linear - logarithmic scale for the B-field Z component and dB/dt responses in the Z and X components. B-field Z component time channel recorded at 0.880 & 1.531 milliseconds after the termination of the impulse is also presented as contour colour images. Fraser Filter X component is also presented as a colour image. Calculated Time Constant (TAU) with anomaly contours of Calculated Vertical Derivative of TMI is presented in Appendix D & F. Tau was calculated using noise level of 0.01 for Borden Lake and 0.001 for White Owl. Resistivity Depth Image (RDI) is also presented in Appendix D and G.

VTEM has two receiver coil orientations. Z-axis coil is oriented parallel to the transmitter coil axis and both are horizontal to the ground. The X-axis coil is oriented parallel to the ground and along the line-of-flight. This combined two coil configuration provides information on the position, depth, dip and thickness of a conductor. Generalized modeling results of VTEM data, are shown in Appendix E.

In general X-component data produce cross-over type anomalies: from "+ to – "in flight direction of flight for "thin" subvertical targets and from "- to +" in direction of flight for "thick" targets. Z component data produce double peak type anomalies for "thin" subvertical targets and single peak for "thick" targets.

The limits and change-over of "thin-thick" depends on dimensions of a VTEM system. For example, for VTEM-26 the border corresponds to diameter of the system (Appendix E, Fig.E-16).

Graphical representations of the VTEM transmitter input current and the output voltage of the receiver coil are shown in Appendix C.

4.3 Horizontal Magnetic Gradiometer Data

The horizontal gradients data from the VTEM^{plus} are measured by two magnetometers 12.5 metres apart on an independent bird mounted10 metres above the VTEM loop. A GPS and a Gyro help to determine the positions and orientations of the magnetometers. The data from the two magnetometers are corrected for position and orientation variations, as well as for the diurnal variations using the basestation data.

The position of the centre of the horizontal magnetic gradiometer bird is calculated form the GPS utilizing in-house processing tool in Geosoft. Following that total magnetic intensity is calculated at the center of the bird by calculating the mean values from both sensors. In addition to the total intensity advanced processing is done to calculate the in-line and cross-line (or lateral) horizontal gradient which enhance the understanding of magnetic targets. The in-line (longitudinal) horizontal gradient is calculated from the difference of two consecutive total magnetic field readings divided by the distance along the flight line direction, while the cross-line (lateral) horizontal magnetic gradient is calculated from the difference in the magnetic readings from both magnetic sensors divided by their horizontal separation.

Two advanced magnetic derivative products, the total horizontal derivative (THDR), and tilt angle derivative and are also created. The total horizontal derivative or gradient is also called the analytic signal, is defined as:

THDR = sqrt(Hx*Hx+Hy*Hy), where Hx and Hy are cross-line and in-line horizontal gradients.

The tilt angle derivative (TDR) is defined as:

TDR = arctan(Vz/THDR), where THDR is the total horizontal derivative, and Vz is the vertical derivative.

Measured cross-line gradients can help to enhance cross-line linear features during gridding.

5. DELIVERABLES

5.1 Survey Report

The survey report describes the data acquisition, processing, and final presentation of the survey results. The survey report is provided in two paper copies and digitally in PDF format.

5.2 Maps

Final maps were produced at scale of 1:10,000 for best representation of the survey size and line spacing. The coordinate/projection system used was NAD83 Datum, UTM Zone 17 North. All maps show the mining claims, flight path trace and topographic data; latitude and longitude are also noted on maps.

The preliminary and final results of the survey are presented as EM profiles, a late-time gate gridded EM channel, and a color magnetic TMI contour map. The following maps are presented on paper;

- VTEM B-Field Z Component Time Component Grid
- VTEM B-Field profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
- Total Horizontal Gradient of Total Magnetic Intensity (TotalHGrad)
- Total magnetic intensity (TMI) color image and contours.

5.3 Digital Data

- Two copies of the data and maps on 2 DVDs were prepared to accompany the report. Each DVD contains a digital file of the line data in GDB Geosoft Montaj format as well as the maps in Geosoft Montaj Map and PDF format.

- DVD structure was organized by block

Data	contains databases, grids and mapsfor specific block as described below.
Report	contains a copy of the report and appendices in PDF format.

Databases in Geosoft GDB format, containing the channels listed in Table 5.

Table 5 - Geosoft GDB Data Format

Channel name	Units	Description
X:	metres	UTM Easting NAD83 Zone 17 North
Y:	metres	UTM Northing NAD83 Zone 17 North
Longitude:	Decimal Degrees	WGS 84 Longitude data
Latitude:	Decimal Degrees	WGS 84 Latitude data
Z:	metres	GPS antenna elevation (above Geoid)
Radar:	metres	helicopter terrain clearance from radar altimeter
Radarb:	metres	Calculated EM bird terrain clearance from radar altimeter
DEM:	metres	Digital Elevation Model
Gtime:	Seconds of the day	GPS time
Mag1_L:	nT	Raw Total Magnetic field data (left sensor)
Mag1_R:	nT	Raw Total Magnetic field data (right sensor)
Basemag:	nT	Magnetic diurnal variation data
Mag2_L:	nT	Diurnal corrected Total Magnetic field data (left sensor)
Mag2_R:	nT	Diurnal corrected Total Magnetic field data (right sensor)
Mag2Lz	nT	Z corrected (w.r.t. loop center) magnetic field left mag
Mag2Rz	nT	Z corrected (w.r.t. loop center) magnetic field right mag
Mag2Cz	nT	Calculated total magnetic field intensity of the centre of the loop
MagGrad	nT/m	Measured Horizontal gradient
Mag3Cz:	nT	Levelled Total Magnetic field data
Hgcxline		Measured cross-line gradient
hginline		Calculated in line gradient
SFz[14]:	pV/(A*m^4)	Z dB/dt 96 microsecond time channel
SFz[15]:	pV/(A*m^4)	Z dB/dt 110 microsecond time channel
SFz[16]:	pV/(A*m^4)	Z dB/dt 126 microsecond time channel
SFz[17]:	pV/(A*m^4)	Z dB/dt 145 microsecond time channel
SFz[18]:	pV/(A*m^4)	Z dB/dt 167 microsecond time channel
SFz[19]:	pV/(A*m^4)	Z dB/dt 192 microsecond time channel
SFz[20]:	pV/(A*m^4)	Z dB/dt 220 microsecond time channel
SFz[21]:	pV/(A*m^4)	Z dB/dt 253 microsecond time channel
SFz[22]:	pV/(A*m^4)	Z dB/dt 290 microsecond time channel
SFz[23]:	pV/(A*m^4)	Z dB/dt 333 microsecond time channel
SFz[24]:	pV/(A*m^4)	Z dB/dt 383 microsecond time channel
SFz[25]:	pV/(A*m^4)	Z dB/dt 440 microsecond time channel
SFz[26]:	pV/(A*m^4)	Z dB/dt 505 microsecond time channel
SFz[27]:	pV/(A*m^4)	Z dB/dt 580 microsecond time channel
SFz[28]:	pV/(A*m^4)	Z dB/dt 667 microsecond time channel
SFz[29]:	pV/(A*m^4)	Z dB/dt 766 microsecond time channel
SFz[30]:	pV/(A*m^4)	Z dB/dt 880 microsecond time channel
SFz[31]:	pV/(A*m^4)	Z dB/dt 1010 microsecond time channel
SFz[32]:	pV/(A*m^4)	Z dB/dt 1161 microsecond time channel
SFz[33]:	pV/(A*m^4)	Z dB/dt 1333 microsecond time channel
SFz[34]:	pV/(A*m^4)	Z dB/dt 1531 microsecond time channel
SFz[35]:	pV/(A*m^4)	Z dB/dt 1760 microsecond time channel
SFz[36]:	pV/(A*m^4)	Z dB/dt 2021 microsecond time channel
SFz[37]:	pV/(A*m^4)	Z dB/dt 2323 microsecond time channel
SFz[38]:	pV/(A*m^4)	Z dB/dt 2667 microsecond time channel
SFz[39]:	pV/(A*m^4)	Z dB/dt 3063 microsecond time channel
SFz[40]:	pV/(A*m^4)	Z dB/dt 3521 microsecond time channel
SFz[41]:	pV/(A*m^4)	Z dB/dt 4042 microsecond time channel
SFz[42]:	pV/(A*m^4)	Z dB/dt 4641 microsecond time channel

Channel name	Units	Description
SFz[43]:	$pV/(A*m^4)$	Z dB/dt 5333 microsecond time channel
SFz[44]:	$pV/(A*m^4)$	Z dB/dt 6125 microsecond time channel
SFz[45]:	$pV/(A*m^4)$	Z dB/dt 7036 microsecond time channel
SFx[20]:	$pV/(A*m^4)$	X dB/dt 220 microsecond time channel
SFx[21]:	$pV/(A*m^4)$	X dB/dt 253 microsecond time channel
SFx[22]:	$pV/(A*m^4)$	X dB/dt 290 microsecond time channel
SFx[23]:	$pV/(A*m^4)$	X dB/dt 333 microsecond time channel
SFx[24]:	$pV/(A*m^4)$	X dB/dt 383 microsecond time channel
SFx[25]:	$pV/(A*m^4)$	X dB/dt 440 microsecond time channel
SFx[26]:	$pV/(A*m^4)$	X dB/dt 505 microsecond time channel
SFx[27]:	$pV/(A*m^4)$	X dB/dt 580 microsecond time channel
SFx[28]:	$pV/(A*m^4)$	X dB/dt 667 microsecond time channel
SFx[29]:	$pV/(A*m^4)$	X dB/dt 766 microsecond time channel
SFx[30]:	$pV/(A*m^4)$	X dB/dt 880 microsecond time channel
SFx[31]:	$pV/(A*m^4)$	X dB/dt 1010 microsecond time channel
SFx[32]:	$pV/(A*m^4)$	X dB/dt 1161 microsecond time channel
SFx[33]:	$pV/(A*m^4)$	X dB/dt 1333 microsecond time channel
SFx[34]:	$pV/(A*m^4)$	X dB/dt 1531 microsecond time channel
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SFx[38]:	$pV/(A*m^4)$	X dB/dt 2667 microsecond time channel
SFx[39]:	$pV/(A*m^4)$	X dB/dt 3063 microsecond time channel
SFx[40]:	$pV/(A*m^4)$	X dB/dt 3521 microsecond time channel
SFx[41]:	$pV/(A*m^4)$	X dB/dt 4042 microsecond time channel
SFx[42]:	$pV/(A*m^4)$	X dB/dt 4641 microsecond time channel
SFx[43]:	$pV/(A*m^4)$	X dB/dt 5333 microsecond time channel
SFx[44]:	$pV/(A*m^4)$	X dB/dt 6125 microsecond time channel
SFx[45]:	$pV/(A*m^4)$	X dB/dt 7036 microsecond time channel
BFz	$(pV*ms)/(A*m^4)$	Z B-Field data for time channels 14 to 45
BFx	$(pV*ms)/(A*m^4)$	X B-Field data for time channels 20 to 45
SFxFF	$pV/(A*m^4)$	Fraser filtered X dB/dt
PLM:		60 Hz power line monitor
CVG	nT/m	Calculated Magnetic Vertical Gradient
TauSF	milliseconds	Time Constant (Tau) calculated from dB/dt data
TauBF	milliseconds	Time Constant (Tau) calculated from B-Field data
Nchan_TauBFz:		Last channel where the Tau algorithm stops calculation, B-Field
Nchan_TauSFz:		Last channel where the Tau algorithm stops calculation, dB/dt

Electromagnetic B-field and dB/dt Z component data is found in array channel format between indexes 14 – 45, and X component data from 20 – 45, as described above.

- Database of the VTEM Waveform "10281_waveform_final.gdb" in Geosoft GDB format, containing the following channels:

Time:	Sampling rate interval, 5.2083 microseconds
Rx_Volt:	Output voltage of the receiver coil (Volt)
Tx_Current:	Output current of the transmitter (Amp)

- Grids in Geosoft GRD format, as follows:

BFz34:	B-Field Z Component Channel 34 (Time Gate 1.531 ms)
BFz30:	B-Field Z Component Channel 30 (Time Gate 0.880 ms)
TMI:	Total magnetic intensity (nT)
DEM:	Digital Elevation Model
CVG:	Calculated Magnetic Vertical Gradient
Hgxline:	Horizontal Gradient Cross Line
Hginline:	Horizontal Gradient In-Line
SFx_FF:	Fraser Filtered dB/dt Channel 30 (Time Gate 0.880 ms)
TauBF:	Time Constant B-Field
TauSF:	Time Constant dB/dt
TiltDrv:	Tilt Angle Derivative
TotalHGrad:	Total Horizontal Gradient of Total Magnetic Intensity

A Geosoft .GRD file has a .GI metadata file associated with it, containing grid projection information. A grid cell size of 25 metres was used.

- Maps at 1:10,000 in Geosoft MAP format, as follows:

10281_10k_dBdtz:	dB/dt profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
10281_10k_bfield_bb:	B-field profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
10281_10k_BFz34_bb:	B-field late time Z Component Channel 34, Time Gate 1.531 ms color image.
10281_10k_BFz30_bb:	B-Field late time Z Component Channel 30, Time Gate 0.880 ms color image
10281_10k_TMI_bb:	Total magnetic intensity (TMI) color image and contours.
10281_10k_CVG_bb:	Calculated Magnetic Vertical Gradient
10281_10k_SFxFF_bb:	Fraser Filtered dB/dt, Channel 30, Time Gate 0.880 ms
10281_10k_TauSF_bb:	Time Constant dB/dt
10281_10k_TDR_bb:	Tilt Angle Derivative
10281_10k_TotalHGrad_bb:	Total Horizontal Gradient of Total Magnetic Intensity

Where bb represents the block name (Ex. 10281_10k_TMI_BordenLake)
Maps are also presented in PDF format.

1:50,000 topographic vectors were taken from the NRCAN Geogratis database at; http://geogratis.gc.ca/geogratis/en/index.html.

- A Google Earth file *10281_BordenLake.kml & 10281_WhiteOwl* showing the flight path of the block is included. Free versions of Google Earth software from: http://earth.google.com/download-earth.html

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A helicopter-borne versatile time domain electromagnetic (VTEM) geophysical survey has been completed over the Borden Lake & White Owl Projects near Chapleau, Ontario.

The total area coverage is 256 km^2. Total survey line coverage is 3063.7 line kilometres. The principal sensors included a Time Domain EM system and a magnetometer. Results have been presented as stacked profiles, and contour color images at a scale of 1:10,000. No formal Interpretation has been included.

6.2 Recommendations

Based on the geophysical results obtained, a number of interesting EM anomalies that were identified across the property. The magnetic results may also contain worthwhile information in support of exploration targets of interest. We therefore recommend a detailed interpretation of the available geophysical data, in conjunction with the geology. It should include 2D - 3D inversion modeling analyses and magnetic derivative analysis prior to ground follow up and drill testing.

Respectfully submitted[6],

Neil Fiset
Geotech Ltd.

Alexander Prikhodko, P. Geo
Geotech Ltd.

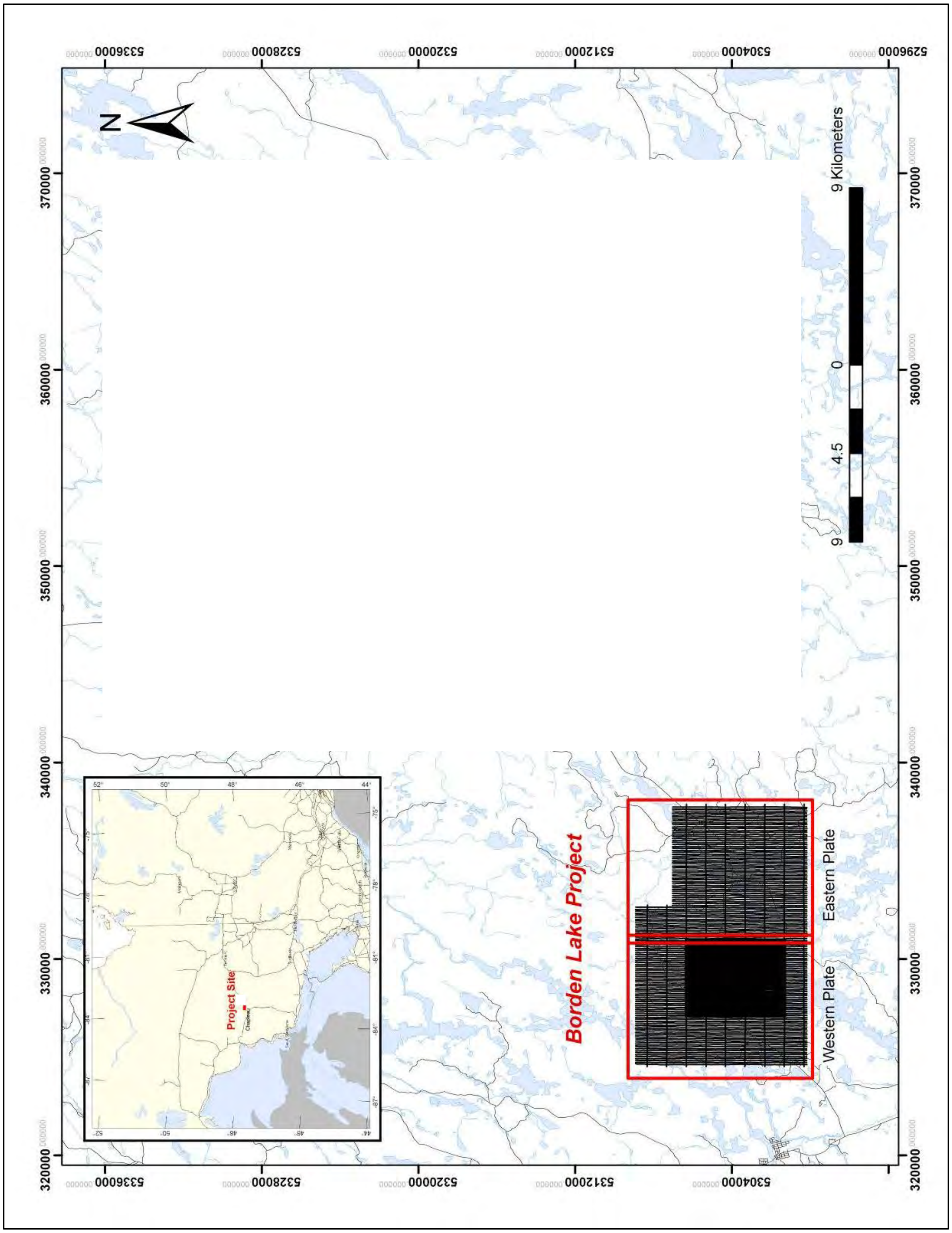
Harish Kumar, P.Geo.
Geotech Ltd.

March 2011

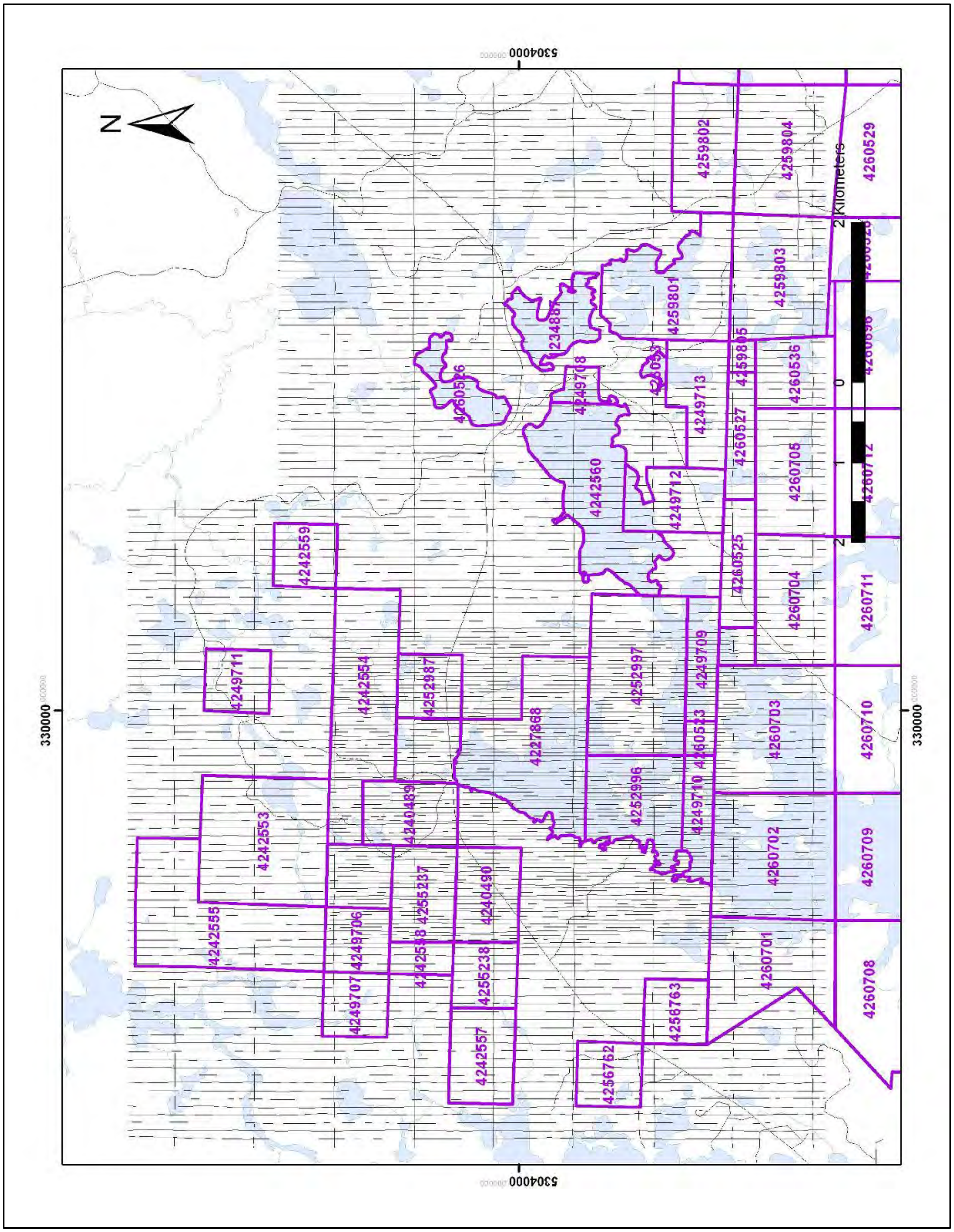
[6]Final data processing of the EM and magnetic data were carried out by Neil Fiset, from the office of Geotech Ltd. in Aurora, Ontario, under the supervision of Harish Kumar, Assitant Manager of Data Processing and Alexander Prikhodko, P.Geo., PhD, Senior Geophysicist, VTEM Interpretation Supervisor.

APPENDIX A

SURVEY BLOCK LOCATION MAP



Survey Overview of the Block



Mining Claims for the Borden Lake Project

APPENDIX B

SURVEY BLOCK COORDINATES

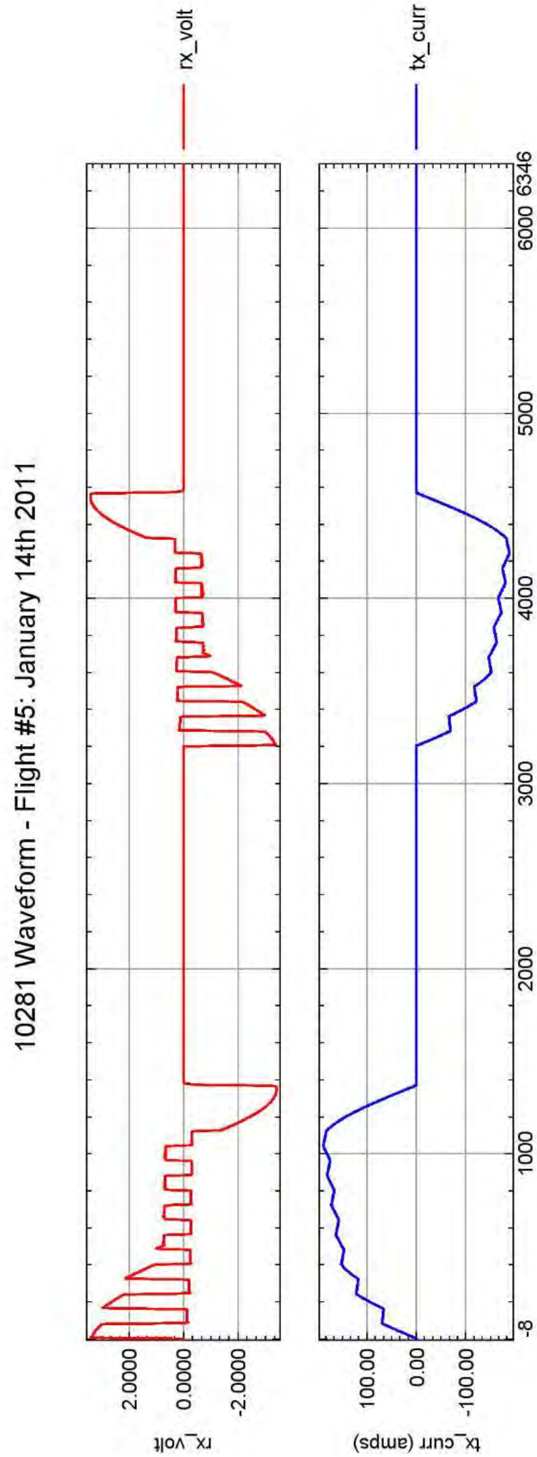
(WGS 84, UTM Zone 17 North)

Borden Lake Project

X	Y
324607.9	5308846
324607.9	5300231
337815.6	5300231
337815.6	5306959
332652.4	5306959
332652.4	5308846

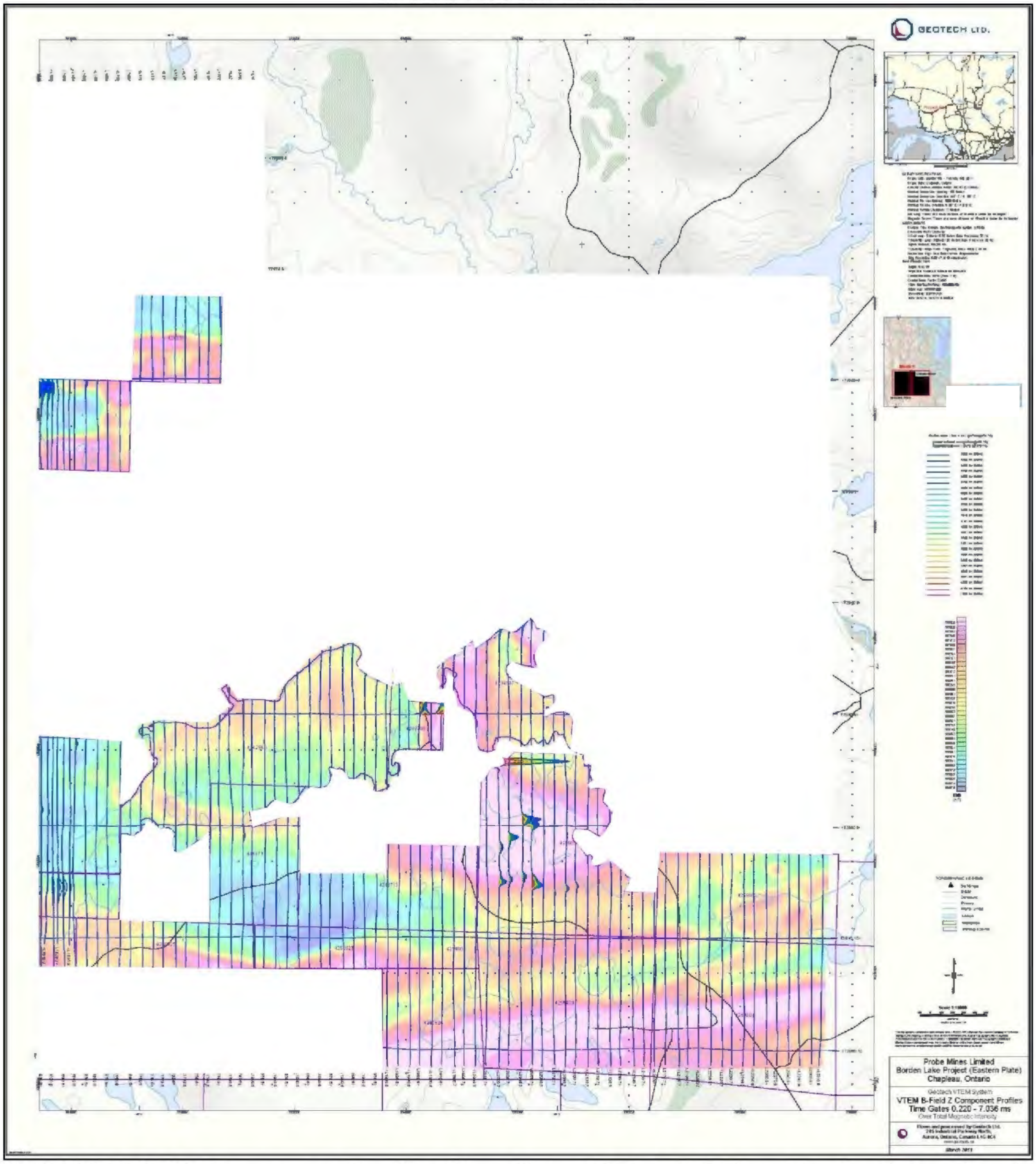
APPENDIX C

VTEM WAVEFORM



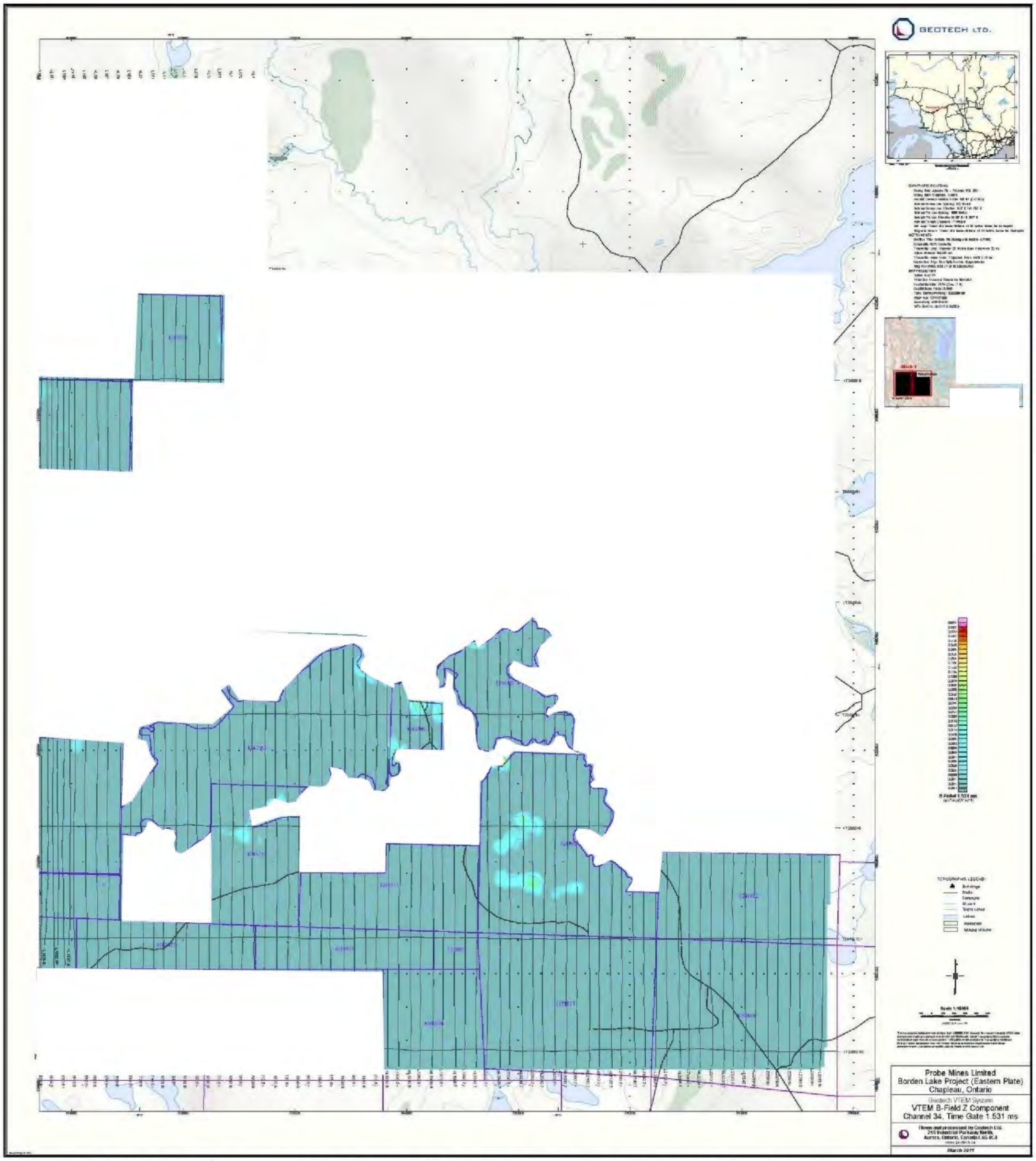
APPENDIX D

GEOPHYSICAL MAPS[1]

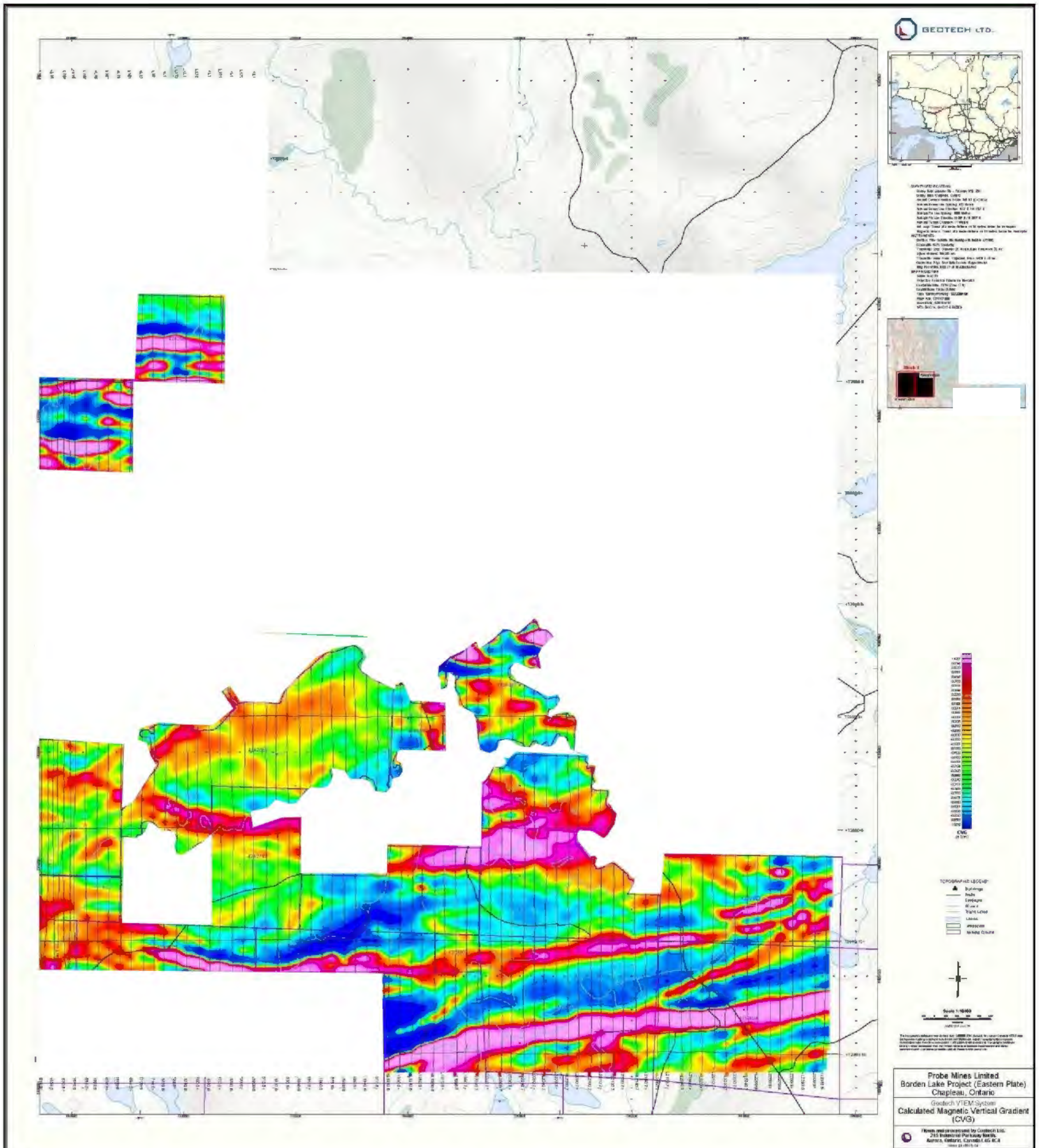


VTEM B-Field Z Component Profiles, Time Gates 0.220 to 7.036 ms (Borden Lake – East)

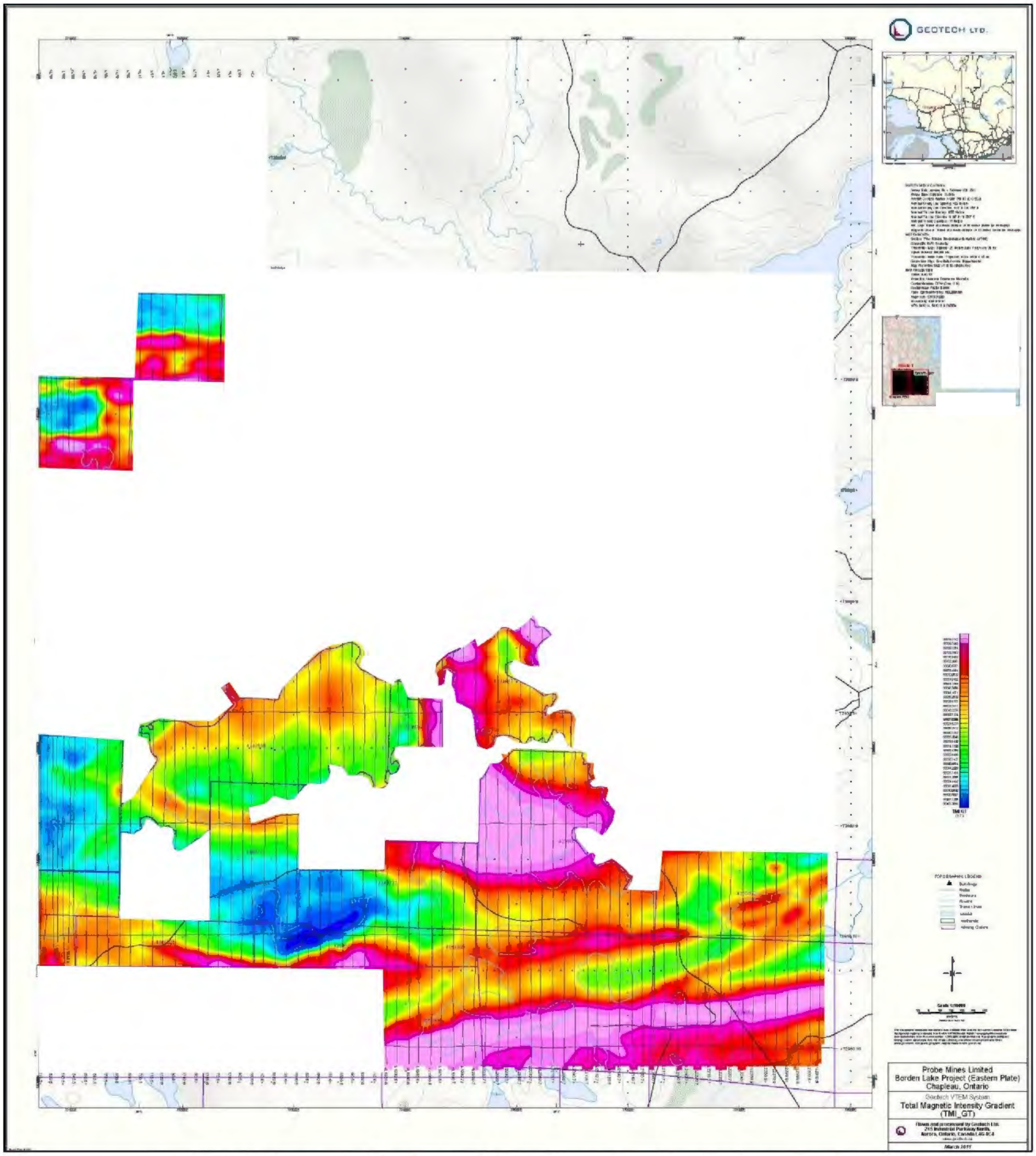
[1] Full size geophysical maps are also available in PDF format on the final DVD



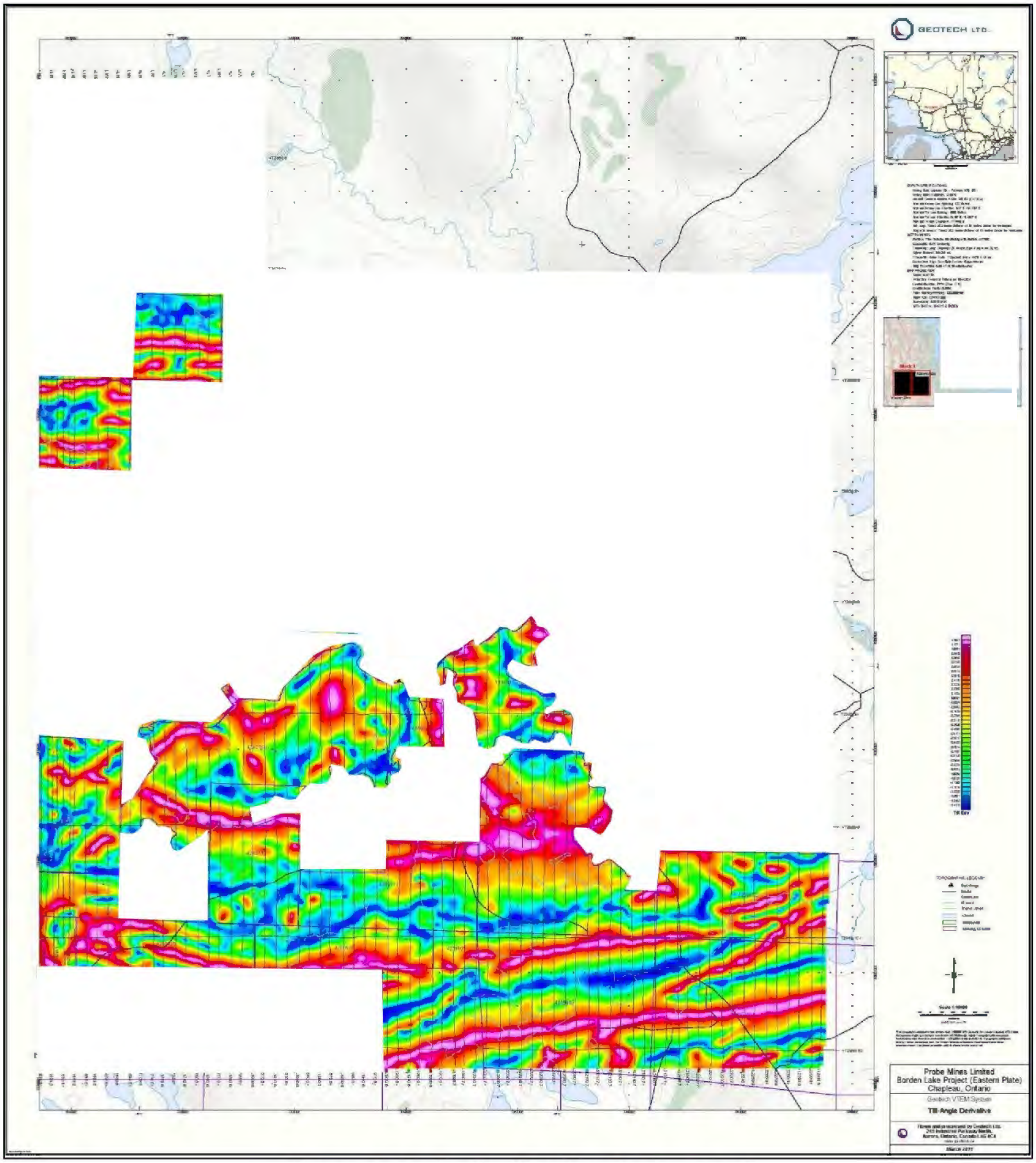
B-Field Z Component, Channel 34, Time Gate 1.531 ms (Borden Lake – East)



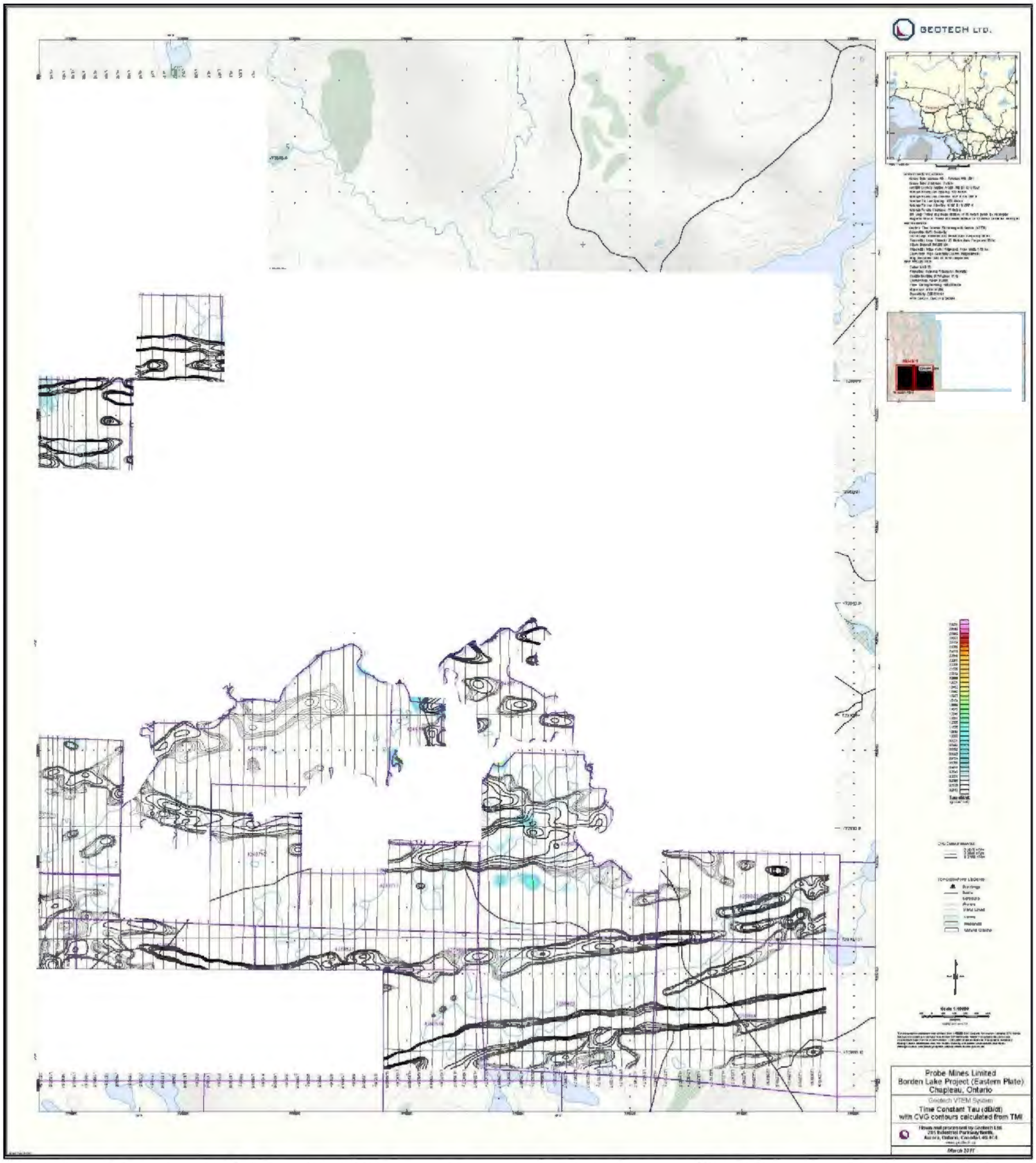
Calculated Magnetic Vertical Gradient (CVG) (Borden Lake – East)



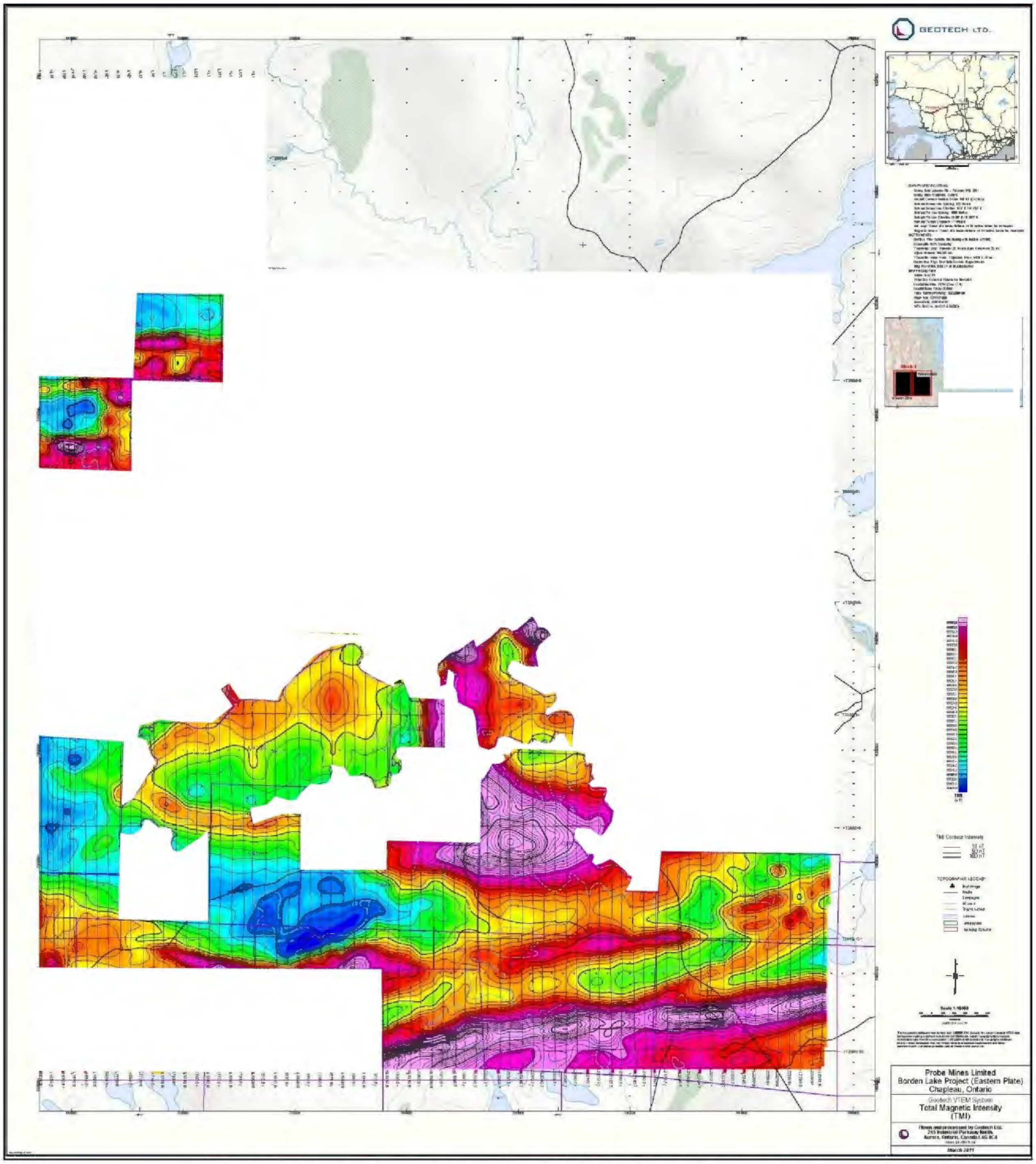
Total Magnetic Horizontal Gradient (Borden Lake – East)



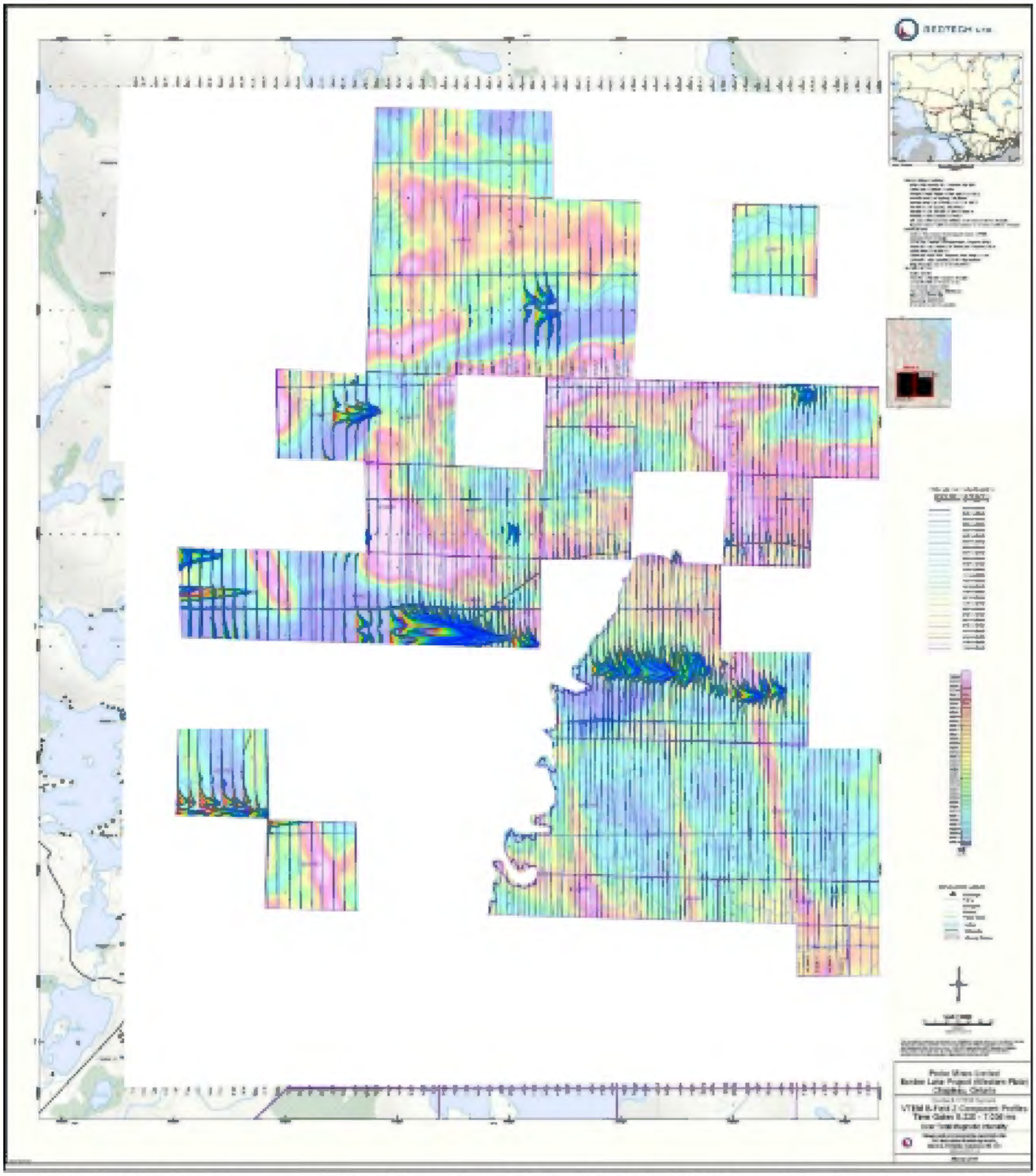
Tilt-angle derivative(Borden Lake – East)



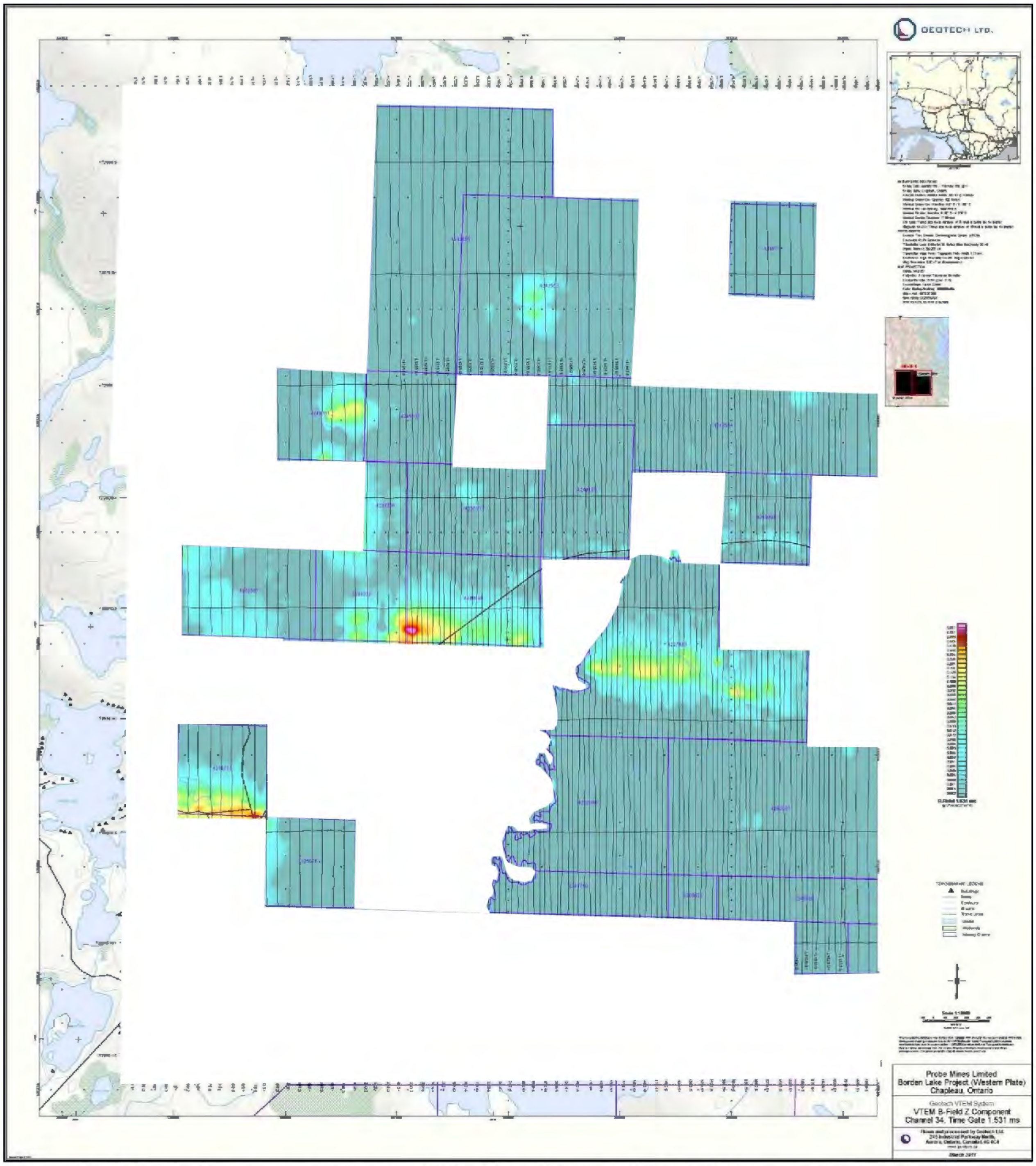
Time Constant dB/dt with CVG contours calculated from TMI (Borden Lake – East)



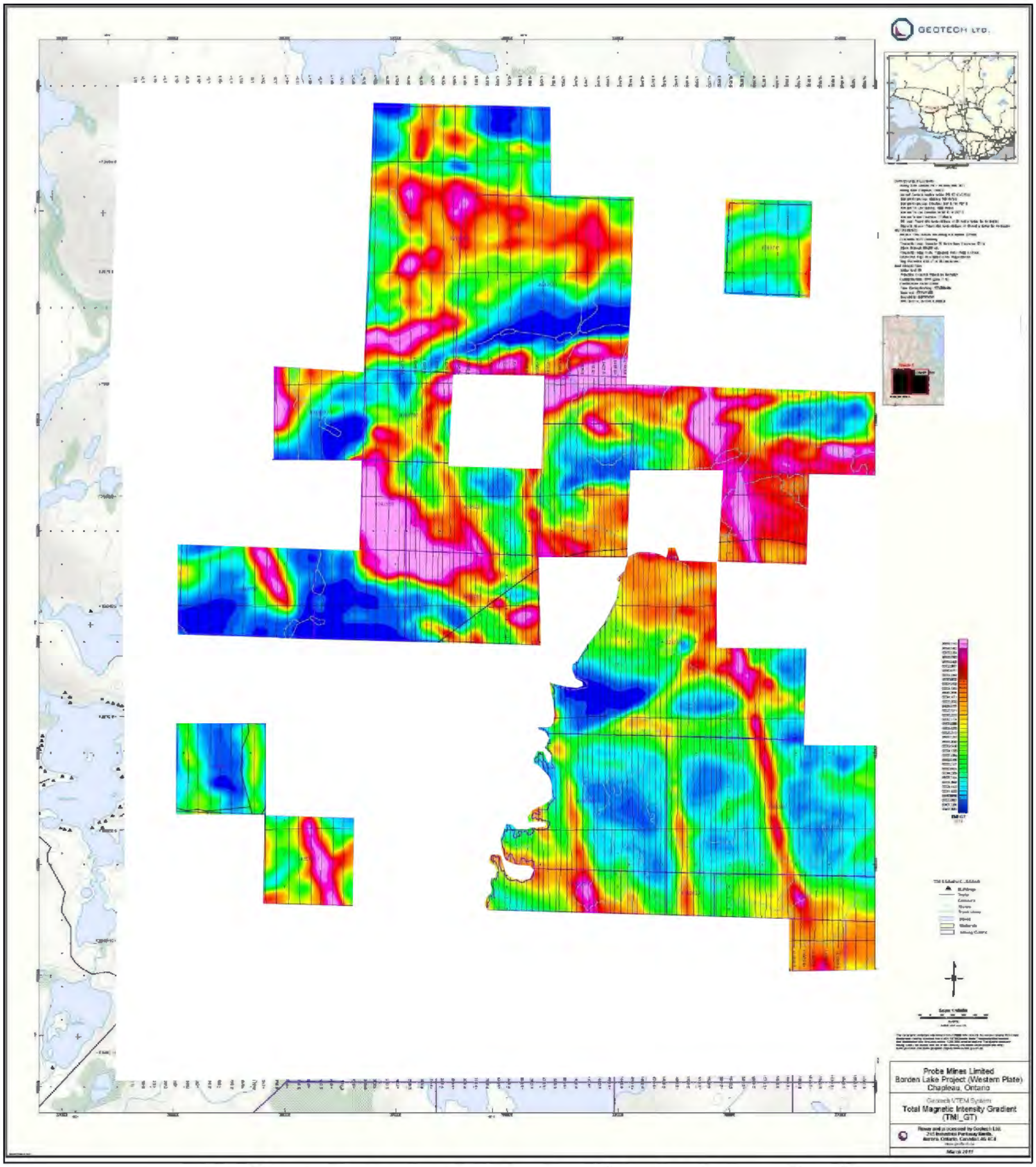
Total Magnetic Intensity (TMI) (Borden Lake – East)



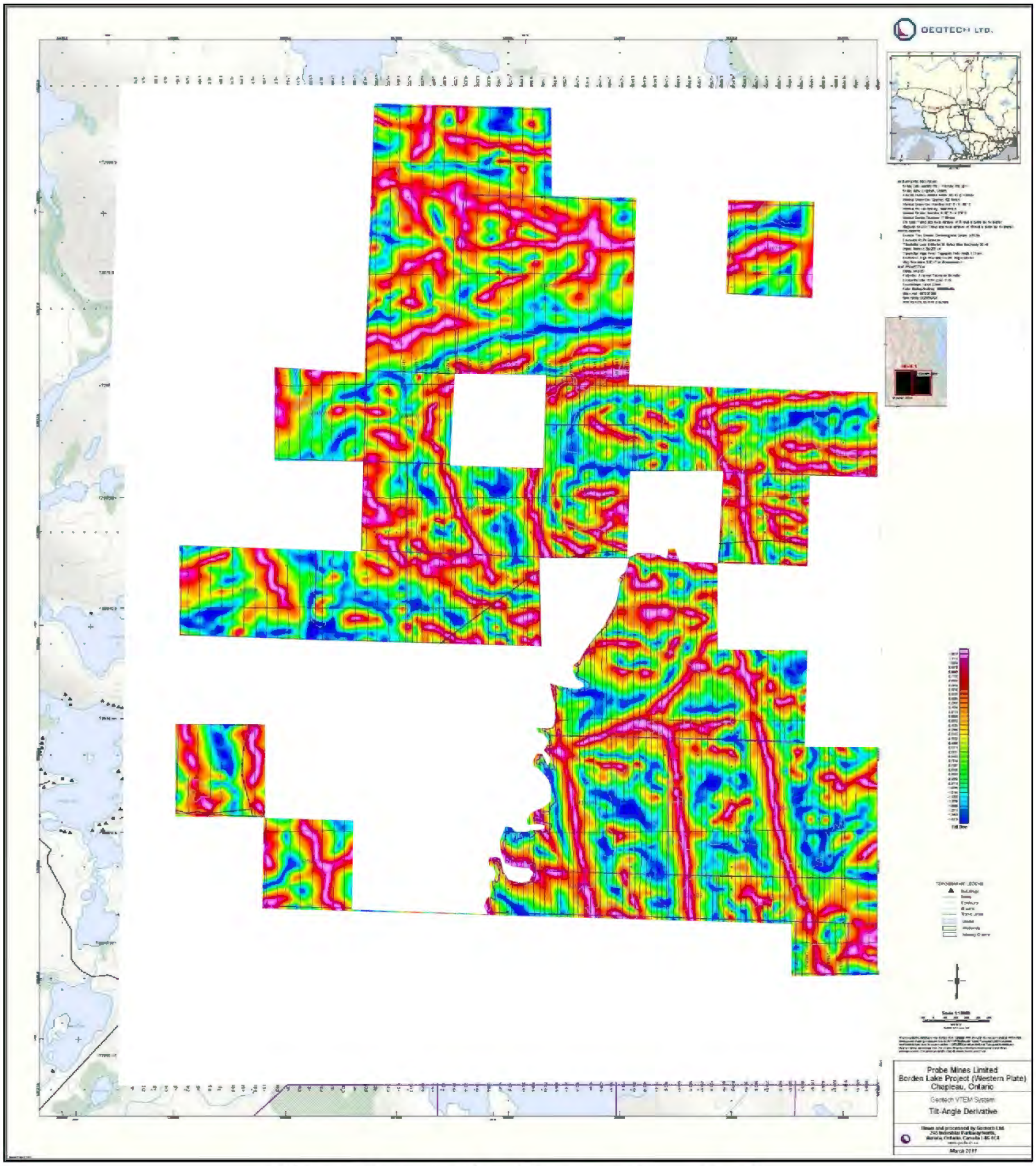
VTEM B-Field Z Component Profiles, Time Gates 0.220 to 7.036 ms (Borden Lake – West)



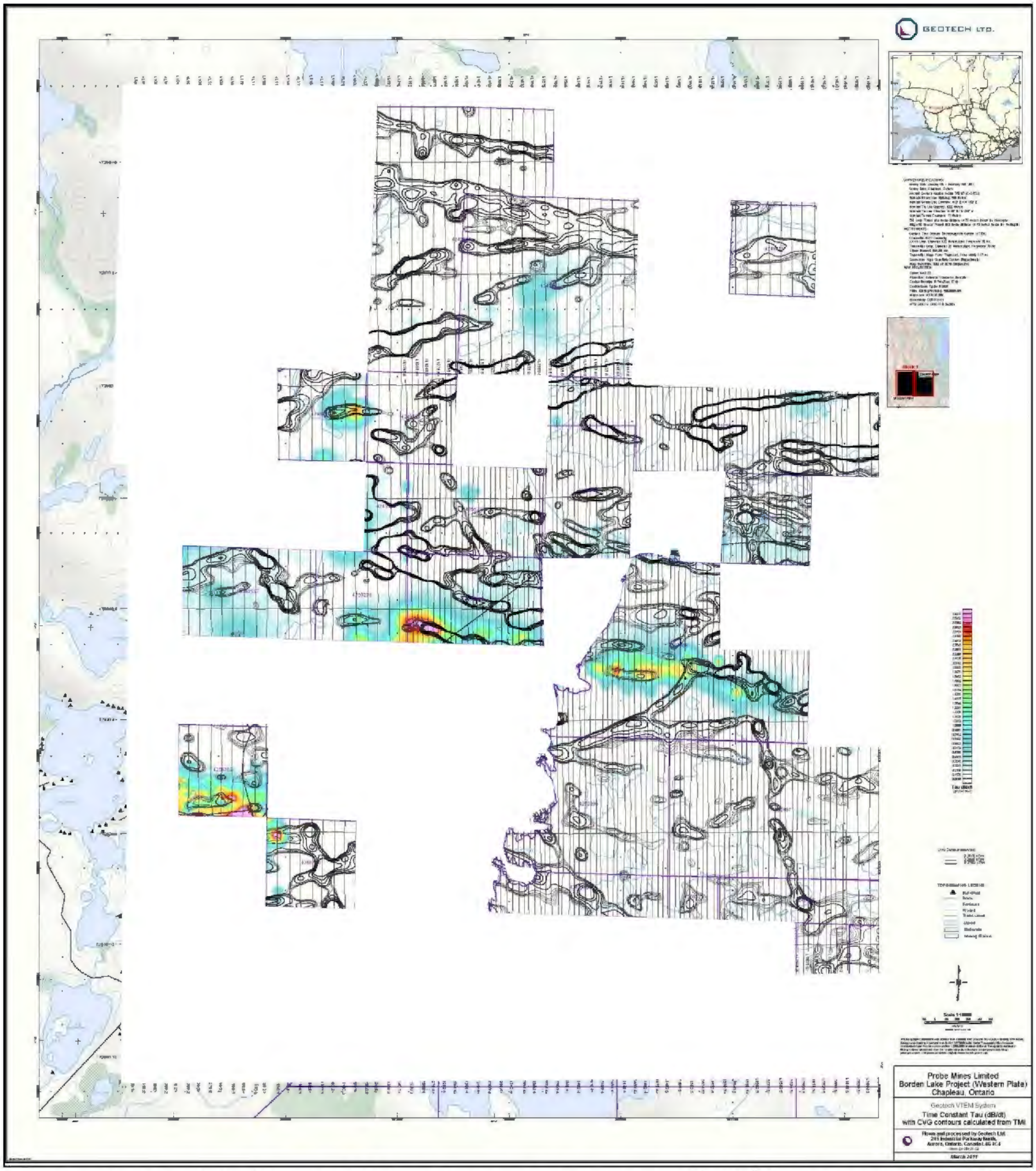
B-Field Z Component, Channel 30, Time Gate 0.880 ms (Borden Lake – West)



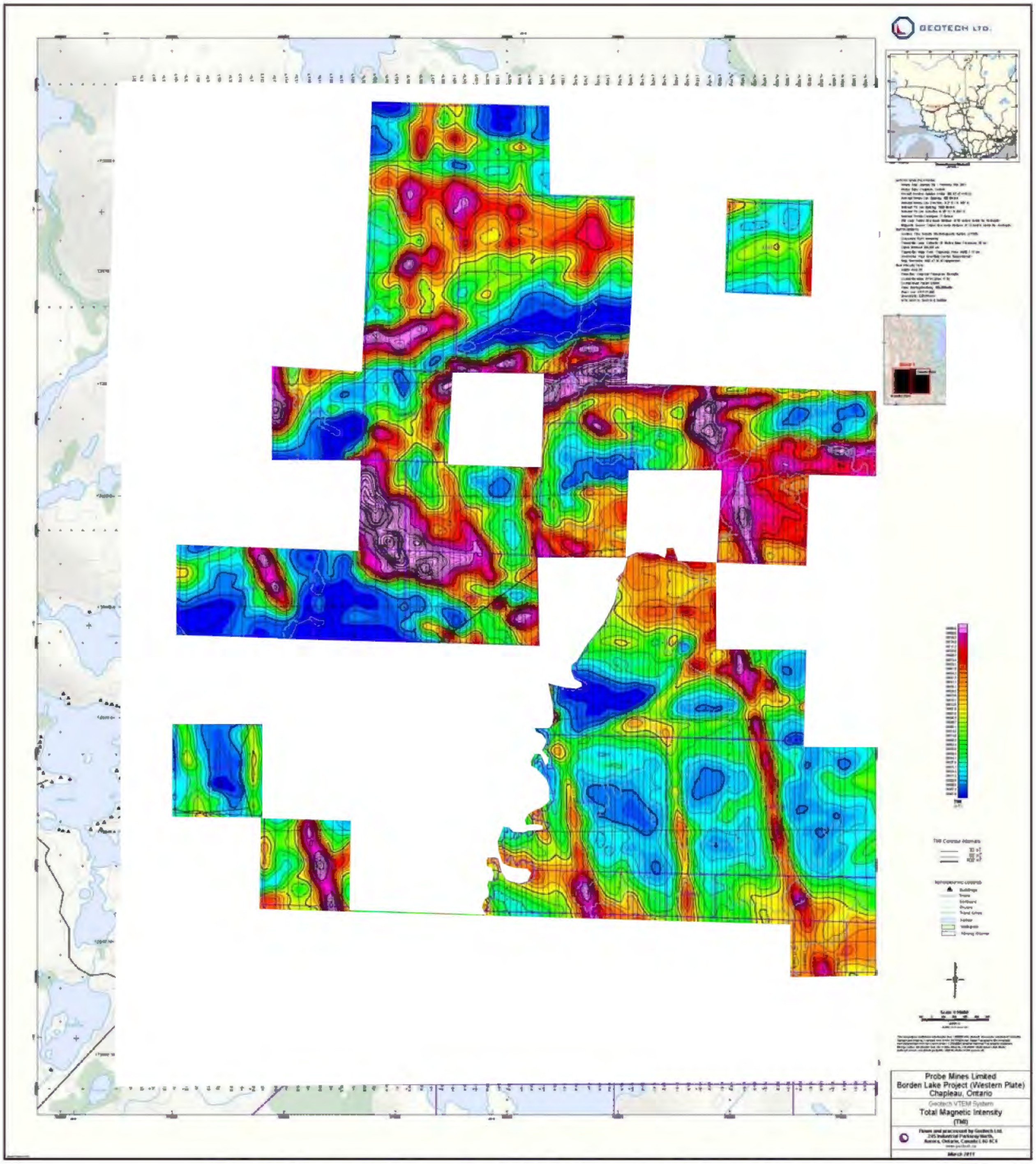
Total Magnetic Horizontal Gradient (Borden Lake – West)



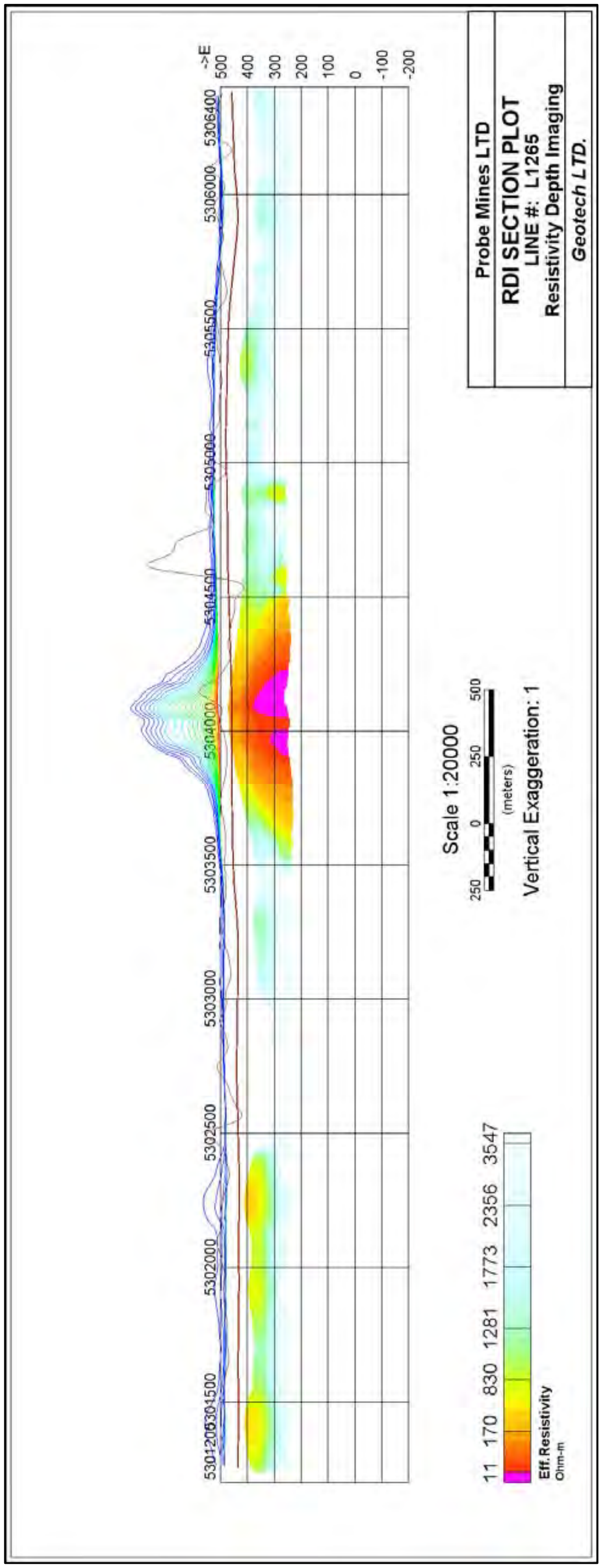
Tilt-angle derivative (Borden Lake – West)



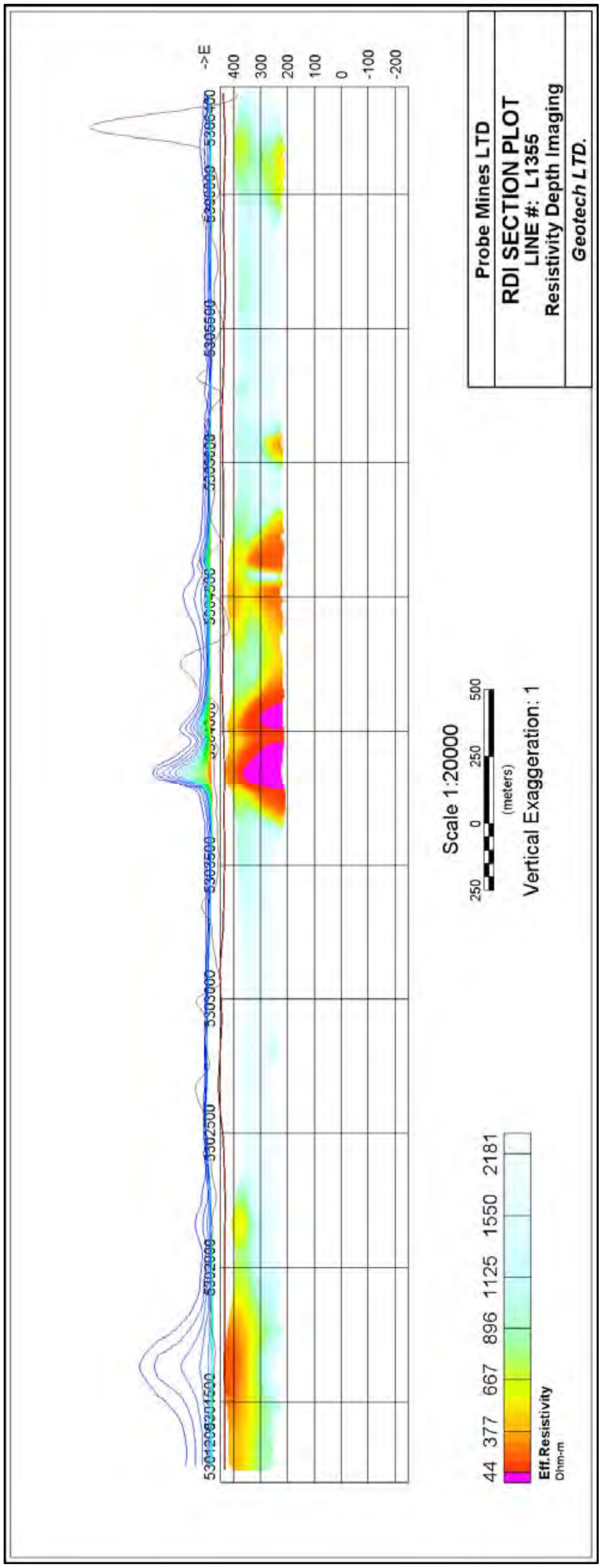
Time Constant dB/dt with CVG contours calculated from TMI (Borden Lake – West)



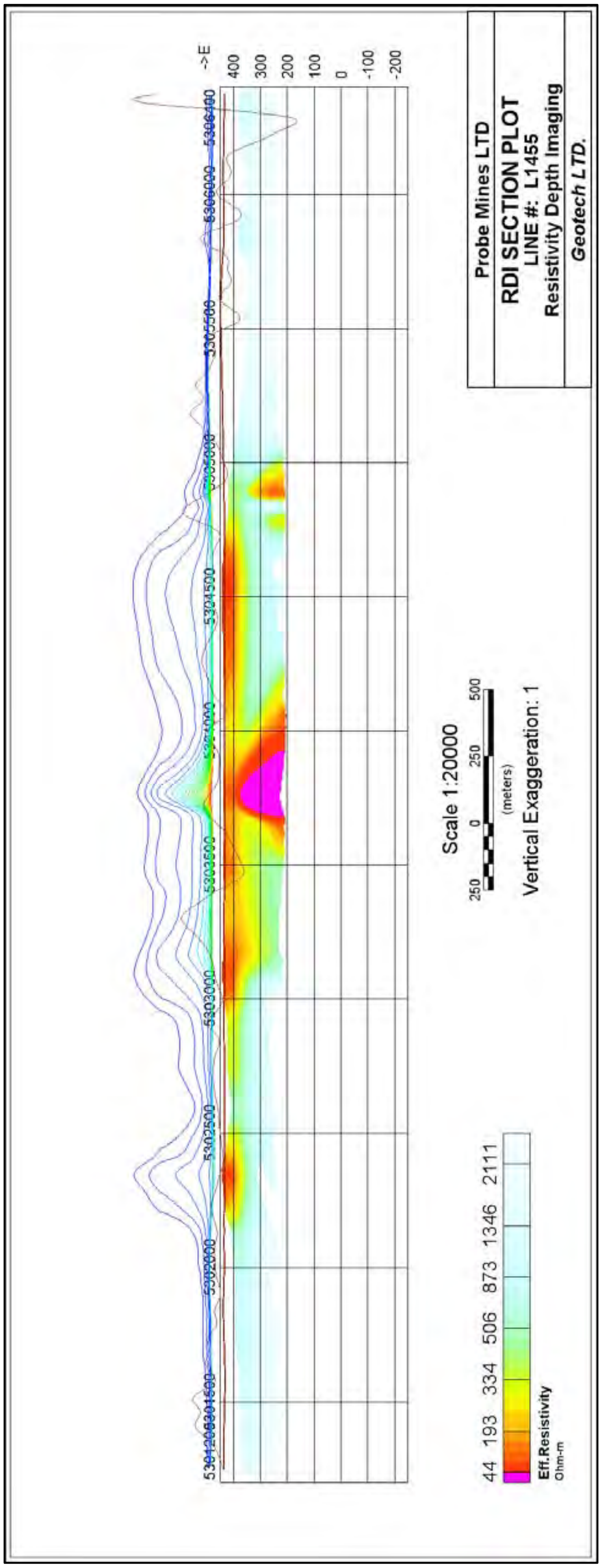
Total Magnetic Intensity (TMI) (Borden Lake – West)



RDI Section – L1265 (Borden Lake)



RDI Section – L1355 (Borden Lake)



RDI Section – L1455 (Borden Lake)

APPENDIX E

GENERALIZED MODELING RESULTS OF THE VTEM SYSTEM

Introduction

The VTEM system is based on a concentric or central loop design, whereby, the receiver is positioned at the centre of a transmitter loop that produces a primary field. The wave form is a bi-polar, modified square wave with a turn-on and turn-off at each end.

During turn-on and turn-off, a time varying field is produced (dB/dt) and an electro-motive force (emf) is created as a finite impulse response. A current ring around the transmitter loop moves outward and downward as time progresses. When conductive rocks and mineralization are encountered, a secondary field is created by mutual induction and measured by the receiver at the centre of the transmitter loop.

Efficient modeling of the results can be carried out on regularly shaped geometries, thus yielding close approximations to the parameters of the measured targets. The following is a description of a series of common models made for the purpose of promoting a general understanding of the measured results.

A set of models has been produced for the Geotech VTEM® system dB/dT Z and X components (see models E1 to E15). The Maxwell ™ modeling program (EMIT Technology Pty. Ltd. Midland, WA, AU) used to generate the following responses assumes a resistive half-space. The reader is encouraged to review these models, so as to get a general understanding of the responses as they apply to survey results. While these models do not begin to cover all possibilities, they give a general perspective on the simple and most commonly encountered anomalies.

As the plate dips and departs from the vertical position, the peaks become asymmetrical.

As the dip increases, the aspect ratio (Min/Max) decreases and this aspect ratio can be used as an empirical guide to dip angles from near 90º to about 30º. The method is not sensitive enough where dips are less than about 30º.

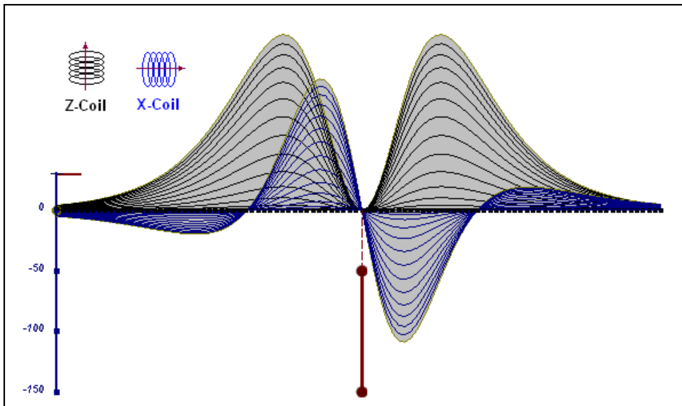


Fig E-1: vertical thin plate

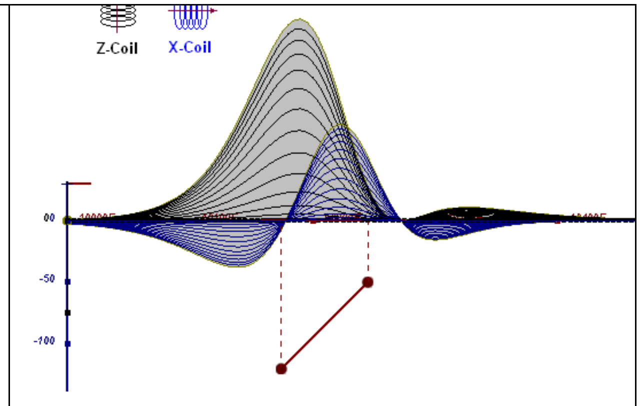


Fig E-2: inclined thin plate

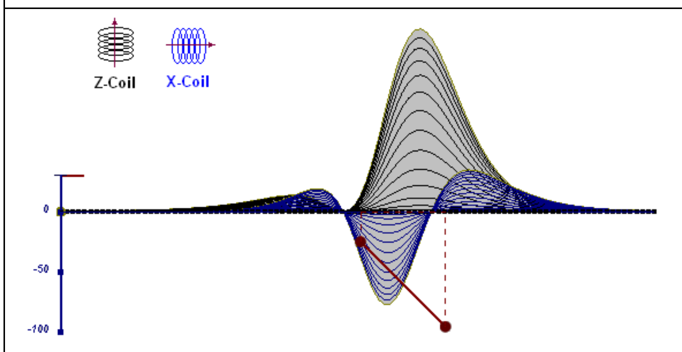


Fig E-3: inclined thin plate

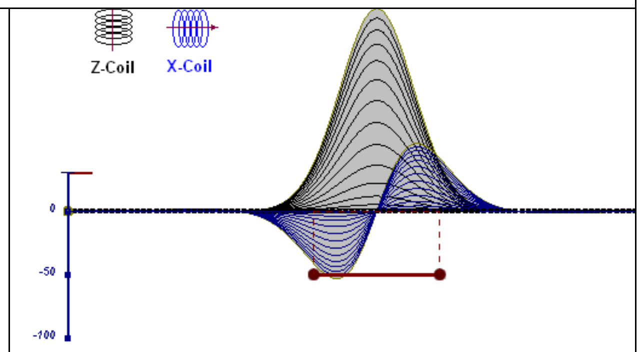


Fig E-4: horizontal thin plate

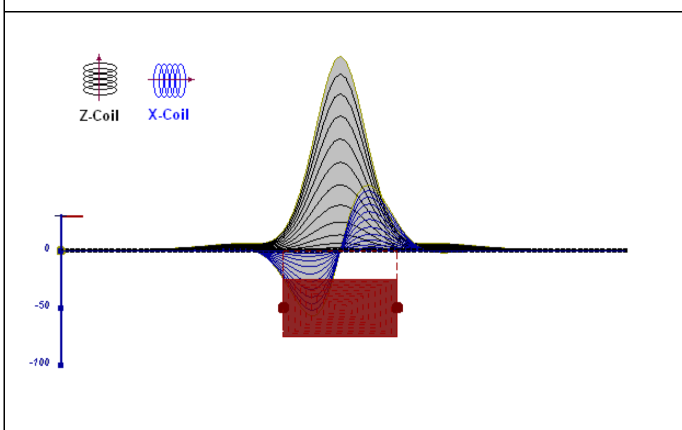


Figure E-5: horizontal thick plate (linear scale of the response)

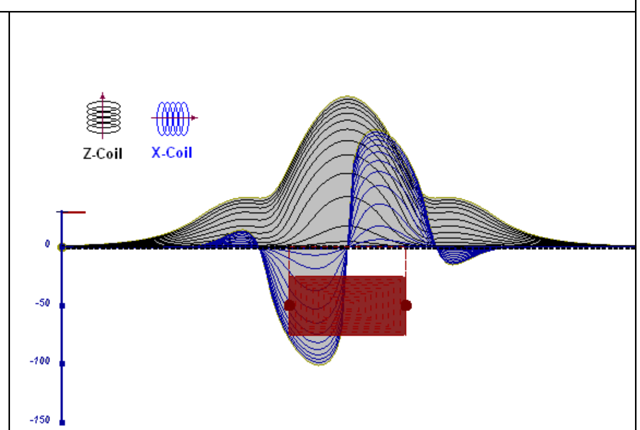


Figure E-6: horizontal thick plate (log scale of the response)

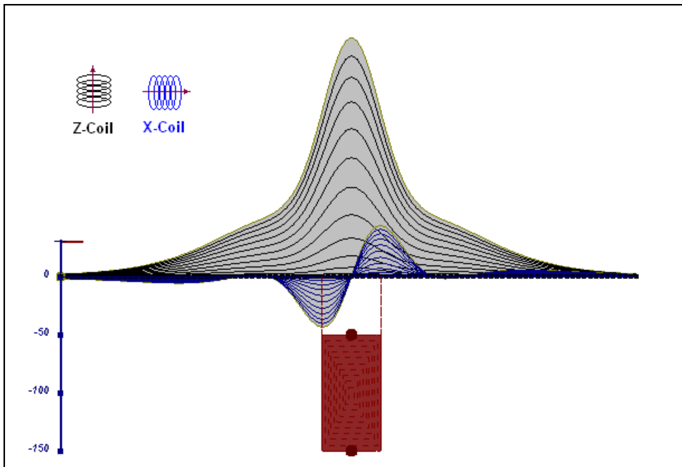


Figure E-7: vertical thick plate (linear scale of the response). 50 m depth

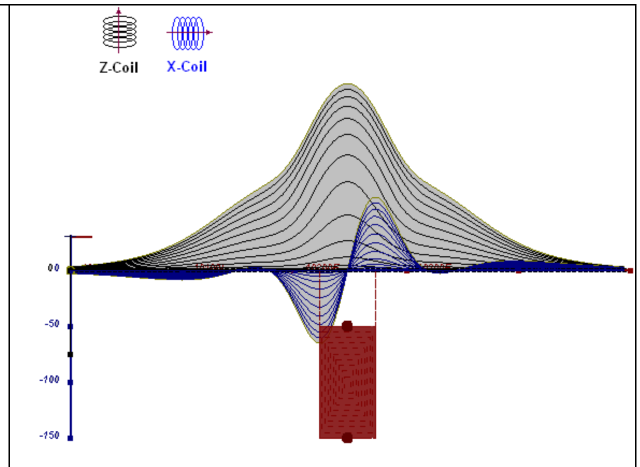


Figure E-8: vertical thick plate (log scale of the response). 50 m depth

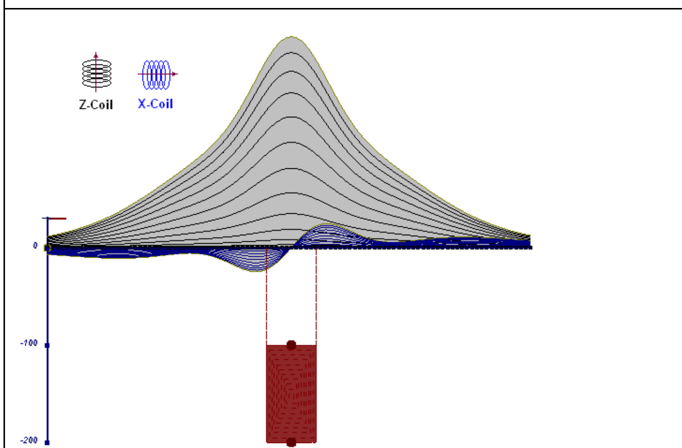


Fig E-9: vertical thick plate (linear scale of the response). 100 m depth

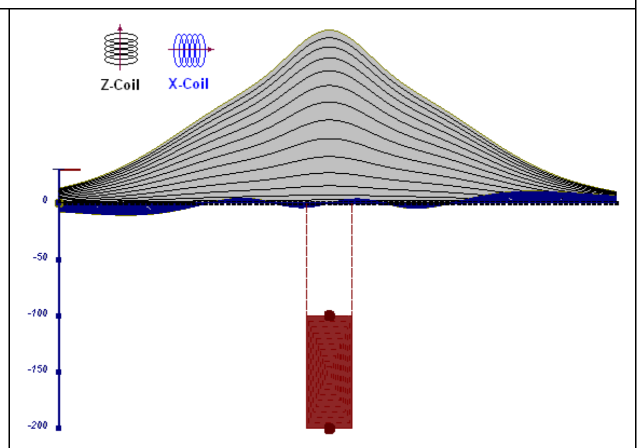


Fig E-10: vertical thick plate (linear scale of the response). Depth/hor.thickness=2.5

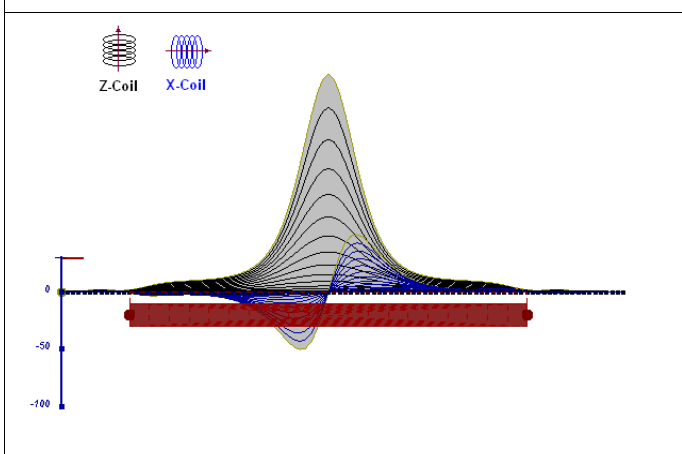


Fig E-10: horizontal thick plate (linear scale of the response)

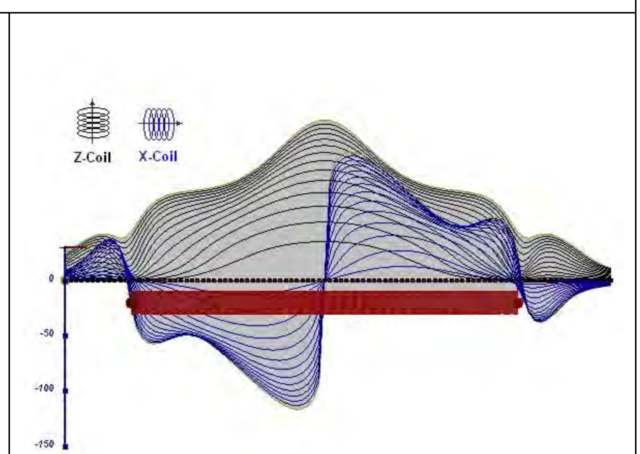


Fig E-11: horizontal thick plate (log scale of the response)

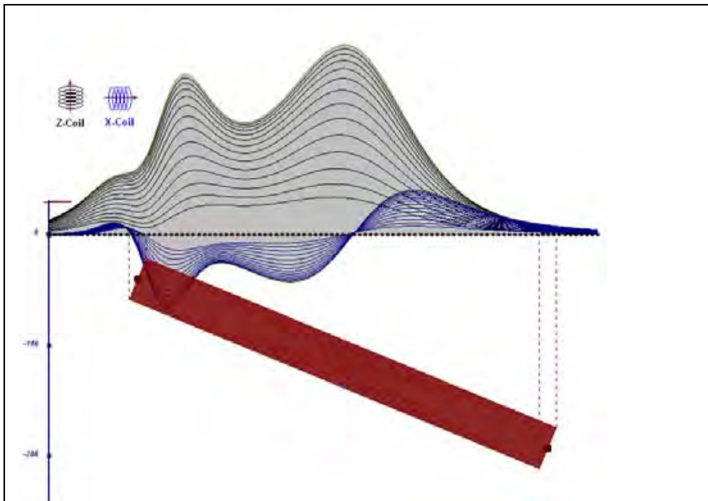


Fig E-12: inclined long thick plate

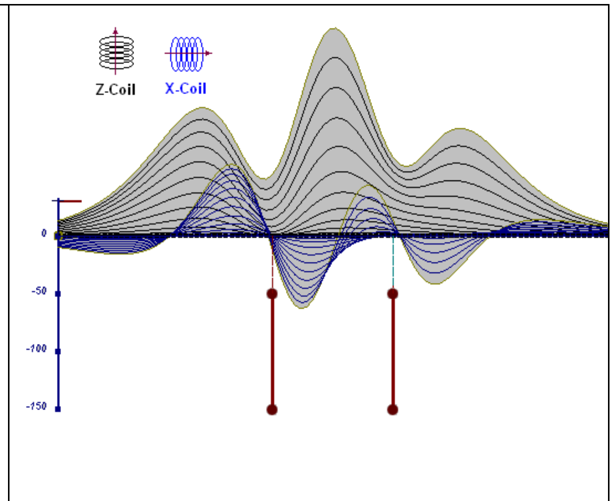


Fig E-13: two vertical thin plates

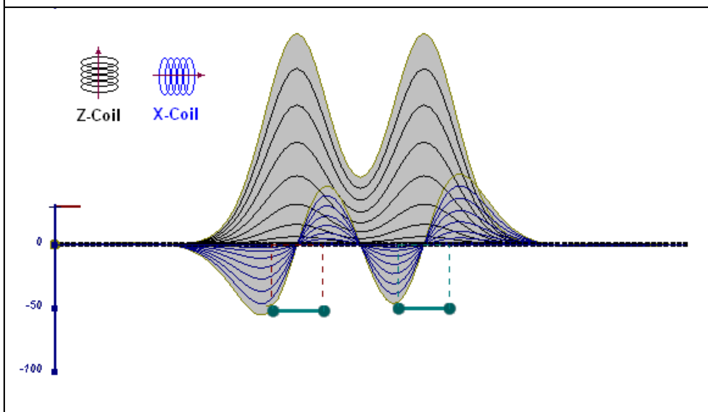


Fig E-14: two horizontal thin plates

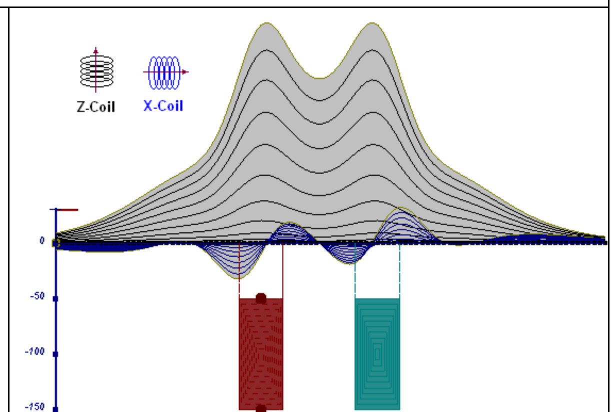


Fig E-15: two vertical thick plates

The same type of target but with different thickness, for example, creates different form of the response:

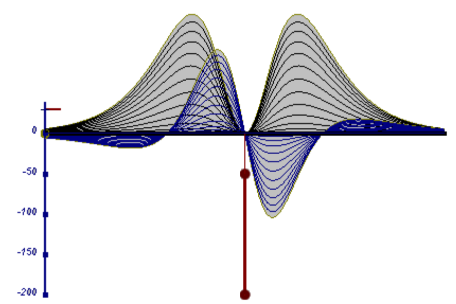
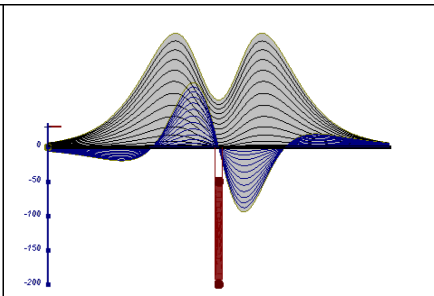
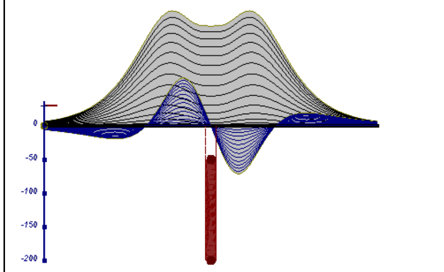
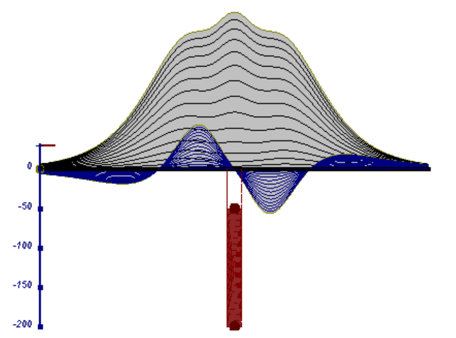
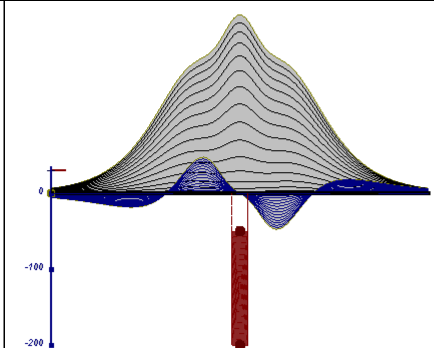
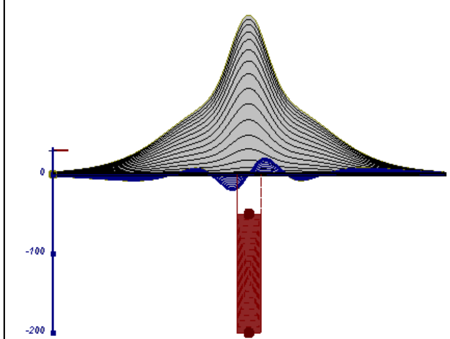
		
“thin”	10 m thickness	15 m thickness
		
18 m thickness	20 m thickness	30 m thickness

Fig.E-16 Conductive vertical plate, depth 50 m, strike length 200 m, depth extend 150 m.

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September 2010

APPENDIX F

EM TIME CONSTANT (TAU) ANALYSIS

Estimation of time constant parameter[1] in transient electromagnetic method is one of the steps toward the extraction of the information about conductances beneath the surface from TEM measurements.

The most reliable method to discriminate or rank conductors from overburden, background or one and other is by calculating the EM field decay time constant (TAU parameter), which directly depends on conductance despite their depth and accordingly amplitude of the response.

Theory

As established in electromagnetic theory, the magnitude of the electro-motive force (emf) induced is proportional to the time rate of change of primary magnetic field at the conductor. This emf causes eddy currents to flow in the conductor with a characteristic transient decay, whose Time Constant (Tau) is a function of the conductance of the survey target or conductivity and geometry (including dimensions) of the target. The decaying currents generate a proportional secondary magnetic field, the time rate of change of which is measured by the receiver coil as induced voltage during the Off time.

The receiver coil output voltage (**e_0**) is proportional to the time rate of change of the secondary magnetic field and has the form,

$$e_0 \ \alpha \ (1 / \tau) \ e^{-(t / \tau)}$$

Where,
τ = L/R is the characteristic time constant of the target (TAU)
R = resistance
L = inductance

From the expression, conductive targets that have small value of resistance and hence large value of τ yield signals with small initial amplitude that decays relatively slowly with progress of time. Conversely, signals from poorly conducting targets that have large resistance value and small τ, have high initial amplitude but decay rapidly with time[1] (Fig. F1).

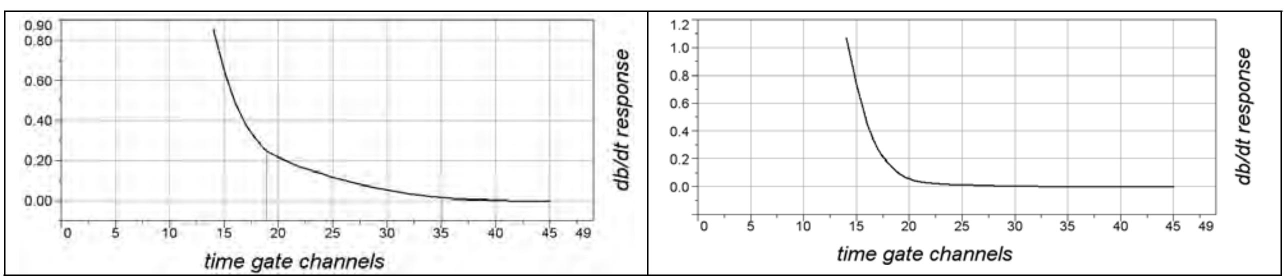

Figure F1 Left – presence of good conductor, right – poor conductor.

[1] McNeill, JD, 1980, "Applications of Transient Electromagnetic Techniques", Technical Note TN-7 page 5, Geonics Limited, Mississauga, Ontario.

EM Time Constant (Tau) Calculation

The EM Time-Constant (TAU) is a general measure of the speed of decay of the electromagnetic response and indicates the presence of eddy currents in conductive sources as well as reflecting the "conductance quality" of a source. Although TAU can be calculated using either the measured dB/dt decay or the calculated B-field decay, dB/dt is commonly preferred due to better stability (S/N) relating to signal noise. Generally, TAU calculated on base of early time response reflects both near surface overburden and poor conductors whereas, in the late ranges of time, deep and more conductive sources, respectively. For example early time TAU distribution in an area that indicates conductive overburden is shown in Figure 2.

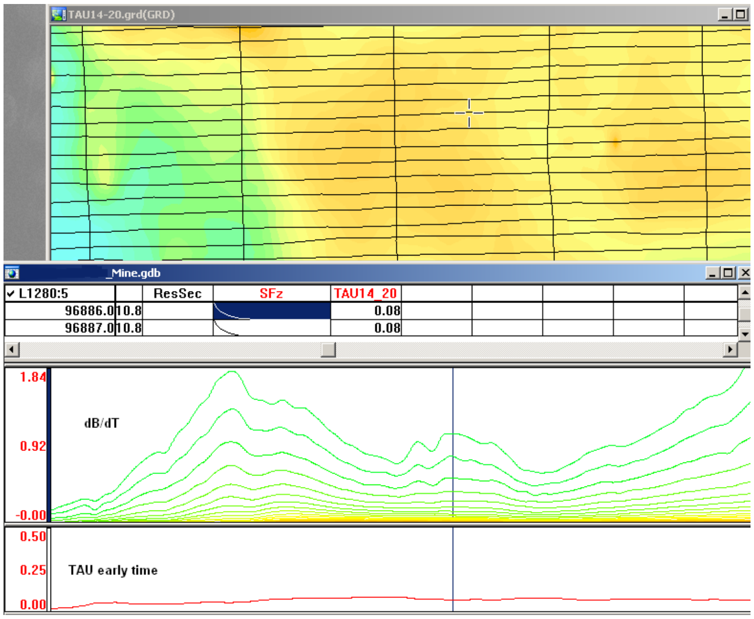

Figure F2 – Map of early time TAU. Area with overburden conductive layer and local sources.

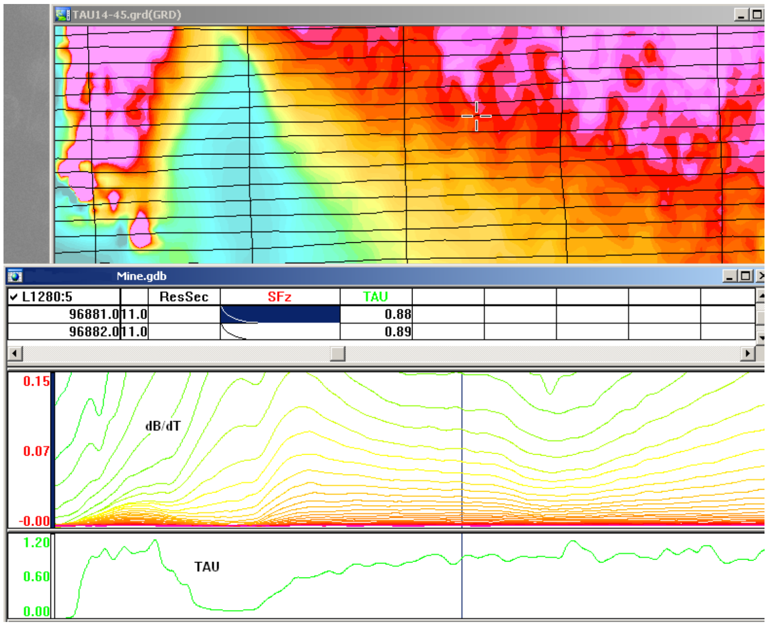

Figure F3 – Map of full time range TAU with EM anomaly due to deep highly conductive target.

There are many advantages of TAU maps:

- TAU depends only on one parameter (conductance) in contrast to response magnitude;
- TAU is integral parameter, which covers time range and all conductive zones and targets are displayed independently of their depth and conductivity on a single map.
- Very good differential resolution in complex conductive places with many sources with different conductivity.
- Signs of the presence of good conductive targets are amplified and emphasized independently of their depth and level of response accordingly.

In the example shown in Figure 4 and 5, three local targets are defined, each of them with a different depth of burial, as indicated on the resistivity depth image (RDI). All are very good conductors but the deeper target (number 2) has a relatively weak dB/dt signal yet also features the strongest total TAU (Figure 4). This example highlights the benefit of TAU analysis in terms of an additional target discrimination tool.

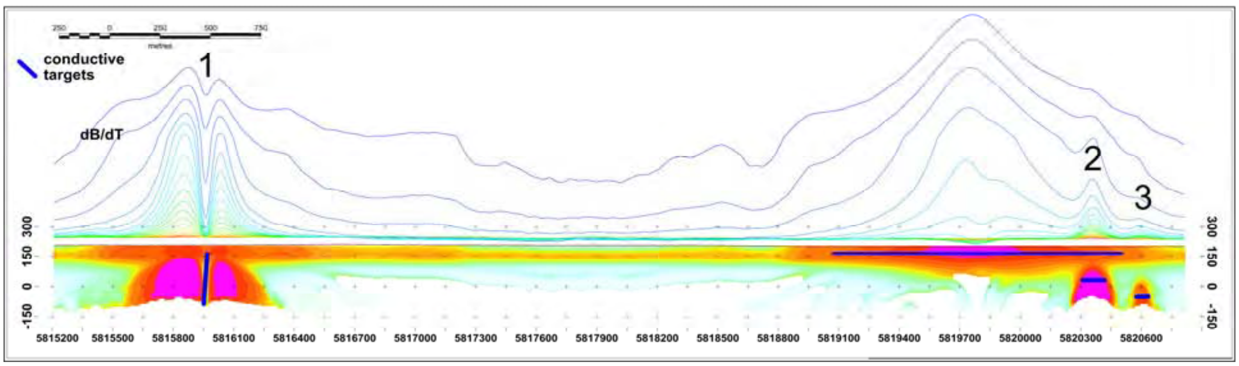

Figure F4 – dB/dt profile and RDI with different depths of targets.

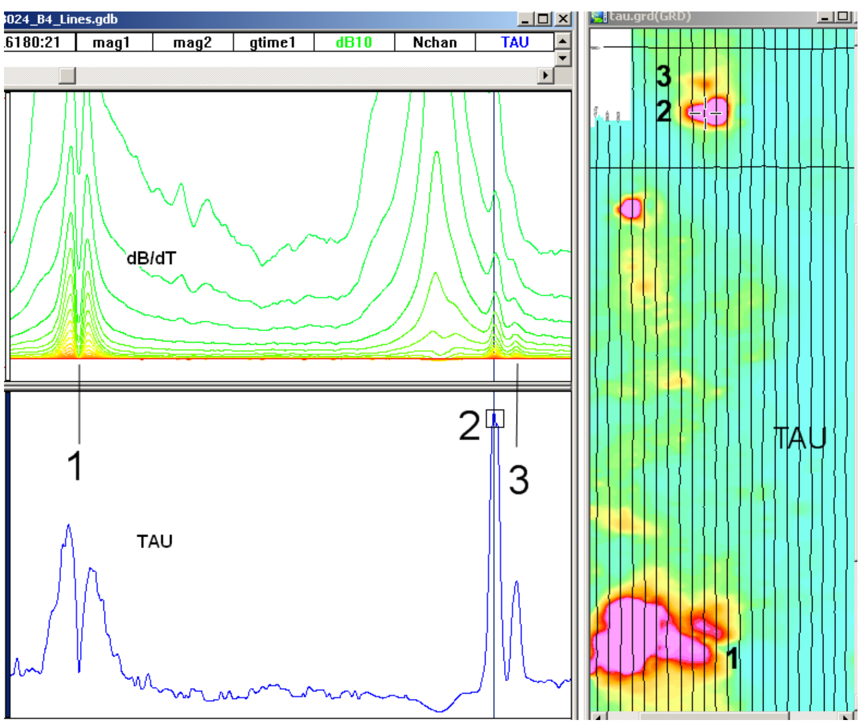

Figure F5 – Map of total TAU and dB/dt profile.

The EM Time Constants for dB/dt and B-field were calculated using the “sliding Tau” in-house program developed at Geotech2. The principle of the calculation is based on using of time window (4 time channels) which is sliding along the curve decay and looking for latest time channels which have a response above the level of noise and decay. The EM decays are obtained from all available decay channels, starting at the latest channel. Time constants are taken from a least square fit of a straight-line (log/linear space) over the last 4 gates above a pre-set signal threshold level (Figure F6). Threshold settings are pointed in the “label” property of TAU database channels. The sliding Tau method determines that, as the amplitudes increase, the time-constant is taken at progressively later times in the EM decay. Conversely, as the amplitudes decrease, Tau is taken at progressively earlier times in the decay. If the maximum signal amplitude falls below the threshold, or becomes negative for any of the 4 time gates, then Tau is not calculated and is assigned a value of “dummy” by default.

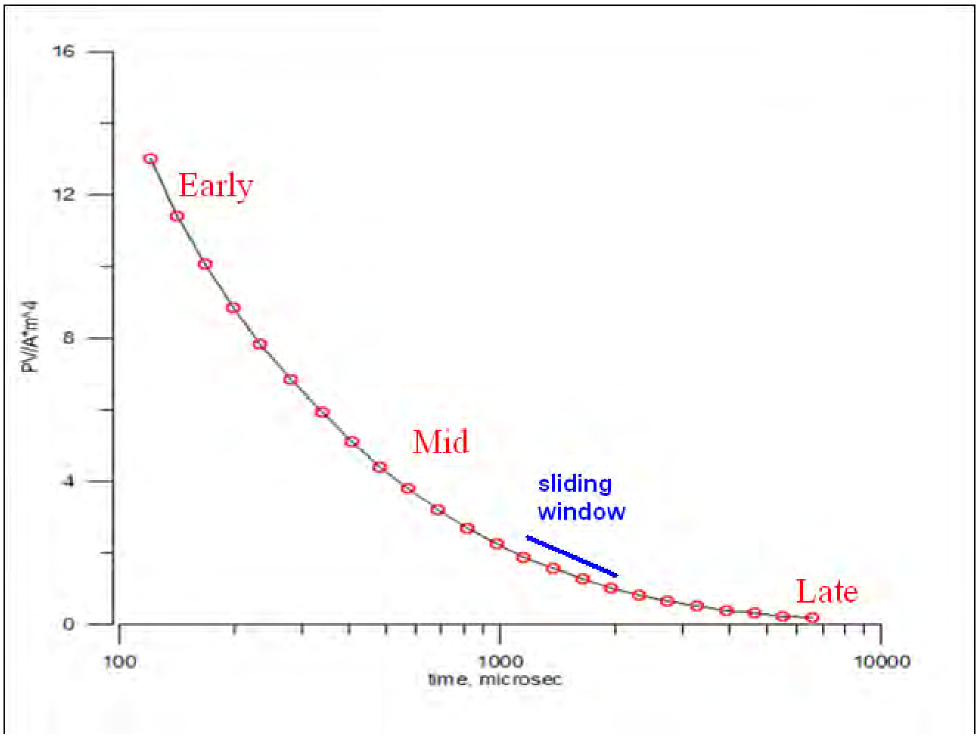

Figure F6 - Typical dB/dt decays of Vtem data

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September 2010

[2] by A.Prikhodko

APPENDIX G

TEM Resistivity Depth Imaging (RDI)

Resistivity depth imaging (RDI) is technique used to rapidly convert EM profile decay data into an equivalent resistivity versus depth cross-section, by deconvolving the system or measured waveforms from the EM data. There are many different schemes to get conductivity/resistivity depth sections from time-domain data. The used RDI algorithm of Resistivity-Depth transformation is based on scheme of on the apparent resistivity transform of Maxwell A.Meju (1998)[1] and TEM response from conductive half-space adopted for time-domain data and system configuration. The program is in-house developed at Geotech for VTEM data[2].

The VTEM Resistivity Depth Sections have checked and proven on several real known targets, results of drilling and synthetic models (Fig. 1-12). Adding individual responses across the profile produces a pseudo 2-dimensional cross-section, called a RDI. RDIs provide reasonable indications of conductor relative depth and vertical extent, as well as accurate 1D layered-earth apparent conductivity/resistivity structure across a VTEM flight line.

Approximate depth of investigation of a TEM system, image of secondary field distribution in half space, effective resistivity, initial geometry and position of conductive targets is the information obtained on base of the RDIs.

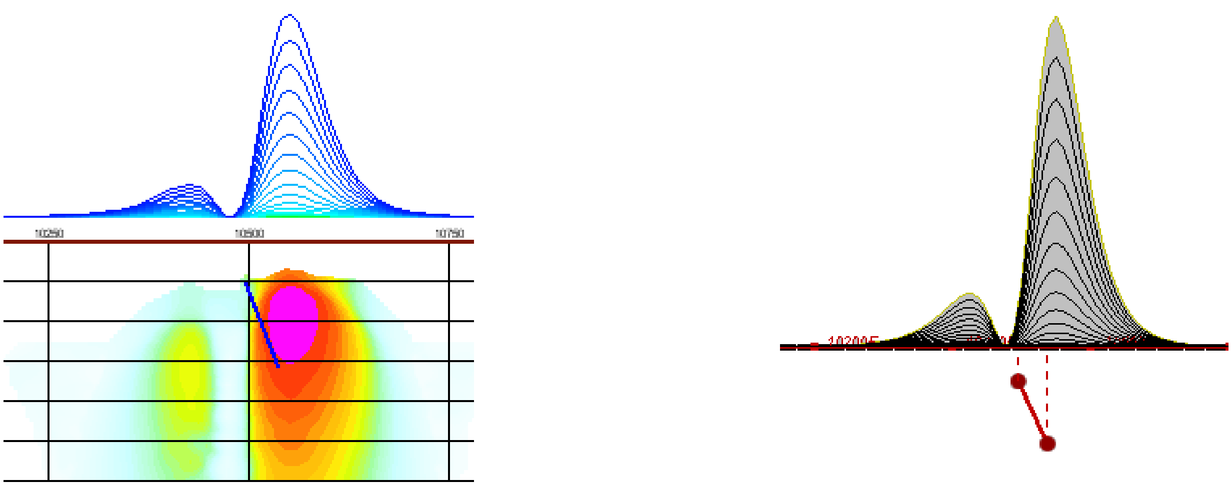


Fig. 1 Maxwell plate model and RDI from the calculated response for conductive “thin” plate (depth 50 m, dip 65 degree, depth extend 100 m).

[1] Maxwell A.Meju, 1998, Short Note: A simple method of transient electromagnetic data analysis, Geophysics, **63**, 405–410.
[2] by A.Prikhodko

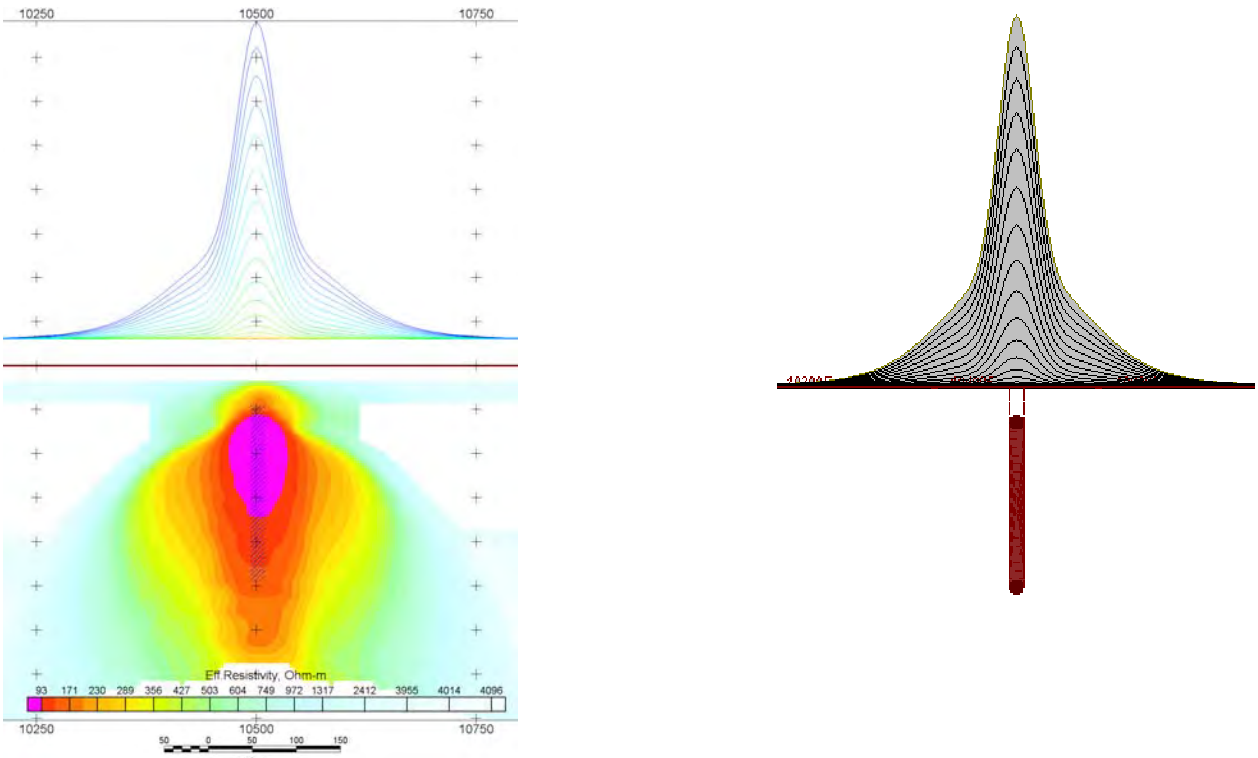


Fig. 2 Maxwell plate model and RDI from the calculated response for “thick” plate 18 m thickness, depth 50 m, depth extend 200 m).

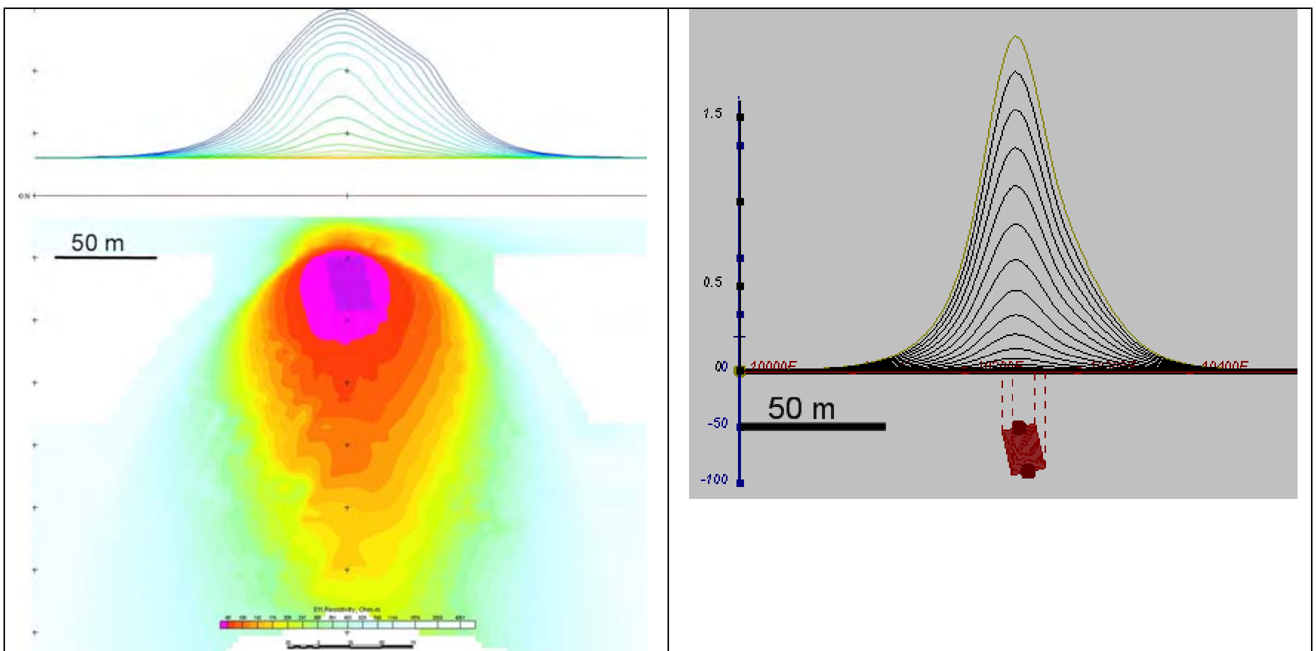


Fig.3 Maxwell plate model and RDI from the calculated response for bulk (“thick”) 100 m length, 40 m depth extend, 30 m thickness

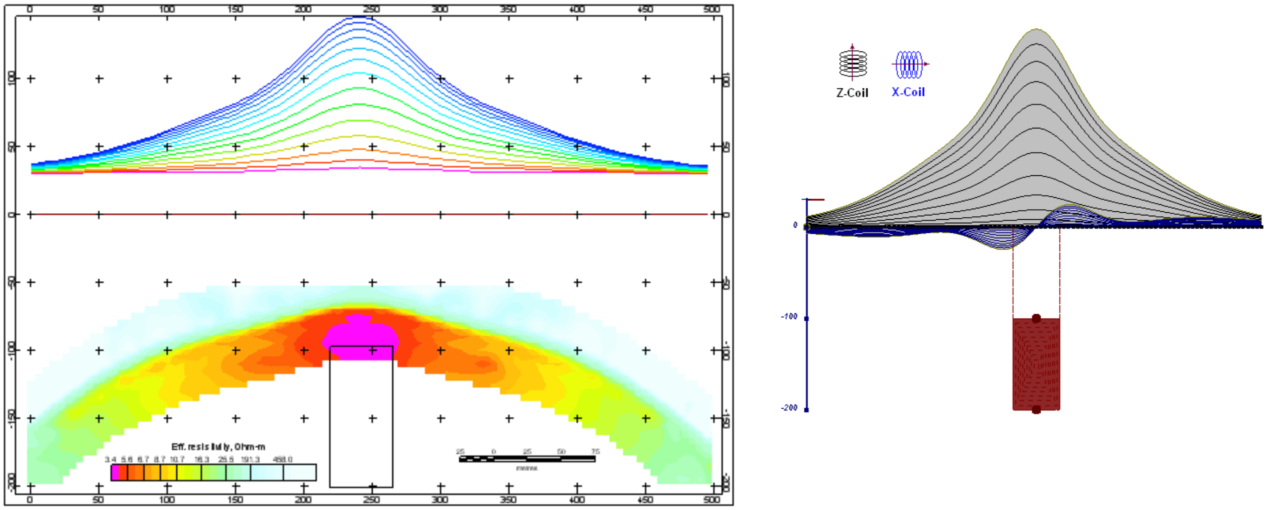


Fig. 4 Maxwell plate model and RDI from the calculated response for "thick" vertical target (depth 100 m, depth extend 100 m). 19-44 chan.

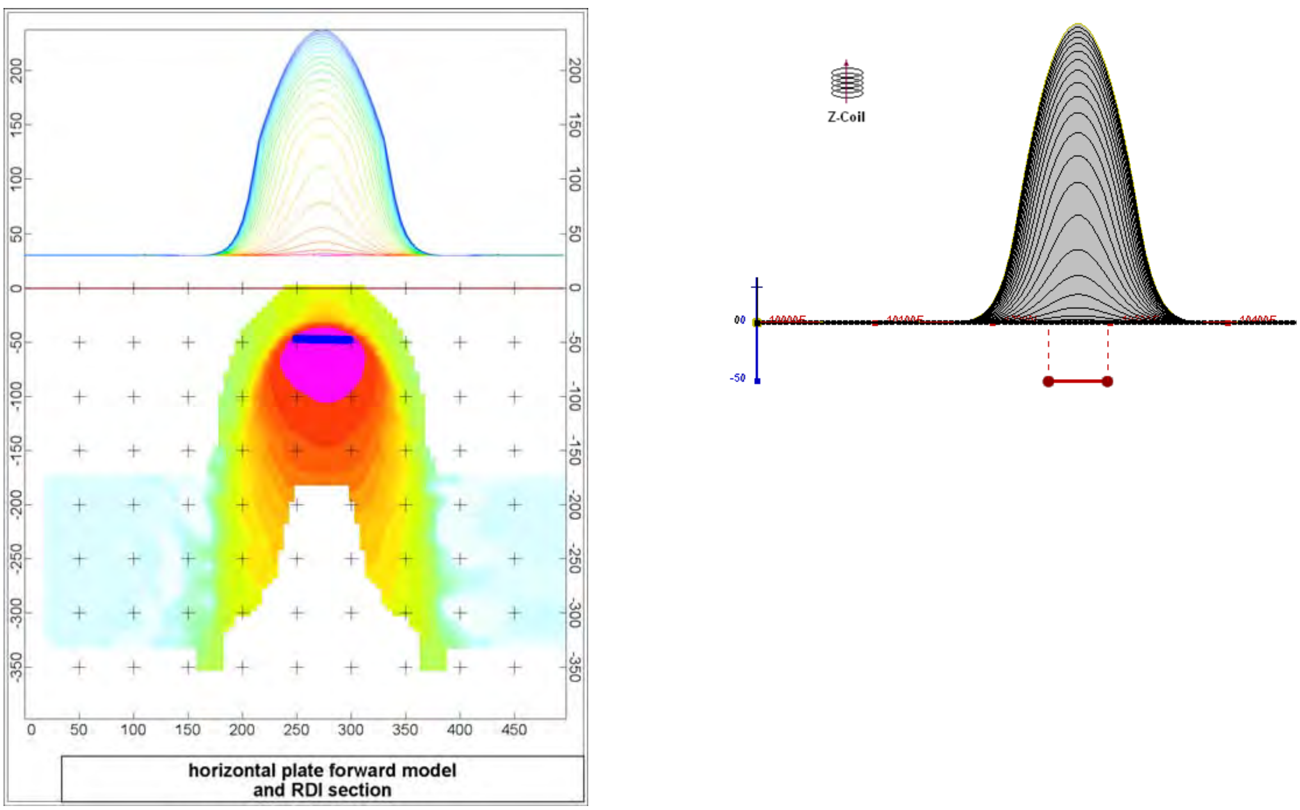


Fig. 5 Maxwell plate model and RDI from the calculated response for horizontal thin plate (depth 50 m, dim 50x100 m). 15-44 chan.

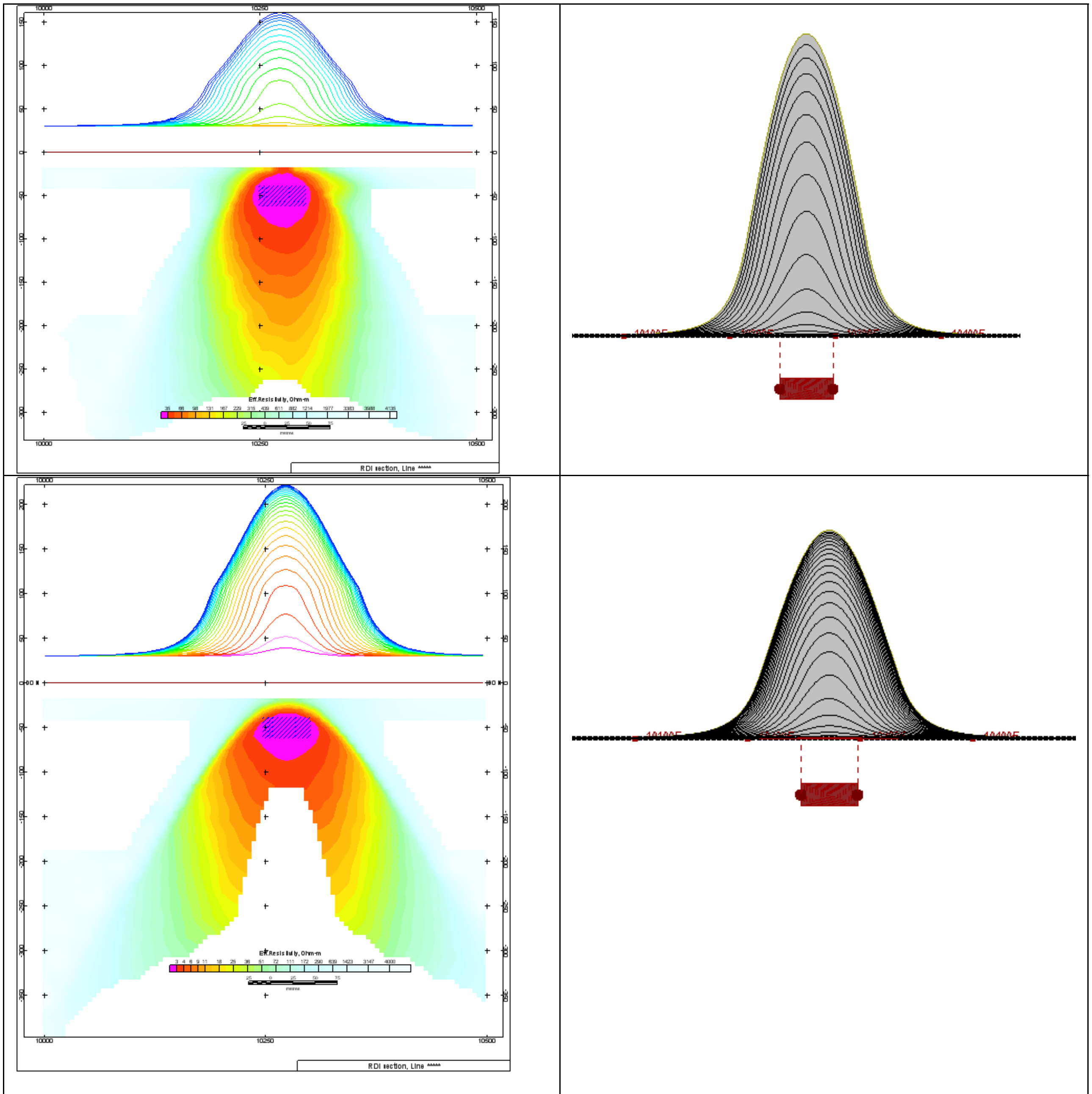


Fig.6 Maxwell plate model and RDI from the calculated response for horizontal thick (20m) plate – less conductive (on the top), more conductive (below)

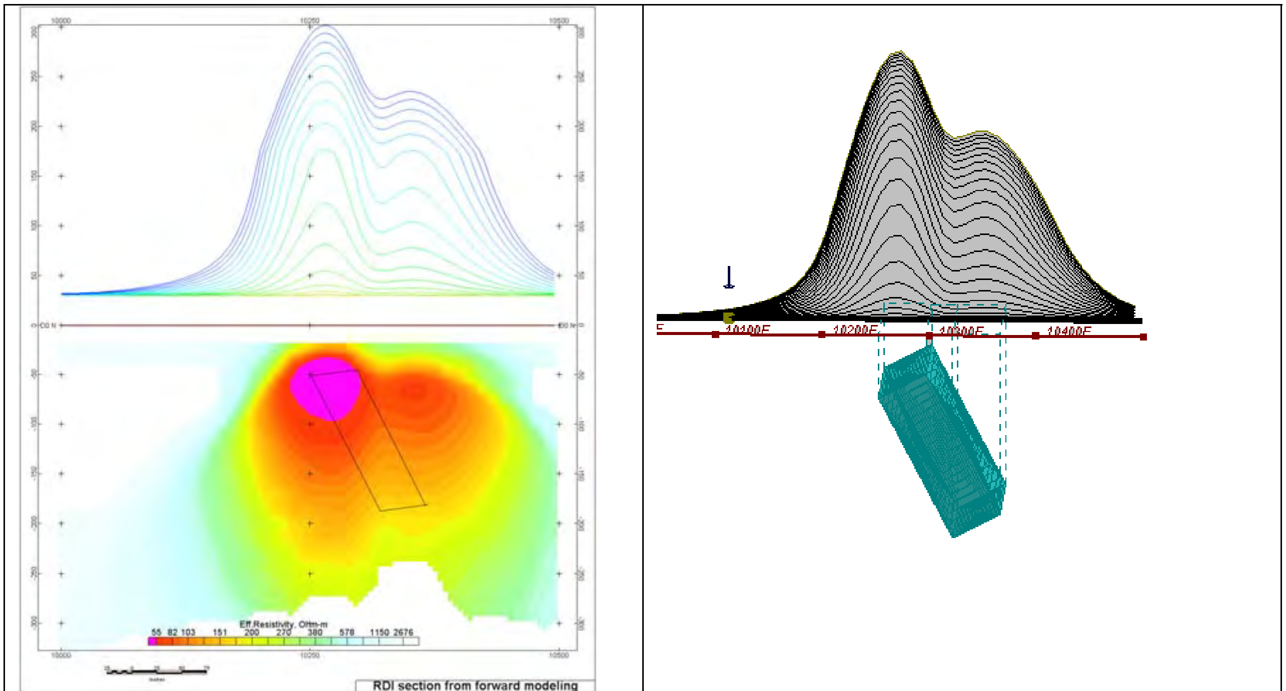


Fig.7 Maxwell plate model and RDI from the calculated response for inclined thick (50m) plate. Depth extend 150 m, depth to the target 50 m.

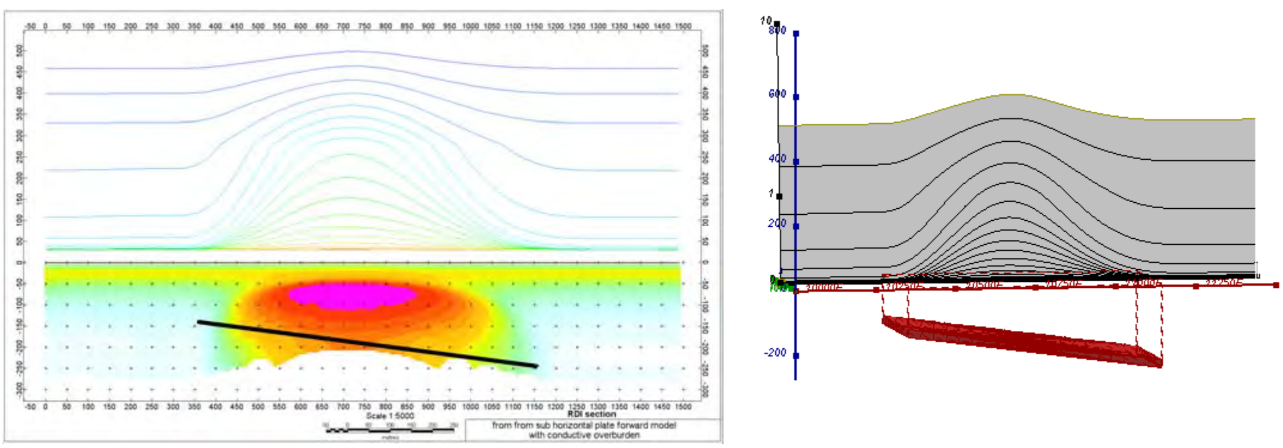


Fig.8 Maxwell plate model and RDI from the calculated response for the long, wide and deep subhorizontal plate (depth 140 m, dim 25x500x800 m) with conductive overburden.

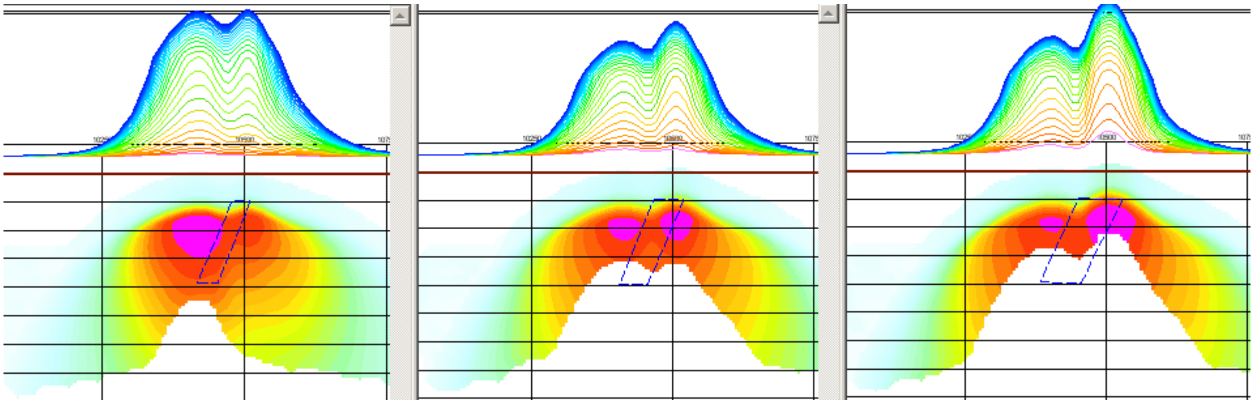


Fig.9 Maxwell plate models and RDIs from the calculated response for “thick” dipping plates (35, 50, 75 m thickness), depth 50 m, conductivity 2.5 S/m.

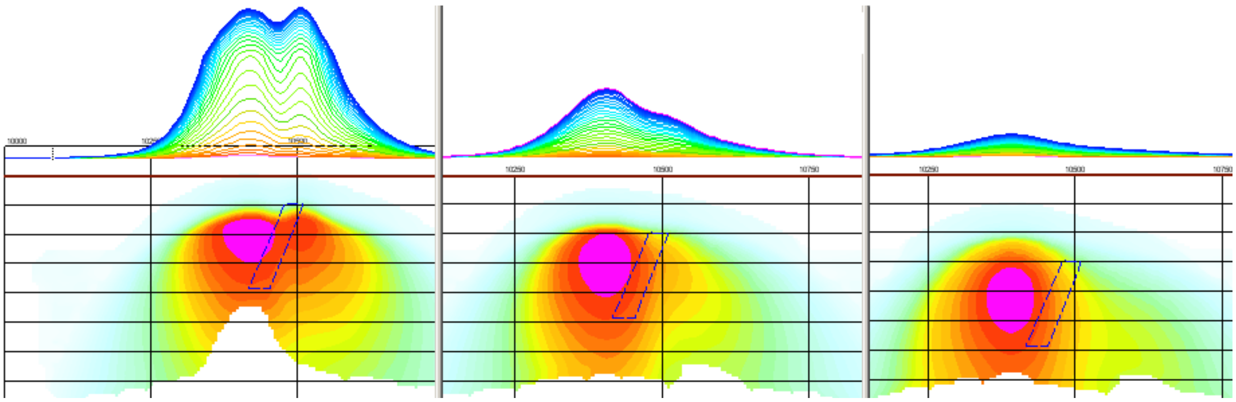


Fig.10 Maxwell plate models and RDIs from the calculated response for “thick” (35 m thickness) dipping plate on different depth (50, 100, 150 m),, conductivity 2.5 S/m.

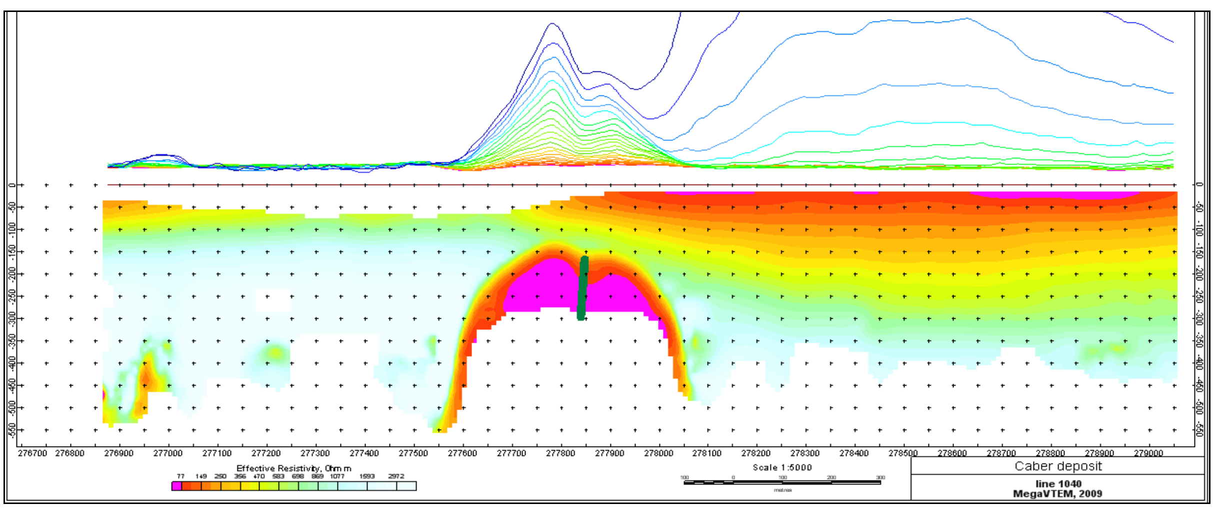


Fig. 11 RDI section of the line over Caber deposit (“thin” subvertical plate target and conductive overburden.

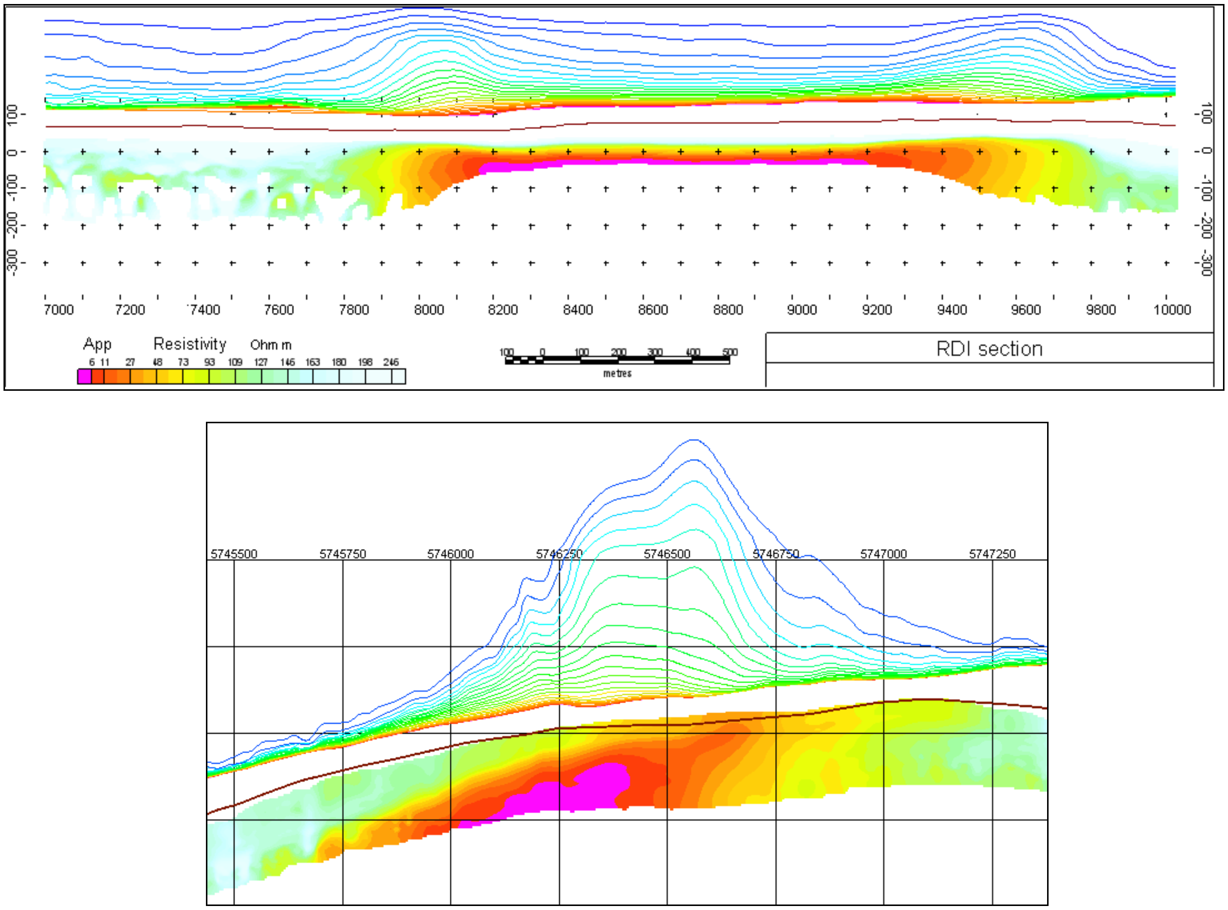
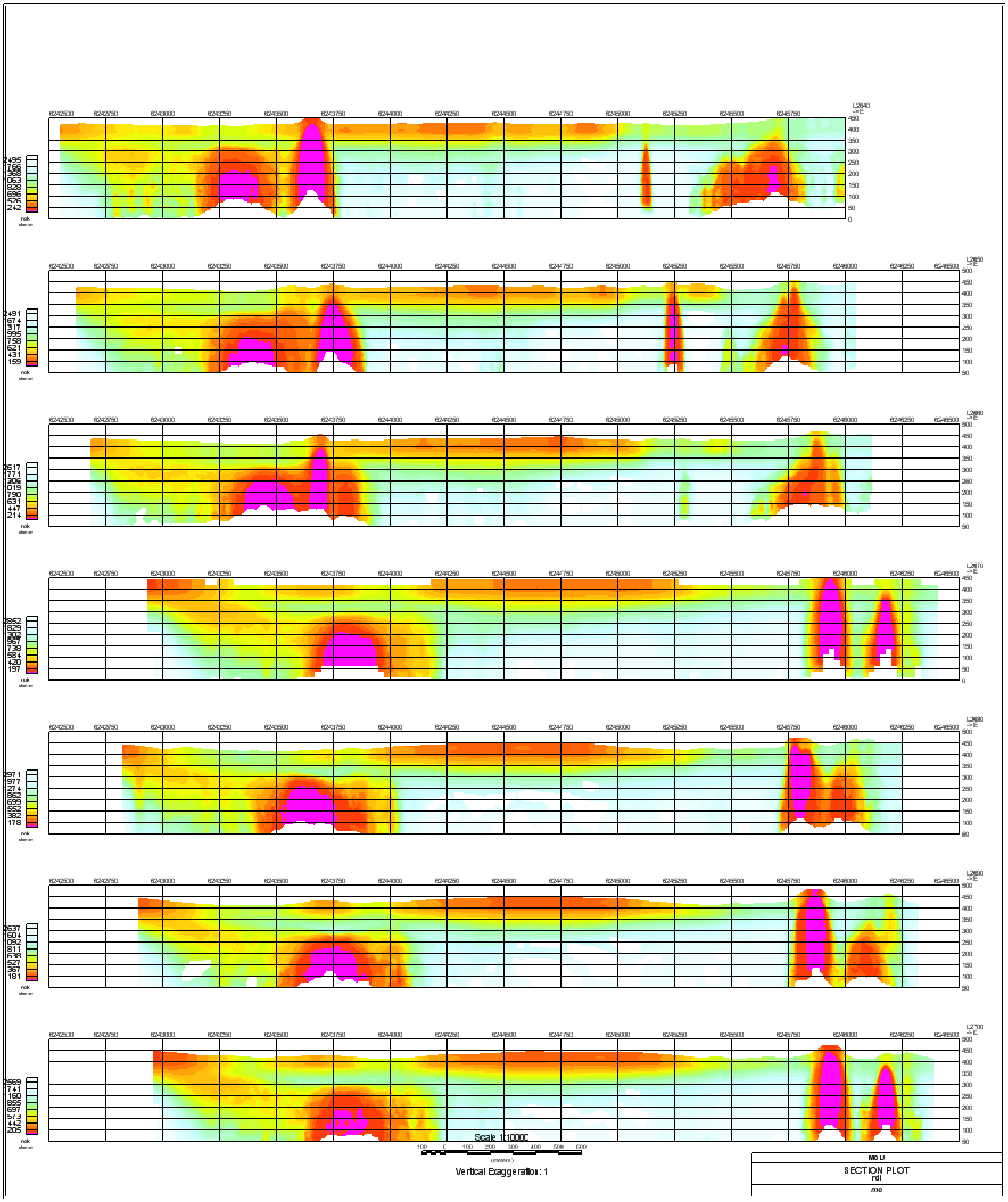
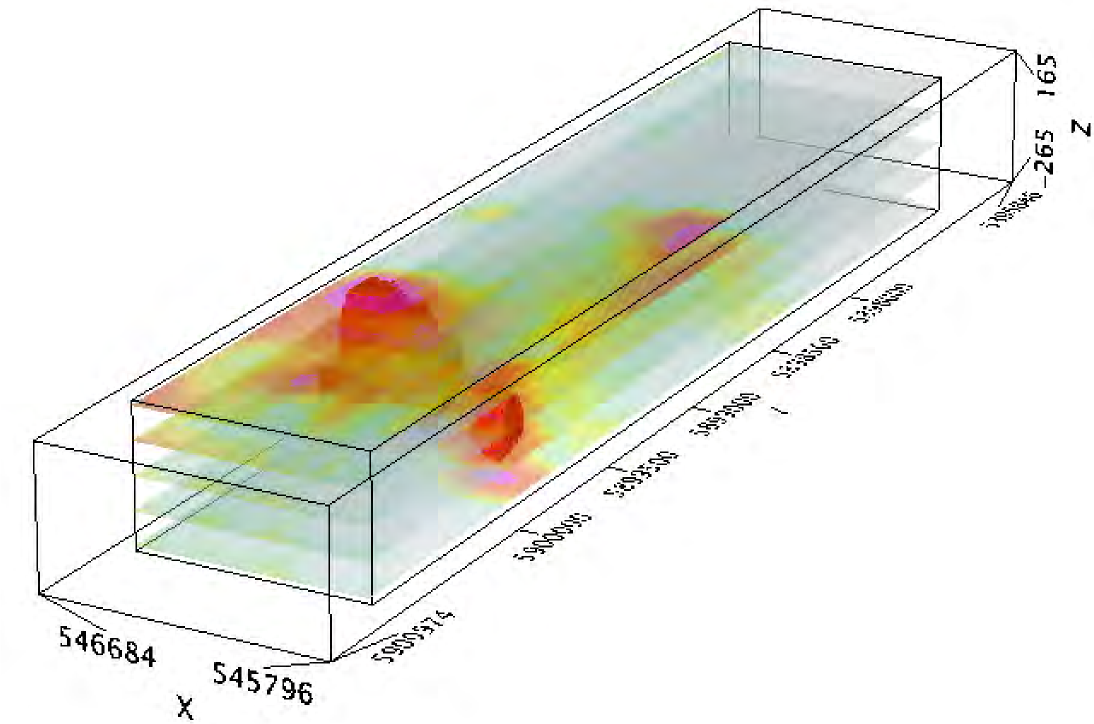


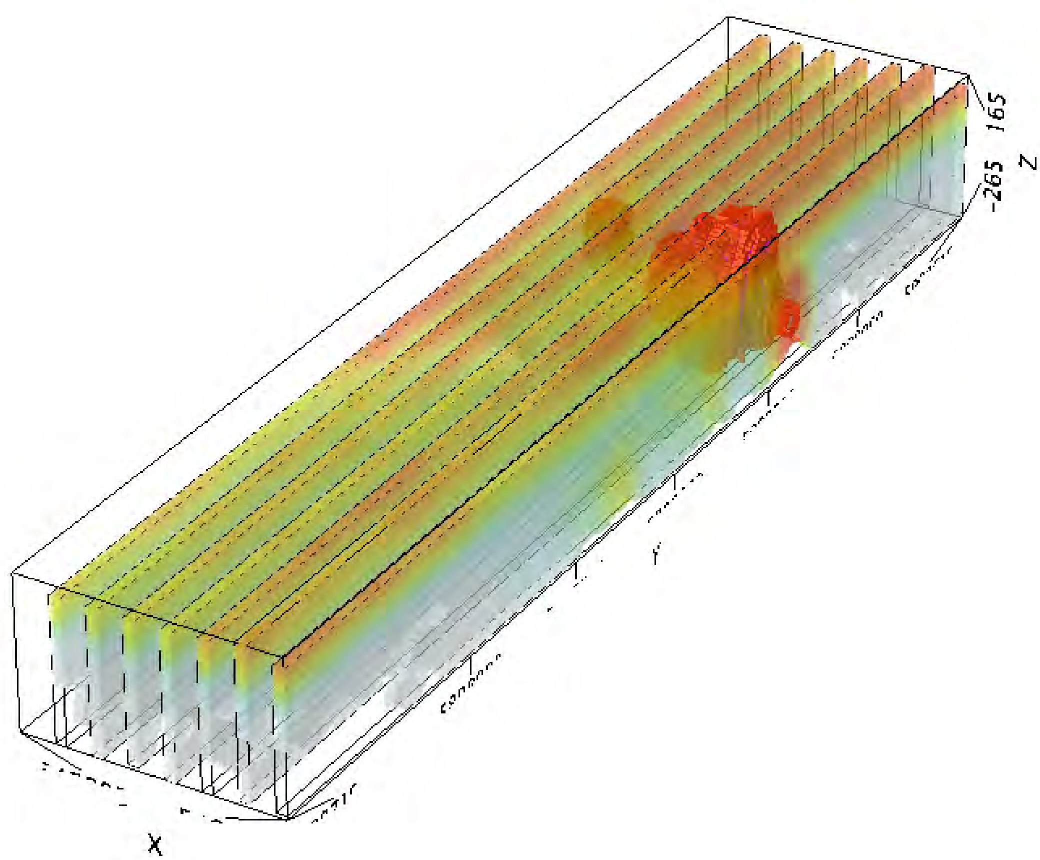
Fig.12 RDI section for the real horizontal and slightly dipping conductive layers

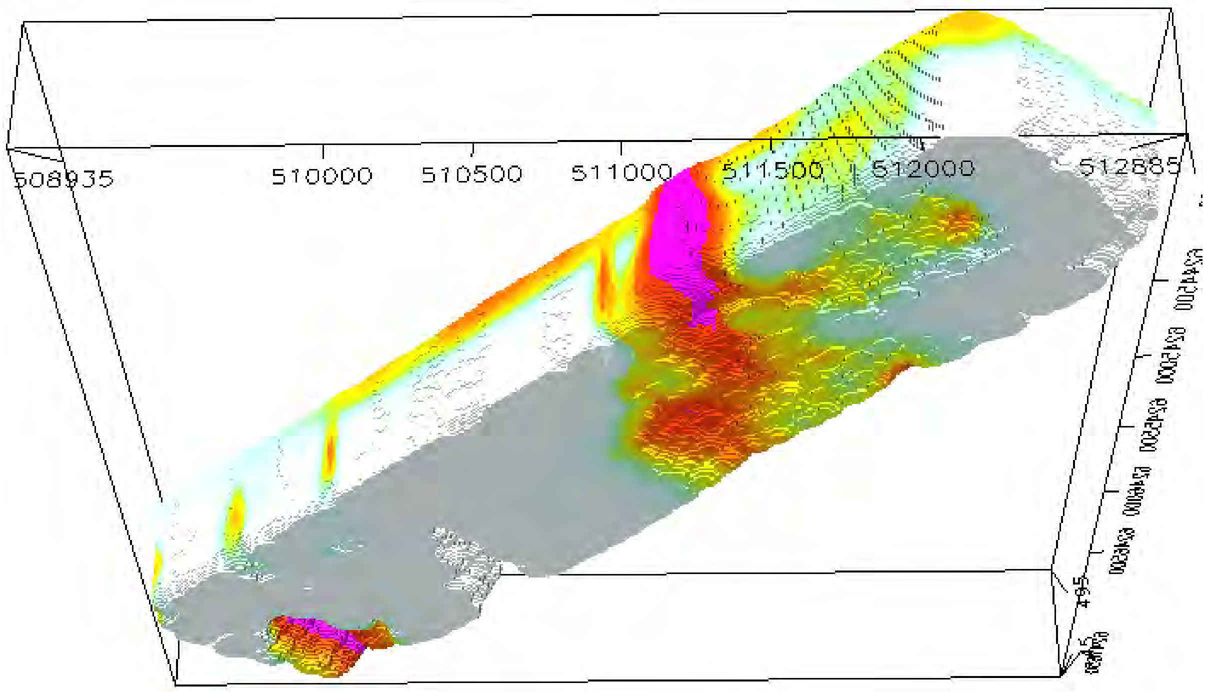
Presentation of series of lines

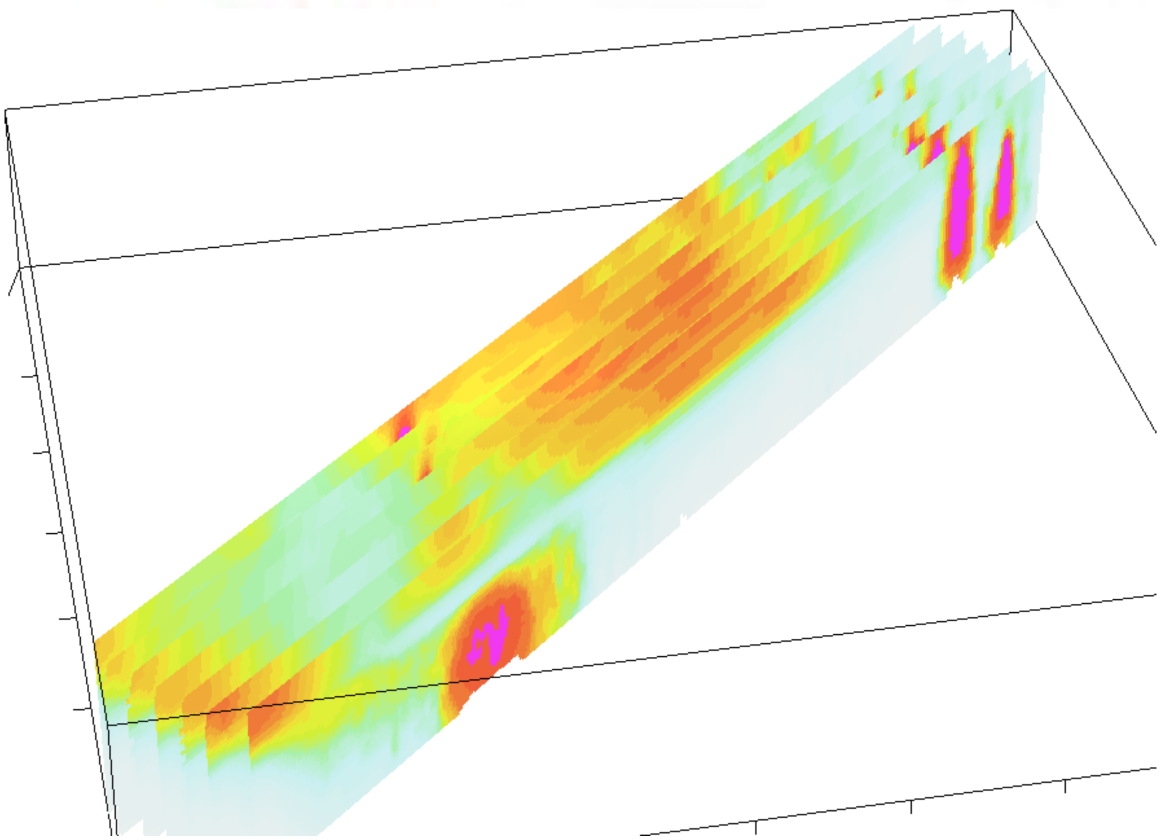


3d presentation of RDIs









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September 2010