2014 HELICOPTER-BORNE VTEM

GEOPHYSICAL SURVEY

ASSESSMENT REPORT

on the

FYRE LAKE PROPERTY

Owned by Pacific Ridge Exploration Ltd.

Grant No.	Name	No.		Grant No.	Name	No.
YA56602-605	KONA	43-46		YB33826	FIRE	79
YB33749	FIRE	2		YB33828	FIRE	81
YB33751	FIRE	4		YB33878-880	FIRE	131-133
YB33753	FIRE	6		YB86834	FIRE	195
YB33759	FIRE	12		YB88869-906	EMBER	62-99
YB33761	FIRE	14		YB93671-713	STRAW	1-43
YB33766-768	FIRE	19-21		YB94275-280	FIRE	301-306
YB33770	FIRE	23		YB94281-297	FIRE	312-328
YB33773	FIRE	26		YC22651-655	FIRE	307-311
YB33775-776	FIRE	28-29		YC31894	FIRE	185
YB33778	FIRE	31		YC31895	FIRE	193
YB33795-807	FIRE	48-60		YC91767-775	SPARK	1-9
YB33820-824	FIRE	73-77				

Claim Sheets No 105G/01, 105G/02, 105G/07 and 105G/08
Latitude 61° 14’ N, Longitude 131° 30’ W
Watson Lake Mining District, Yukon

For Work Performed between October 5th to October 12th, 2014
by Geotech Ltd.

by

Gerald G. Carlson, Ph.D., P.Eng.

August 10, 2016

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SUMMARY

The Fyre Lake property, in the Finlayson Lake District in central Yukon, hosts a Cu-Au-Co(+/-Zn-Ag) VMS deposit. The Property has a long exploration history beginning with the first discovery of mineralization by prospectors with Cassiar Asbestos Corporation in 1960 and culminating with the completion of 23,667 m of drilling in 116 holes in 1996-97 by Pacific Ridge. From this work, a NI 43-101 compliant mineral resource estimate for the Kona Deposit was completed by Minorex Consulting Ltd. (Blanchflower, 2006) who estimated an indicated mineral resource of 3.571 million tonnes grading 1.57% copper, 0.10% cobalt and 0.61 grams per tonne (gpt) gold at a 1 percent copper cut-off grade and an inferred mineral resource, at the same cut-off grade, of 5.361 million tonnes grading 1.48% copper, 0.08% cobalt and 0.53 gpt gold. No further physical exploration work has been carried out on the Property since that time.

In July, 2014, Pacific Ridge optioned the Property to MinQuest Limited (formerly Merah Resources) and in October, 2014, MinQuest contracted Geotech Ltd. to fly an 809.5 line km Versatile Time Domain Electromagnetic (VTEM) survey over the Property, the subject of this report. The work was carried out under the direct supervision of Chris Doornbos of MinQuest. The survey successfully identified the known Kona Zone mineralization and also identified other potential mineralized zones. In July, 2016, MinQuest terminated the option and the Property was returned to Pacific Ridge.

INTRODUCTION

The Fyre Lake volcanogenic massive sulphide ("VMS") copper-gold-cobalt property (the "Property") is situated immediately east of Fire Lake in the Watson Lake Mining District of southeastern Yukon Territory, Canada. It includes 161 Yukon Quartz mineral claims covering approximately 3,200 ha. The Property lies within the Finlayson District of the Yukon Tanana Terrain, southeast of Ross River, an area well-known for an abundance of VMS-style mineral deposits and prospects. The BMC Minerals' ("BMC") Kudz Ze Kayah property is located 30 km north of the Property and Yukon Zinc's Wolverine Mine is 30 km to the northeast.

In September, 1960 prospectors of Cassiar Asbestos Corp. discovered a large boulder of massive sulphide mineralization on a glacial esker near the south end of Fire Lake, followed by the discovery of in-situ massive pyrite mineralization in Kona Creek. Numerous companies explored the Property over the years, but it wasn't until 1996 and 1997 that Columbia Gold Mines Ltd. ("Columbia Gold"), now Pacific Ridge Exploration Ltd. ("Pacific Ridge") completed a large drill campaign that resulted in the definition of a 43-101 compliant resource for the Kona Zone. Preliminary metallurgical testing was also carried out. In 2013, Pacific Ridge utilized satellite imagery to prepare contour maps and a 1:10,000 scale orthophoto image of the Property.

In July, 2014, Pacific Ridge optioned the Property to MinQuest Limited ("MinQuest", formerly Merah Resources) and in October, 2014, MinQuest contracted Geotech Ltd. ("Geotech) to fly an 809.5 line km Versatile Time Domain Electromagnetic ("VTEM") survey over the Property, the subject of this report. The survey successfully identified the known Kona Zone mineralization and also identified other potential mineralized zones. In July, 2016, MinQuest terminated the option and the Property was returned to Pacific Ridge.

This report is presented in satisfaction of a filing for a Certificate of Work on January 7, 2015. It describes the Property, including its exploration history, geological setting and mineralization. It also presents the results of the Geotech VTEM survey, which was completed at a cost of $135,000.

LOCATION, ACCESS AND PHYSIOGRAPHY

The Property is located immediately east of Fire Lake within the North River drainage, approximately 160 km northwest of Watson Lake, 140 km southeast of Ross River and 250 km east of Whitehorse, in the Finlayson Lake district of southeastern Yukon, Canada (Figure 1). It is centred at latitude 61^{o} 14' N and longitude 131^{o} 30' W (N.T.S. 105 G/01, 02, 07 and 08) in the Watson Lake Mining District.

The property is readily accessible year-round by fixed wing aircraft or helicopter. Fire Lake is 8 km long with excellent approaches that can be utilized by a variety of float- or ski-mounted fixed wing aircraft throughout the year. Charter fixed wing aircraft are available in Watson Lake and Whitehorse. Helicopters are available for charter in Ross River, Watson Lake and Whitehorse.

The property is situated within the Yukon Plateau physiographic region in the Simpson Range of the eastern Pelly Mountains, approximately five km northeast of the Tintina Trench. The Fire Lake area has linear open valleys and high rolling to craggy ridges and mountains. Topographic relief is moderate to locally high with elevations ranging from 1,100 m at Fire Lake to 1,900 m along the eastern ridge crests. A 2,351 m high peak situated six kilometres north of the property is the highest mountain in the area.

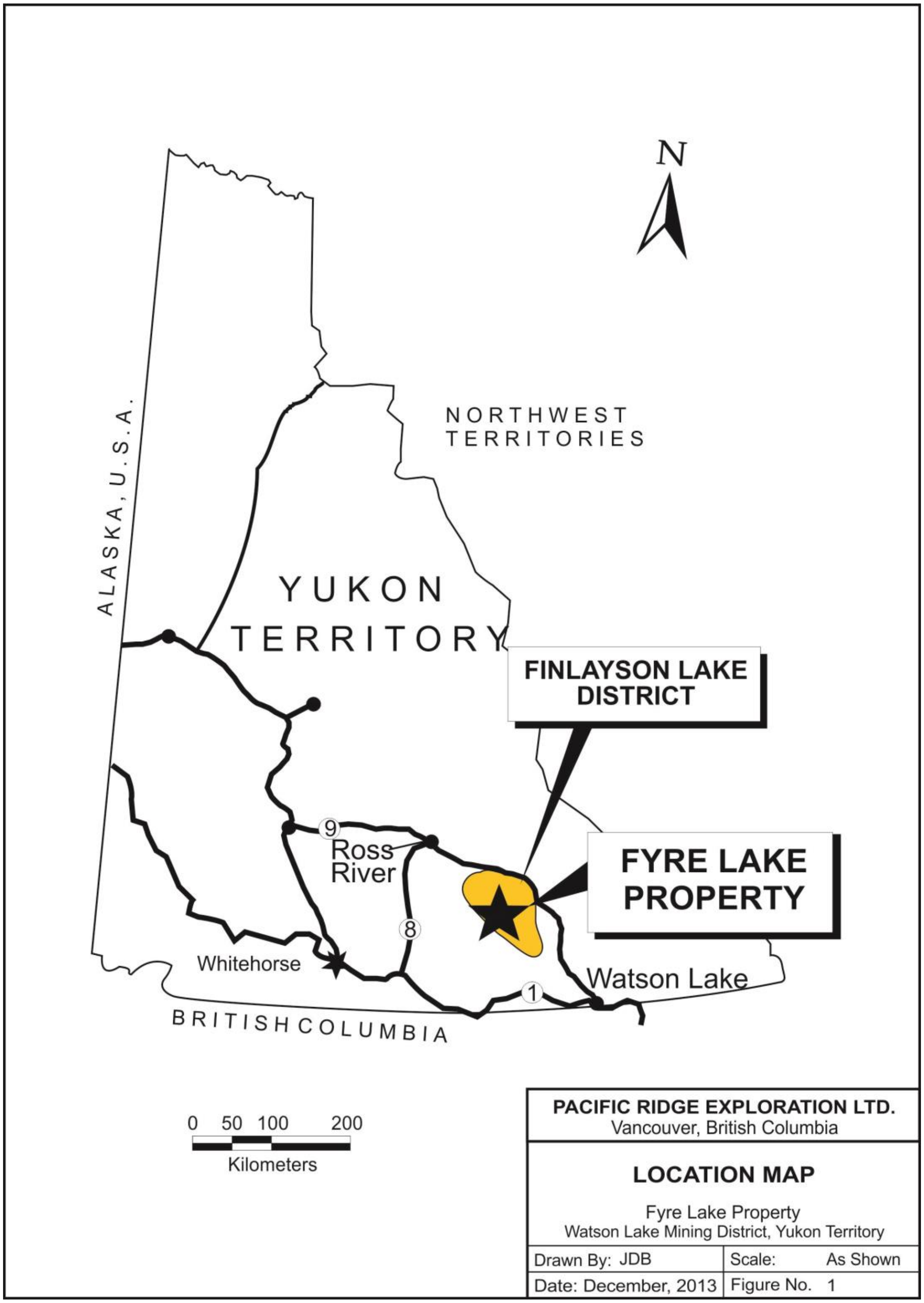

Figure 1. Yukon Location Sketch.

The various mineral showings on the Property are situated between elevations of 1,450 m and 1,700 m.

Fire Lake is situated midway along the southeasterly-flowing North River. To the northeast, there are two easterly trending hanging valleys and broad open cirques. The drainage from the northern hanging valley within which most of the known mineral showings are situated is called Kona Creek and the central valley is drained by Outfitters Creek. The southern drainage which joins North River south of Fire Lake is not named.

The annual mean daily temperature for the eastern Pelly mountains is -5^o C ranging from approximately -50^o C during the winter months to 13^o C during the summer months. Snow cover is minimal, averaging about 60 cm by late winter. Permafrost is discontinuous but widespread. Bedrock exposures are mainly limited to stream canyons, ridges and cliffs and are generally absent in areas of low to moderate relief due to extensive glacial till cover.

In the vicinity of Fire Lake, a dense spruce forest extends to tree line at an elevation of 1,500 m. The dense vegetation thins with increasing elevation to buckbrush (dwarf birch) and eventually to caribou moss cover. Kona and Outfitters Creek drainages have sufficient flows of water for diamond drilling purposes until at least mid-October.

CLAIM STATUS

The Fyre Lake property covers approximately 3,200 ha and consists of 161 Yukon Quartz mineral claims located in the Watson Lake Mining District (the “Property”). The claims are listed in Table I and a full claim list is included in Appendix I. All claims are owned 100% by Pacific Ridge.

Table I. Fyre Lake Property Claim List

Grant No.	Name	No.	Owner	Expiry	NTS
YA56602-605	KONA	43-46	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Sep-20	105G02
YB33749	FIRE	2	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33751	FIRE	4	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33753	FIRE	6	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33759	FIRE	12	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33761	FIRE	14	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33766-768	FIRE	19-21	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33770	FIRE	23	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33773	FIRE	26	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33775-776	FIRE	28-29	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33778	FIRE	31	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33795-807	FIRE	48-60	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB33820-824	FIRE	73-77	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G01
YB33826	FIRE	79	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G01
YB33828	FIRE	81	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G01
YB33878-880	FIRE	131-133	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-20	105G02
YB86834	FIRE	195	PACIFIC RIDGE EXPLORATION LTD. - 100%	14-Aug-21	105G02
YB88869-906	EMBER	62-99	PACIFIC RIDGE EXPLORATION LTD. - 100%	3-Dec-20	105G02
YB93671-713	STRAW	1-43	PACIFIC RIDGE EXPLORATION LTD. - 100%	8-Jan-21	105G02
YB94275-280	FIRE	301-306	PACIFIC RIDGE EXPLORATION LTD. - 100%	12-Nov-20	105G02
YB94281-297	FIRE	312-328	PACIFIC RIDGE EXPLORATION LTD. - 100%	12-Nov-20	105G02
YC22651-655	FIRE	307-311	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Dec-20	105G02
YC31894	FIRE	185	PACIFIC RIDGE EXPLORATION LTD. - 100%	25-Aug-21	105G02
YC31895	FIRE	193	PACIFIC RIDGE EXPLORATION LTD. - 100%	25-Aug-21	105G02
YC91767-775	SPARK	1-9	PACIFIC RIDGE EXPLORATION LTD. - 100%	14-Dec-20	105G02

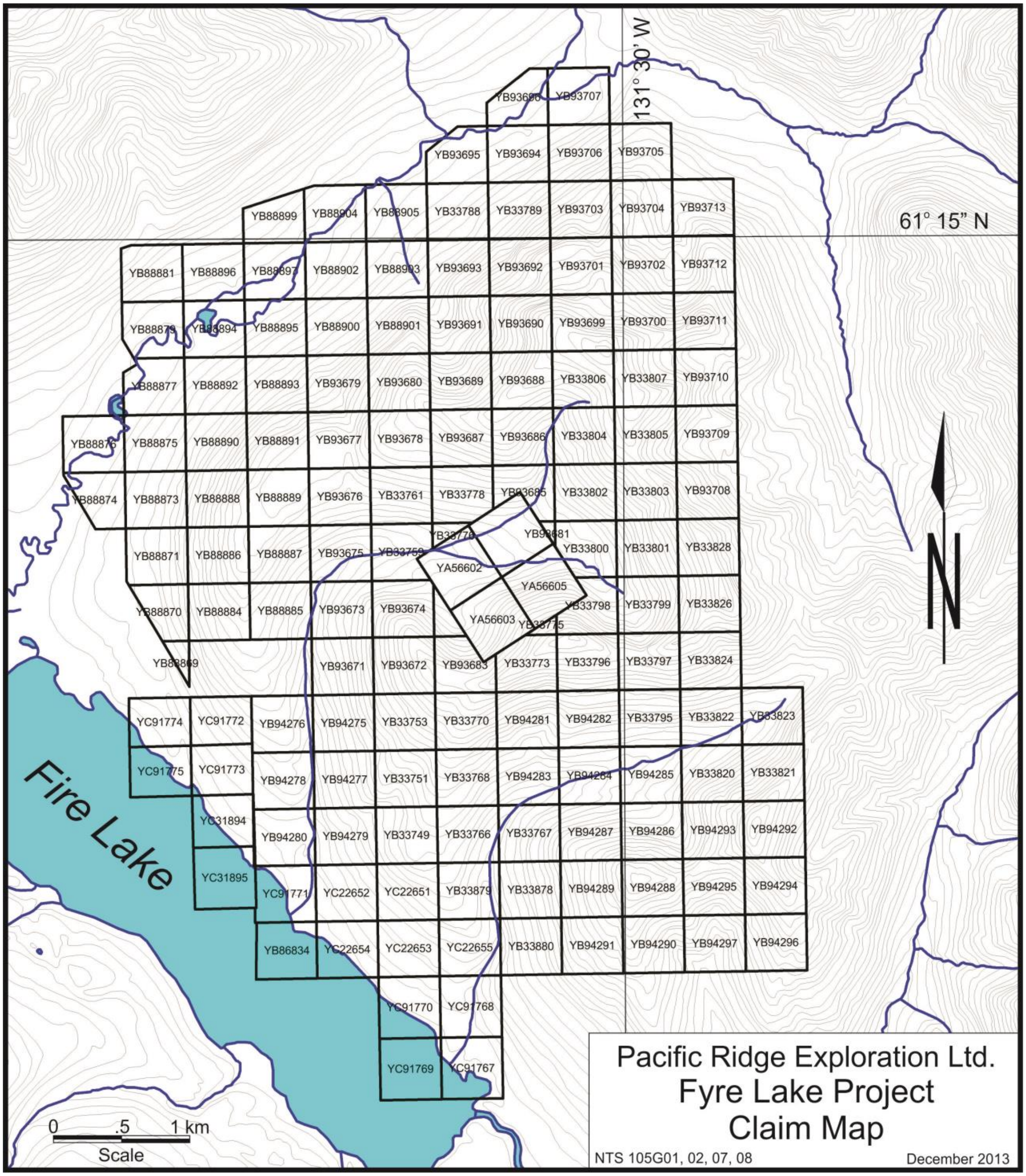

Figure 2. Fyre Lake Property Claim Map.

EXPLORATION HISTORY

The Pelly Mountains were mapped by the Geological Survey of Canada in 1958 and 1959 and the results of this work were published as the Finlayson Lake map-sheet in (Wheeler et. al, 1960). In September, 1960 prospectors employed by Cassiar Asbestos Corporation ("Cassiar") discovered a 2.5 by 2.0 m massive sulphide float boulder on a glacial esker near a guide outfitter's cabin at the south end of Fire Lake. Shortly after, prospectors discovered massive pyrite mineralization exposed in Kona Creek, referred to as the 'E' zone. During the fall and winter of 1960, Cassiar staked the TOP claims covering the southwesterly facing slopes of Fire Lake and in 1961 they carried out prospecting, mapping, geophysical surveys (electromagnetics and magnetics), trenching and drilling. The drilling included twenty-three shallow packsack drill holes, for a total of 224 m, and twelve AX-core diamond drill holes, for a total of 582 m. They reportedly encountered mineralization with an average grade of 1.0% Cu, 0.95% Zn, 4.80 gpt Ag and 0.72 gpt Au (Crawford, 1981).

Recent exploration attention to the Finlayson Lake and eastern Pelly Mountains region began in the fall of 1993 when Cominco Ltd. carried out soil geochemical and geophysical surveys in the headwaters of a creek where there were anomalous lead, zinc and copper values in stream sediments reported from a government-sponsored regional survey, approximately 30 kilometres due north of the Property. The surveys discovered coincident soil geochemical anomalies, electromagnetic conductors and positive magnetic features, and prospecting downstream of the survey area discovered massive sulphide float. The first diamond drill hole, collared in April, 1994, intersected massive sulphide mineralization, now known as the Kudz Ze Kayah deposit. By the fall of 1994 Cominco had completed 50 diamond drill holes, totaling 8,300 m, to outline a shallow-dipping massive sulphide deposit located within 200 m of the surface and suitable for open pit mining, and had staked approximately 4,200 mineral claims to acquire other airborne geophysical targets in the region. Exploration and development continued in 1995, including the construction of a 20-kilometre access road extending from the Robert Campbell Highway to the Kudz Ze Kayah deposit, the completion of 131 diamond drill holes (16,540 m) to define the resources, plus engineering and environmental studies. Reported resources (not NI 43-101 compliant) were 13 million tonnes grading 5.5% Zn, 1% Cu, 1.3% Pb, 125 gpt Ag and 1.2 gpt Au (Yukon Minfile).

In June, 1995 surface exploration of the former 'Fetish' mineral showing by the Wolverine JV (Westmin Resources Limited and Atna Resources Ltd.) at the southeastern end of Wolverine Lake, approximately 30 kilometres northeast of the Fyre Lake property, resulted in the recognition of a sequence of rhyolitic tuffs, sediments and exhalative units with coincident high copper, lead, zinc and barium soil geochemistry along an 8-kilometre strike length. In August, a 15-hole drill program tested the Fetish chalcopyrite-sphalerite showing and discovered the Wolverine volcanic massive sulphide deposit beneath and immediately northeast of the showing (Tucker, 1996). By the end of 1997, the Wolverine JV had completed 40,582 m of drilling in 141 holes to define a geologic inventory of the Wolverine and Lynx zones totaling 5,311,000 tonnes grading 1.81 gpt Au, 359.1 gpt Ag, 1.41% copper, 1.53% lead and 12.96% zinc (G.C.N.L., 1996). By 2000, Expatriate Resources had acquired a 100% interest in the property. Expatriate changed its name to Yukon Zinc Corporation and, in 2011, placed the property into production with a design mill capacity of 1,700 tpd.

In February, 2015, BMC purchased the Kudz ze Kayah property from Teck and, in the 2015 field season, completed a program of 20,000 m of drilling. In January, 2016, BMC announced an updated mineral resource of 20.1 million tonnes grading 6.4% Zn, 2.0% Pb, 0.9% Cu, 151 gpt Ag and 1.4 gpt Au. BMC has announced plans to release a Prefeasibility Study later in 2016.

Fyre Lake Property

Following discovery in 1960 by Cassiar, Atlas Explorations Ltd. (“Atlas”) optioned the DUB claims and in June, 1966 additional claims were staked to cover the Fyre Lake mineral showings. An airborne electromagnetic and magnetics survey was conducted over the Kona Creek cirque and along the eastern slopes of Fire Lake and North River that identified two target areas, called DUB I and DUB II. A 31.5 line-km grid was cut over the northern DUB II area and horizontal loop electromagnetic (HLEM) and magnetometer surveys were conducted with concurrent soil geochemical sampling (Cu, Pb, Zn). Five diamond drill holes, totaling 589 m, tested and extended the copper-bearing zone at the ‘I’ and ‘K’ mineral showings which had been identified by earlier Cassiar drilling. Intersections of massive sulphide mineralization up to 12.2 m thick were reported from this drilling (Sadlier-Brown, 1966). Selected drill core from three of the drill holes is stored at the H.S. Bostock Core Library in Whitehorse (Stroshein, 1991).

In 1967 Atlas explored the southern DUB I target area near the original massive sulphide float boulder discovery site. A 15.5 line-km survey control grid was established, and the grid area was explored with HLEM and magnetometer surveying, soil geochemical sampling (Cu, Pb, Zn) and diamond drilling (3 AX-core holes for 252 m). The diamond drilling intersected disseminated pyrite and pyrrhotite mineralization but no significant base or precious metal mineralization (Sadlier-Brown, 1967).

Between 1974 and 1977 Tempelman-Kluit (1977) remapped and revised the regional geology of the Pelly Mountains. As a consequence of this work, Amax Potash Limited (“Amax”) re-staked the Fyre Lake massive sulphide showings and conducted a limited geological mapping and rock geochemical sampling program. Due to a lack of funding for the project the claims were allowed to lapse (Crawford, 1981).

In 1980, Welcome North Mines Ltd. (“Welcome North”) discovered disseminated copper mineralization in metamorphosed volcanic rocks approximately 2 kilometres north of the known KONA mineral showings and staked sixty-eight KONA claims. In 1981, Welcome North extended the soil sampling coverage with a 16.9 line-km survey grid and 255 soil samples analyzed for Cu, Pb and Zn. This work showed the Fyre Lake mineralization to be exposed in intermittent outcrops for 2.5 km in a northwesterly direction (Crawford, 1981). The mineralization was described as being hosted by a cupriferous iron formation facies, varying in character from laminated massive pyrite (± chalcopyrite, sphalerite, quartz), through banded cupriferous iron formation (quartz, magnetite, chlorite, chalcopyrite, and/or sphalerite), to disseminated chalcopyrite and pyrite in greenschist. The mineralization was noted to occur in a dark green chlorite schist unit approximately 100 m beneath its contact with an overlying quartz-sericite schist unit. The mineralization was described by Morin (1981) as being characteristic of a ‘Besshi-type’ volcanogenic exhalative model.

Placer Dome Inc. (“Placer Dome”) optioned the KONA mineral claims from Welcome North in November 1990 and staked additional claims. They contracted Dighem to carry out a helicopter-supported airborne survey of a 308 flight line-km covering a 36 km^2 area centred on the Fyre Lake showings. Dighem prepared a report with total field magnetics, calculated vertical gradient, resistivity and VLF-EM interpretations and maps (Smith, 1990).

In 1991, Placer Dome conducted a surface exploration program, including geological mapping, Max Min HLEM and soil, silt and rock geochemical sampling over 35 km of line grids, guided by the 1990 airborne geophysical survey results. A total of 1,750 B- and C-horizon soil samples and 7 stream sediment samples were collected during the program, and were analyzed for Au plus a 27-element suite of base metal, pathfinder, trace and mineral forming elements. In addition, 112 rock geochemical samples were collected and analyzed for ten elements including precious and base metals. Placer Dome concluded that the Fyre Lake mineral showings are volcanogenic massive sulphide ("VMS") deposits hosted by metamorphosed and highly deformed Late Devonian volcanic rocks. Furthermore, the iron formations hosting the mineralization could be traced by airborne and ground geophysics and soil geochemistry for 1 kilometre southeast of the Kona Creek cirque. Placer Dome terminated the property option agreement in 1992.

In 1995 Columbia Gold Mines Ltd. ("Columbia") acquired the Property from Welcome North. In 1996 and 1997 Columbia completed a comprehensive, helicopter-supported exploration program that included drilling 23,667 m of core in 116 drill holes (Blanchflower, 1997; Foreman, 1998). Other work completed included surveying, geological mapping, extending soil geochemistry and ground geophysical survey grids, including magnetics, Max-Min and a large loop time domain electromagnetic (UTEM-3) test survey. Total expenditures on the Property by Columbia amounted to approximately $6 million.

The diamond drilling undertaken during the 1996 exploration program discovered three horizons of massive to semi-massive sulphide and magnetite mineralization hosting significant copper-cobalt-gold over a combined thickness of 70 to 80 m, a continuous strike length of more than 800 m and widths in excess of 100 m. This mineralization was named the 'Kona' deposit. The 1997 drill program extended the mineralization down dip, to a vertical depth of 400 m. The deposit remains open to depth. No drilling has been completed on the property since 1997.

Preliminary resource calculations of the Kona deposit were prepared by Columbia (Blanchflower, 1997) utilizing 1966, 1996 and 1997 diamond drill data. Calculations utilizing the sectional block method showed the Kona deposit to contain a drill indicated resource of 8.2 million tonnes grading 2.08% copper, 0.11% cobalt and 0.73 gpt Au. **Note: This historic resource estimate is NOT compliant with current NI 43-101 standards of resource definition classification and should NOT be relied upon.**

Copper-cobalt-gold VMS mineralization from drill hole reject material was sent to Lakefield Research Ltd. for preliminary metallurgical testing (Lakefield 1997a, 1997b; Melis, 1997). Eight preliminary flotation tests were completed that suggested a copper-gold concentrate could be produced at a grade of approximately 20% copper and 16 gpt gold with recoveries of 90% for copper and 70% for gold. Preliminary cobalt leach tests on pyrite concentrate produced Co recoveries in the 65% to 70% range (Melis, 1997).

Columbia contracted Kilborn Engineering Pacific Ltd. ("Kilborn") to carry out a preliminary economic study to determine the economic parameters of developing the Kona deposit into a combined open-pit and underground mine (Kilborn, 1997). Kilborn prepared capital and operating cost estimates and developed a financial model that suggested that, at current grades, the tonnage would need to be roughly doubled to be considered as a potentially economically viable development project.

In 1999, Columbia changed its name to Pacific Ridge Exploration Ltd. ("Pacific Ridge").

In 2002, the Property was optioned to Rock Resources Inc., who commissioned a NI 43-101 compliant technical report and mineral resource estimate (Blanchflower, 2002). The results of this study are summarized below in Table II.

Table II. Fyre Lake 43-101 Resource Summary

Indicated Mineral Resources*

Copper Cut-Off Grade (% Cu)	Tonnage (million tonnes)	Copper (%)	Cobalt (%)	Gold (gpt)
2.00	0.595	2.46	0.11	0.82
1.50	1.639	1.97	0.10	0.70
1.00	**3.571**	**1.57**	**0.10**	**0.61**
0.50	6.415	1.20	0.08	0.50
No Cut-off	7.772	1.05	0.07	0.44

Inferred Mineral Resources*

Copper Cut-Off Grade (% Cu)	Tonnage (million tonnes)	Copper (%)	Cobalt (%)	Gold (gpt)
2.00	0.418	2.69	0.08	0.61
1.50	2.056	1.87	0.09	0.54
1.00	**5.361**	**1.48**	**0.08**	**0.53**
0.50	9.148	1.18	0.07	0.42
No Cut-off	12.407	0.93	0.06	0.32

*** The above mineral resource estimates are NOT mineral reserves and do not have demonstrated economic viability.**

In 2006, Blanchflower (2006) updated his technical report for Pacific Ridge. Other than the updated studies, no physical exploration has been carried out on the Property since the end of the 1997 drill program.

In July, 2013, Pacific Ridge engaged PhotoSat Information Ltd. ("PhotoSat") of Vancouver to collect 50 cm resolution stereo satellite images over the Property, including a 100 km^2 area, and produce a number of products including a 1:10,000 scale orthophoto image, contour maps (1 m, 5 m, 10 m, and 50 m contour intervals) and digital elevation models (Carlson, 2014).

GEOLOGICAL SETTING

The Fyre Lake deposit is one of several known volcanogenic massive sulphide ("VMS") occurrences within the Finlayson Lake district. This district occurs in the central part of an outlier of Yukon-Tanana and Slide Mountain Terranes and related overlap assemblages (Mortensen, 1992; Sebert et. al. 2004; Murphy et.al., 2006). This outlier is lozenge-shaped, approximately 400 km long and up to 50 km wide belt of rocks that have been displaced up to 450 km southeasterly along the Eocene dextral strike-slip Tintina Fault (Murphy and Mortensen, 2003). The Tintina fault zone forms the southwestern boundary of the outlier while the Inconnu Thrust fault zone separates it from Proterozoic and Paleozoic miogeoclinal strata of the ancestral North American continental margin to the northeast (Figure 3).

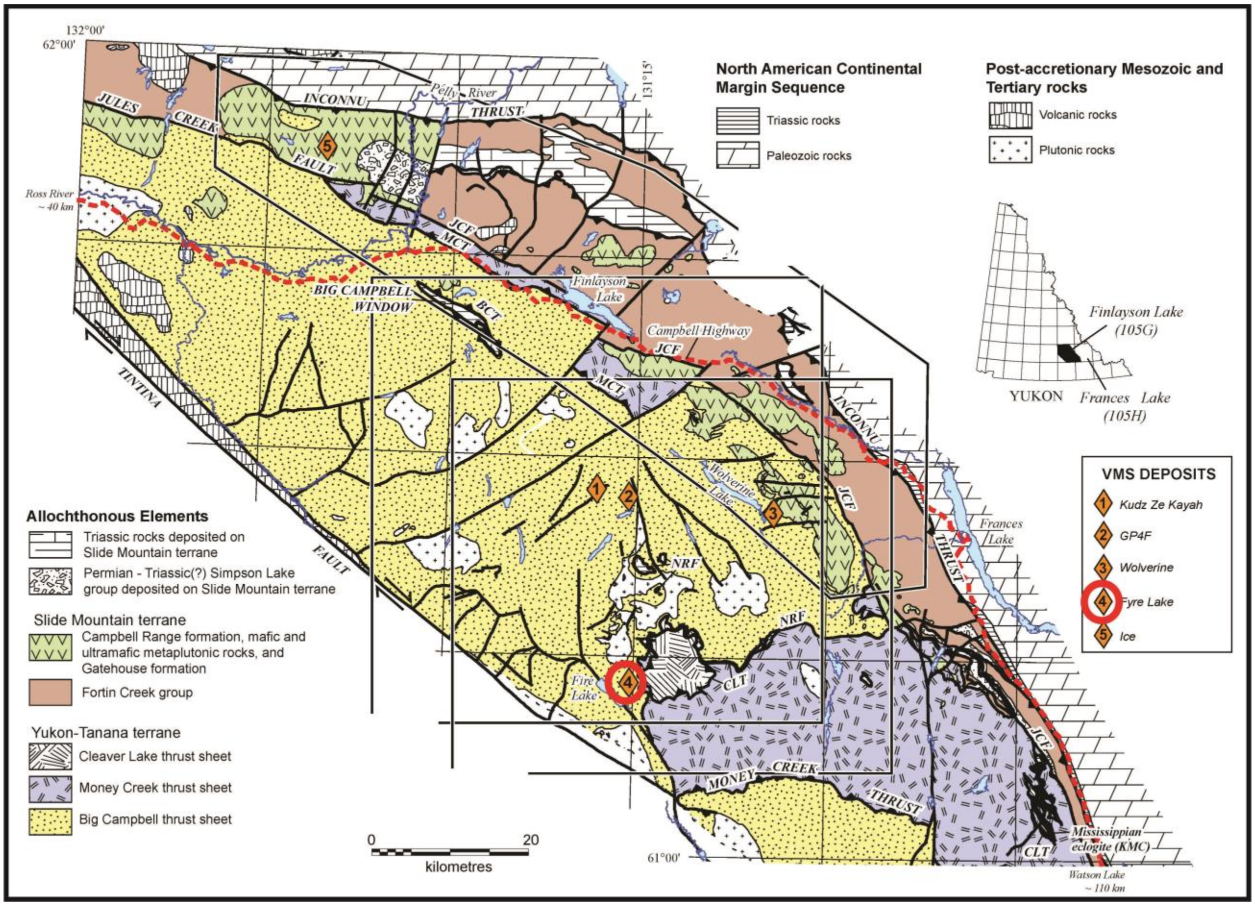

Figure 3. Finlayson District regional geology (taken from Murphy et.al. 2006).

The YTT is made up of Middle to Late Paleozoic polydeformed pelitic to quartzo-feldspathic metasedimentary schist and gneiss with minor marble and deformed mafic to felsic metavolcanic and metaplutonic rocks. Mapping by Tempelman-Kluit (1977), Mortensen (1992) and the Yukon Geological Survey (summarized in Murphy et.al., 2006) has helped to unravel this complex stratigraphic succession and define the tectono-stratigraphic setting of the VMS mineralization. Most units display a penetrative ductile deformation fabric and have been affected by regional-scale thrust faulting (e.g., Mortensen and Jilson, 1985; Mortensen, 1992; Murphy, 2004).

The following discussion is taken mainly from Murphy et.al. (2006). The Late Devonian to Early Mississippian period in the Finlayson Lake district is represented by three fault-bounded assemblages that formed in different depositional environments. From the structurally deepest levels these include: (1) the Big Campbell thrust sheet, including the Grass Lakes and Wolverine Lake groups and affiliated metaplutonic rocks in, (2) the Money Creek thrust sheet, including the Waters Creek and Tuchitua River formations and affiliated intrusions and (3) the Cleaver Lake formation and intrusions of the Cleaver Lake thrust sheet.

The most important of these is the Grass Lakes group within the Big Campbell thrust sheet, host to the key VMS deposits (Murphy *et al.*, 2002). It comprises three map units, the Fire Lake, Kudz Ze Kayah and

Wind Lake formations. The oldest unit is the laterally extensive Upper Devonian Fire Lake formation, host of the Fyre Lake Cu-Co-Au VMS deposit (Foreman, 1998; Sebert et.al. 2004). The Fire Lake formation consists of chloritic phyllite or schist (mafic volcanic and volcaniclastic rocks) and lesser carbonaceous phyllite or schist and muscovite-quartz phyllite or schist (felsic volcanic or volcaniclastic rocks). Bodies of mafic and variably serpentinized ultramafic metaplutonic rocks occur within the Fire Lake formation and are interpreted as sills within the Fire Lake formation and dikes in the underlying North River formation.

The Fire Lake formation passes upward into the Kudz Ze Kayah formation, a carbonaceous phyllite-dominated succession that includes the felsic metavolcanic rocks that host the Kudz Ze Kayah and GP4F deposits in the lower part, and the Wind Lake formation, including mafic metavolcanic rocks and quartzite in the upper part.

Property Geology

The following description of the geology of the Fyre Lake property is taken from Foreman (1998) and Sebert et.al. (2004). The Property is underlain by three main units including the North River formation, the Fire Lake formation and the Kudz Ze Kayah formation. All three form the lowest stratigraphic units within the Big Campbell thrust sheet. A simplified geology plan map and a schematic stratigraphic column for the Fyre Lake property are presented in Figures 4 and 5. Ultramafic rock bodies mapped on the property have been included in the Fire Lake formation.

North River formation

North River formation rocks outcrop to the north and west of Kona cirque and just east of Fire Lake. They include grey to brown muscovite quartz-rich and biotite-muscovite-quartz-rich phyllite, biotite-quartz-rich schist and chlorite-muscovite-quartz schist. The chlorite-muscovite-quartz schist is strongly deformed and the interpreted protolith is clastic sediments, with local lenses of metavolcanic rocks. The phyllite has a mudstone and siltstone protolith.

Fire Lake formation

Fire Lake formation overlies the metasedimentary rocks of the North River formation and is composed of green chlorite-actinolite and quartz-chlorite-actinolite schist interpreted as mafic to intermediate metavolcanic rocks, with a subordinate volume of intercalated metasedimentary rocks. The metavolcanic rocks occur within several laterally discontinuous and chemically distinct subunits known as the Lake Zone, Outfitter’s Creek, Kona Bowl and Kona Cirque.

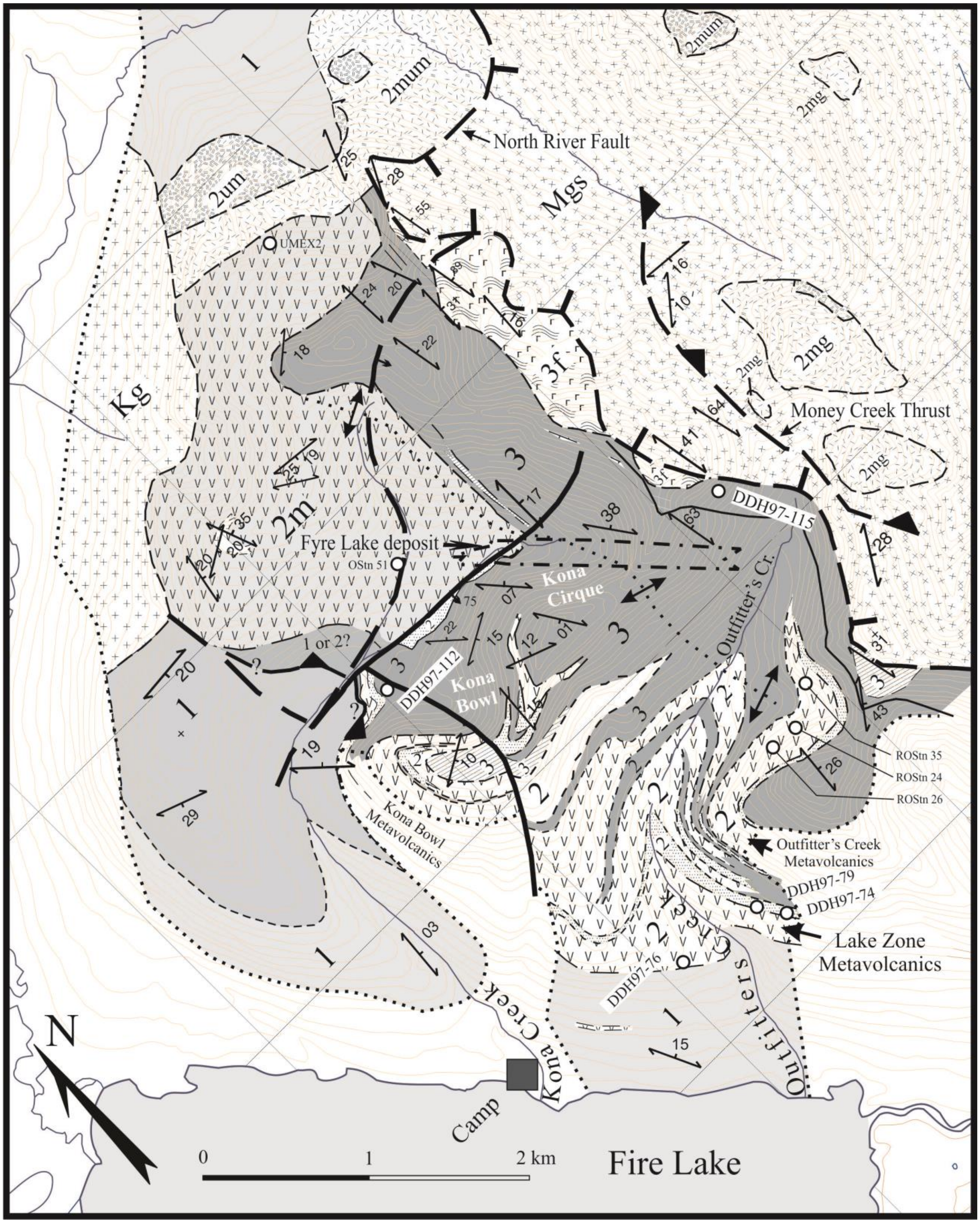

Figure 4. Fyre Lake property geology (taken from Sebert et.al. 2004)

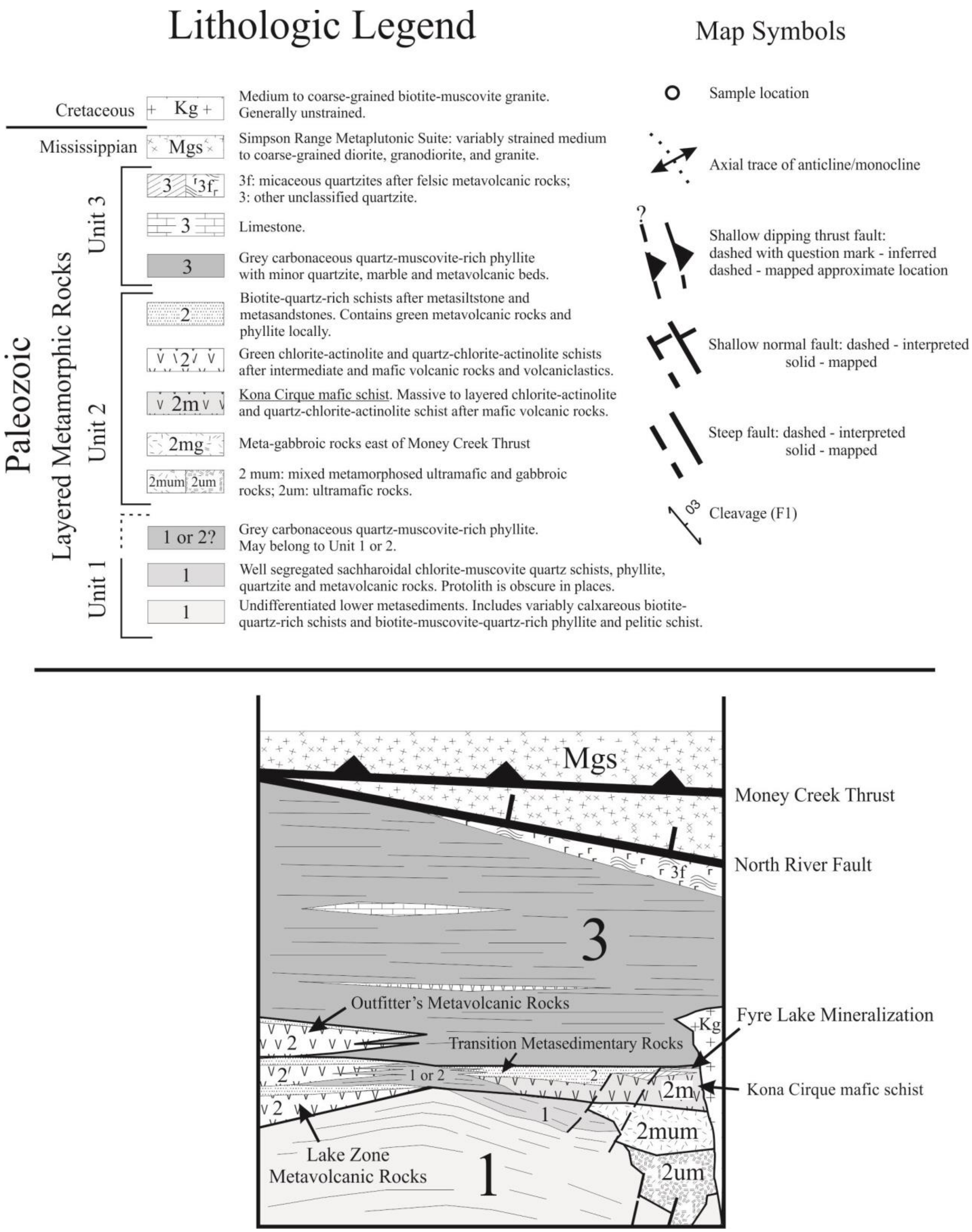

Figure 5. Legend and section for Fyre Lake geology map (taken from Sebert et.al. 2004)

The Lake Zone, largely composed of thinly bedded, fine-grained, mafic metavolcaniclastic rock, is in excess of 100 m thick and forms an east-dipping belt on the east side of Fire Lake. Many coarser grained sandy layers are feldspar-rich and locally display normal grading and may in part have been emplaced as turbidites. It also contains minor coarse-grained lapilli tuff or lapillistone beds and weakly foliated massive layers, which may be flows or large blocks of lava. The basal contact of the Lake Zone metavolcanic rocks is locally gradational with metasedimentary rocks of North River formation.

The Kona Cirque mafic schist of the Fire Lake formation outcrops to the north of Kona Cirque and hosts the Fyre Lake deposit. It is a metavolcanic rock unit that is lower in the stratigraphy than the Outfitter's Creek and Kona Bowl metavolcanic rocks and is at least locally underlain by carbonaceous phyllite in the west, which may be part of the North River or Fire Lake formations.

Overlying the Lake Zone metavolcanic rocks is a mixed sequence of highly strained green quartz-chlorite-actinolite schist, light green chlorite-muscovite-quartz schist and phyllite, interpreted as intercalated mafic or intermediate volcaniclastic rocks, and biotite-quartz schist that is outwardly similar to that of North River formation and is interpreted as metamorphosed felsic siltstone and sandstone.

The Outfitter's Creek and Kona Bowl metavolcanic rocks include green biotite-quartz-chlorite-actinolite-rich schists up to 75 m thick. They are stratigraphically above the metavolcanic rocks hosting the Fyre Lake deposit and represent original flow rocks and bedded volcaniclastic rocks. Both units thin to the east where they interfinger with phyllites of Kudz Ze Kayah formation.

In the northeast corner of the Fyre Lake property, the Kona Cirque mafic schist is underlain by variably strained metamorphosed mafic and ultramafic intrusive rocks of the Fire Lake formation. The mafic intrusive rocks are fine- to coarse-grained feldspar-pyroxene-amphibole gabbros. The ultramafic rocks are altered and contain talc, serpentine, tremolite, phlogopite, orthopyroxene, chromite and olivine. Regional mapping by Murphy (1997, 1998) suggests that these intrusive rocks cross-cut the metavolcanic rocks of North River formation and form intrusive bodies, which are spatially in intimate contact with the metavolcanic rocks of Fire Lake formation.

Kudz Ze Kayah formation

Kudz Ze Kayah formation consists of carbonaceous, biotite-muscovite-quartz phyllite that is up to 580 m thick. It overlies and laterally interfingers with rocks of Fire Lake formation. It also includes minor bodies of feldspar porphyritic felsic metavolcanic or metaplutonic rocks that occur in the upper parts of the phyllite exposed on the eastern ridge of Kona Cirque.

Simpson Range metaplutonic suite

Mississippian-aged Simpson Range metaplutonic rocks occur on the Fyre Lake property as a pluton of K-feldspar-biotite-hornblende granite in a large fault bounded stock. The wall rocks of this intrusive are pyritized and form prominent gossans. Isolated bodies of mafic and ultramafic rocks of the Fire Lake formation occur within the Simpson Range suite. The pluton is separated from the layered Paleozoic metasedimentary and metavolcanic rocks east of Kona Cirque by the east dipping North River fault.

Cretaceous plutonic rocks

Medium-grained, weakly foliated biotite-muscovite granite underlies the northeastern portion of the Property. These rocks are the southern part of a large Cretaceous stock that cuts Paleozoic rocks of the Yukon-Tanana Terrane in this area.

Structure

The following brief discussion is taken from Sebert et.al. (2004). The presence of biotite and garnet in the metasedimentary and metavolcanic rocks indicate upper greenschist facies metamorphism in the Fire Lake area. A strong schistosity (F1) is present in all the layered Paleozoic lithologies on the Fyre Lake property. It is parallel to compositional layering and generally dips shallowly eastward or southward. A strong mineral lineation (L1) occurs in the plane of the (F1) foliation. It trends 120° to 140° and plunges shallowly to the southeast. Interfolial folds are well developed in some metasedimentary units and the fold axes are generally parallel to the L1 mineral elongation. At the property-scale, rocks in the area of the Fyre Lake deposit are gently folded along a northerly trending anticlinal to monoclinal structure.

Mineralization

Copper-cobalt-gold VMS mineralization occurs within the Kona Cirque unit of the Fire Lake Formation, a strongly deformed and metamorphosed chlorite-actinolite-quartz schist sequence that is interpreted to be a succession of mafic to possibly intermediate flows with intercalated volcaniclastics and volcanically-derived fine-grained sedimentary rocks. Massive sulphide mineralization has been located in outcrop and in boulder trains over a six kilometre strike length from the southern portion of the Lake grid to the northern Kona grid area. During 1996 and 1997, Pacific Ridge (at the time, Columbia Gold Mines Ltd.) defined the deposit as it is currently known with a drill program of 23,667 m of core drilling in 116 holes (Blanchflower, 2006; see Figure 6 for collar locations).

Mineralization within the Fyre Lake deposit occurs in two parallel, elongated zones, the East and West Kona (Deighton et al., 1997; Foreman, 1998; see Figures 6 and 7).

The stratigraphically higher East Zone consists of two stacked lenses, the Upper and Lower horizons, of interlayered stratiform massive and semi-massive sulphide mineralization and magnetite. Both lenses have been drill tested for a strike length in excess of 1000 m and a width of 100 to 200 m. The Upper Horizon is up to 12 m thick and is located immediately below the contact between metasedimentary and metavolcanic strata. Locally, at the western periphery, the Upper Horizon overlies metasiltstone and metasandstone layers. The Lower Horizon is up to 16 m thick and lies about 40 to 80 m below the Upper Horizon.

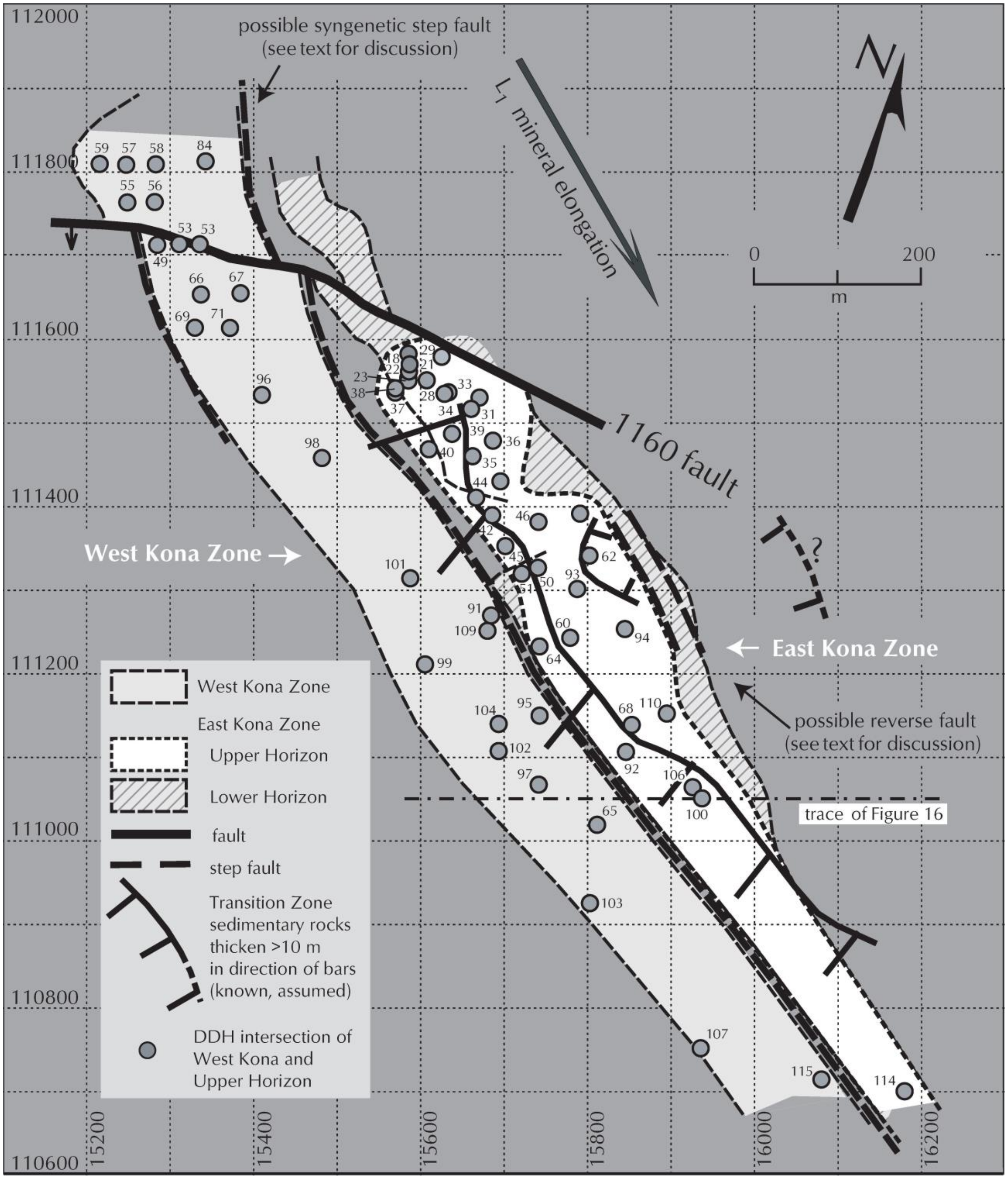

Figure 6. Plan view of the Fyre Lake VMS deposit showing the surface traces of the East and West Kona Zones and the locations of the 1996-97 drill collars (taken from Sebert et.al. 2004)

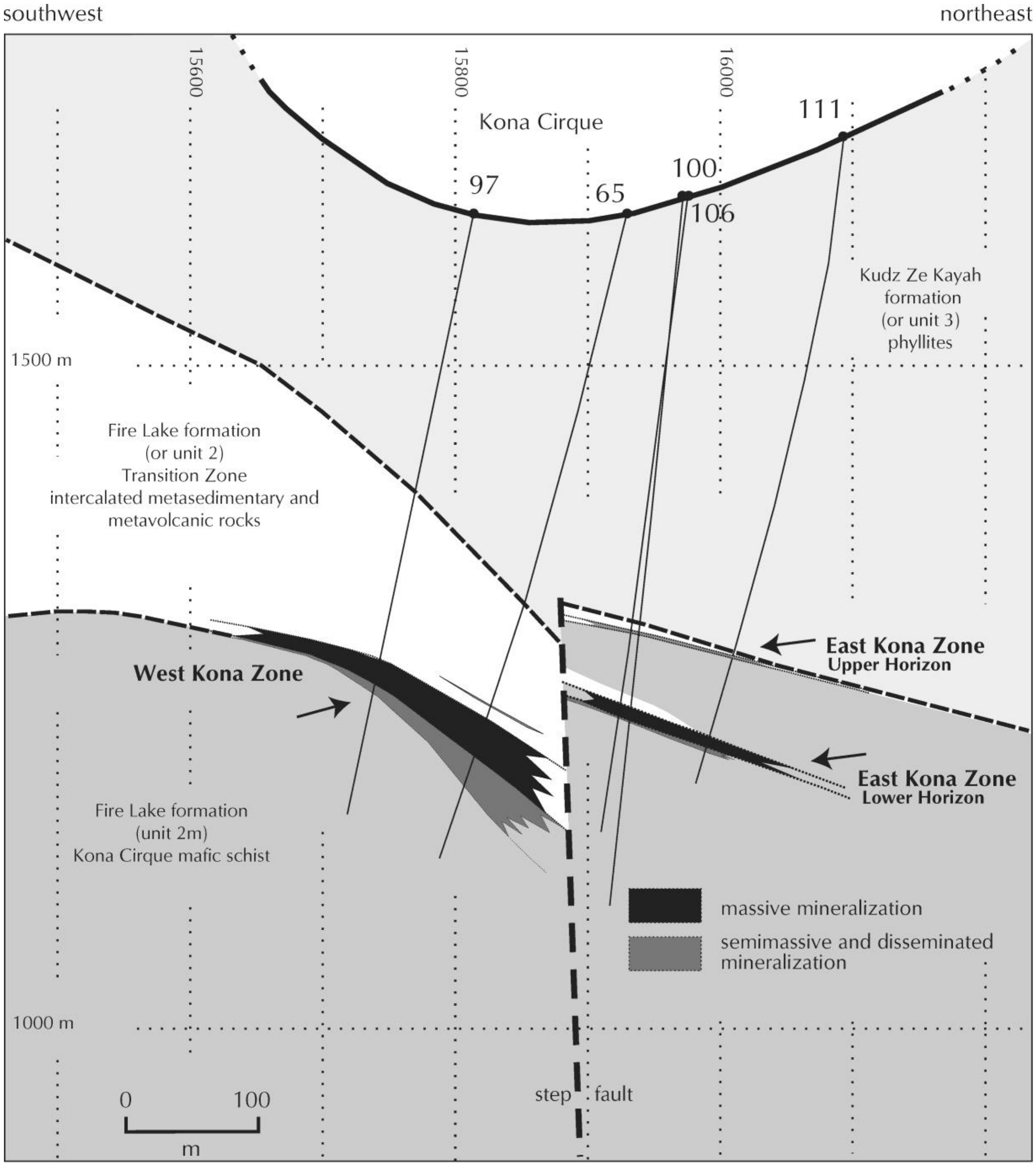

Figure 7. Cross section through the Fyre Lake deposit (taken from Sebert et.al., 2004)

The West Kona Zone consists of one stratiform massive to semi-massive sulphide-magnetite-rich lens located at the metasedimentary to metavolcanic contact. It is up to 44 m thick on its northeastern edge, and has been drill-tested over a strike length of 1420 m and a width of 75 to 125 m (Foreman, 1998). All three mineralized lenses dip moderately (20–40°) to the east and plunge shallowly (5–15°) to the south (Foreman, 1998). The 1160 cross-fault offsets the lenses at the mouth of Kona Cirque.

The two zones are elongated in a northwest to southeast direction parallel to the L1 lineation and to an inferred step fault, which appears to separate the East and West Kona zones. The step fault is inferred from the approximate 100 m down-drop of the West Kona Zone with respect to the East Kona Zone side, based on the different relative elevations of the metasedimentary/metavolcanic contact (Foreman, 1998).

The Transition Zone, composed of intercalated metasedimentary and metavolcanic rocks, also thickens abruptly to the west across this step structure. The presence of metasandstone layers within the Kona Cirque mafic schist located between the Upper and Lower horizons, and of green metavolcanic rocks chemically similar to the Kona Cirque mafic schist in the Transition Zone suggests that there also is a facies change across the step fault. Overall, the geologic data implies that the stepped offset of the underlying Kona Cirque mafic schist is an older, syngenetic fault.

The mineralized lenses consist of single and multiple layers of semi-massive (<50%) and massive (>50%) sulphide minerals and magnetite. Pyrite is the dominant sulphide mineral, with lesser but locally significant amounts of pyrrhotite and chalcopyrite. The sulphide minerals occur as disseminations, patchy bands or massive layers. Finely banded or layered sulphide beds are rare. Chalcopyrite and pyrrhotite commonly occur together and may be intergrown with pyrite or occur in gangue minerals as patches and small discontinuous bands. Sphalerite is a relatively minor phase that occurs locally.

Fine-grained magnetite is intimately intergrown and intercalated with sulphide minerals over large sections of the deposit. Sections of the mineralized lenses consist almost entirely of finely banded magnetite iron formation in bands up to 6 m thick. The beds of magnetite iron formation contain variable amounts of quartz bands, and minor sulphide minerals, carbonate and chlorite bands. Minor hematite occurs locally with the magnetite. In places, it appears that fragmental magnetite, and also clastic quartz and sulphide minerals, were cemented and partially replaced by later sulphide minerals.

Hydrothermal alteration has not been well documented except that weak quartz-chlorite alteration appears to occur in the footwall rocks of the magnetite and pyrite iron formation. These rocks are of original mafic composition and the chloritic alteration reported may be mainly metamorphically derived.

2014 Exploration Program

During October 5th to October 12th, 2014 Geotech carried out a helicopter-borne geophysical survey over the Fyre Lake Project located near Finlayson Lake, Yukon, Canada. Principal geophysical sensors included a versatile time domain electromagnetic (VTEM) system, and a cesium magnetometer. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 709.5 line-kilometres of geophysical data were acquired during the survey, as shown in Figure 8. The work was carried out under the direct supervision of Chris Doornbos of MinQuest.

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 in Aurora, Ontario. The final report from Geotech is include as Appendix II to this report.

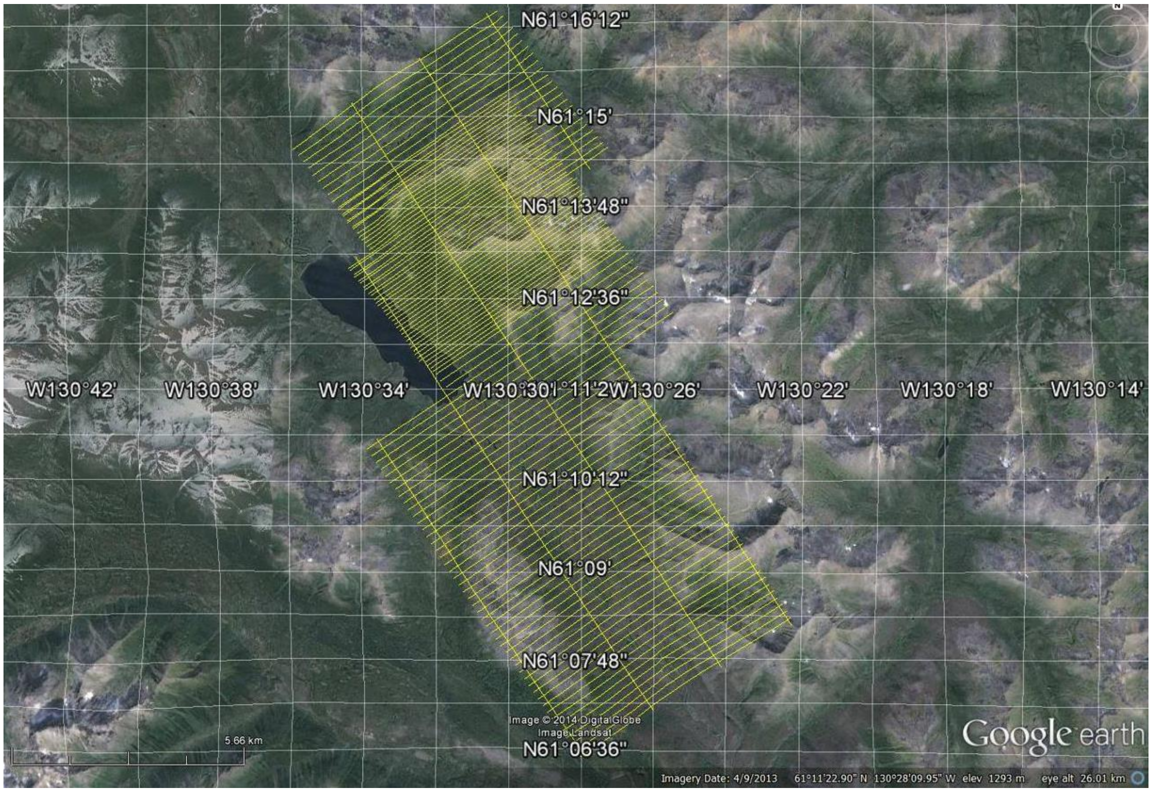

Figure 8. Flight lines for Geotech helicopter borne VTEM survey.

Interpretation

The Fyre Lake massive sulphide horizon contains both pyrite and pyrrhotite, so the horizon is expected to be recognized as a conductor to the depths typically visible to the VTEM system, approximately 200-250 m. Both pyrrhotite and magnetite occur within and adjacent to the massive sulfides, so the magnetics are expected to reflect the mineralized horizon. However, false anomalies are also likely within the map area as some of the volcanics within the local stratigraphy are magnetic and some of the metasediments contain graphite, a good conductor.

The total magnetic intensity (TMI)map is shown in Figure 9 while the EM profiles (dBdt) are shown in Figure 10. The strong north-northwesterly trending linear conductor and magnetic feature is expected to be formational, perhaps with a related fault structure.

The Kona deposit area is shown enlarged in Figure 11 in the reduced to pole (RTP) magnetic map. Outlined on the map are the Kona deposit and three interpreted target areas. Historical drill holes are shown as blue circles. The shallower northern portion of the deposit is evident in both the magnetic and EM data.

Target 1 - NW Ridge - Magnetic and EM anomalies continue for 1km to the NW past northern limit of the Kona Mineral Resource.

Target 2 - Kona West Fault Block - Targets east and west exist in fault blocks similar to those that host the Kona Mineral Resource.

Target 3 - East Ridge – Linear and discrete EM anomalies exist along the east ridge in the KZK Formation.

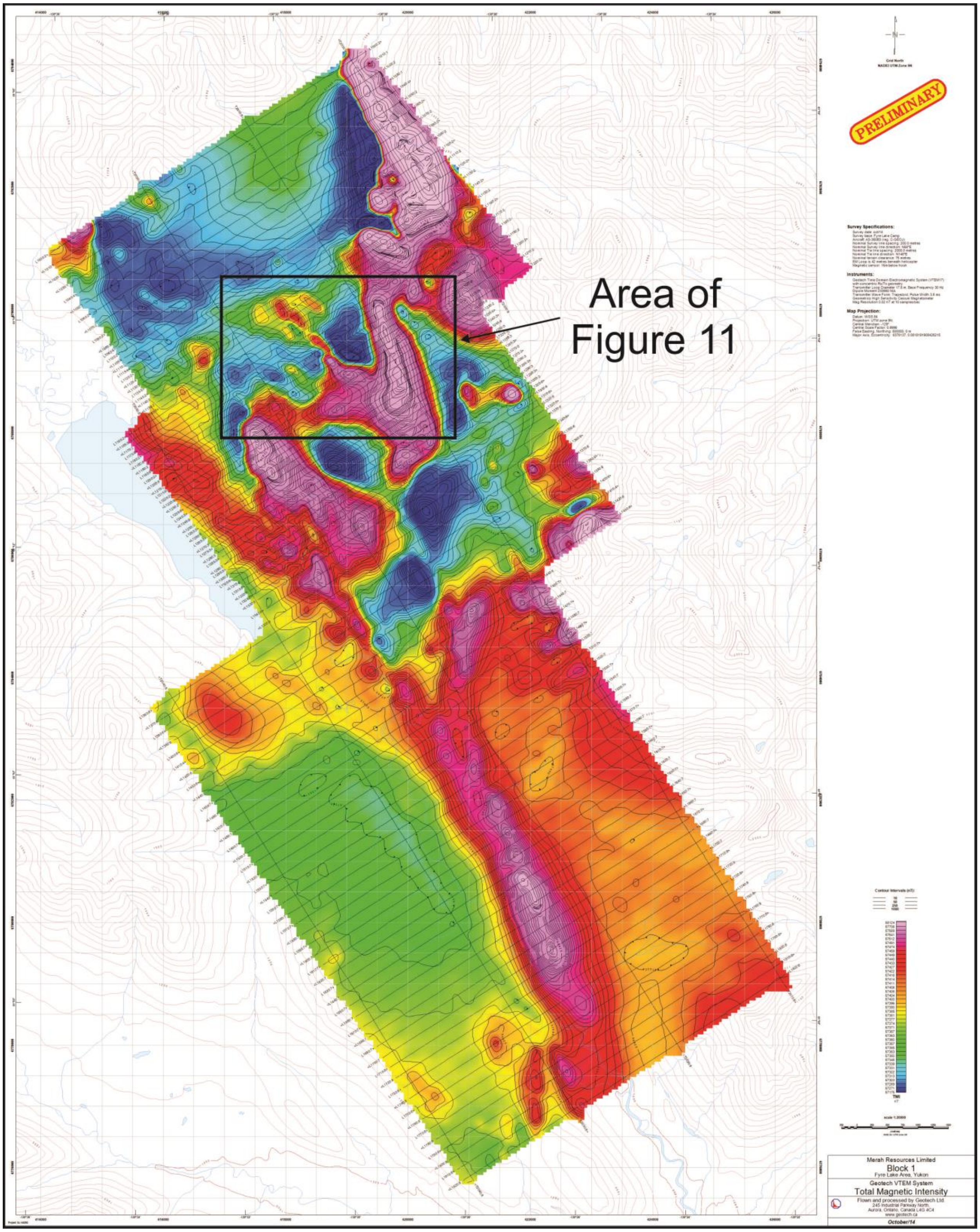

Figure 9. Geotech VTEM survey total magnetic intensity plan map.

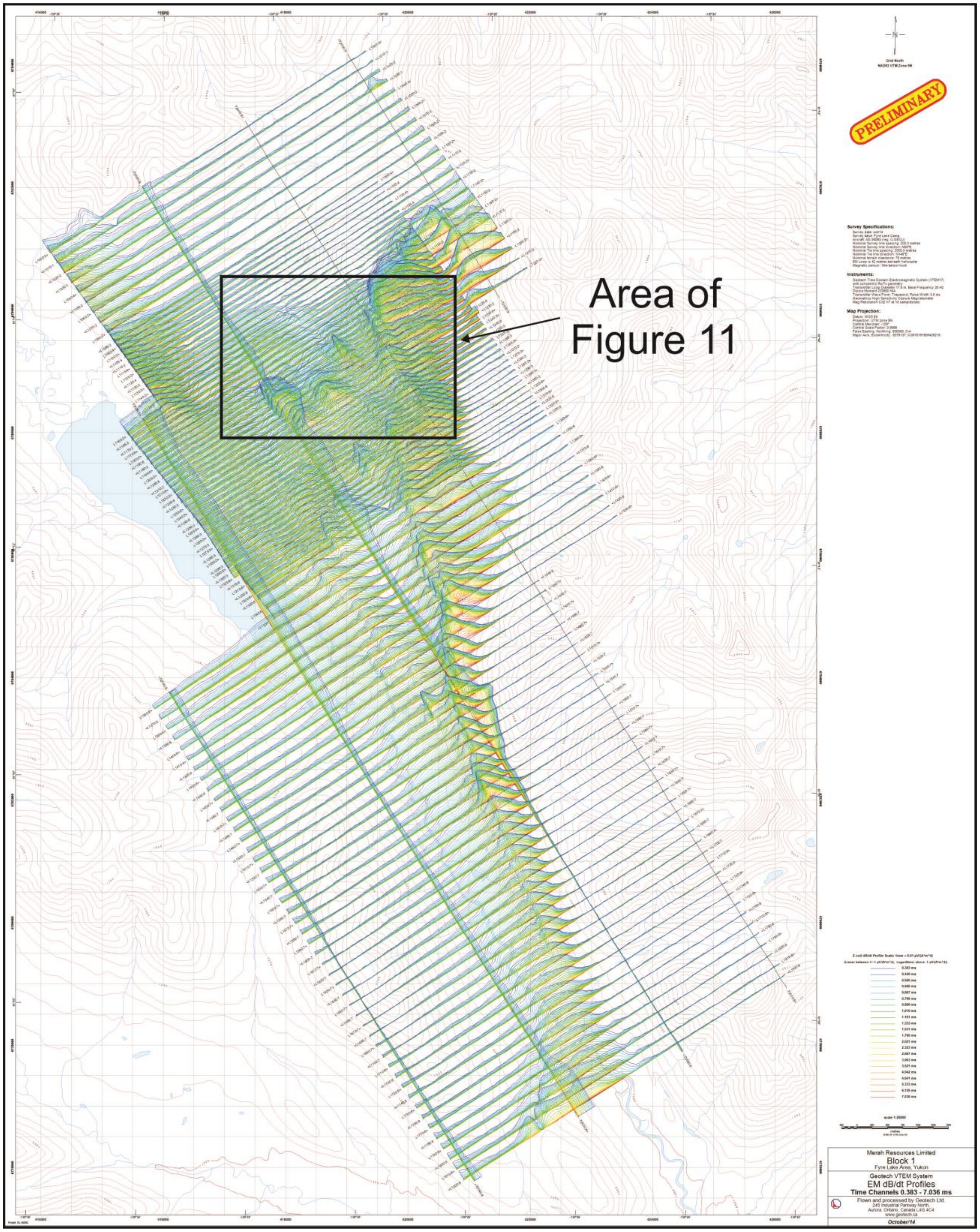

Figure 10. Geotech VTEM survey dBdt Z component profiles plan map.

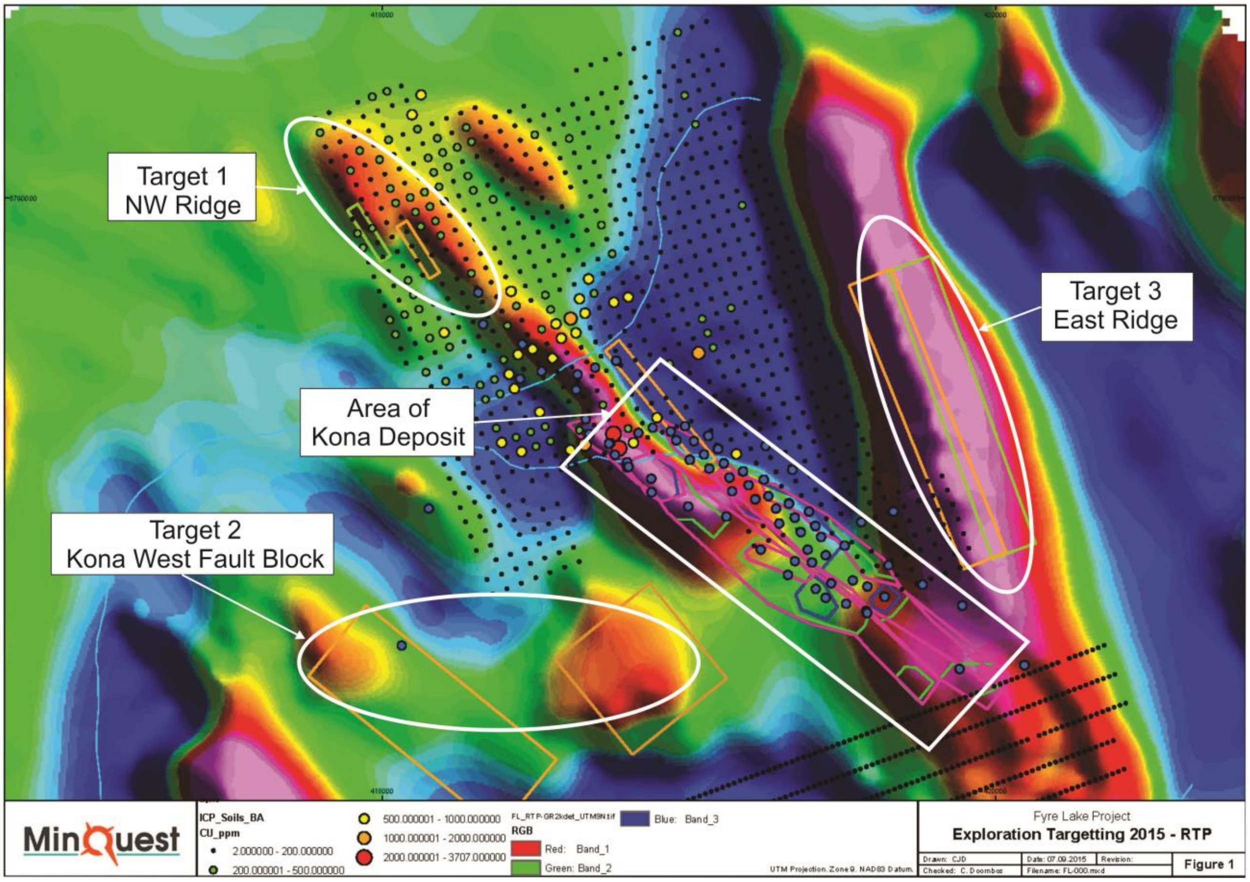

Figure 11. RTP magnetics with new exploration targets in Kona deposit area.

CONCLUSIONS

The Fyre Lake property, in the Finlayson Lake District in central Yukon, hosts a Cu-Au-Co(+/-Zn-Ag) VMS deposit. The Property has a long exploration history beginning with the first discovery of mineralization by prospectors with Cassiar Asbestos Corporation in 1960 and culminating with the completion of 23,667 m of drilling in 116 holes in 1996-97 by Pacific Ridge. From this work, a NI 43-101 compliant mineral resource estimate for the Kona Deposit was completed by Minorex Consulting Ltd. (Blanchflower, 2006) who estimated an indicated mineral resource of 3.571 million tonnes grading 1.57% copper, 0.10% cobalt and 0.61 gpt gold at a 1 percent copper cut-off grade and an inferred mineral resource, at the same cut-off grade, of 5.361 million tonnes grading 1.48% copper, 0.08% cobalt and 0.53 gpt gold. No further physical exploration work has been carried out on the Property since that time.

During October 5th to October 12th, 2014 Geotech carried out a helicopter-borne geophysical survey over the Fyre Lake Project. Principal geophysical sensors included a versatile time domain electromagnetic (VTEM) system, and a cesium magnetometer.

The Fyre Lake massive sulphide horizon is both magnetic (pyrrhotite and magnetite content) and a conductor (pyrite and pyrrhotite content). The shallower northern portion of the deposit is evident in both the magnetic and EM data from the VTEM survey. In addition, three targets have been identified from the VTEM survey:

- Target 1 - NW Ridge - Magnetic and EM anomalies continue for 1km to the NW past northern limit of the Kona Mineral Resource.
- Target 2 - Kona West Fault Block - Targets east and west exist in fault blocks similar to those that host the Kona Mineral Resource.
- Target 3 - East Ridge – Linear and discrete EM anomalies exist along the east ridge in the KZK Formation.

Diamond drilling is recommended to test these targets.

STATEMENT OF EXPENDITURES

2014 Field Season Expenditures	
Item	**Amount**
Geotech VTEM Survey	$137,098
Total	**$137,098**

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CERTIFICATE OF QUALIFICATIONS

I, Gerald G. Carlson, hereby certify that:

1. I am a consulting mineral exploration geologist and President and CEO of Pacific Ridge Exploration Ltd., 11th Floor – 1111 Melville St., Vancouver, B.C. V6E 3V6.

2. I am a graduate of the University of Toronto, with a degree in Geological Engineering (B.A.Sc., 1969). I attended graduate school at Michigan Technological University (M.Sc., 1974) and Dartmouth College (Ph.D., 1978). I have been involved in geological mapping, mineral exploration and the management of mineral exploration programs and companies continuously since 1969, with the exception of time between 1972 and 1978 for graduate studies in economic geology.

3. I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia, Registration No. 12513 and of the Association of Professional Engineers of Yukon, Registration No. 0198.

4. I am the author of this report on the Fyre Lake Project, Yukon.

5. The report is based on a literature review, on private company reports and on the 2014 work program.

6. I am an insider and I own shares in Pacific Ridge Exploration Ltd.

7. I was personally involved in the planning and execution of the exploration program discussed in this report.

Dated at Vancouver, B.C. this 10th day of August, 2016.

Gerald G. Carlson, Ph.D., P. Eng.

APPENDIX I

Fyre Lake Property

List of Claims

Grant No.	Name	No.	Owner	Expiry	NTS
YA56602	KONA	43	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Sep-21	105G02
YA56603	KONA	44	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Sep-21	105G02
YA56604	KONA	45	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Sep-21	105G02
YA56605	KONA	46	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Sep-21	105G02
YB33749	FIRE	2	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-21	105G02
YB33751	FIRE	4	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-21	105G02
YB33753	FIRE	6	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-21	105G02
YB33759	FIRE	12	PACIFIC RIDGE EXPLORATION LTD. - 100%	31-Dec-21	105G02
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Grant No.	Name	No.	Owner	Expiry	NTS
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YB88893	EMBER	86	PACIFIC RIDGE EXPLORATION LTD. - 100%	3-Dec-21	105G02
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YB88899	EMBER	92	PACIFIC RIDGE EXPLORATION LTD. - 100%	3-Dec-21	105G02
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YC22655	FIRE	311	PACIFIC RIDGE EXPLORATION LTD. - 100%	9-Dec-21	105G02
YC31894	FIRE	185	PACIFIC RIDGE EXPLORATION LTD. - 100%	25-Aug-22	105G02
YC31895	FIRE	193	PACIFIC RIDGE EXPLORATION LTD. - 100%	25-Aug-22	105G02
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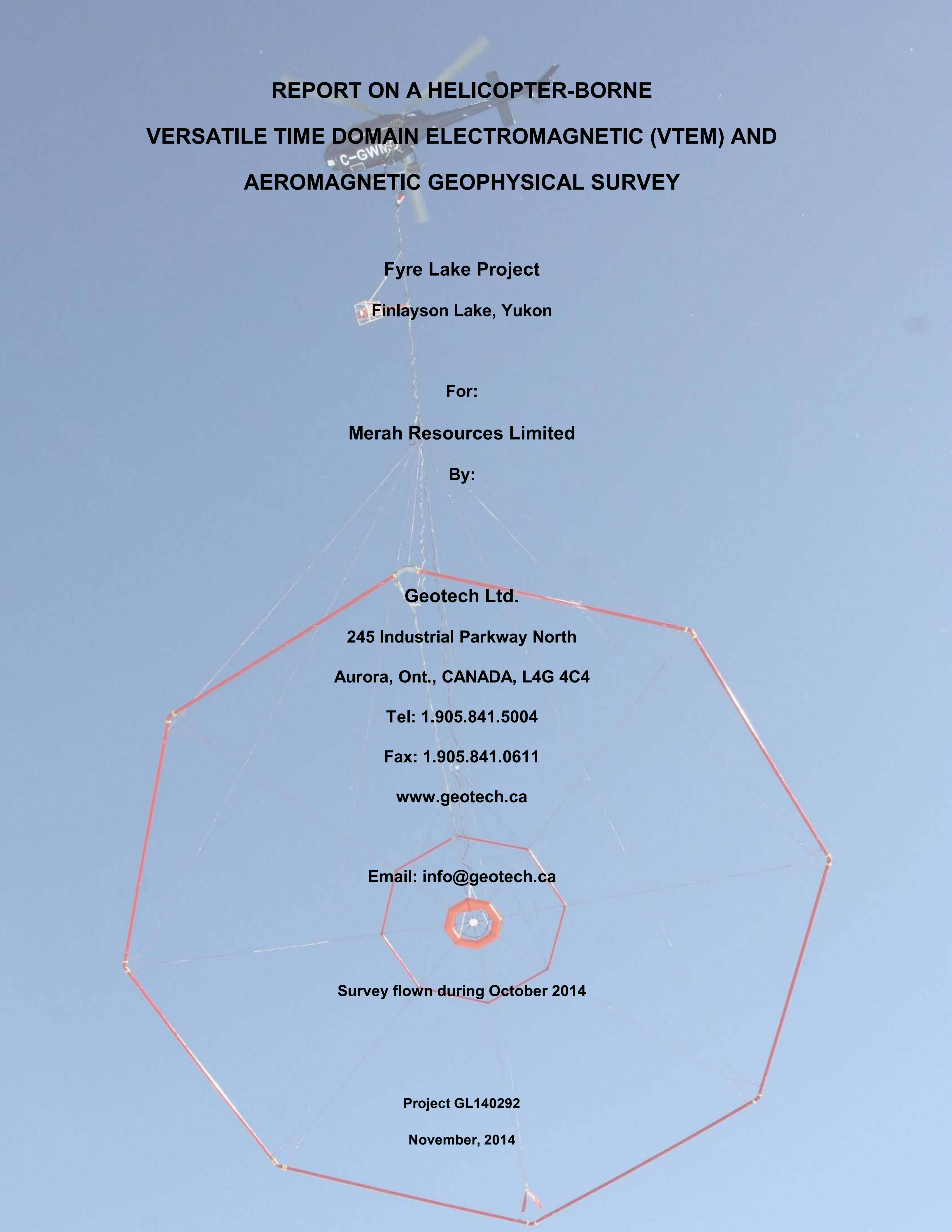
APPENDIX II

Geotech VTEM Report



REPORT ON A HELICOPTER-BORNE VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM) AND AEROMAGNETIC GEOPHYSICAL SURVEY

Fyre Lake Project

Finlayson Lake, Yukon

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Merah Resources Limited

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Survey flown during October 2014

Project GL140292

November, 2014

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REPORT ON A HELICOPTER-BORNE VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM) and AEROMAGNETIC SURVEY

Fyre Lake Project
Finlayson Lake, Yukon

Executive Summary

During October 5th to October 12th, 2014 Geotech Ltd. carried out a helicopter-borne geophysical survey over the Fyre Lake Project located near Finlayson Lake, Yukon, Canada.

Principal geophysical sensors included a versatile time domain electromagnetic (VTEM) system, and a cesium magnetometer. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 709.5 line-kilometres of geophysical data were acquired during the survey.

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 dB/dt Z Components,
- Total Magnetic Intensity (TMI),
- Calculated Time Constant (Tau) with Calculated Vertical Derivative contours
- RDI sections are presented.

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

This 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 Fyre Lake Project located near Finlayson Lake, Yukon, Canada (Figure 1 & Figure 2).

Jeremy Read and Chris Doornbos represented Merah Resources 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) system with Z component measurements and aeromagnetics using a caesium magnetometer. A total of 709.5 line-km of geophysical data were acquired during the survey.

The crew was based out of Fyre Lake Camp, Yukon for the acquisition phase of the survey. Survey flying started on October 5th, 2014 and was completed on October 12th, 2014.

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 November, 2014.

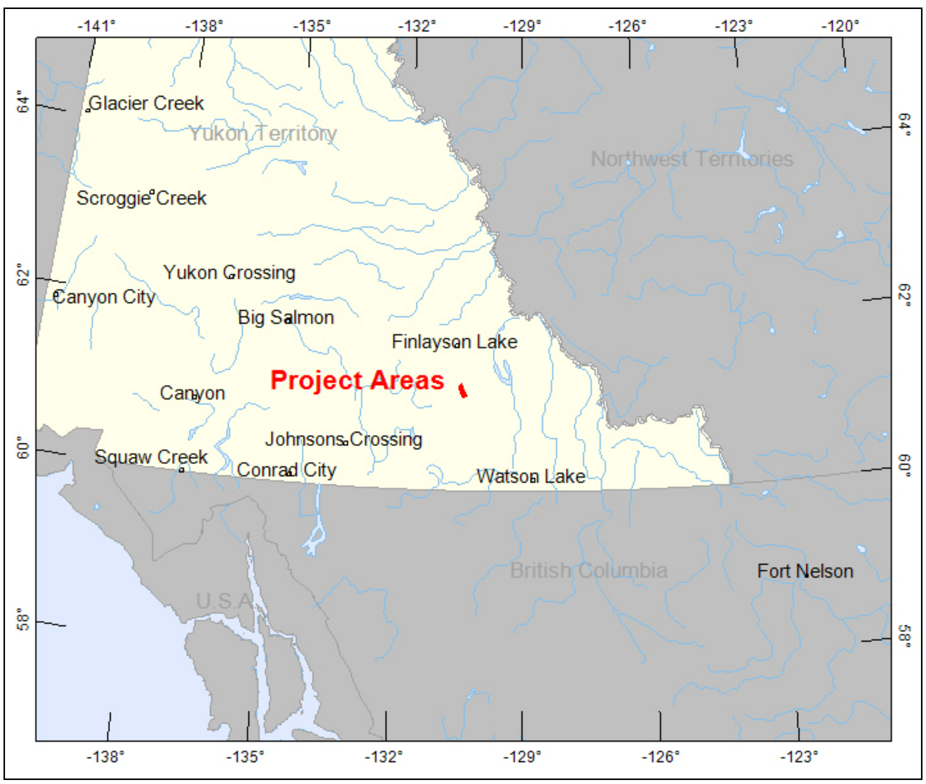

Figure 1: Property Location.

1.2 Survey and System Specifications

The survey area is located approximately 50 kilometres south of Finlayson Lake, Yukon (Figure 2).

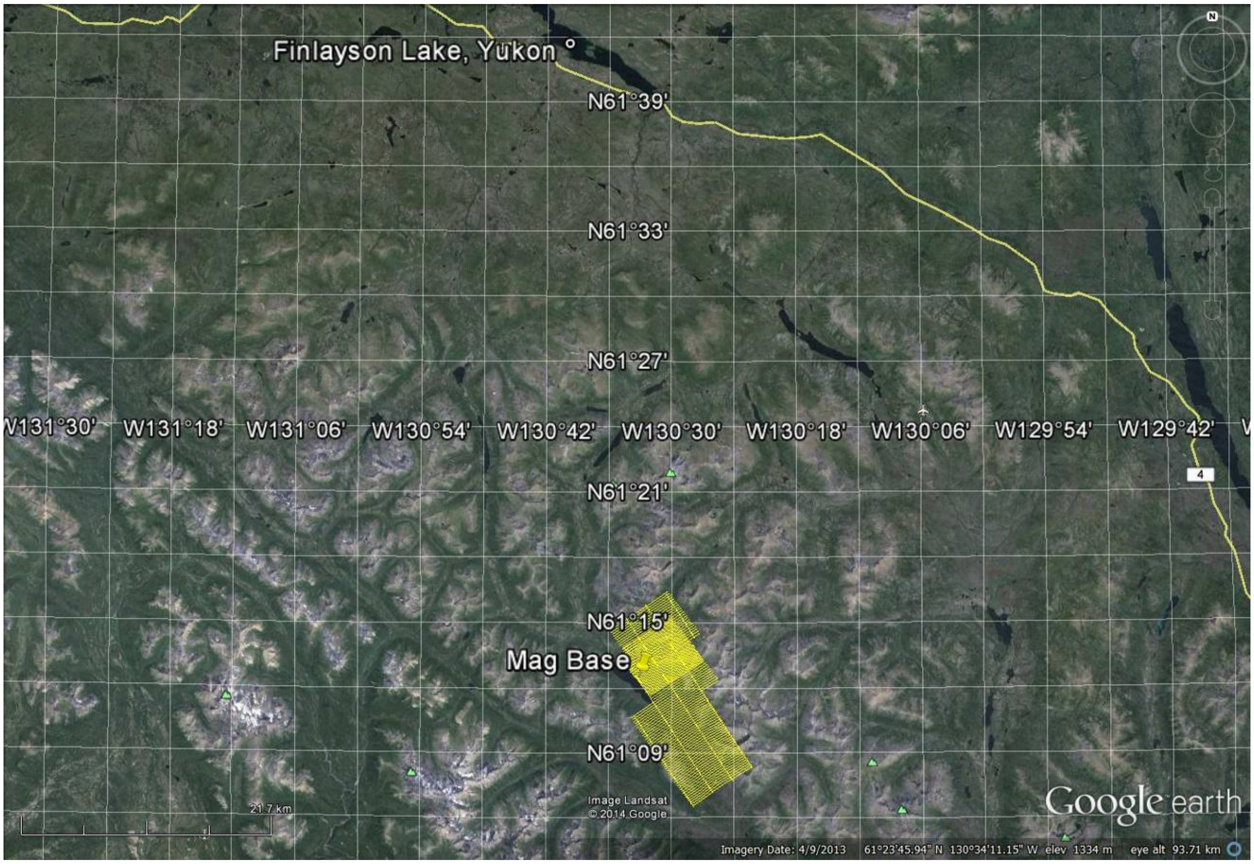

Figure 2: Survey area location on Google Earth.

The survey was flown in a southwest to northeast (N 58° E azimuth) direction with traverse line spacing of 100 and 200 metres as depicted in Figure 3. Tie lines were flown perpendicular to the traverse lines at a spacing of 2000 metres (N 148° E azimuth).

For more detailed information on the flight spacing and direction see Table 1.

1.3 Topographic Relief and Cultural Features

Topographically, the survey area exhibit a highly rugged relief with elevations ranging from 1006 to 1959 metres above mean sea level over an area of 103 square kilometres (Figure 3).

There are various rivers and streams running through the survey area which connect various lakes and wetlands. There are no visible signs of culture such as roads or buildings throughout the survey area.

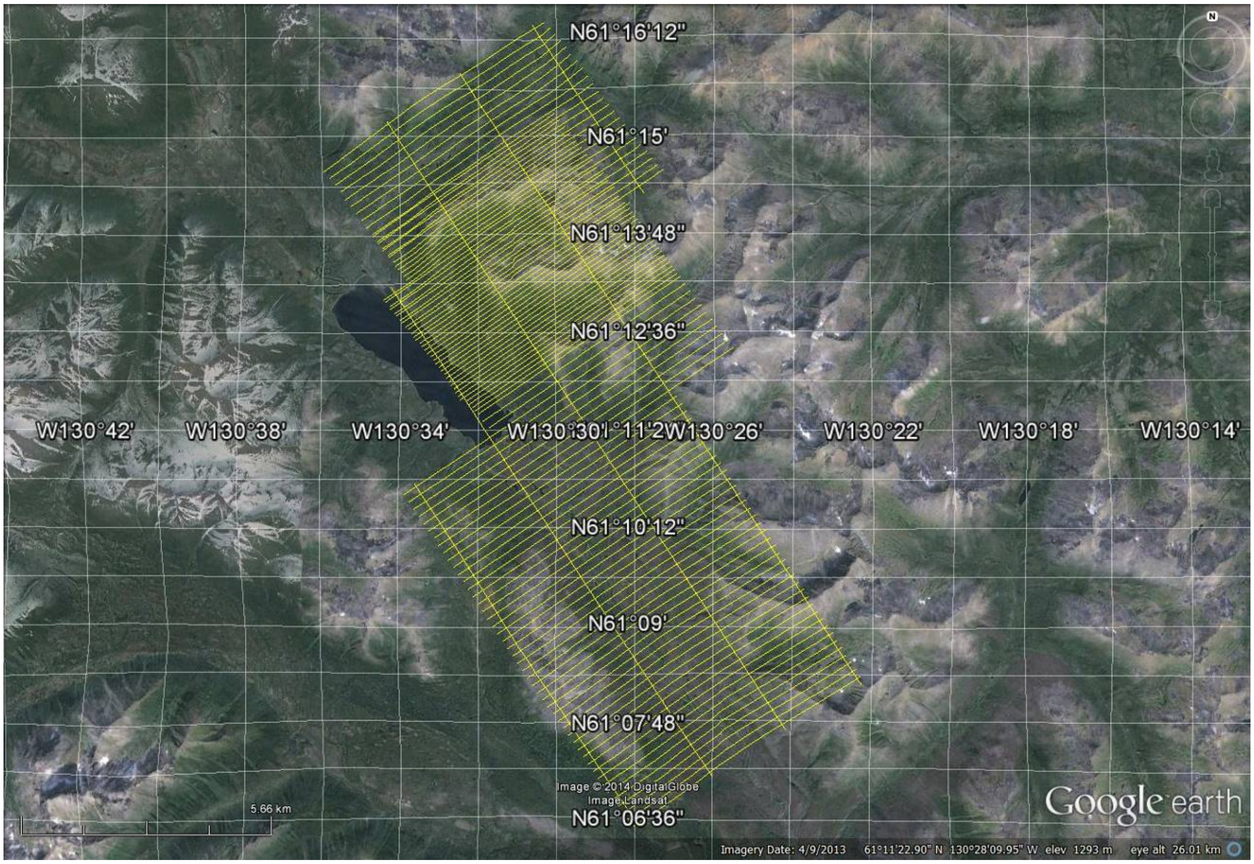

Figure 3: Flight path over a Google Earth Image - Fyre Lake Project.

The survey area is covered by NTS (National Topographic Survey) of Canada sheets 105G01, 105G02, 105G07 and 105G08.

2. DATA ACQUISITION

2.1 Survey Area

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

Table 1: Survey Specifications

Survey block	Line spacing (m)	Area (Km²)	Planned[1] Line-km	Actual Line-km	Flight direction	Line numbers
Fyre Lake Project	Traverse: 100 and 200	103	649.3	662.1	N 58° E / N 238° E	L1000 - L1820
	Tie: 2000		60.2	60.9	N 148° E / N 328° E	T2000 - T2040
TOTAL		103	709.5	723		

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

2.2 Survey Operations

Survey operations were based out of Fyre Lake Camp in Yukon from October 1st to October 12th, 2014. The following table shows the timing of the flying.

Table 2: Survey schedule

Date	Flight #	Flown km	Area	Crew location	Comments
27-Sep-2014				Watson Lake, YK	Mobilization
28-Sep-2014				Watson Lake, YK	Crew arrived & logistics coordinated
29-Sep-2014				Watson Lake, YK	System assembly
30-Sep-2014				Watson Lake, YK	System assembly
1-Oct-2014				Watson Lake, YK	Helicopter arrived & installation completed
2-Oct-2014				Fyre Lake Camp, YK	Mobilized to camp
3-Oct-2014				Fyre Lake Camp, YK	Coordinated local logistics
4-Oct-2014				Fyre Lake Camp, YK	Test flight
5-Oct-2014	1	12	Fyre Lake Project	Fyre Lake Camp, YK	12 km flown - limited due to weather
6-Oct-2014				Fyre Lake Camp, YK	No production due to weather
7-Oct-2014	2,3	204	Fyre Lake Project	Fyre Lake Camp, YK	204 km flown
8-Oct-2014	4	36	Fyre Lake Project	Fyre Lake Camp, YK	36 km flown - Limited due to weather
9-Oct-2014				Fyre Lake Camp, YK	No production due to weather
10-Oct-2014				Fyre Lake Camp, YK	No production due to weather
11-Oct-2014	5,6,7, 8	445	Fyre Lake Project	Fyre Lake Camp, YK	445 km flown
12-Oct-2014	9	21	Fyre Lake Project	Fyre Lake Camp, YK	Remaining kms were flown - flying complete

[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. However, the survey was stopped early as per the client.

2.3 Flight Specifications

During survey the helicopter was maintained at a mean altitude of 85 metres above the ground with an average survey speed of 80 km/hour. This allowed for an average EM transmitter-receiver loop terrain clearance of 48 metres and a magnetic sensor clearance of 72 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-GEOJ. The helicopter is owned and operated by Geotech Aviation. 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. VTEM, with the serial number 17 had been used for the survey. The configuration is as indicated in Figure 5.

The VTEM Receiver and transmitter coils were in concentric-coplanar and Z-direction oriented configuration. The EM transmitter-receiver loop was towed at a mean distance of 35 metres below the aircraft as shown in Figure 5. The VTEM transmitter current waveform is shown diagrammatically in Figure 4.

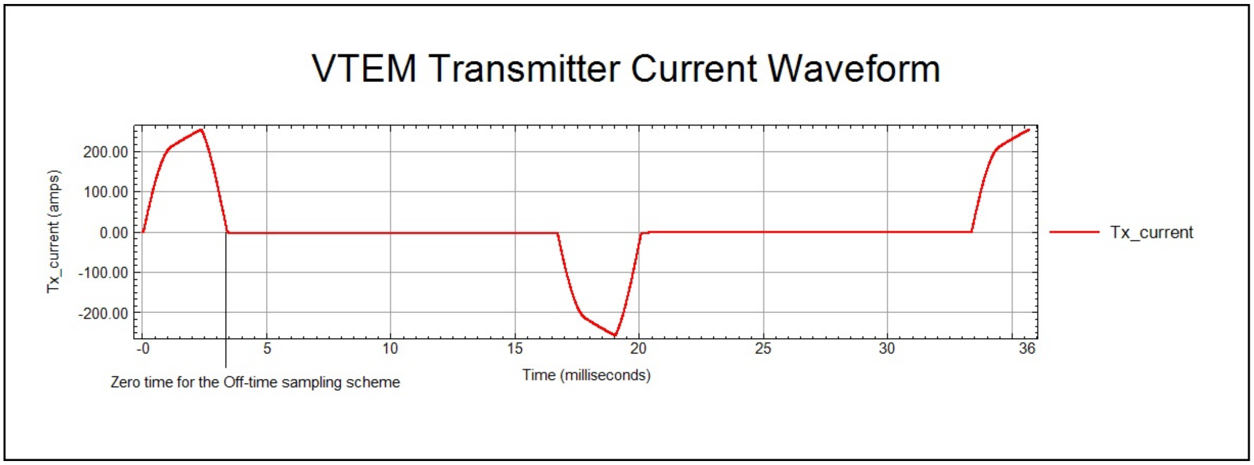

Figure 4: VTEM Transmitter Current Waveform.

The VTEM decay sampling scheme is shown in Table 3 below. Thirty-six time measurement gates were used for the final data processing in the range from 0.096 to 8.083 msec. Zero time for the off-time sampling scheme is equal to the current pulse width and is defined as the time near the end of the turn-off ramp where the dI/dt waveform falls to 1/2 of its peak value.

Table 3: Off-Time Decay Sampling Scheme

VTEM Decay Sampling Scheme				
Index	**Start**	**End**	**Middle**	**Width**
Milliseconds				
14	0.090	0.103	0.096	0.013
15	0.103	0.118	0.110	0.015
16	0.118	0.136	0.126	0.018
17	0.136	0.156	0.145	0.020
18	0.156	0.179	0.167	0.023
19	0.179	0.206	0.192	0.027
20	0.206	0.236	0.220	0.030
21	0.236	0.271	0.253	0.035
22	0.271	0.312	0.290	0.040
23	0.312	0.358	0.333	0.046
24	0.358	0.411	0.383	0.053
25	0.411	0.472	0.440	0.061
26	0.472	0.543	0.505	0.070
27	0.543	0.623	0.580	0.081
28	0.623	0.716	0.667	0.093
29	0.716	0.823	0.766	0.107
30	0.823	0.945	0.880	0.122
31	0.945	1.086	1.010	0.141
32	1.086	1.247	1.161	0.161
33	1.247	1.432	1.333	0.185
34	1.432	1.646	1.531	0.214
35	1.646	1.891	1.760	0.245
36	1.891	2.172	2.021	0.281
37	2.172	2.495	2.323	0.323
38	2.495	2.865	2.667	0.370
39	2.865	3.292	3.063	0.427
40	3.292	3.781	3.521	0.490
41	3.781	4.341	4.042	0.560
42	4.341	4.987	4.641	0.646
43	4.987	5.729	5.333	0.742
44	5.729	6.581	6.125	0.852
45	6.581	7.560	7.036	0.979
46	7.560	8.685	8.083	1.125

VTEM system specification:

<u>Transmitter</u>

- Transmitter loop diameter: 17.6 m
- Number of turns: 4
- Effective Transmitter loop area: 973 m^2
- Transmitter base frequency: 30 Hz
- Peak current: 255 A
- Pulse width: 3.40 ms
- Wave form shape: Bi-polar trapezoid
- Peak dipole moment: 248,150 nIA
- Actual average EM transmitter-receiver loop terrain clearance: 48 metres above the ground

<u>Receiver</u>

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

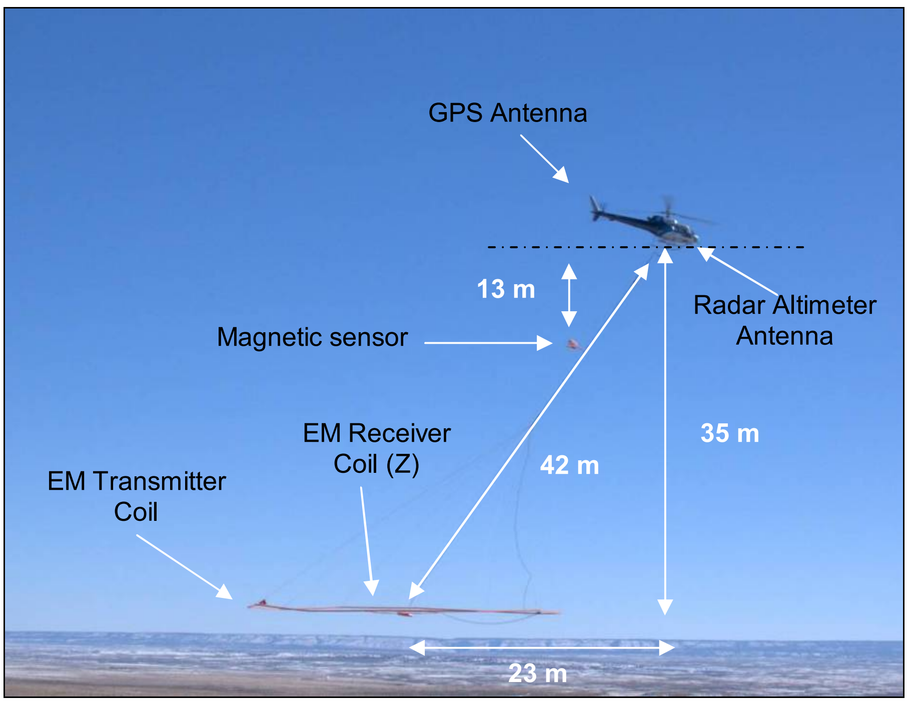

Figure 5: VTEM System Configuration.

2.4.3 Airborne magnetometer

The magnetic sensor utilized for the survey was Geometrics optically pumped cesium vapour magnetic field sensor mounted 13 metres below the helicopter, as shown in Figure 5. The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds.

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 5).

2.4.5 GPS Navigation System

The navigation system used was a Geotech PC104 based navigation system utilizing a NovAtel's WAAS (Wide Area Augmentation System) enabled GPS receiver, Geotech navigate software, a full screen display with controls in front of the pilot to direct the flight and a NovAtel GPS antenna mounted on the helicopter tail (Figure 5). As many as 11 GPS and two WAAS satellites may be monitored at any one time. The positional accuracy or circular error probability (CEP) is 1.8 m, with WAAS 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 towards the back of Fyre Lake Camp (61° 12.4997' N, 130° 33.0815' 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:	Les Moschuk
Operator:	Juan Carlos Florez Osorio

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

Pilot:	Brad Macrae
Mechanical Engineer:	Nathan Shirey

Office:

Preliminary Data Processing:	Neil Fiset
Final Data Processing:	Tai-Chyi Shei
Final Data QA/QC:	Geoffrey Plastow
Reporting/Mapping:	Liz Mathew

Data acquisition phase was carried out under the supervision of Andrei Bagrianski, P. Geo, Chief Operations Officer. The processing and interpretation phase was under the supervision of Geoffrey Plastow, P. Geo, Data Processing Manager. The overall contract management and customer relations were by Mandy Long.

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 9 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 dB/dt Z component responses. Calculated Time Constant (TAU) with Calculated Vertical Derivative contours is presented in Appendix C and E. Tau was calculated for B-Field and dB/dt. Resistivity Depth Image (RDI) is also presented in Appendix F and H.

VTEM receiver coil orientation Z-axis coil is oriented parallel to the transmitter coil axis and is horizontal to the ground. Generalized modeling results of VTEM data, are shown in Appendix D.

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 TEM system the system's height and depth of a target. For example see Appendix D, Fig.D-16.

4.3 Magnetic Data

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

Tie line levelling was carried out by adjusting intersection points along traverse lines. A micro-levelling procedure was applied to remove persistent low-amplitude components of flight-line noise remaining in the data.

The corrected magnetic data was interpolated between survey lines using a random point gridding method to yield x-y grid values for a standard grid cell size of 50 metres at the mapping scale. The Minimum Curvature algorithm was used to interpolate values onto a rectangular regular spaced grid.

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 1:20,000 for best representation of the survey size and line spacing. The coordinate/projection system used was NAD83 Datum, UTM Zone 9 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 colour magnetic TMI contour map.

- Maps at 1:20,000 in Geosoft MAP format, as follows:

GL140292_20k_dBdtz:	dB/dt profiles Z Component, Time Gates 0.220 - 7.036 ms in linear - logarithmic scale over Geology.
GL140292_20k_TMI:	Total magnetic intensity (TMI) colour image and contours.
GL140292_20k_TauSF:	dB/dt Calculated Time Constant (Tau) with Calculated Vertical Derivative contours

  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 *GL140292_FP.kml* showing the flight path of the survey area is included. Free versions of Google Earth software from: http://earth.google.com/download-earth.html

5.3 Digital Data

- Two copies of the data on DVD 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.

  Data contains databases, grids and maps, 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 9 North
Y:	metres	UTM Northing NAD83 Zone 9 North
Z:	metres	GPS antenna elevation (above Geoid)
Longitude:	Decimal Degrees	WGS 84 Longitude data

Channel name	Units	Description
Latitude:	Decimal Degrees	WGS 84 Latitude data
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:	nT	Raw Total Magnetic field data
Basemag:	nT	Magnetic diurnal variation data
Mag2:	nT	Diurnal corrected Total Magnetic field data
Mag3:	nT	Levelled Total Magnetic field data
CVG:	nT/m	Calculated Magnetic Vertical Gradient
SFz[14]:	pV/(A*m^4)	Z dB/dt 0.096 millisecond time channel
SFz[15]:	pV/(A*m^4)	Z dB/dt 0.110 millisecond time channel
SFz[16]:	pV/(A*m^4)	Z dB/dt 0.126 millisecond time channel
SFz[17]:	pV/(A*m^4)	Z dB/dt 0.145 millisecond time channel
SFz[18]:	pV/(A*m^4)	Z dB/dt 0.167 millisecond time channel
SFz[19]:	pV/(A*m^4)	Z dB/dt 0.192 millisecond time channel
SFz[20]:	pV/(A*m^4)	Z dB/dt 0.220 millisecond time channel
SFz[21]:	pV/(A*m^4)	Z dB/dt 0.253 millisecond time channel
SFz[22]:	pV/(A*m^4)	Z dB/dt 0.290 millisecond time channel
SFz[23]:	pV/(A*m^4)	Z dB/dt 0.333 millisecond time channel
SFz[24]:	pV/(A*m^4)	Z dB/dt 0.383 millisecond time channel
SFz[25]:	pV/(A*m^4)	Z dB/dt 0.440 millisecond time channel
SFz[26]:	pV/(A*m^4)	Z dB/dt 0.505 millisecond time channel
SFz[27]:	pV/(A*m^4)	Z dB/dt 0.580 millisecond time channel
SFz[28]:	pV/(A*m^4)	Z dB/dt 0.667 millisecond time channel
SFz[29]:	pV/(A*m^4)	Z dB/dt 0.766 millisecond time channel
SFz[30]:	pV/(A*m^4)	Z dB/dt 0.880 millisecond time channel
SFz[31]:	pV/(A*m^4)	Z dB/dt 1.010 millisecond time channel
SFz[32]:	pV/(A*m^4)	Z dB/dt 1.161 millisecond time channel
SFz[33]:	pV/(A*m^4)	Z dB/dt 1.333 millisecond time channel
SFz[34]:	pV/(A*m^4)	Z dB/dt 1.531 millisecond time channel
SFz[35]:	pV/(A*m^4)	Z dB/dt 1.760 millisecond time channel
SFz[36]:	pV/(A*m^4)	Z dB/dt 2.021 millisecond time channel
SFz[37]:	pV/(A*m^4)	Z dB/dt 2.323 millisecond time channel
SFz[38]:	pV/(A*m^4)	Z dB/dt 2.667 millisecond time channel
SFz[39]:	pV/(A*m^4)	Z dB/dt 3.063 millisecond time channel
SFz[40]:	pV/(A*m^4)	Z dB/dt 3.521 millisecond time channel
SFz[41]:	pV/(A*m^4)	Z dB/dt 4.042 millisecond time channel
SFz[42]:	pV/(A*m^4)	Z dB/dt 4.641 millisecond time channel
SFz[43]:	pV/(A*m^4)	Z dB/dt 5.333 millisecond time channel
SFz[44]:	pV/(A*m^4)	Z dB/dt 6.125 millisecond time channel
SFz[45]:	pV/(A*m^4)	Z dB/dt 7.036 millisecond time channel
SFz[46]:	pV/(A*m^4)	Z dB/dt 8.083 millisecond time channel
BFz:	(pV*ms)/(A*m^4)	Z B-Field data for time channels 14 to 46
PLM:		60 Hz power line monitor
TauSF:	milliseconds	Time Constant (Tau) calculated from dB/dt data
NchanSF:		Last channel where the Tau algorithm stops calculation, dB/dt data
TauBF:	milliseconds	Time Constant (Tau) calculated from B-Field data
NchanBF:		Last channel where the Tau algorithm stops calculation, B-Field data

Electromagnetic B-field and dB/dt Z component data is found in array channel format between indexes 14 – 46.

- Database of the Resistivity Depth Images in Geosoft GDB format, containing the following channels:

Table 6: Geosoft Resistivity Depth Image GDB Data Format

Channel name	Units	Description
Xg:	metres	UTM Easting NAD83 Zone 9 North
Yg:	metres	UTM Northing NAD83 Zone 9 North
Dist:	meters	Distance from the beginning of the line
Depth:	meters	array channel, depth from the surface
Z:	meters	array channel, depth from sea level
AppRes:	Ohm-m	array channel, Apparent Resistivity
TR:	meters	EM system height from sea level
Topo:	meters	digital elevation model
Radarb:	metres	Calculated EM bird terrain clearance from radar altimeter
SF:	pV/(A*m^4)	array channel, dB/dT
Mag:	nT	Total Magnetic field data
CVG:	nT/m	CVG data
DOI:	metres	Depth of Investigation: a measure of VTEM depth effectiveness
PLM:		60 Hz power line monitor

- Database of the VTEM Waveform “GL140292_waveform_final.gdb” in Geosoft GDB format, contains the channels described in Table 7.

Table 7: Geosoft database for the VTEM waveform

Channel name	Units	Description
Rx_voltage:	volts	Input voltage
Time:	microseconds	Sampling rate interval, 5.2083 microseconds
Tx_Current:	amps	Output current of the transmitter

- Grids in Geosoft GRD and GeoTIFF format, as follows:

CVG: Calculated Vertical Derivative of TMI (CVG)
DEM: Digital Elevation Model
SFz15: dB/dt Z Component Channel 15 (Time Gate 0.110 ms)
SFz30: dB/dt Z Component Channel 30 (Time Gate 0.880 ms)
SFz45: dB/dt Z Component Channel 45 (Time Gate 7.036 ms)
TauSF: dB/dt Calculated Time Constant (TAU)
TauBF: B-Field Calculated Time Constant (TAU)
TMI: Total Magnetic Intensity (TMI)

A Geosoft .GRD file has a .GI metadata file associated with it, containing grid projection information. A grid cell size of 50 metres was used.

6. CONCLUSIONS AND RECOMMENDATIONS

A helicopter-borne versatile time domain electromagnetic (VTEM) geophysical survey has been completed over the Fyre Lake Project near Finlayson Lake, Yukon.

The total area coverage is 103 km^2. Total survey line coverage is 709.5 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 1:20,000. A formal Interpretation has not been included or requested.

Based on the geophysical results obtained, a number of TEM anomalous zones are identified across the properties. They can be seen overlapping the TAU decay parameter image presented with the calculated vertical magnetic gradient (CVG) contours (see Appendix C).

The anomalous zones in this block are mainly orientated near North to South and Northwest to Southeast directions shown as a "Y" shape. They are moderately associated with the magnetic anomalies. The conductive targets can be interpreted as gently to steeply dipping plates, and associated local targets. The anomalous zones have dB/dt time constant ranging from about 0.4 to 1.9 ms. The apparent resistivity of the anomalous zones is estimated to be less than 50 Ohm.m According to apparent resistivity depth images over all lines (Appendix C), the estimated depth of the top of the anomalous zones is approximately from near surface to about 150 meters.

If the conductors correspond to an exploration model on the area it is recommended picking EM anomalies with conductance grading and center localization of the targets, detail resistivity depth imaging and plate modeling with test drill hole parameters planning prior to ground follow up and drill testing.

Respectfully submitted[2],

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Geotech Ltd.

Tai-Chyi Shei
Geotech Ltd.

Geoffrey Plastow, P. Geo
Data Processing Manager
Geotech Ltd.

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GEOFFREY C. PLASTOW
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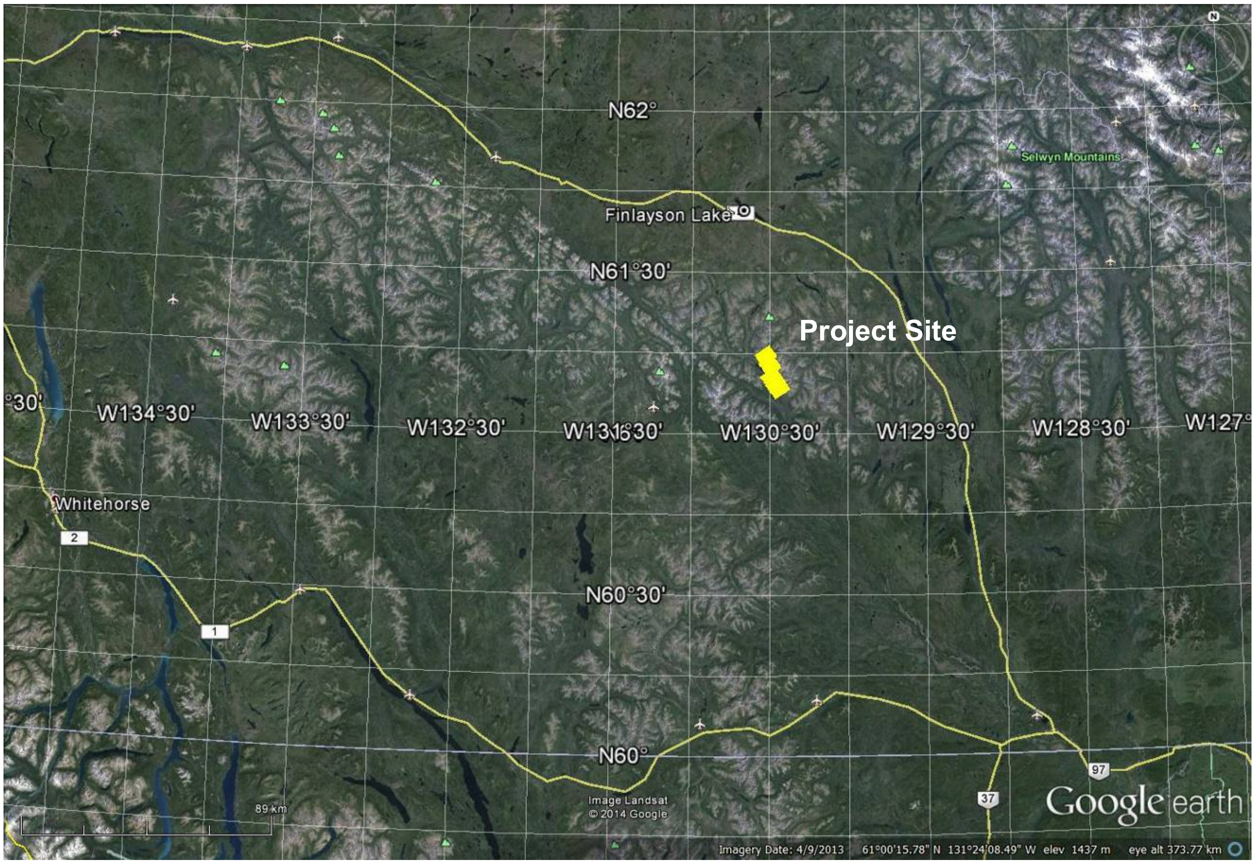
2171
12/6/14
ONTARIO

November 2014

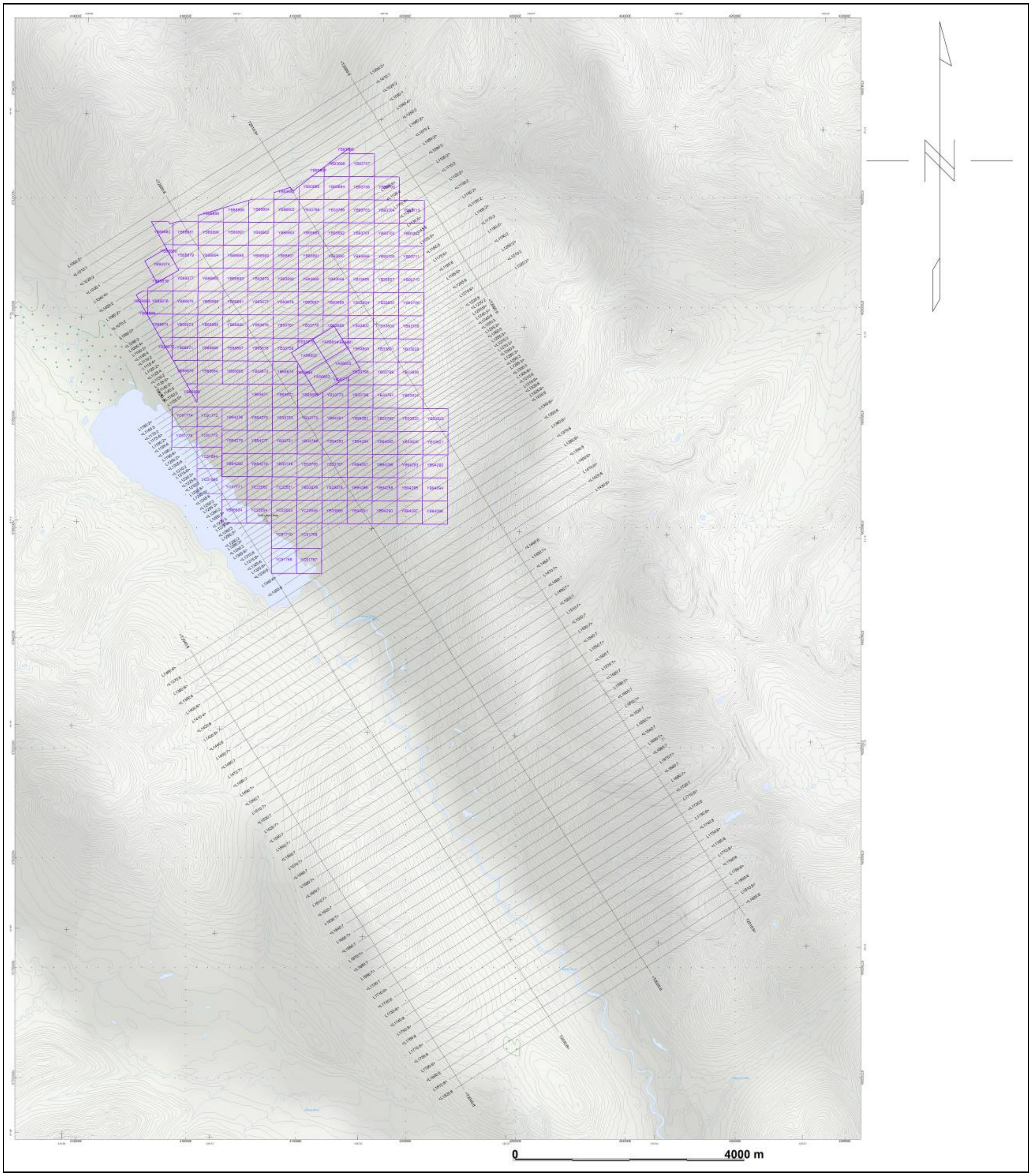
[2] Final data processing of the EM and magnetic data were carried out by TaiChyi Shei, from the office of Geotech Ltd. in Aurora, Ontario, under the supervision of Geoffrey Plastow, P.Geo., Data Processing Manager.

APPENDIX A

SURVEY AREA LOCATION MAP



Survey Overview



Mining Claims - Fyre Lake Project

APPENDIX B

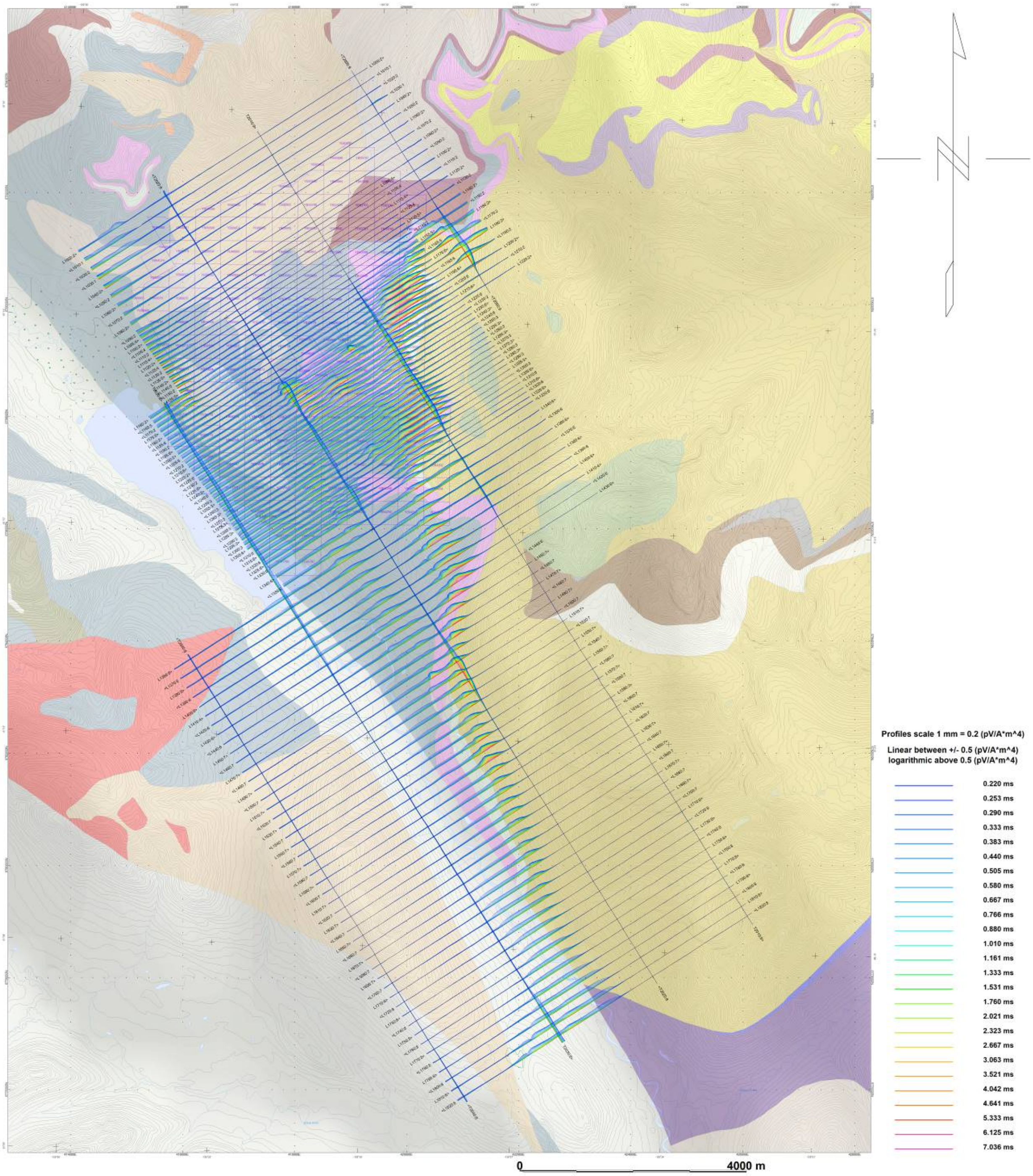
SURVEY BLOCK COORDINATES

(WGS 84, UTM Zone 9 North)

Fyre Lake Project	
X	**Y**
419265	6794201
414194	6790967
416007	6788443
415456	6788007
417934	6784887
415892	6783533
420985	6775779
426147	6778991
422041	6785598
423417	6786539
421077	6789888
421903	6790645
419265	6794201
419265	6794201

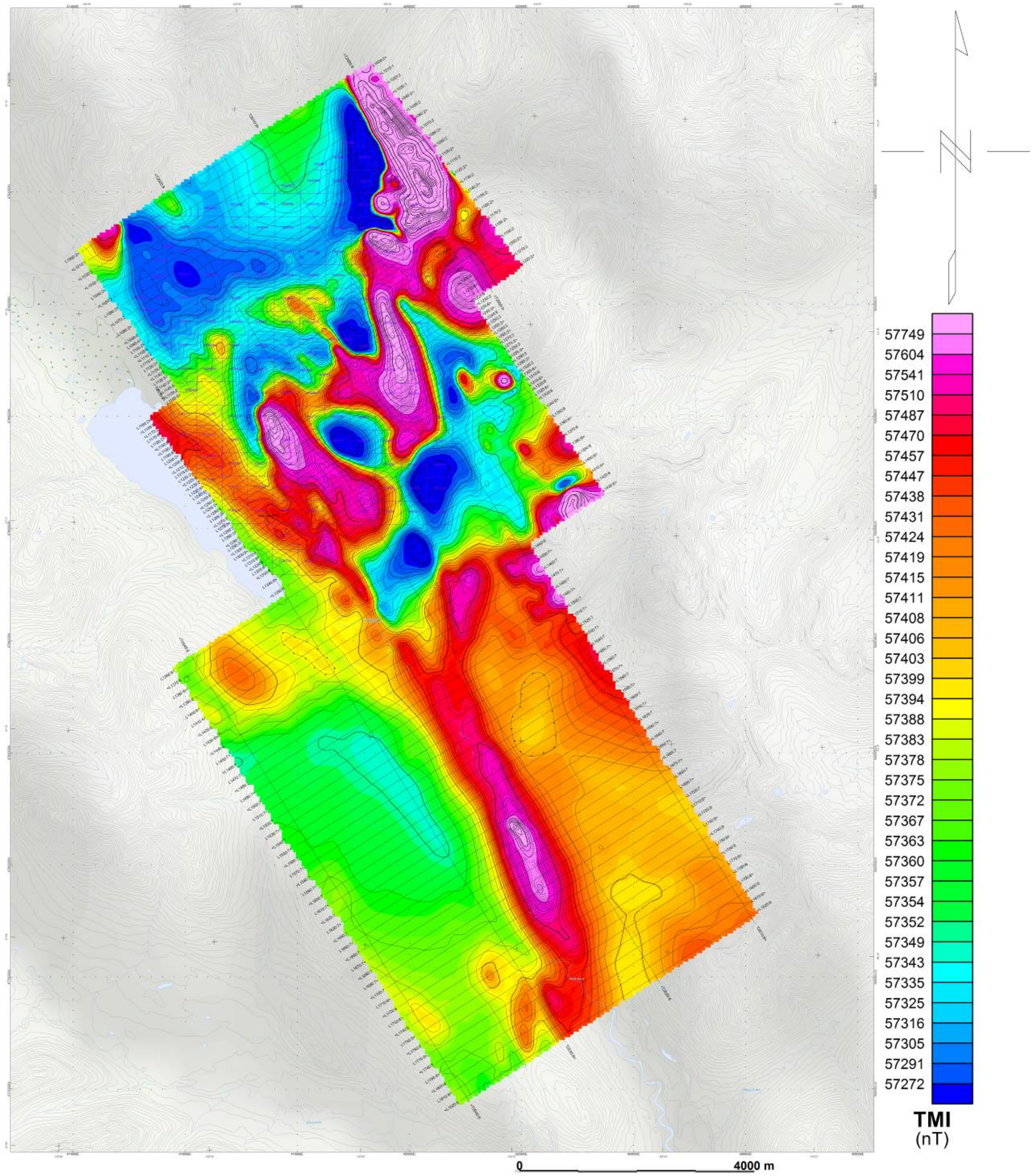
APPENDIX C

GEOPHYSICAL MAPS[1]

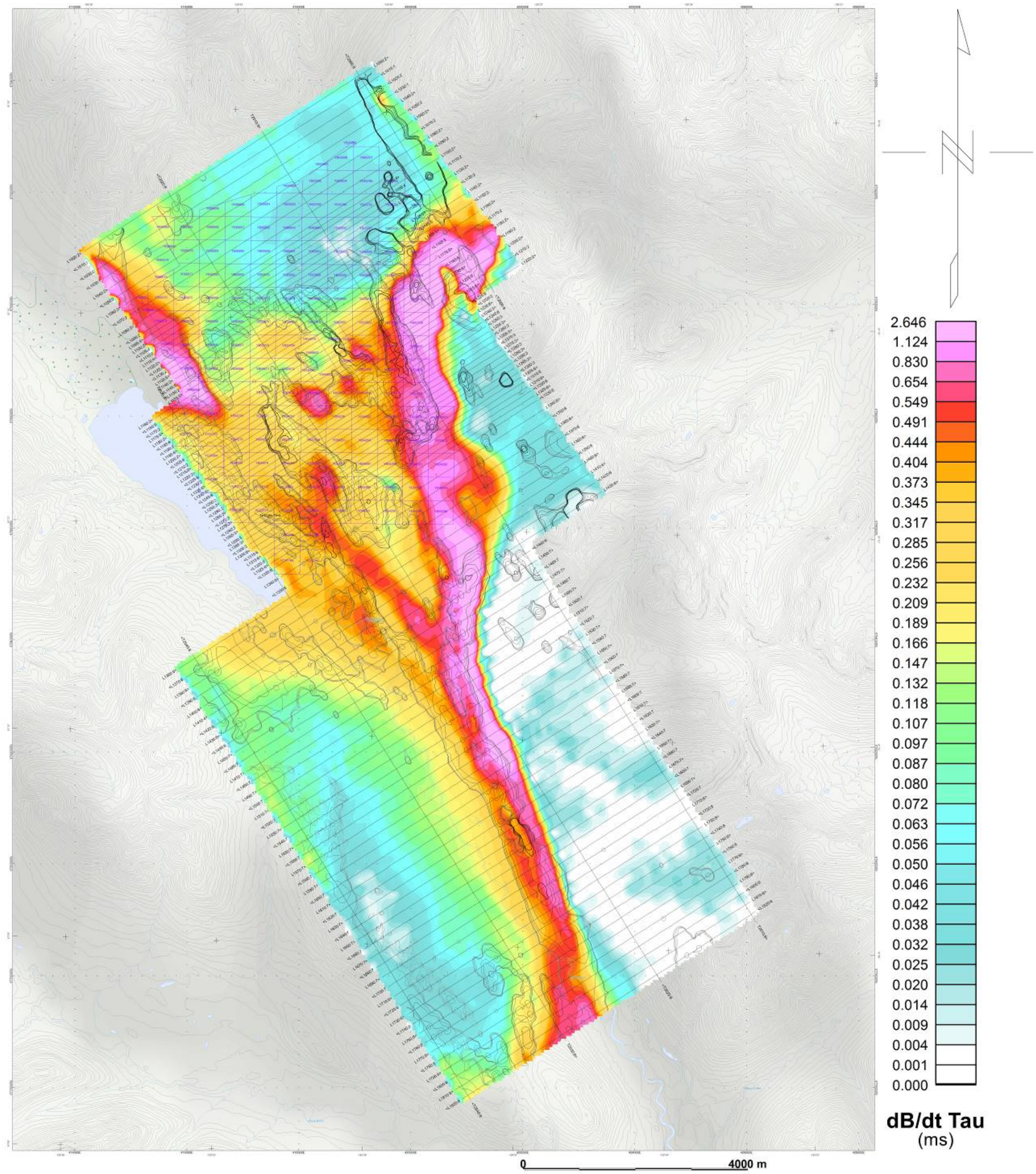


VTEM dB/dt Z Component Profiles, Time Gates 0.220 to 7.036 ms

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



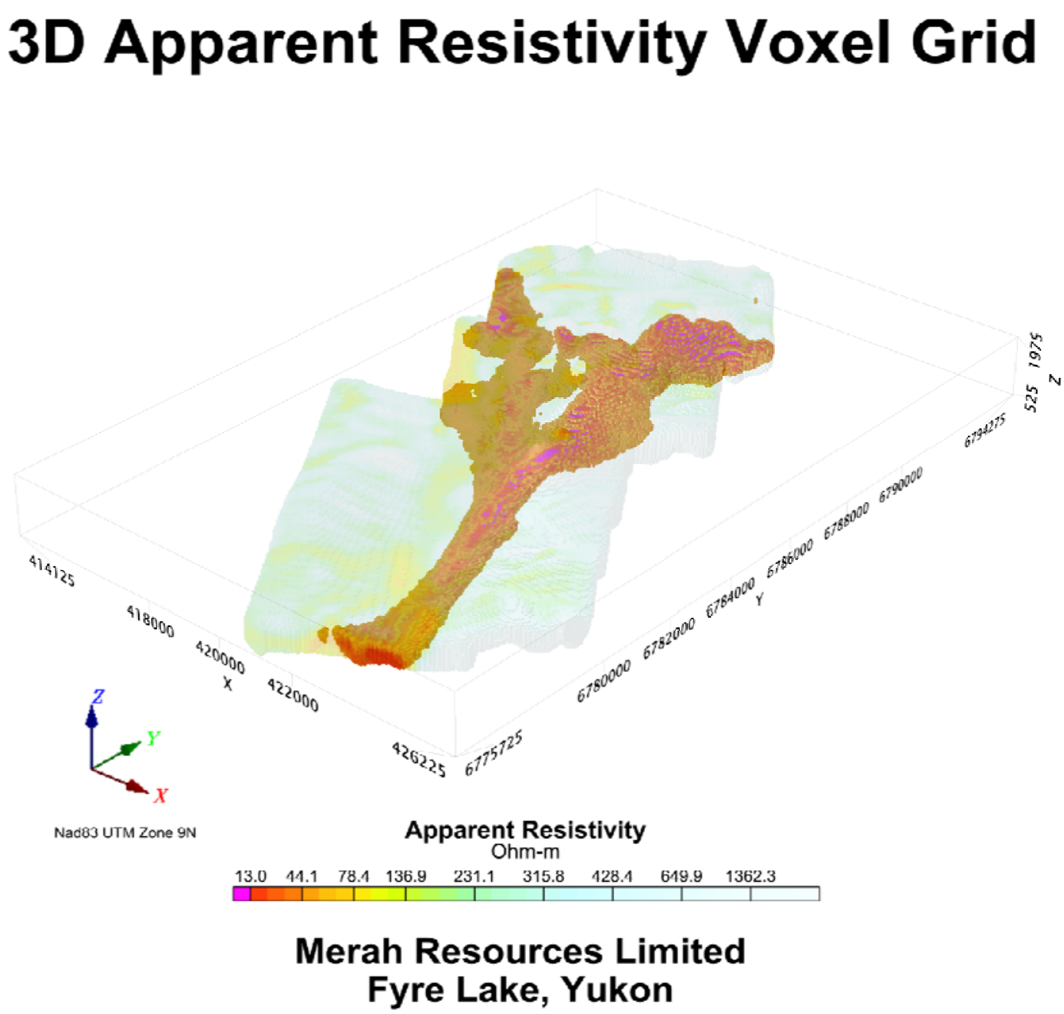
Total Magnetic Intensity

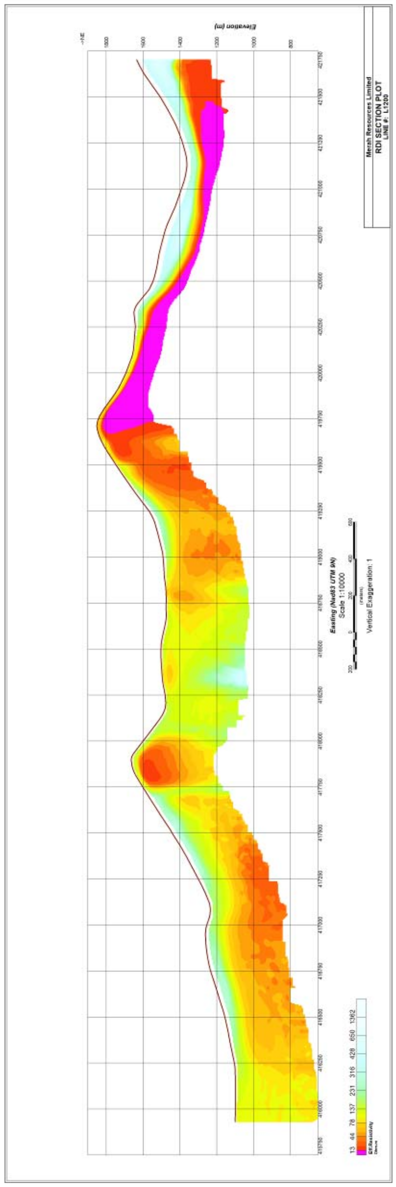


VTEM dB/dt Calculated Time Constant (TAU) with Calculated Vertical Derivative contours

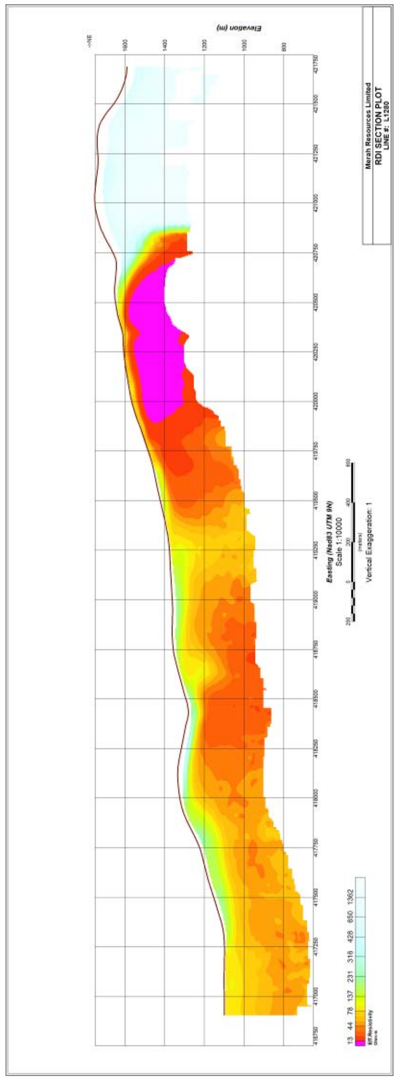
RESISTIVITY DEPTH IMAGE (RDI) MAPS

3D Resistivity Depth Image (RDI)

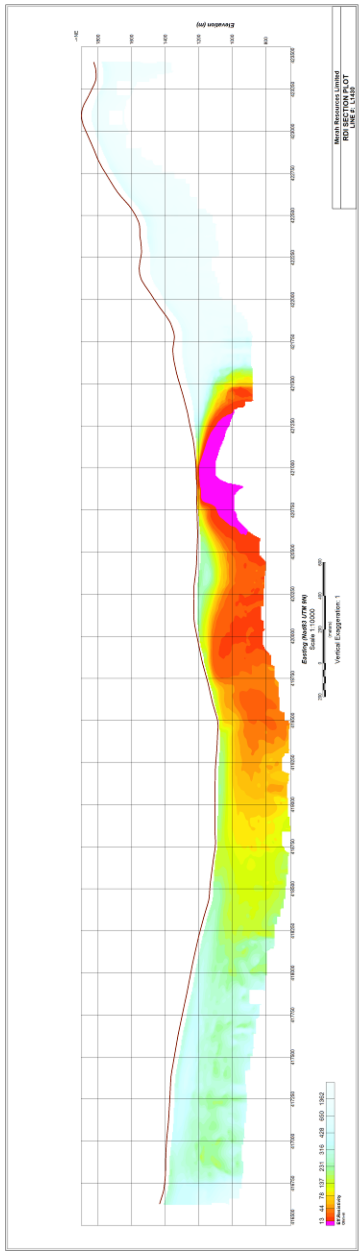




L1200



L1280



L1430

APPENDIX D

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 D1 to D15). 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.

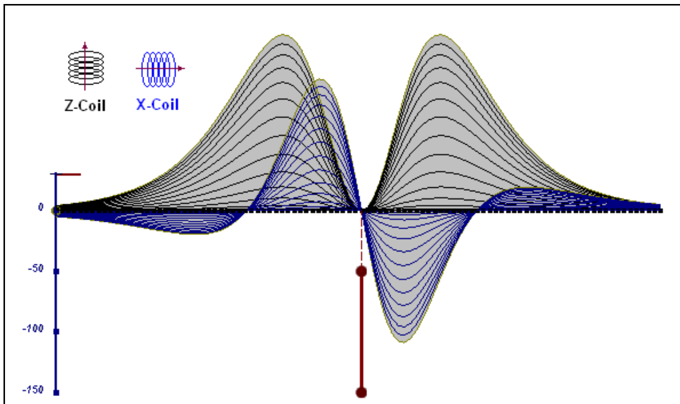


Figure D-1: vertical thin plate

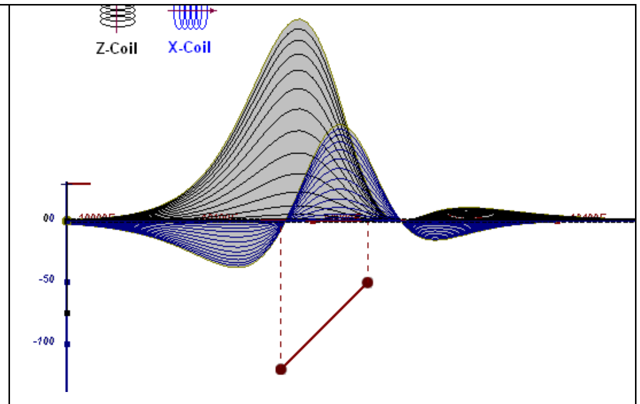


Figure D-2: inclined thin plate

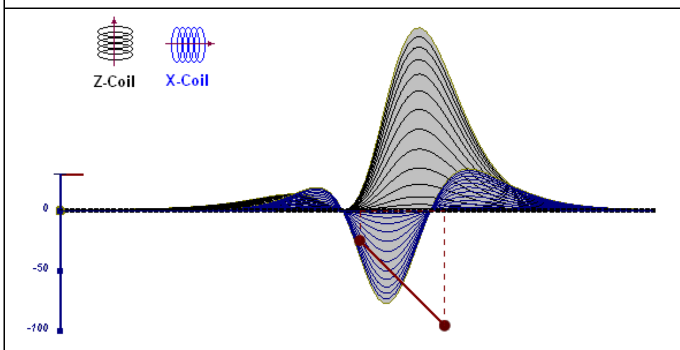


Figure D-3: inclined thin plate

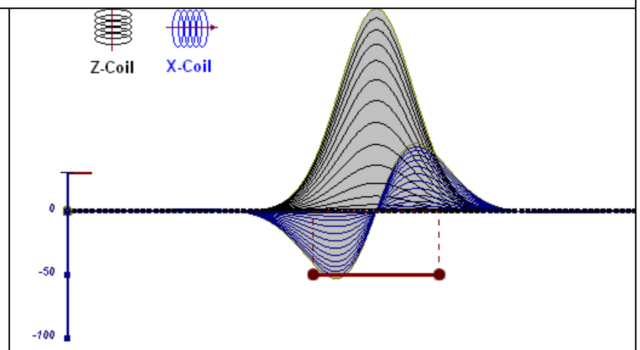


Figure D-4: horizontal thin plate

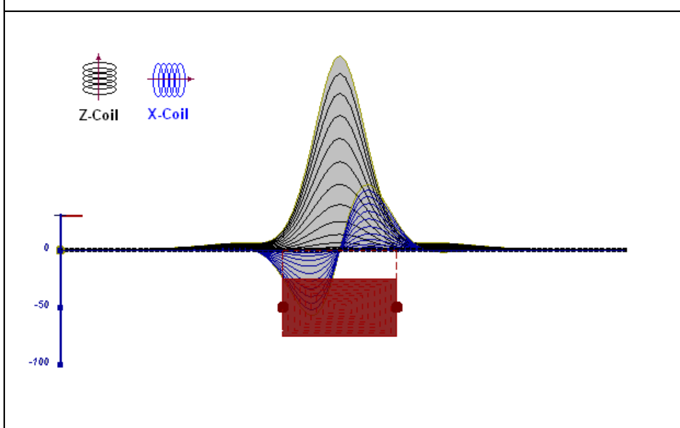


Figure D-5: horizontal thick plate (linear scale of the response)

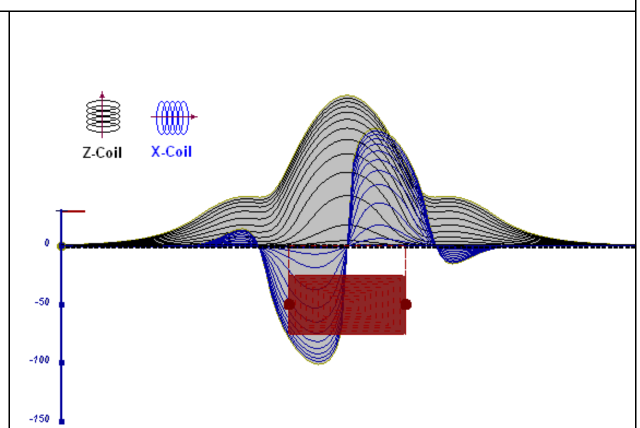


Figure D-6: horizontal thick plate (log scale of the response)

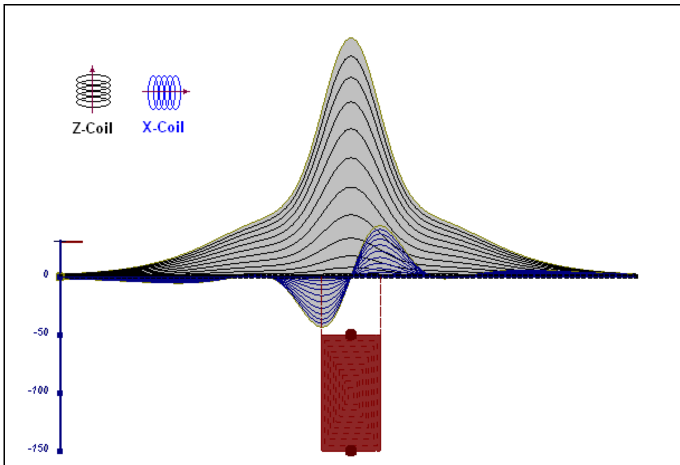


Figure D-7: vertical thick plate (linear scale of the response). 50 m depth

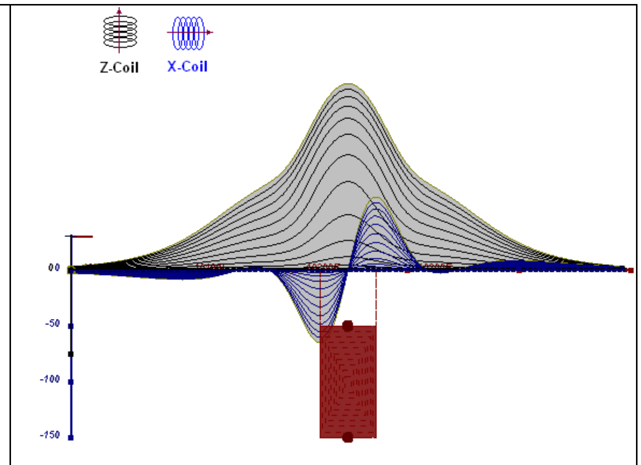


Figure D-8: vertical thick plate (log scale of the response). 50 m depth

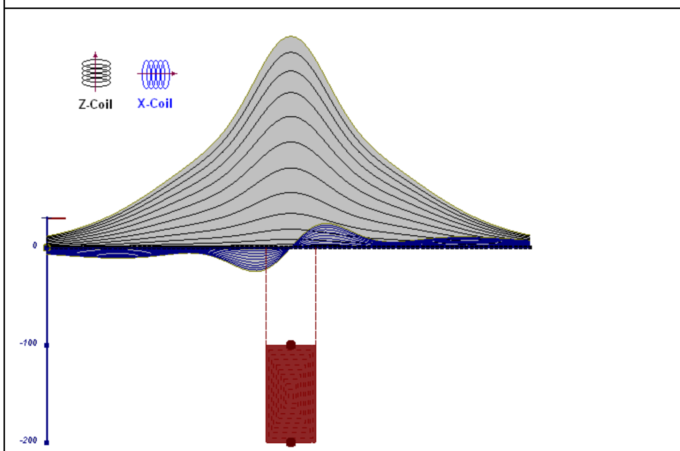


Figure D-9: vertical thick plate (linear scale of the response). 100 m depth

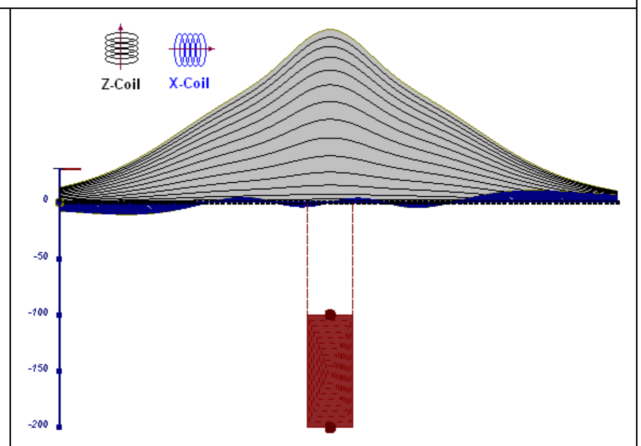


Figure D-10: vertical thick plate (linear scale of the response). Depth/hor.thickness=2.5

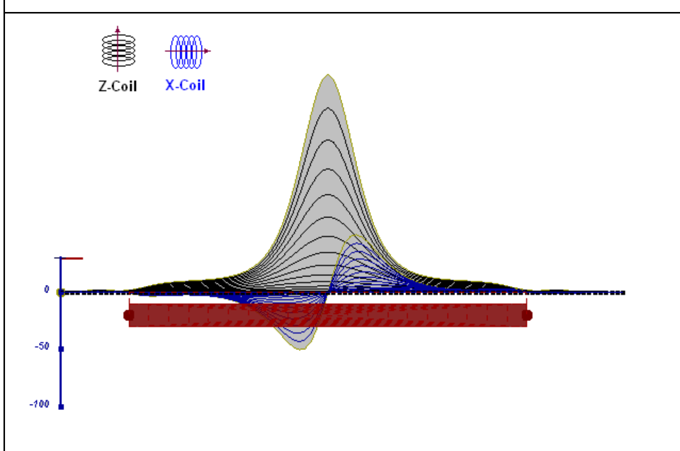


Figure D-10: horizontal thick plate (linear scale of the response)

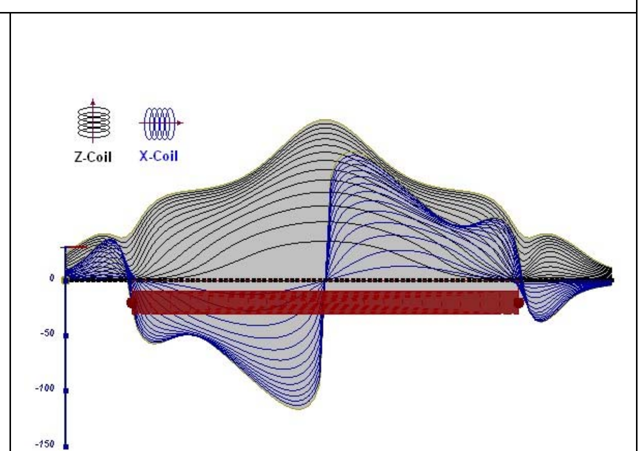


Figure D-11: horizontal thick plate (log scale of the response)

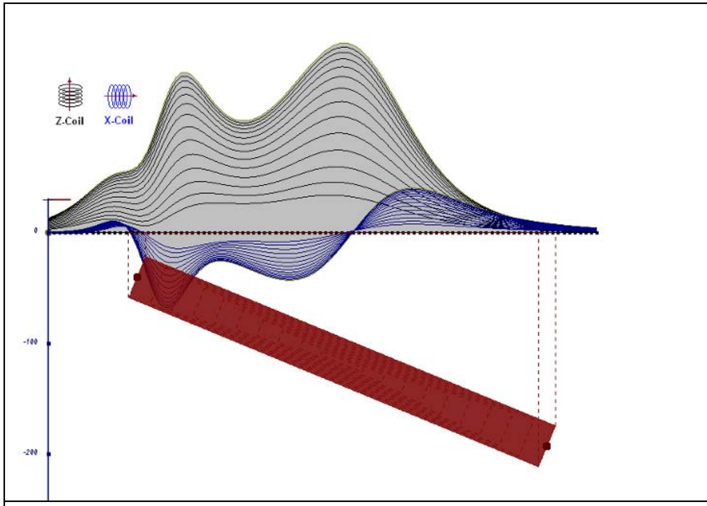


Figure D-12: inclined long thick plate

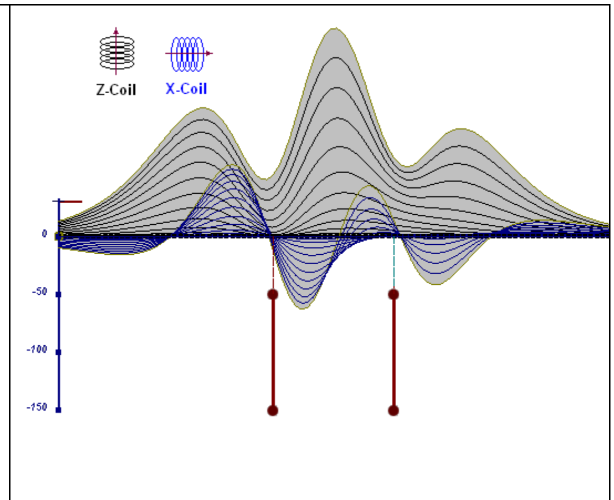


Figure D-13: two vertical thin plates

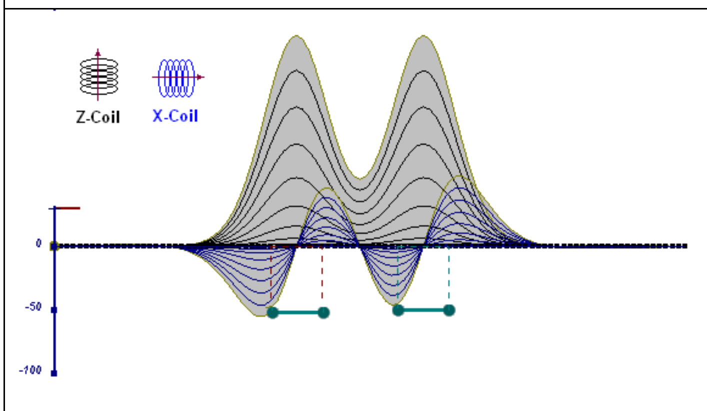


Figure D-14: two horizontal thin plates

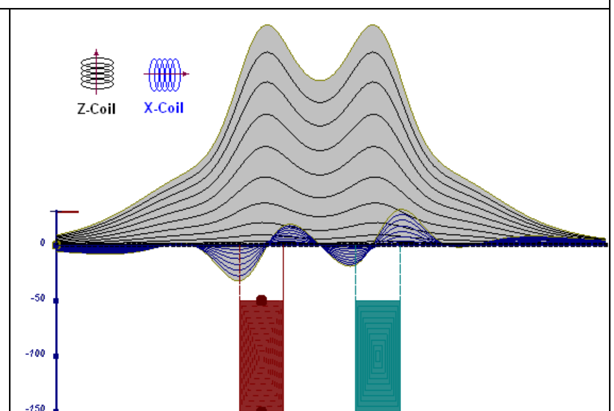


Figure D-15: two vertical thick plates

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

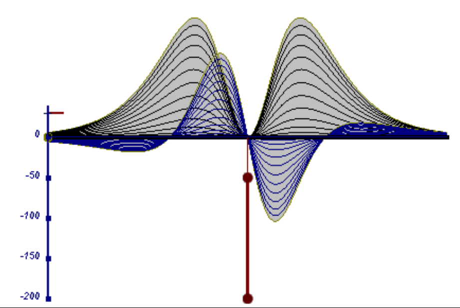
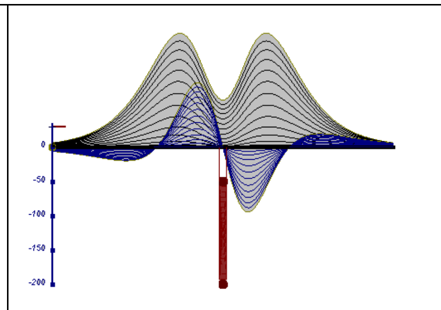
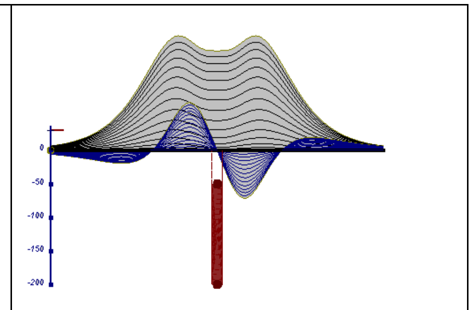
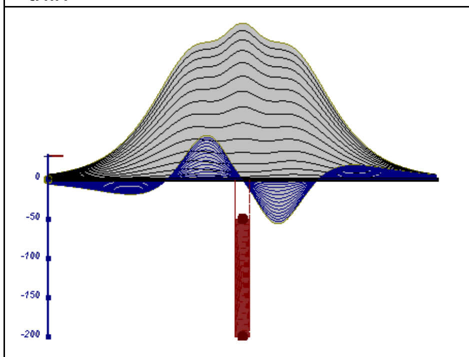
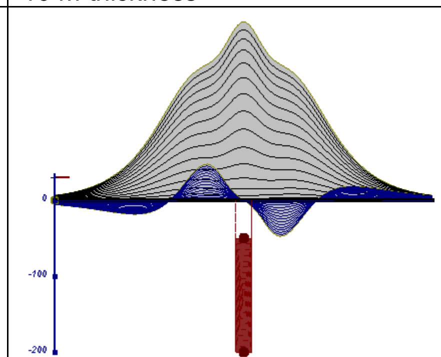
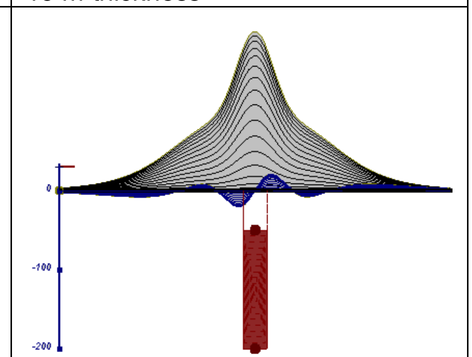
		
"thin"	10 m thickness	15 m thickness
		
18 m thickness	20 m thickness	30 m thickness

Figure D-16: Conductive vertical plate, depth 50 m, strike length 200 m, depth extend 150 m.

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APPENDIX E

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] (Figure E-1).

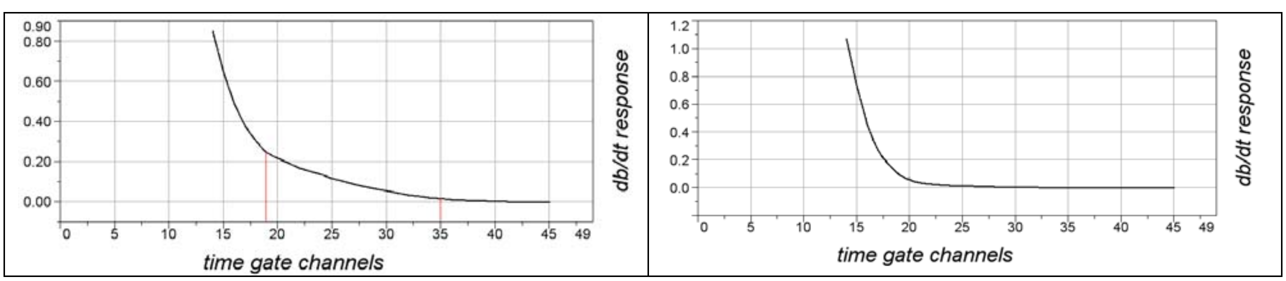

Figure E-1: Left – presence of good conductor, right – poor conductor.

[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.

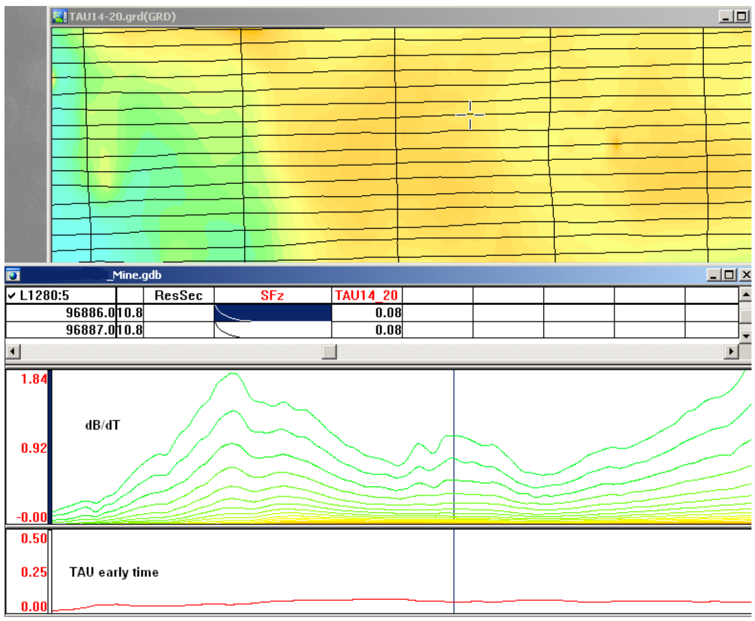

Figure E-2: Map of early time TAU Area with overburden conductive layer and local sources.

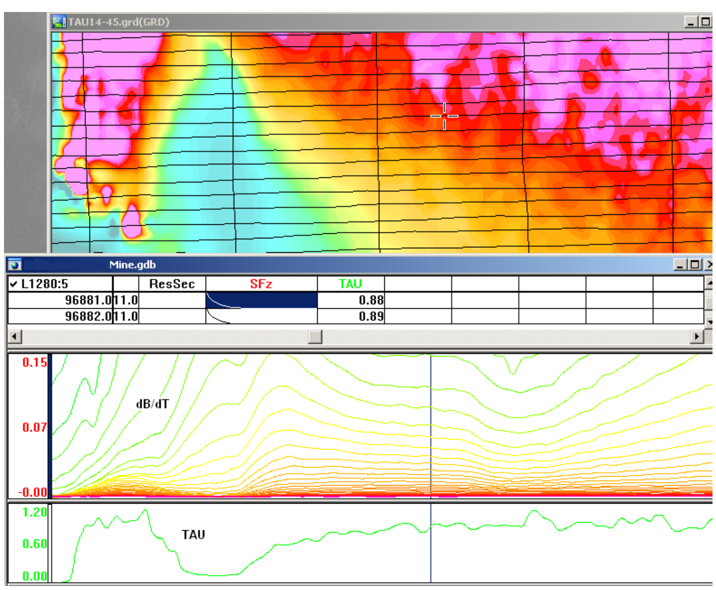

Figure E-3: Map of full time range TAU with EM anomaly due to deep highly conductive target.

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.

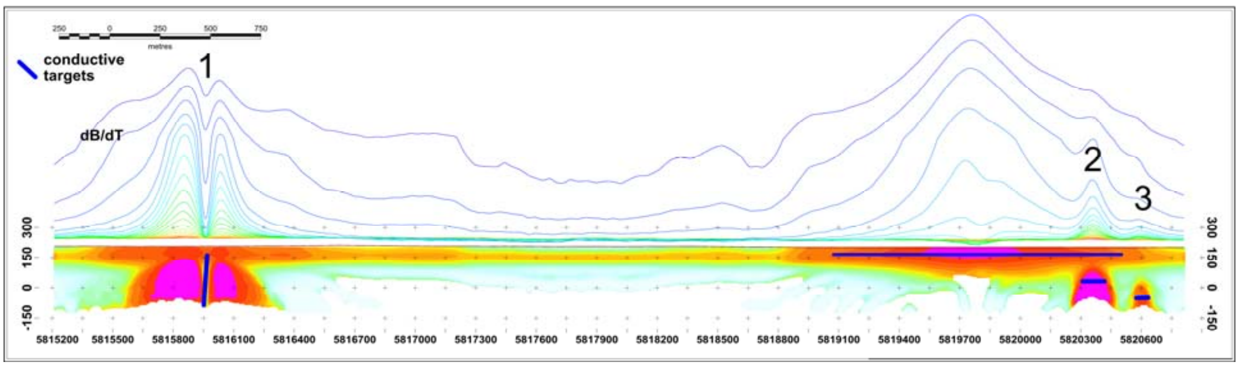

Figure E-4: dB/dt profile and RDI with different depths of targets.

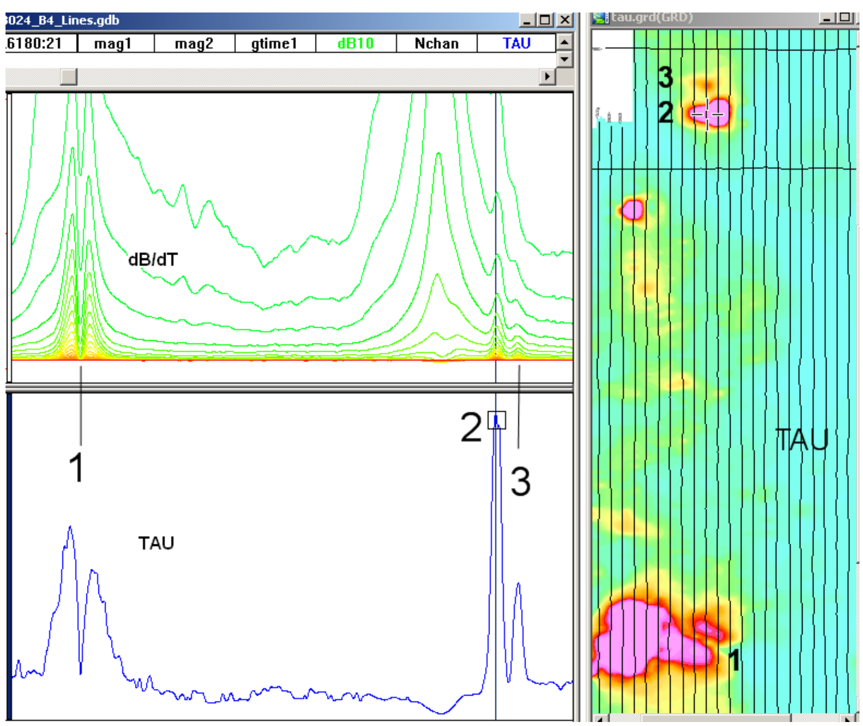

Figure E-5: Map of total TAU and dB/dt profile.

The EM Time Constants for dB/dt and B-field were calculated using the "sliding Tau" in-house program developed at Geotech[2]. 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 E-6). 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.

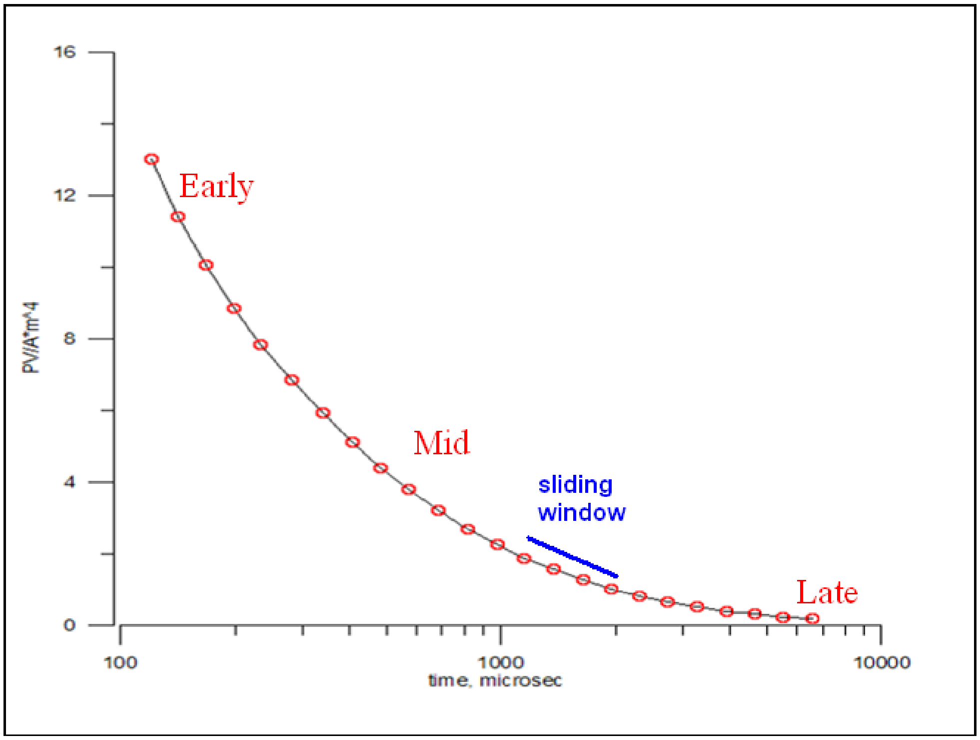

Figure E-6: Typical dB/dt decays of VTEM data

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[2] by A.Prikhodko

APPENDIX F

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 measured TEM data.
The used RDI algorithm of Resistivity-Depth transformation is based on scheme of the apparent resistivity transform of Maxwell A.Meju (1998)[1] and TEM response from conductive half-space. The program is developed by Alexander Prikhodko and depth calibrated based on forward plate modeling for VTEM system configuration (Fig. 1-10).

RDIs provide reasonable indications of conductor relative depth and vertical extent, as well as accurate 1D layered-earth apparent conductivity/resistivity structure across VTEM flight lines. 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.

Maxwell forward modeling with RDI sections from the synthetic responses (VTEM system)

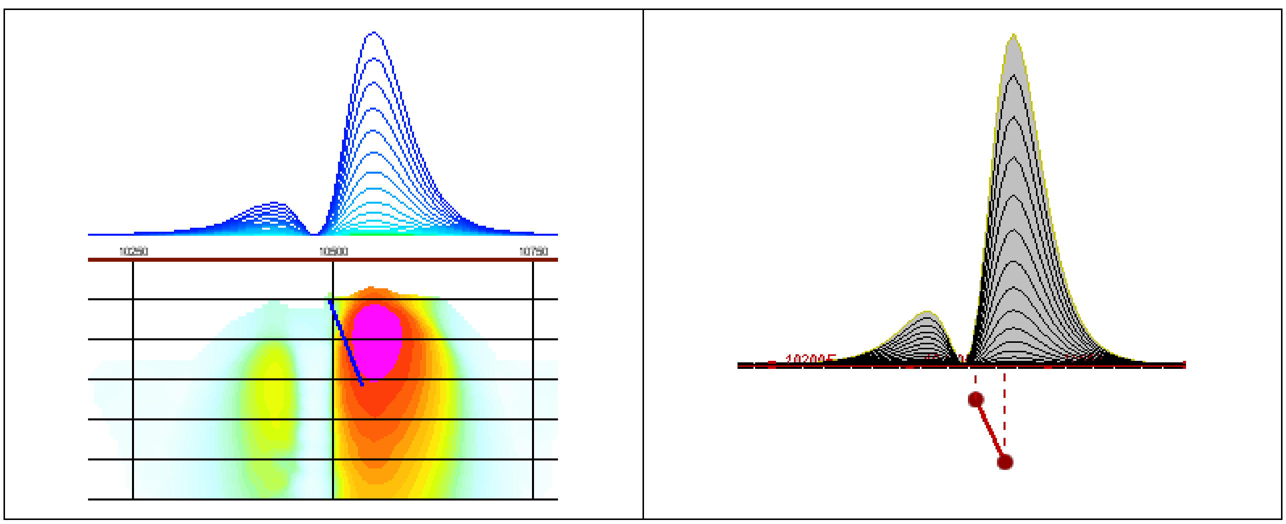


Figure F-1: Maxwell plate model and RDI from the calculated response for conductive "thin" plate (depth 50 m, dip 65 degree, depth extend 100 m).

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

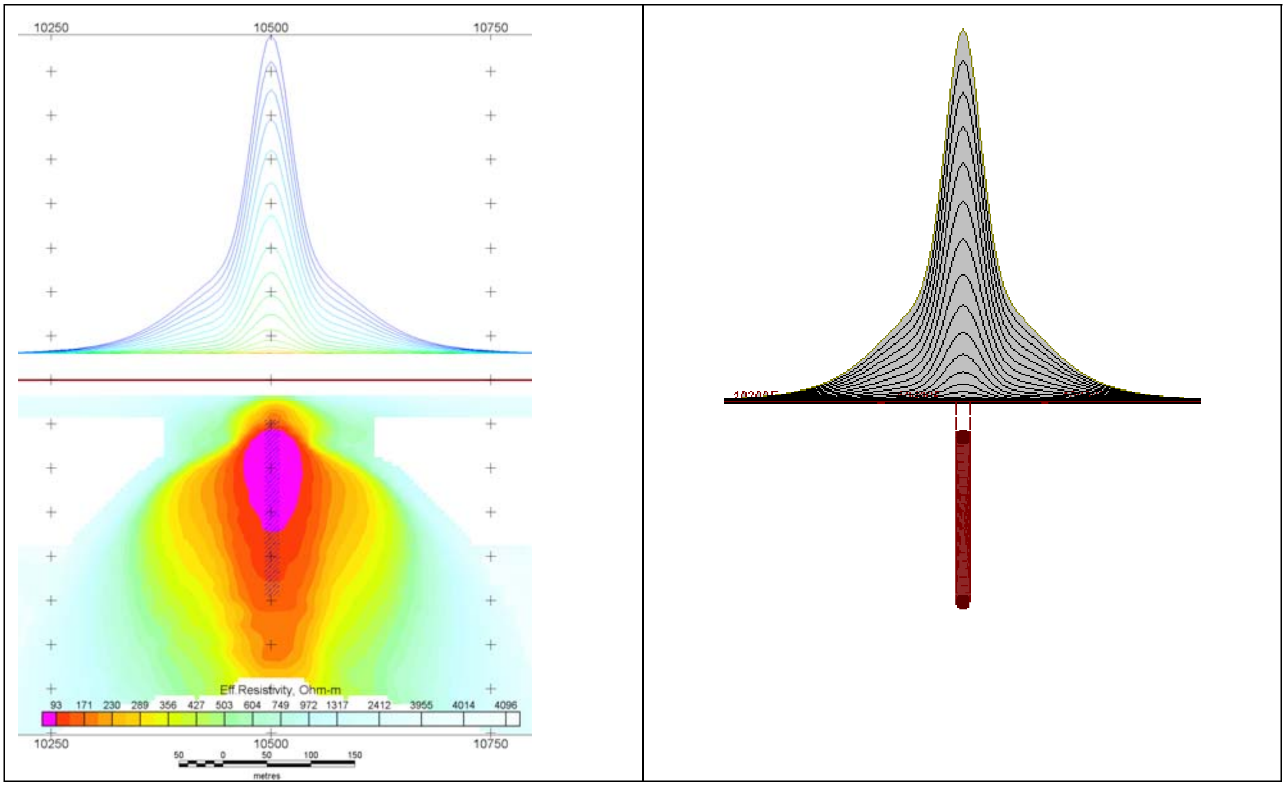


Figure F-2: Maxwell plate model and RDI from the calculated response for "thick" plate 18 m thickness, depth 50 m, depth extend 200 m).

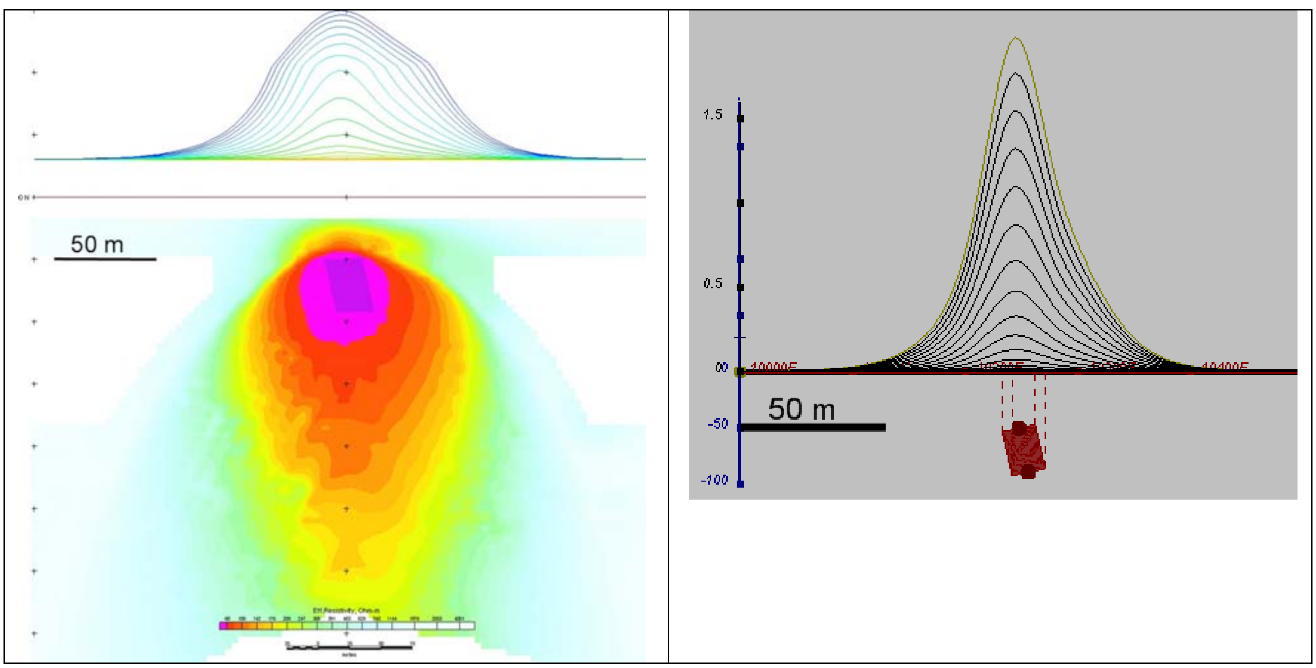


Figure F-3: Maxwell plate model and RDI from the calculated response for bulk ("thick") 100 m length, 40 m depth extend, 30 m thickness

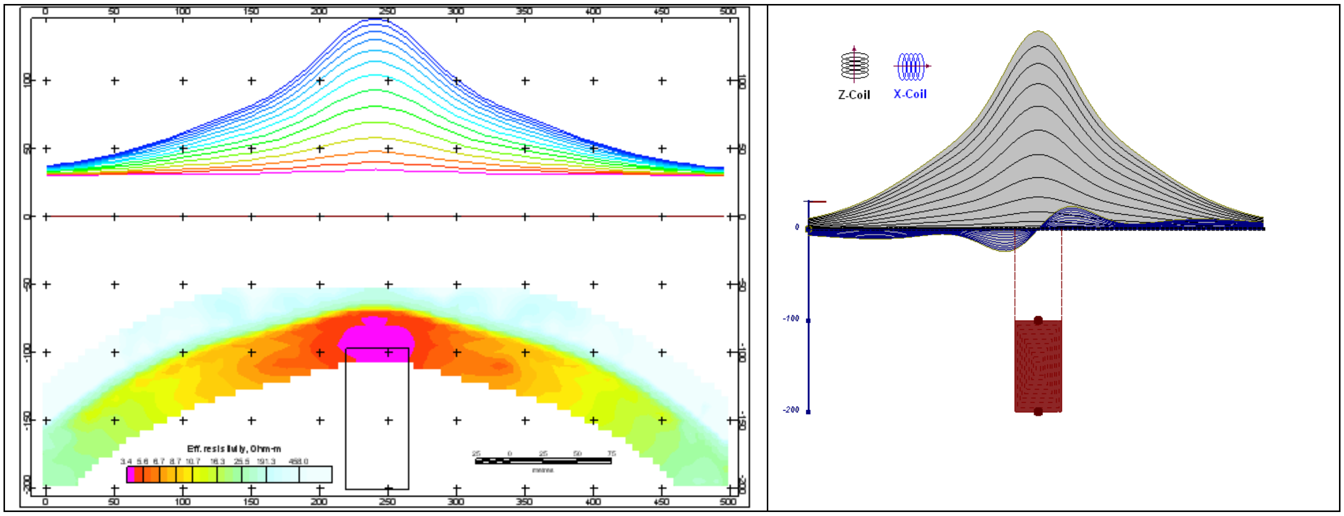


Figure F-4: Maxwell plate model and RDI from the calculated response for “thick” vertical target (depth 100 m, depth extend 100 m). 19-44 chan.

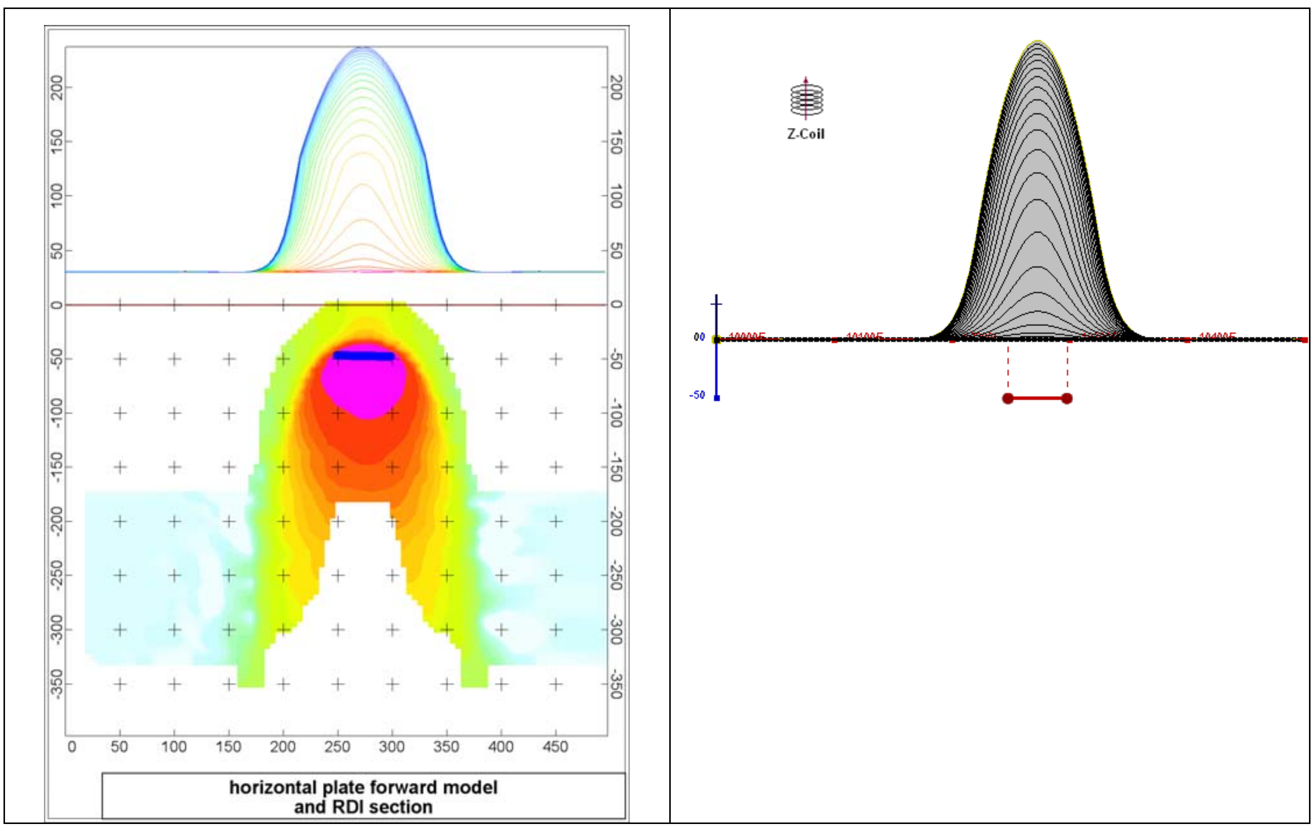


Figure F-5: Maxwell plate model and RDI from the calculated response for horizontal thin plate (depth 50 m, dim 50x100 m). 15-44 chan.

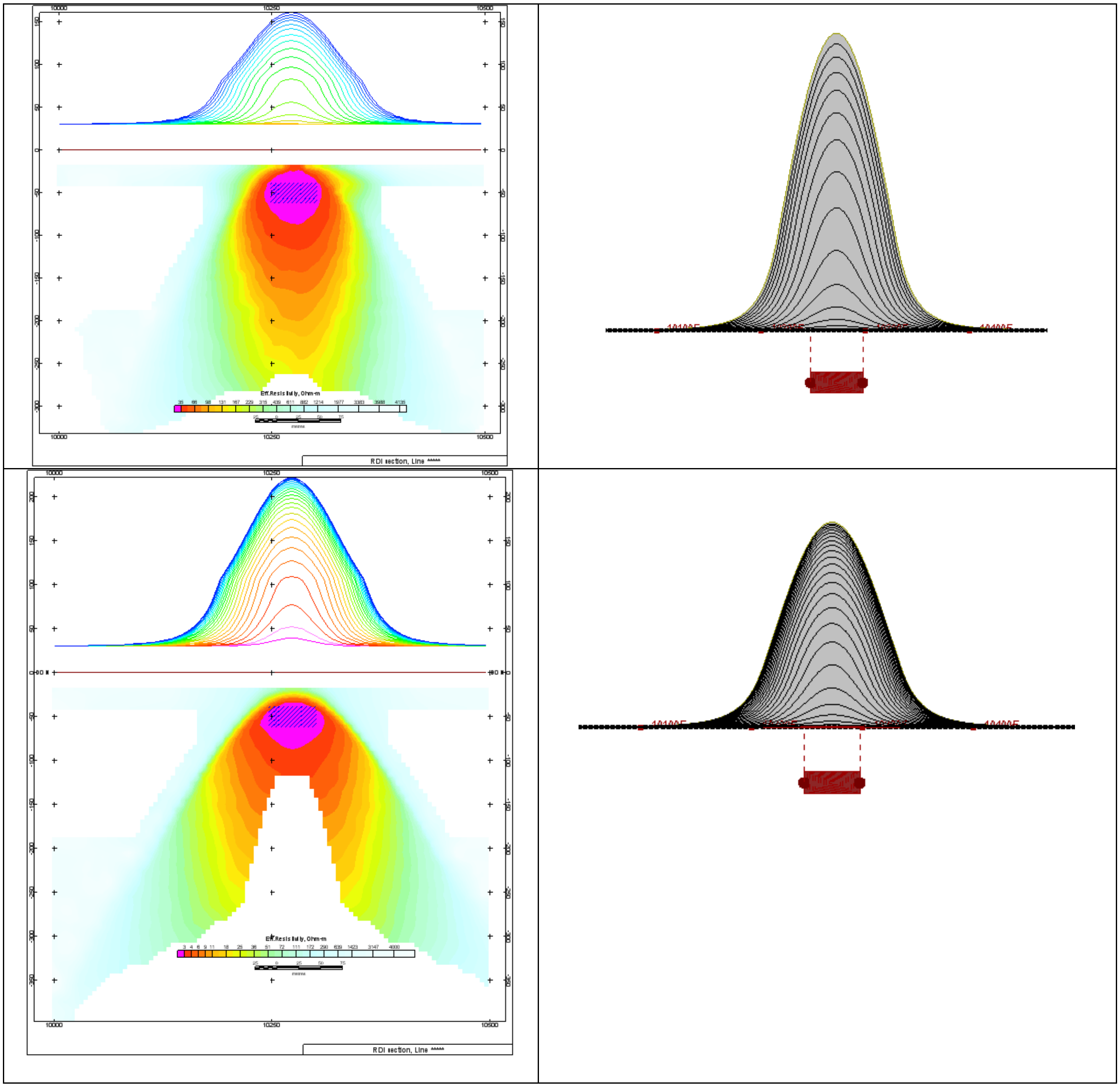


Figure F-6: Maxwell plate model and RDI from the calculated response for horizontal thick (20m) plate – less conductive (on the top), more conductive (below)

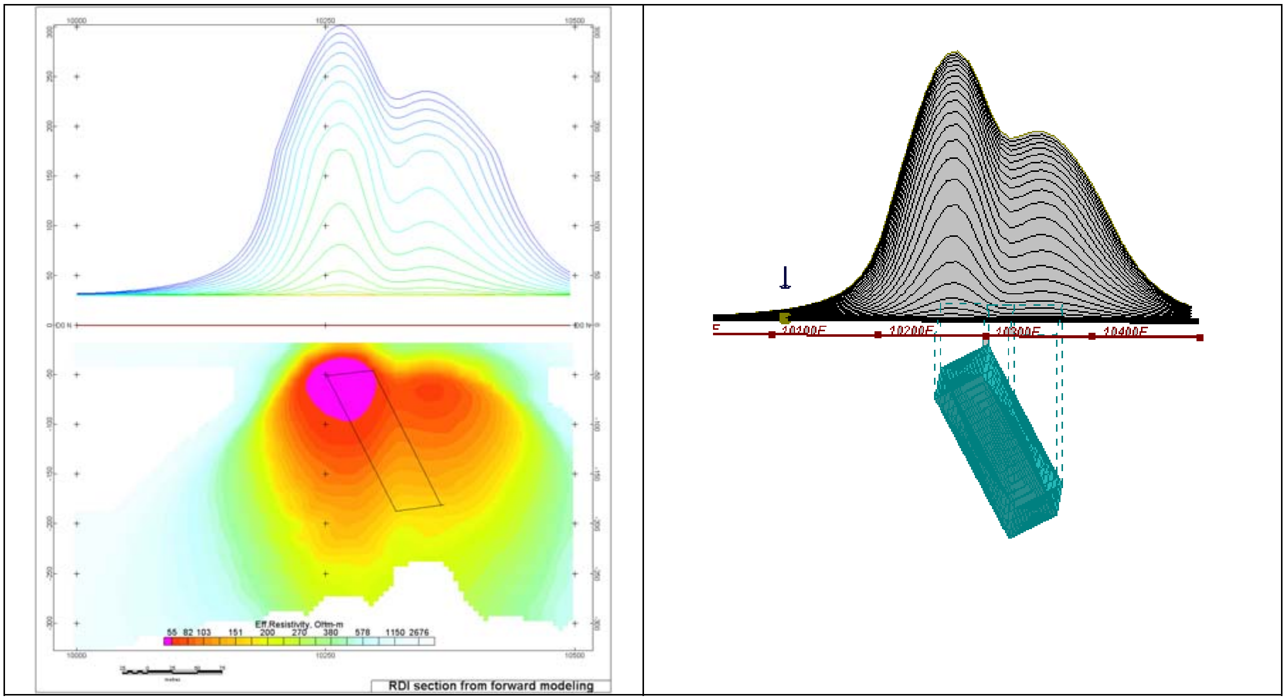


Figure G-7: Maxwell plate model and RDI from the calculated response for inclined thick (50m) plate. Depth extends 150 m, depth to the target 50 m.

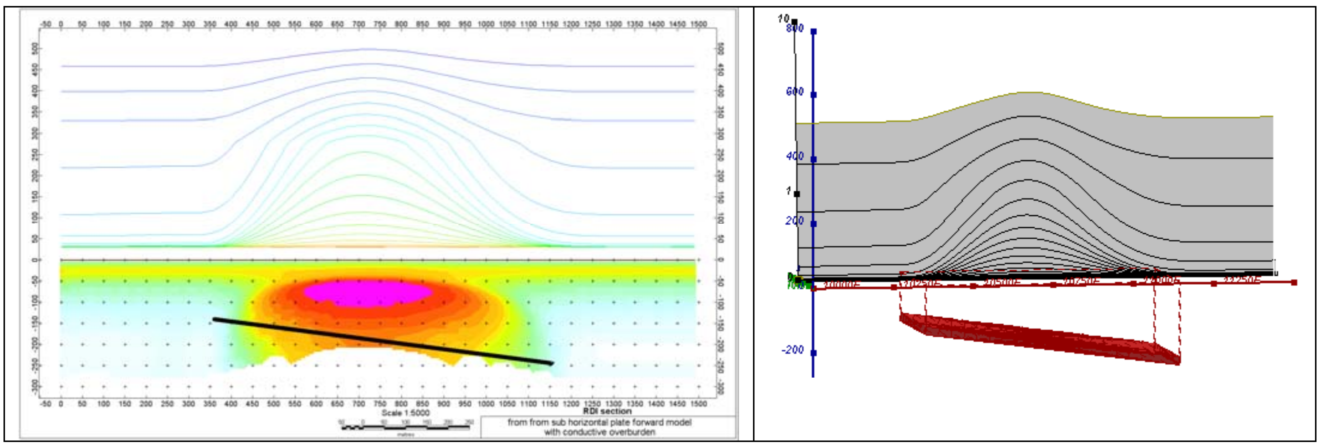


Figure F-8: Maxwell plate model and RDI from the calculated response for the long, wide and deep subhorizontal plate (depth 140 m, dim 25x500x800 m) with conductive overburden.

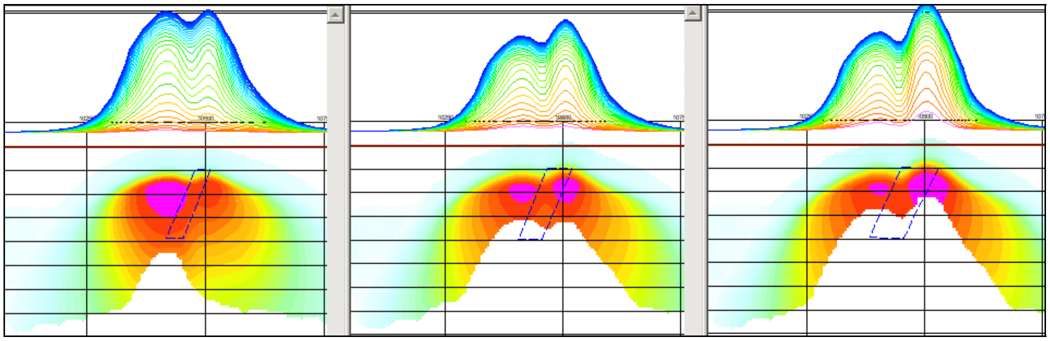


Figure F-9: Maxwell plate models and RDIs from the calculated response for “thick” dipping plates (35, 50, 75 m thickness), depth 50 m, conductivity 2.5 S/m.

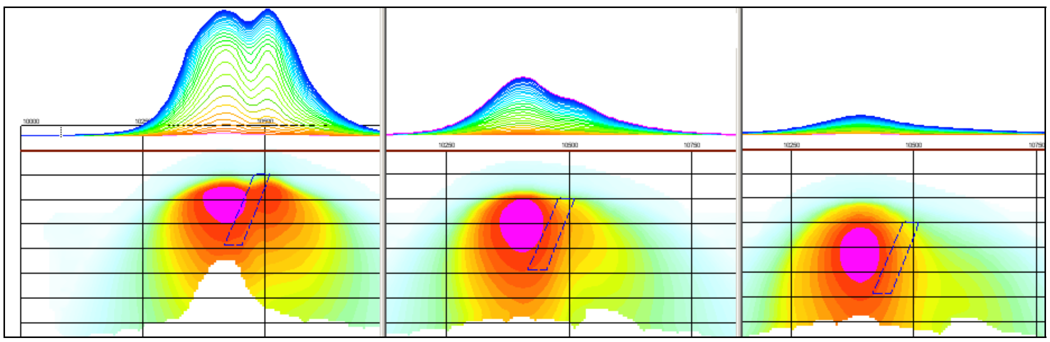


Figure F-10: Maxwell plate models and RDIs from the calculated response for “thick” (35 m thickness) dipping plate on different depth (50, 100, 150 m),, conductivity 2.5 S/m.

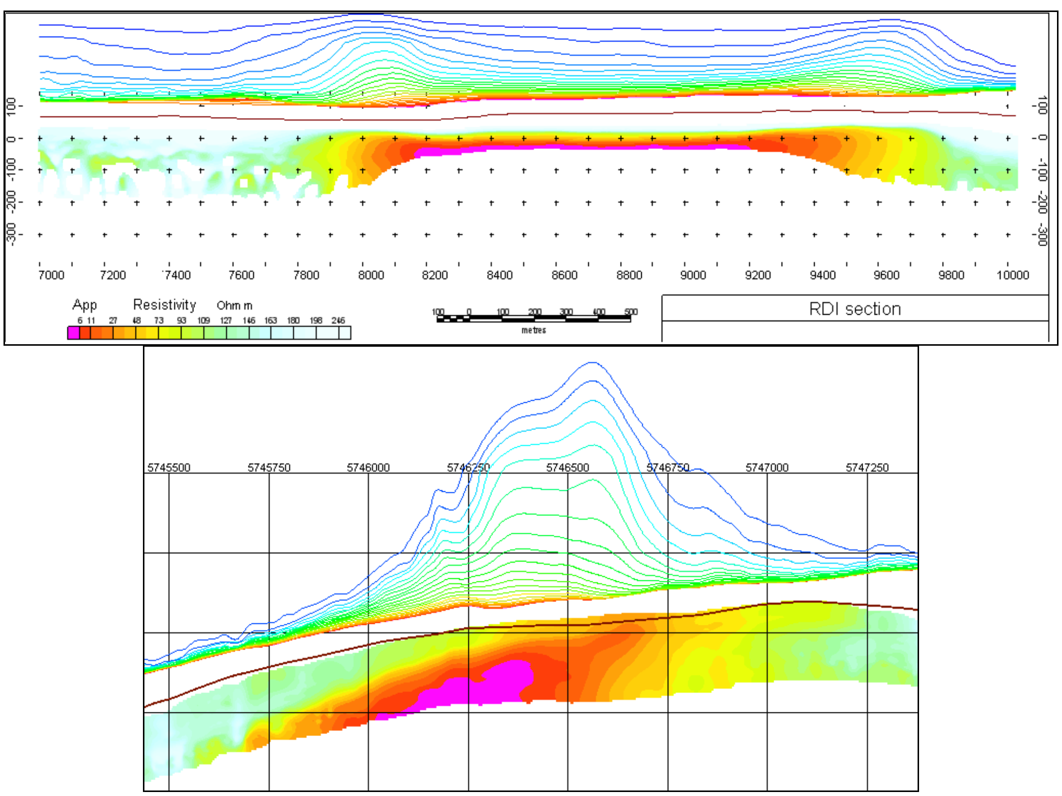
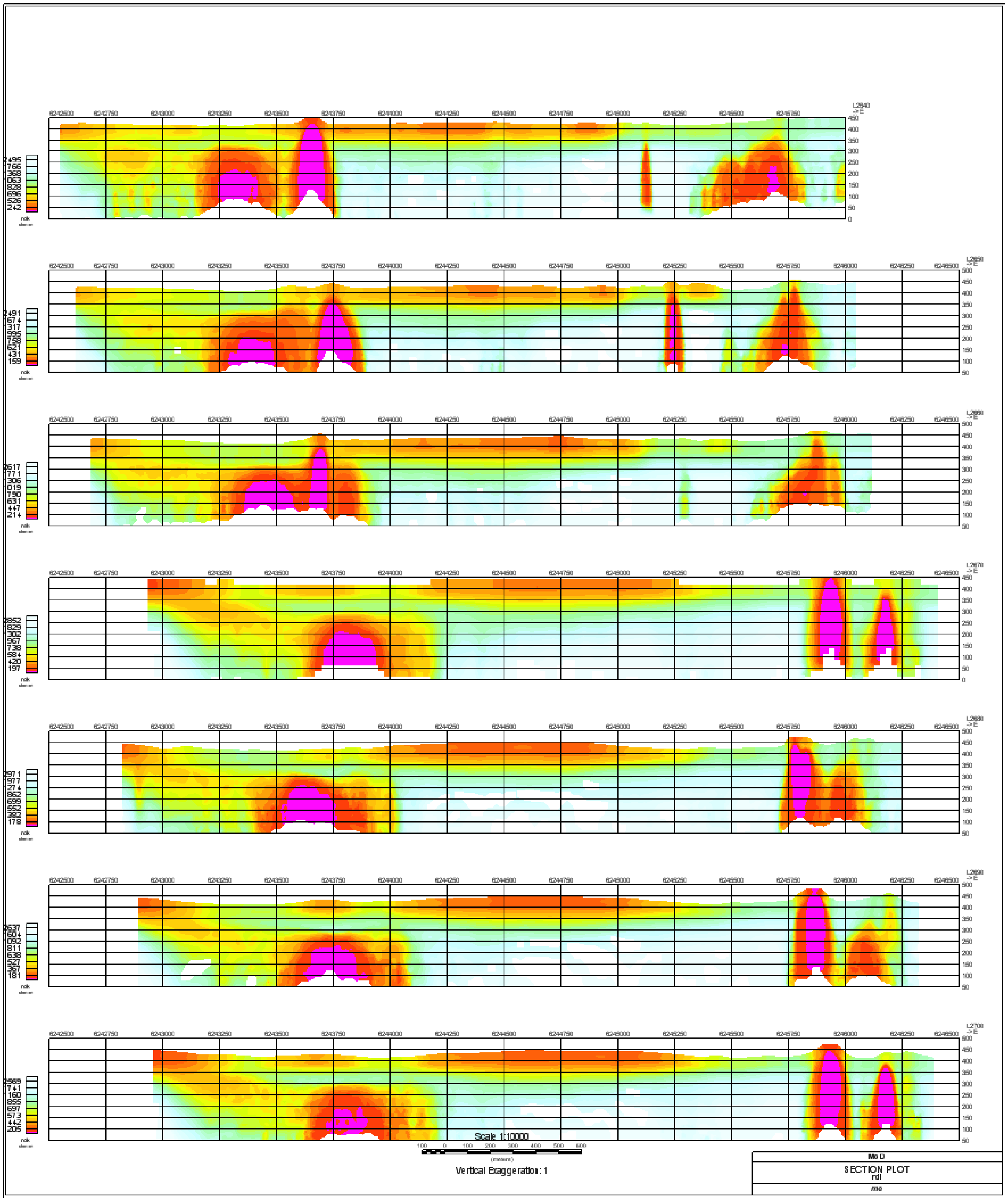


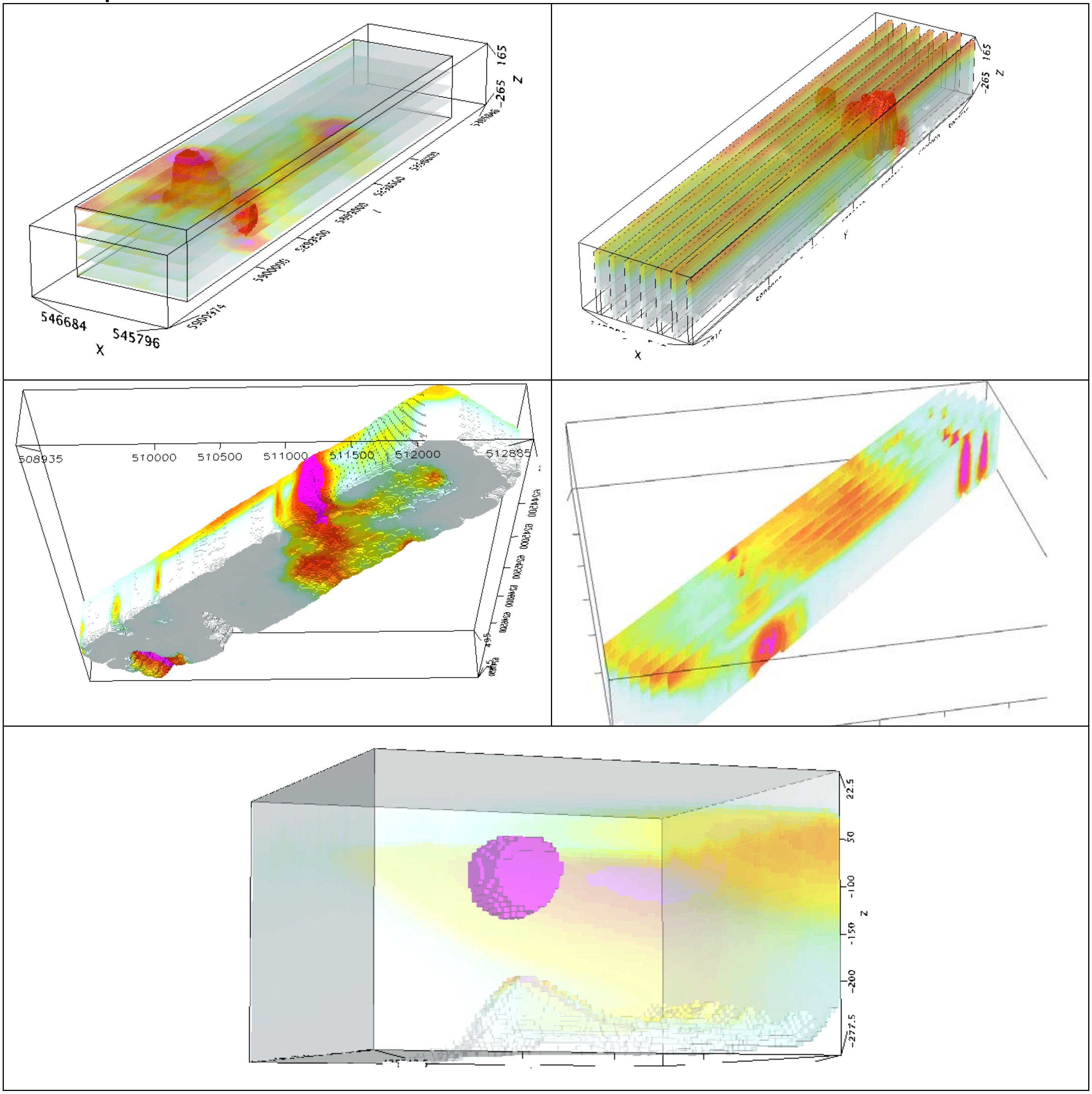
Figure F-11: RDI section for the real horizontal and slightly dipping conductive layers

FORMS OF RDI PRESENTATION

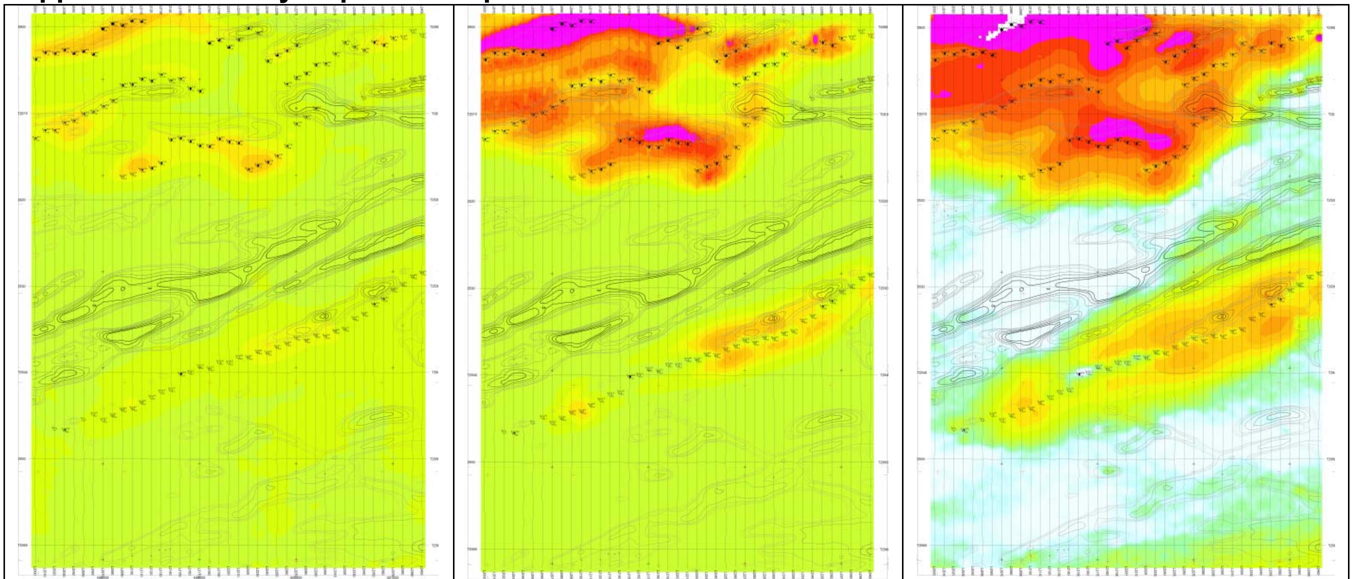
Presentation of series of lines



3d presentation of RDIs

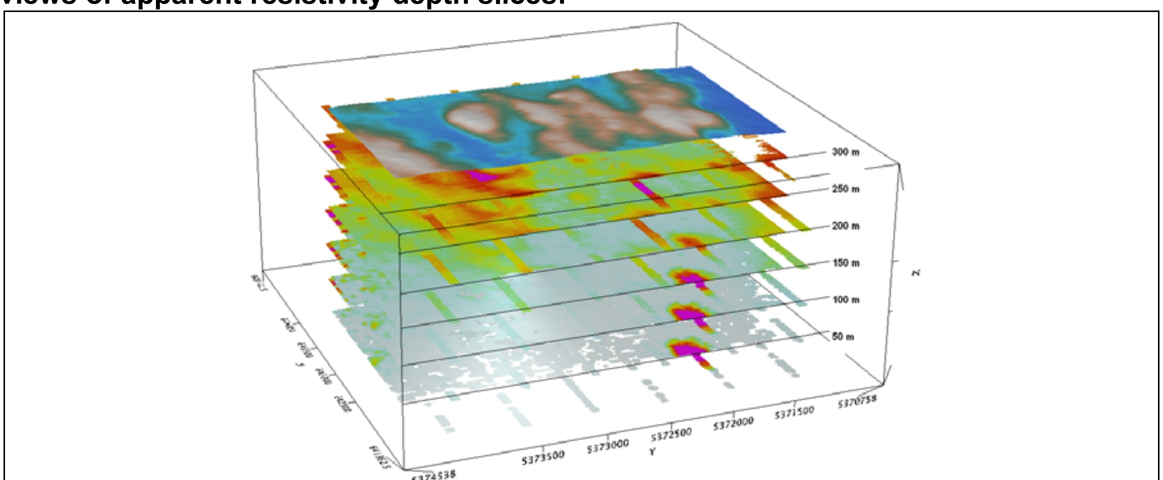


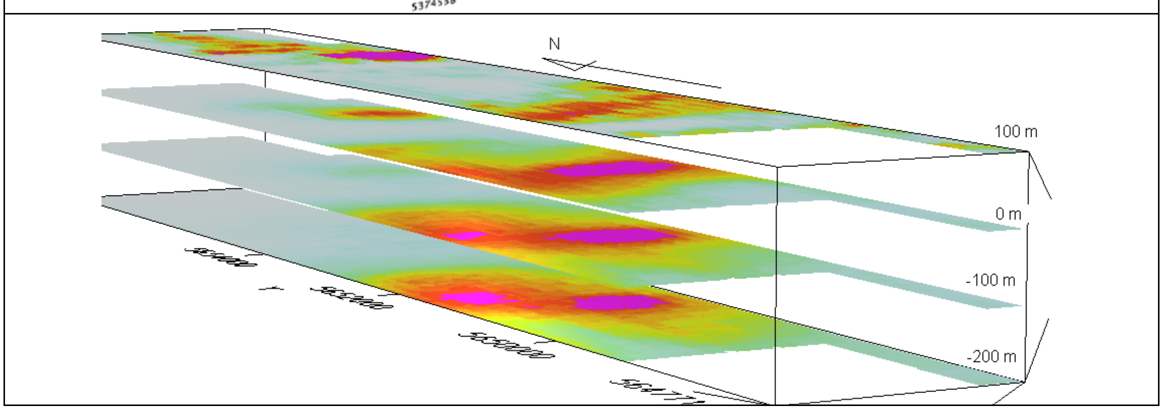
Apparent Resistivity Depth Slices plans:



0 m (surface)	-100 m	-200 m

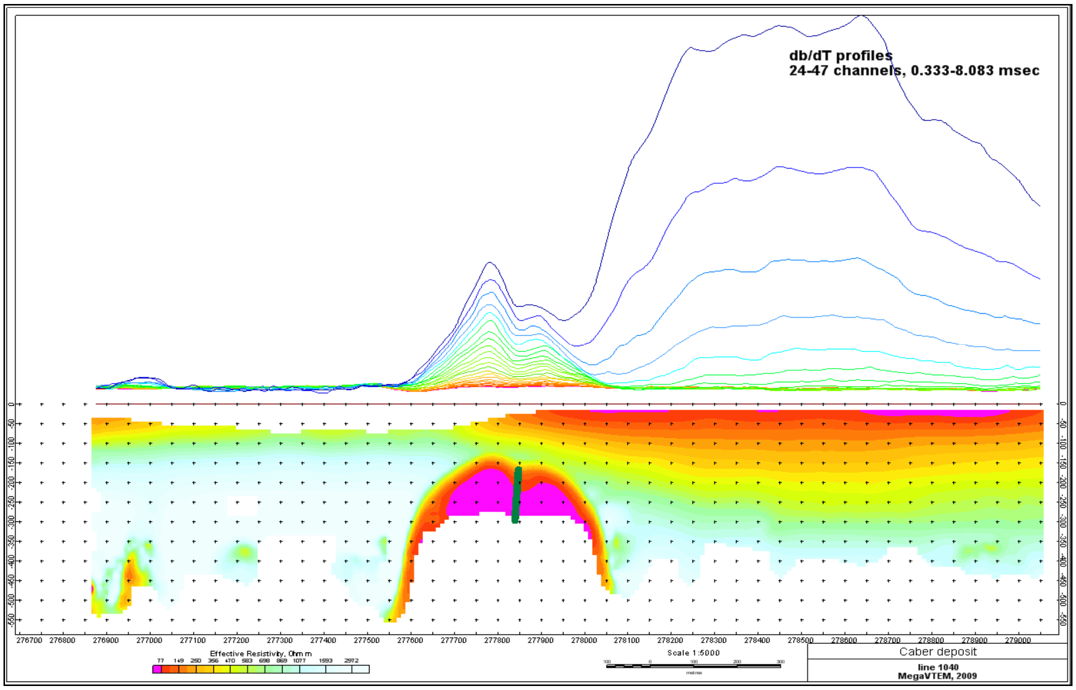
3d views of apparent resistivity depth slices:



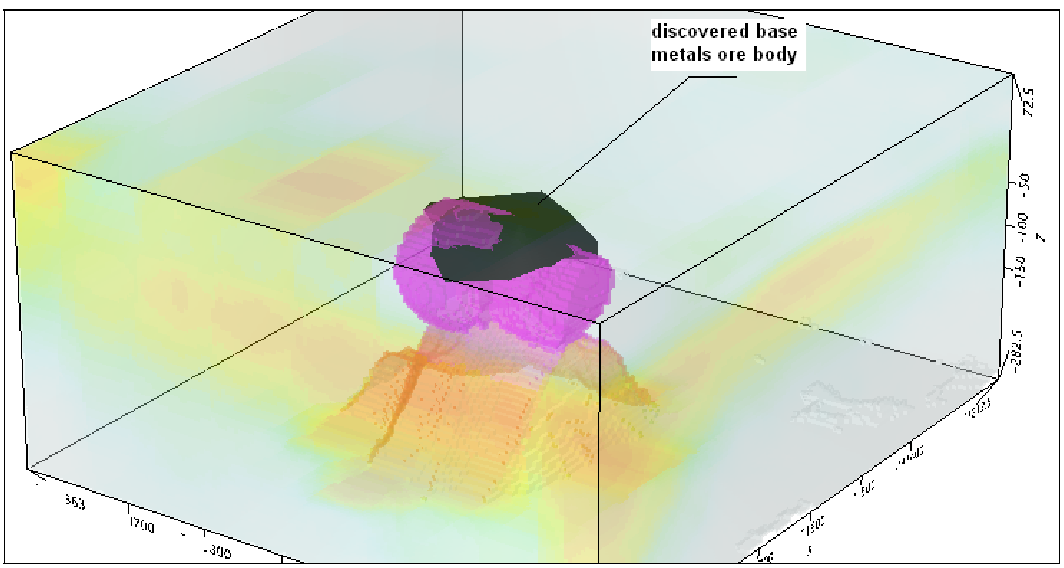


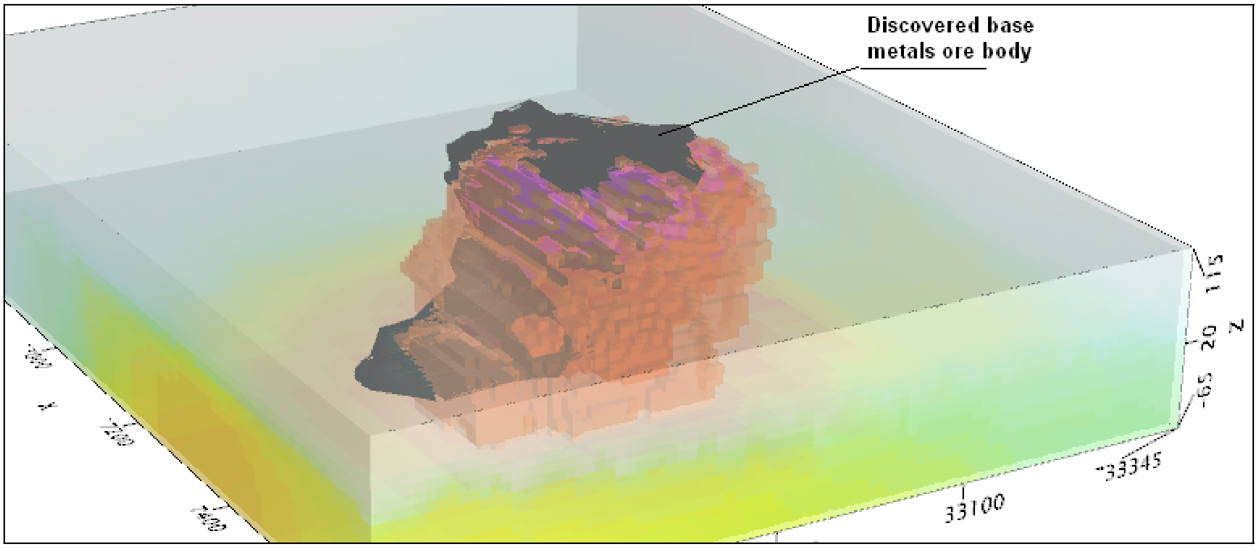
Real base metal targets in comparison with RDIs:

RDI section of the line over Caber deposit ("thin" subvertical plate target and conductive overburden).



3d RDI voxels with base metals ore bodies (Middle East):





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April 2011

APPENDIX G
Resistivity Depth Images (RDI)
Please see RDI Folder on DVD for the PDF document.