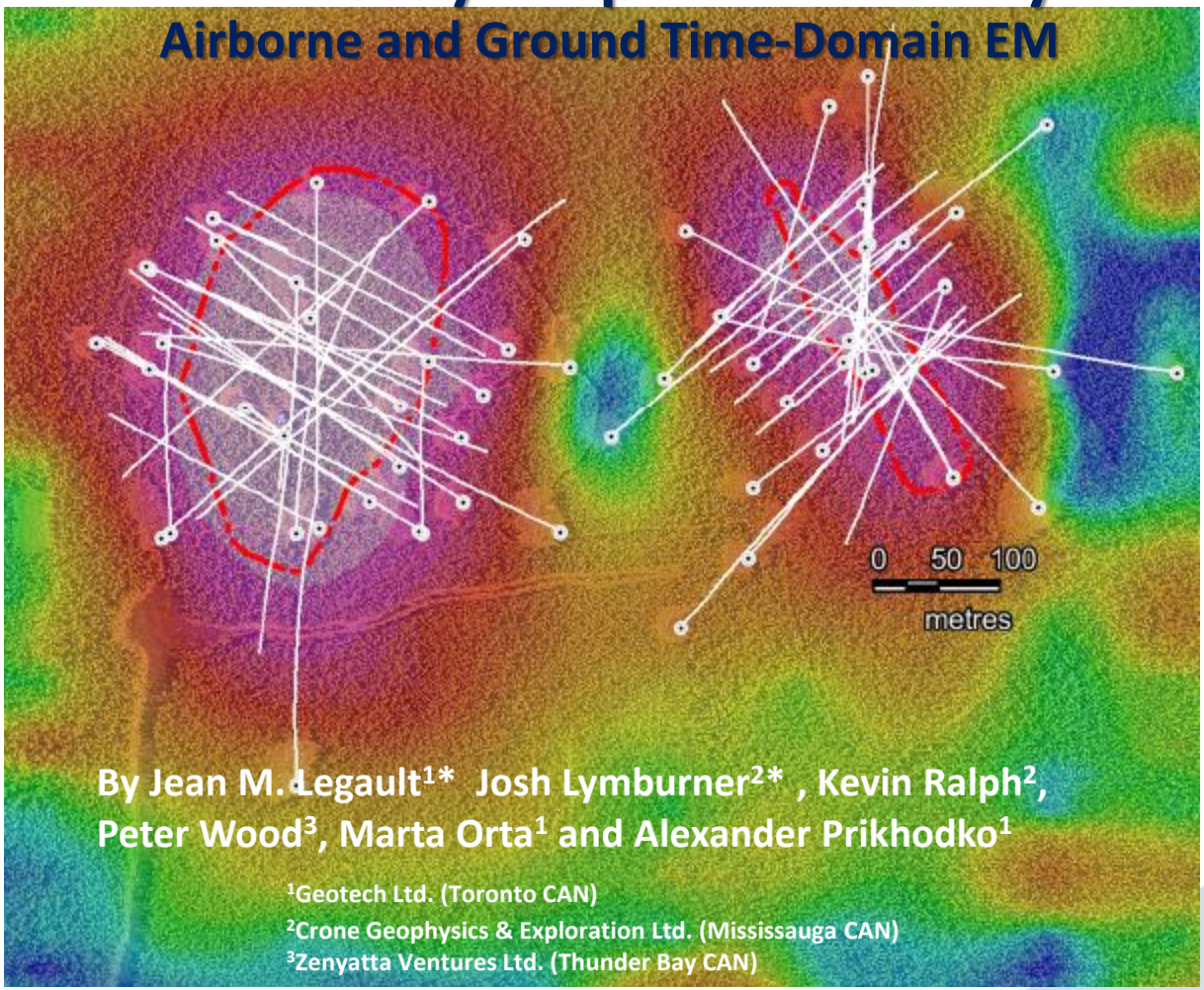
The Albany Graphite Discovery

Airborne and Ground Time-Domain EM



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Presented at KEGS Geophysics Symposium at PDAC 2015, Intercontinental Hotel, February 28th , Toronto, Ontario

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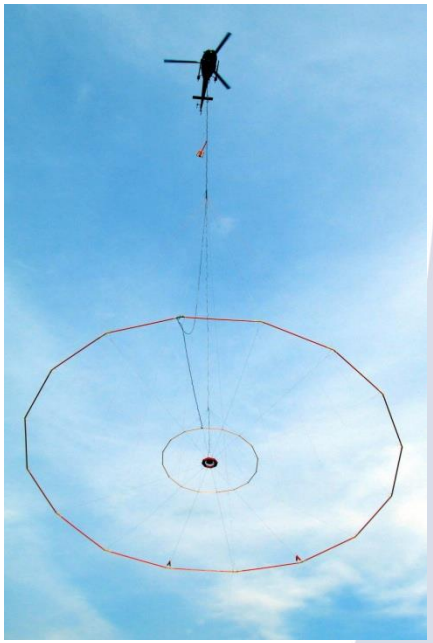
OUTLINE

- Introduction
- Albany Geology
- Airborne EM & Magnetic Results
- Ground EM
- Conclusion



Geotech VTEM^{MAX} System

Crone Surface PEM System

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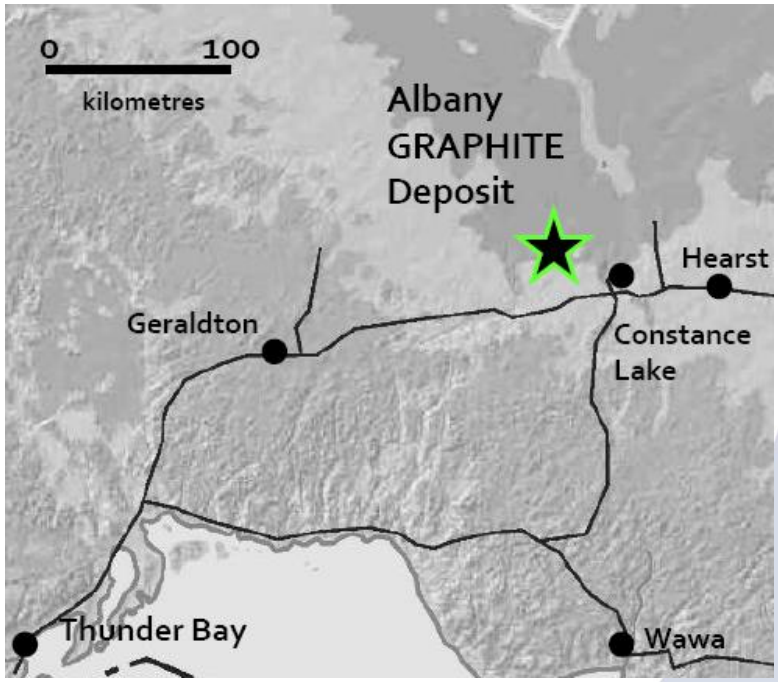
INTRODUCTION

- **While conducting an exploration program targeting nickel (Ni), copper (Cu), and platinum group metals (PGMs) Zenyatta discovered a very rare type of hydrothermal graphite deposit in Jan-2011 on their Albany Graphite Project located 30km north of the Trans-Canada Hwy near Constance Lake and Hearst ON.**

- **The Albany Project area had been largely unexplored in the past as a result of swamp and the younger Phanerozoic (460-360 Ma) cover rocks, up to 200m thick, overlying the prospective Archean rocks.**

ALBANY GRAPHITE LOCATION



- **This case study describes the airborne time-domain EM (TDEM) and magnetic geophysical survey results from 2010 that lead to the discovery and the subsequent ground follow up in 2013 using surface TDEM that better characterized the Albany graphite deposits.**

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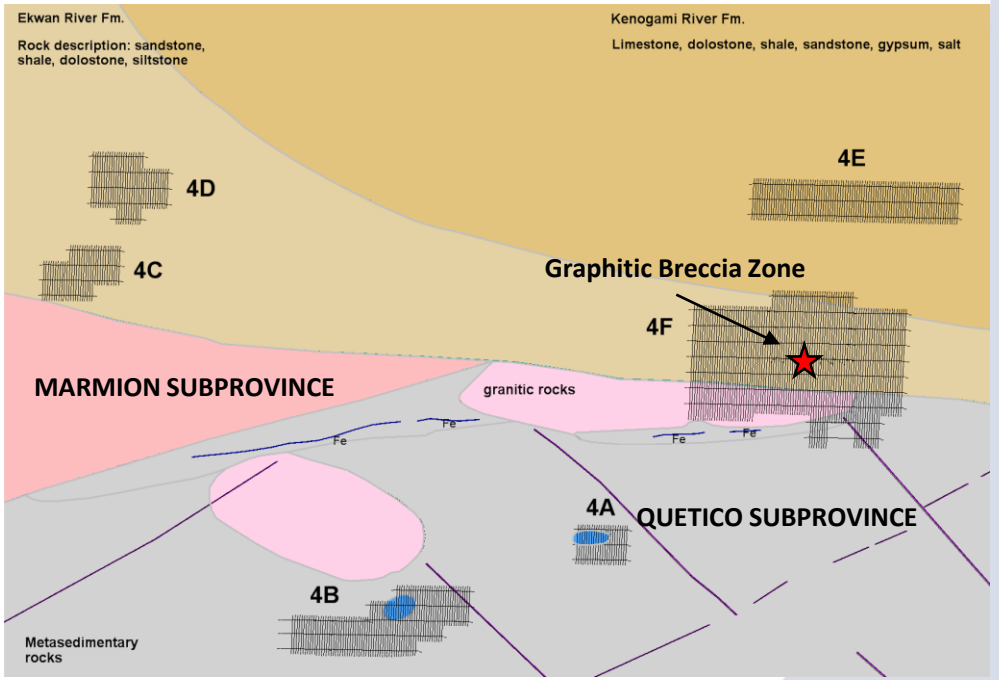
GENERAL GEOLOGY

- Albany graphite deposit is located in the Superior Province of the Canadian Shield, at the Terrane boundary between the Marmion Subprovince to the north and the Quetico Subprovince to the south.

- Basement rocks are covered with up to 15m of relatively thin flat-lying Paleozoic limestone sandstones, shales, dolostones, siltstones and up to 50m of thick overburden.

ALBANY REGIONAL GEOLOGY
(Showing VTEM Regional Coverage)



- Prior to 2010, the Albany project area had been explored by as many as eight companies, dating back to 1959. Aeromagnetic and ground EM survey had defined two large, circular intrusive complexes that had potential to host columbium and rare earth element occurrences. Two holes were drilled on the property in 1964 (Algoma), and one hole in 1978 (Shell) which intersected graphitic breccia (West Pipe).

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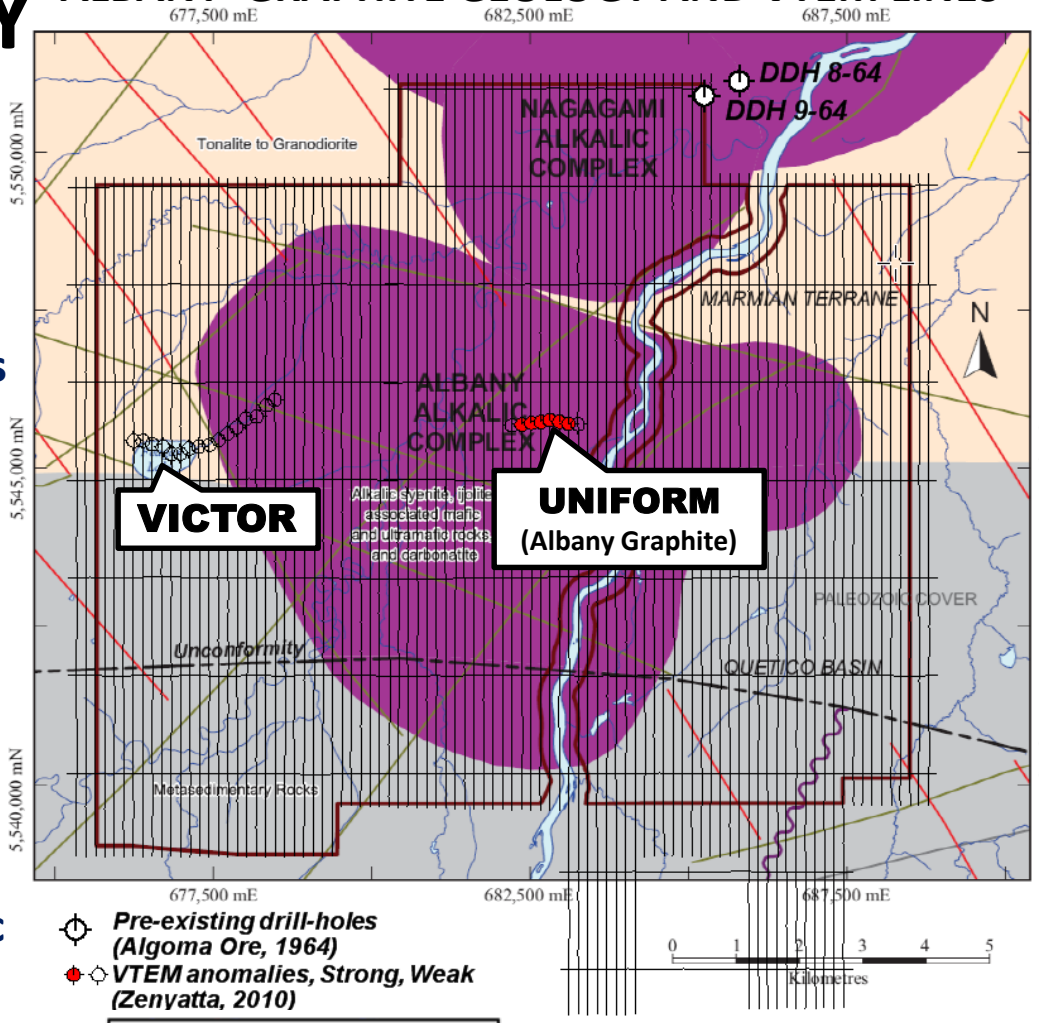
PROPERTY GEOLOGY

- Geology of the survey area consists of Precambrian paragneissic granitoids and migmatitic metasediments to the south and metamorphosed tonalite to granodiorite to the north. These rocks have been intruded by a younger alkalic intrusive complex.

- Albany graphite deposit is hosted within a younger gneissic to unfoliated alkalic syenite, granite, diorite, and monzonite intrusive suite (Albany Alkalic Complex) that are cross-cut by younger dykes, ranging from felsic to mafic in composition. Nagagami Alkalic Complex lies further north.

ALBANY GRAPHITE GEOLOGY AND VTEM LINES



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DEPOSIT GEOLOGY

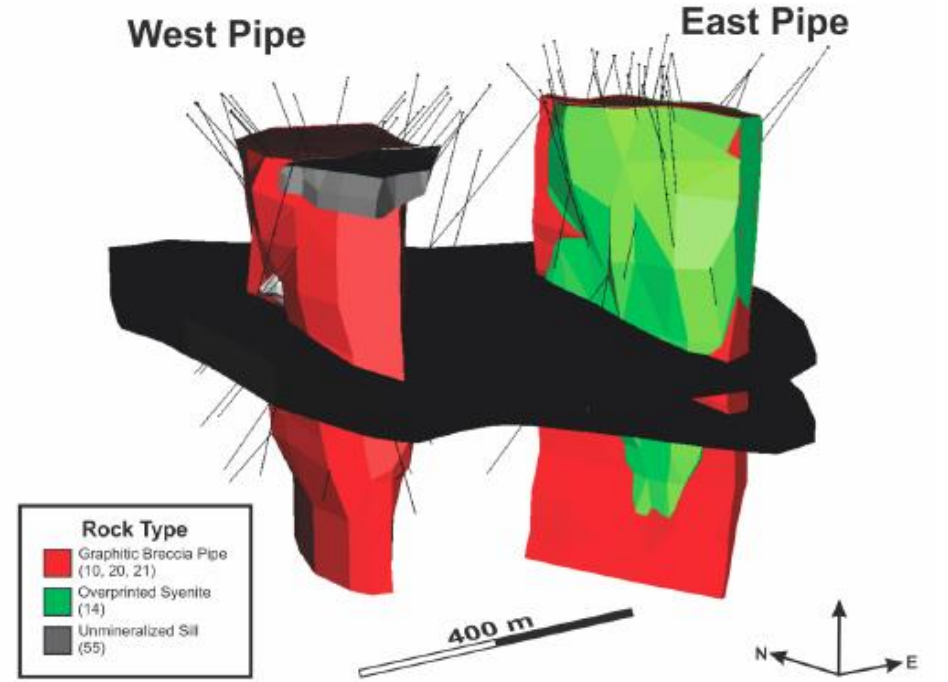
- Albany deposit is a unique example of an epigenetic graphite deposit in which a large volume of highly crystalline, fluid-deposited graphite occurs within an igneous host.

- Deposit is interpreted as a vent pipe breccia that formed from a CH_4-CO_2-rich fluid that evolved due to pressure-related degassing of syenites of the Albany Alkalic Complex.

- Graphite mineralization is related to two separate graphitic breccia pipes (West Pipe and East Pipe) which are typically surrounded by a zone of graphite overprinted syenite. The deposit contains a total indicated resource of 25.1 Mt at 3.89% graphitic carbon (Cg) totalling 977,000 tonnes of contained Cg.

ALBANY GRAPHITE - EAST & WEST PIPES

(Showing Wireframe Models)



(after Ross and Masun, NI 43-101, 2014)

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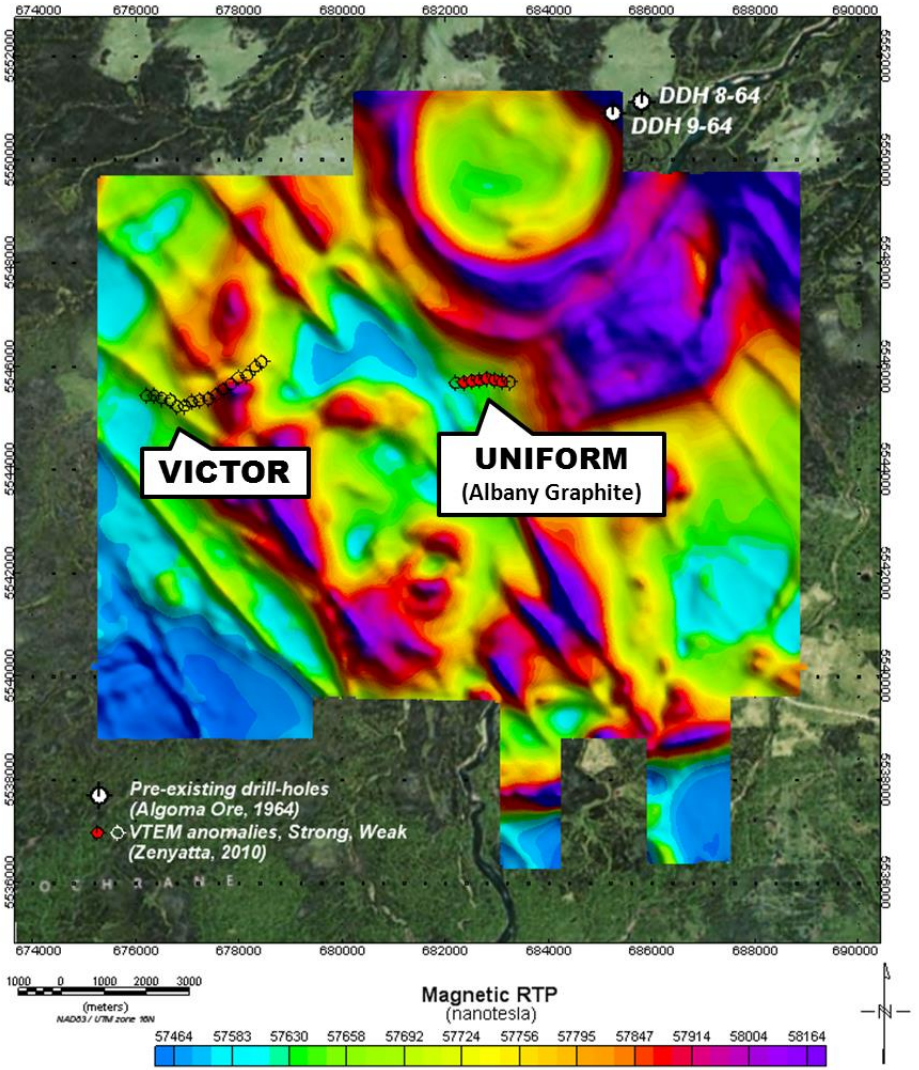
AIRBORNE GEOPHYSICS

- Albany Project airborne EM-magnetic survey for Zenyatta consisted of >10,000 km of helicopter time-domain EM (TDEM) and magnetics, using 150m spaced NS-lines, over multiple (28) blocks from March 17 to May 19, 2010.

- Survey flown with higher power VTEM (versatile time-domain electromagnetic) prototype that featured a larger loop diameter (35m) and higher dipole-moment (0.84 M nIA) than previously used - later develops into VTEM^{MAX}.

- Surveys identify two EM and magnetic targets of significance (Victor & Uniform) that lie in close proximity to a ring-like magnetic anomaly over the Nagagami Alkalic Complex and more subtle zoned mag-anomaly over Albany Alkalic Complex.

ALBANY GRAPHITE - MAGNETIC RTP (REDUCED TO POLE)



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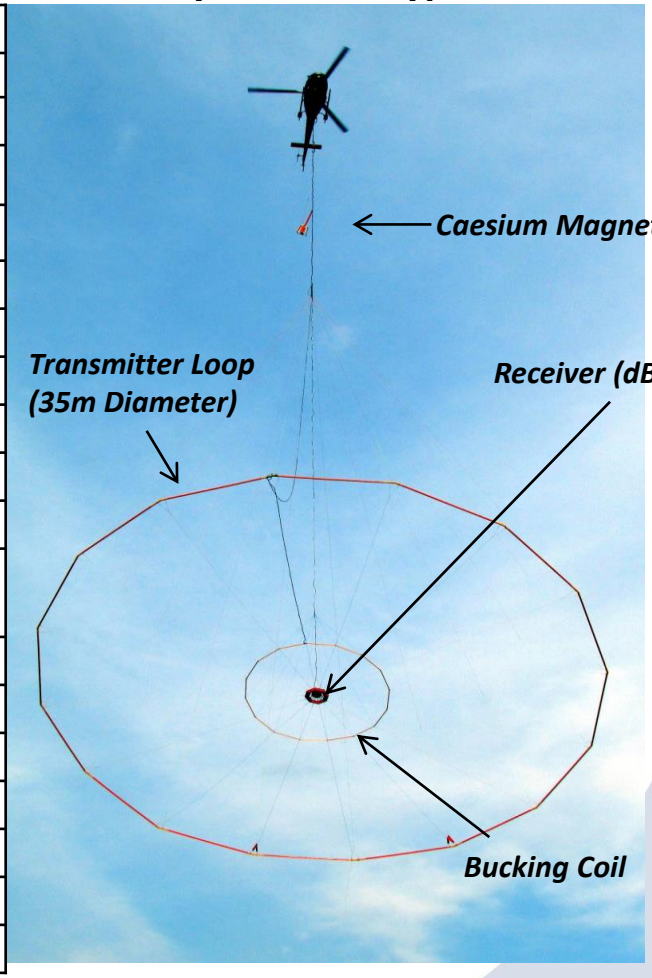
The VTEM^{MAX*} System

Parameter	VTEM^{MAX*}
Base Frequency	30Hz
Waveform	Trapezoid (33% Duty Cycle)
Current	218 A (5.5ms pulse)
Peak dipole moment	837 457 NIA
Tx loop diameter (area)	35m (962 m^2)
Tx number of turns	4
Survey speed	80 km/h
Tx/Rx Clearance	53 m
Tx turn-off time	1.1 ms
Tx Pulse On Time	5.5 ms
Rx Time gates	37 Off-time (0.96-7.026 ms) 46 channels measured
Rx coil diameter, m	1.2 (Z) + 0.32 (X)
Rx number of turns	100 (Z) + 245 (X)
Rx Effective Area, m^2	101.1 (Z) + 19.69 (X)
Tx-Rx Configuration	Coaxial-Coplanar
Magnetometers	Optically-pumped Caesium vapour
Mag Clearance	75m
Mag sensitivity	0.02nT (0.001nT base)

VTEM^{MAX*} System Prototype circa 2010



- **VTEM^{MAX*} prototype system was modified after standard VTEM system (i.e., using heavier/larger 35m transmit loop instead of 26m diameter used at the time).**
- **Implemented on the Zenyatta Albany Project specifically for improving the Depth-of-Investigation in region of thick, conductive Paleozoic cover.**
- **1ST Survey with System Lead to Albany Discovery! Eventually develops into VTEM^{MAX} (1.4M NIA) later in 2011.**

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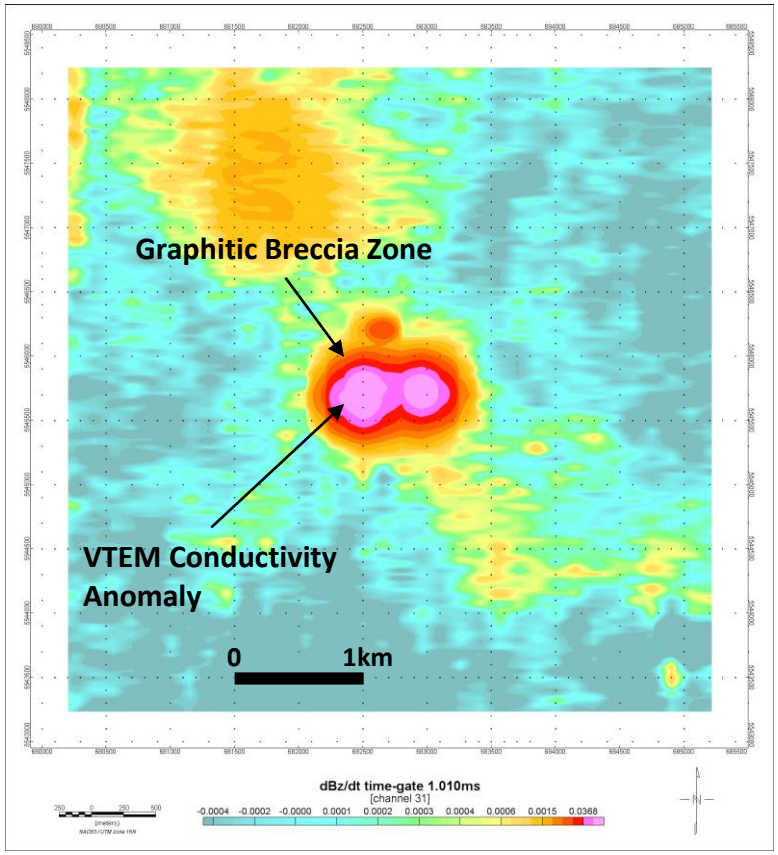
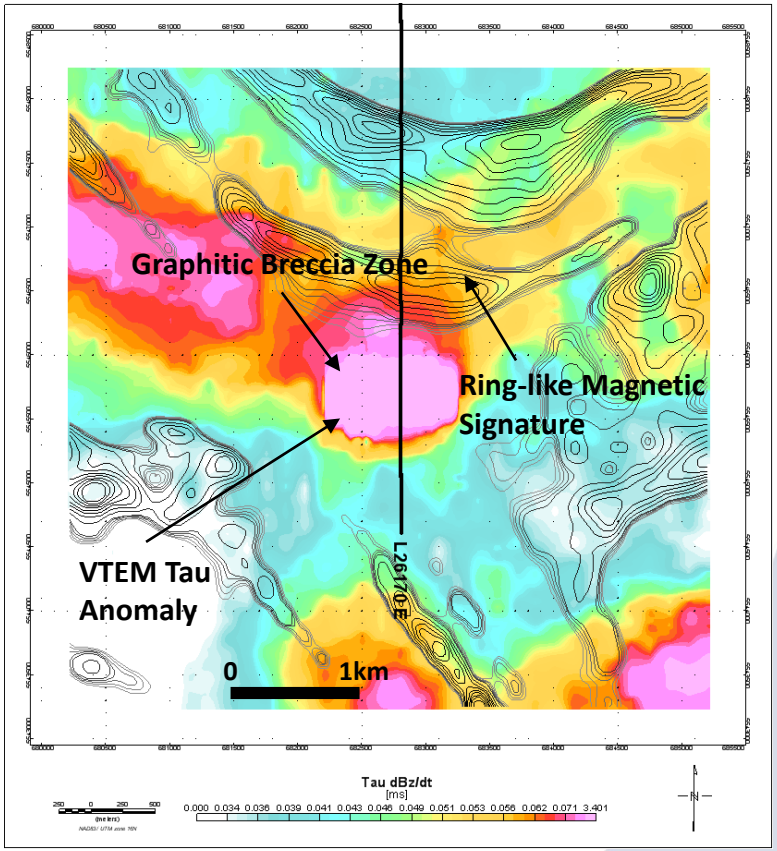
VTEM^{MAX} dBz/dt Ch31 Response



VTEM dBz/dt TIME CONSTANT (TAU)



Albany Graphite Deposit EM anomaly is observed along multiple survey lines that suggest as many as 2 separate zones and with relatively high values of Time Constant (Tau) between 1ms to 3 ms that indicate high conductance

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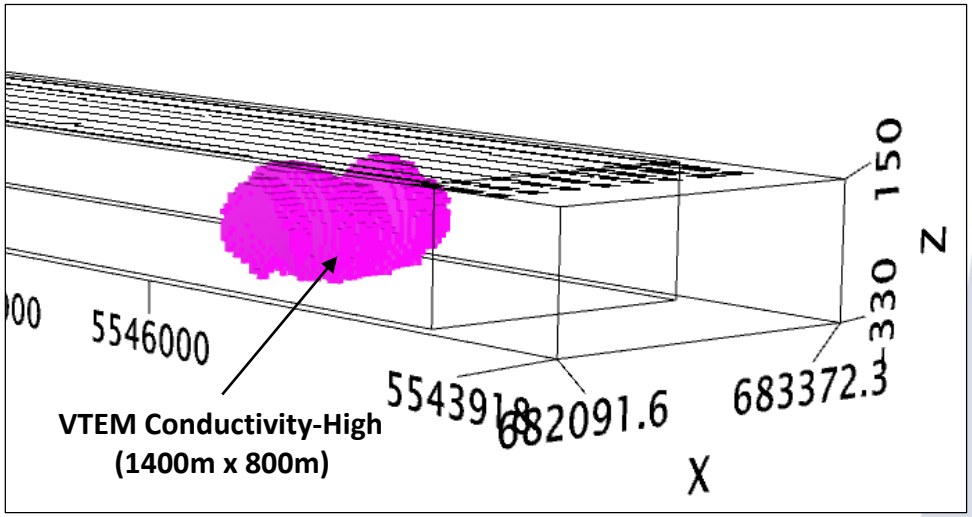
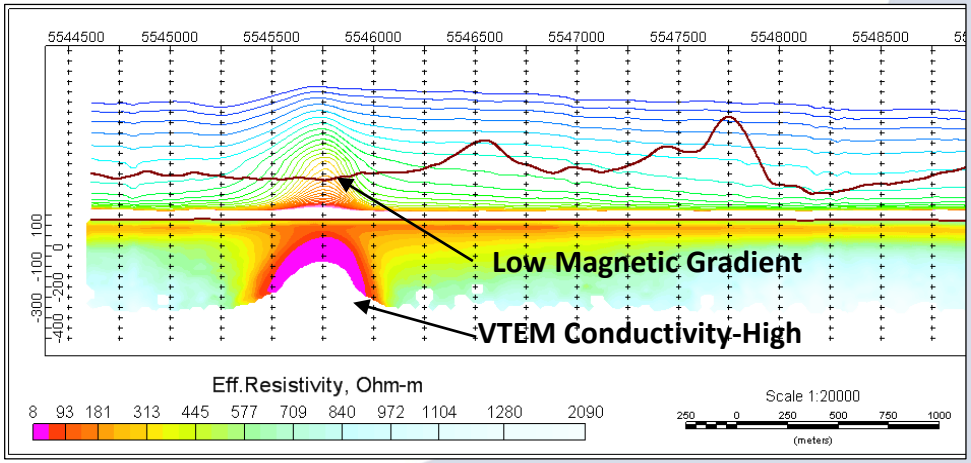
ALBANY GRAPHITE – RDI 3D RESISTIVITY VOLUME

- Resistivity-depth imaging of the VTEM results using the transformation scheme by Meju (1998) indicate a large (1400 m x 800 m) conductivity high that is consistent with a mineralized bedrock source below the overburden cover.

- Albany Graphite EM anomaly is also distinguished by its weak magnetic low response that is consistent with either remanently magnetized magnetite or pyrrhotite, or possibly diamagnetic graphite, which at the time caused it to be initially less favoured, geophysically, relative to other neighbouring anomalies.



L26170E – RDI RESISTIVITY-DEPTH SECTION



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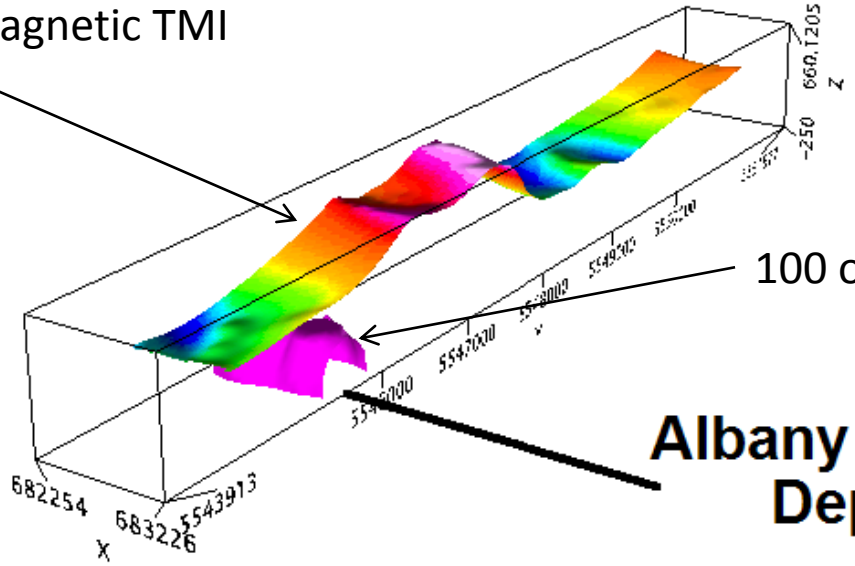
TMI
[nT]

57682 57699 57717 57737 57770 57810 57863 57933 58018 58099

Vertical Relief of Magnetic TMI



100 ohm-m Isosurface of VTEM RDI

Albany Graphite Deposit

Resistivity
[ohm-m]

91 220 270 310 355 407 454 504 552 608 673 737 815 896 982 1077

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Magnetic and Resistivity-depth image of Albany Graphite VTEM Response.

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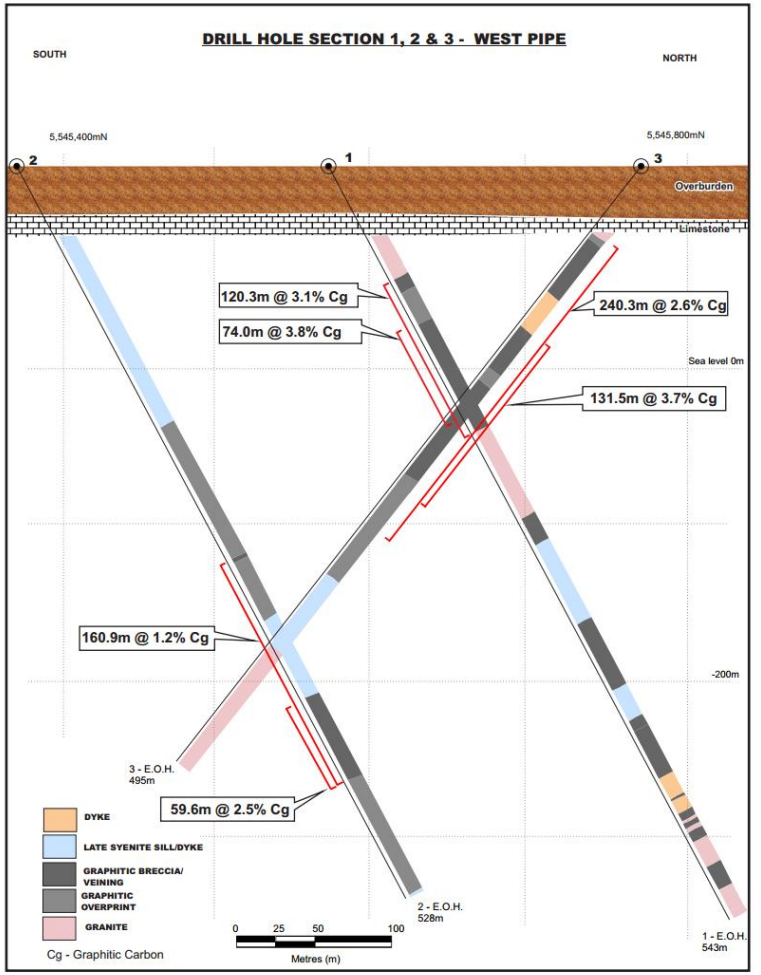
ALBANY GRAPHITE – DISCOVERY HOLES

HOLE-ID	From (m)	To (m)	Total Length (m)	Composite Grade (% Cg)
Z11-4F1	74.74	195.00	120.26	3.06
including	106.00	180.02	74.02	3.81
Z12-4F2	279.00	439.89	160.89	1.15
including	380.27	439.89	59.62	2.48
Z12-4F3	56.71	297.00	240.29	2.64
including	133.50	265.00	131.50	3.65



- In January, 2011, Drilling of the Uniform VTEM anomaly for nickel-copper target with drill-hole Z11-4F1 tested a strong, large airborne EM conductor and intersected eight separate and extensive breccia zones consisting of variably sized granitic fragments set in a black matrix containing graphite.

- In February and March 2013, Crone Geophysics undertakes surface time-domain EM (TDEM) surveys on the Property during February and March 2013.
  - Crone targeted the drill-confirmed East and West graphitic breccia pipes initially identified by VTEM.

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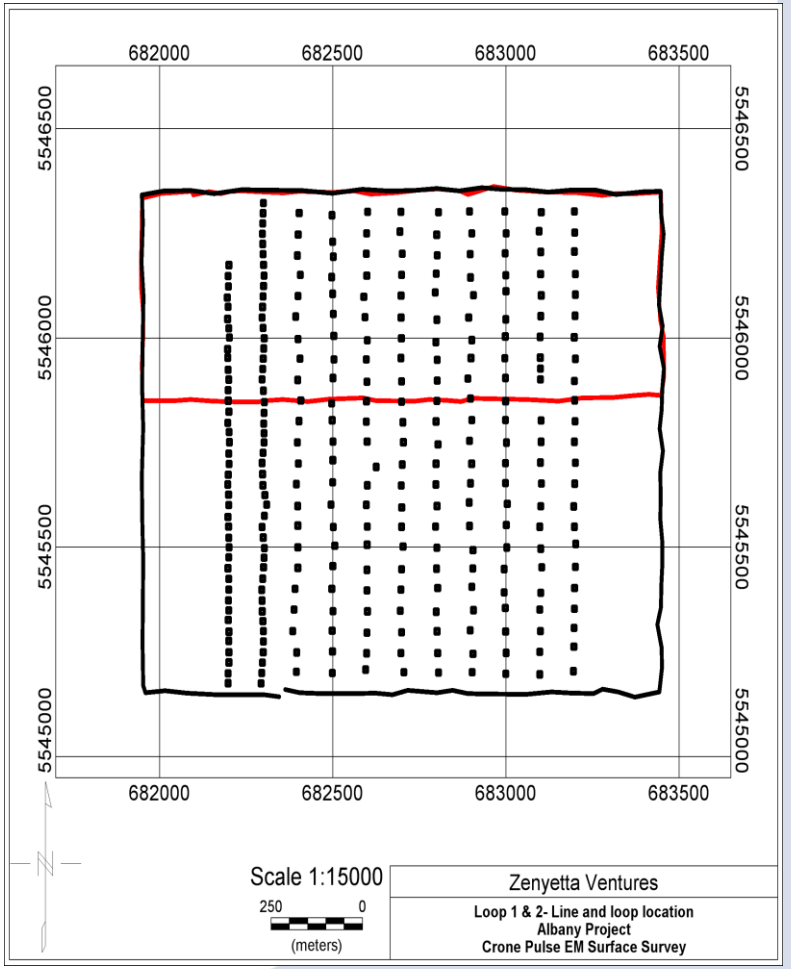
GROUND GEOPHYSICS

- Target was described as a pipe-like structure from previous airborne TDEM results
- Surface TDEM surveys could be influenced by both the top, presumably flat surface of the pipe, as well as the vertical faces if the pipe had a significant depth extent.
  - Offset loop mode (couple with steeply dipping surfaces)
  - In-loop mode to couple with the top, flat, (or relatively shallow dipping), surface of the body.
- Loop 1
  - 1200 m by 1500 m at 11 Amps
- Loop 2
  - 500 m by 1500 m at 12 Amps
  - 11 lines (1000 m to 1100 m in length)
  - Line spacing- 100 m
  - Station spacing- 25 m to 50 m.
  - 50 msec time base



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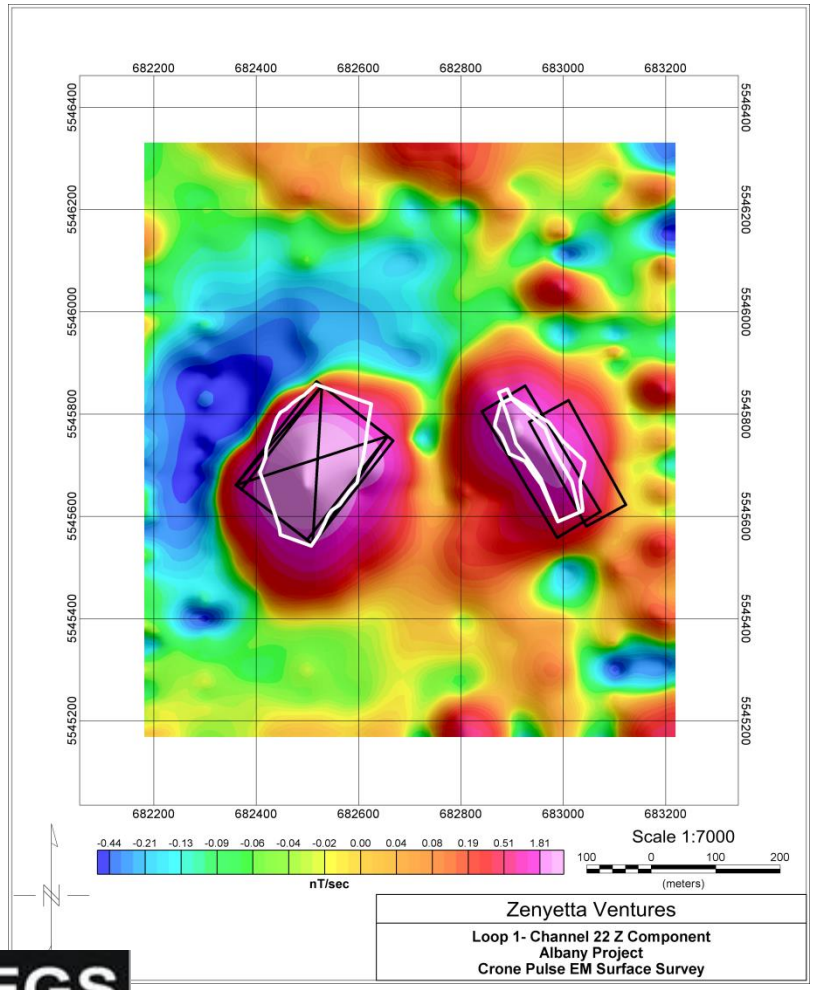
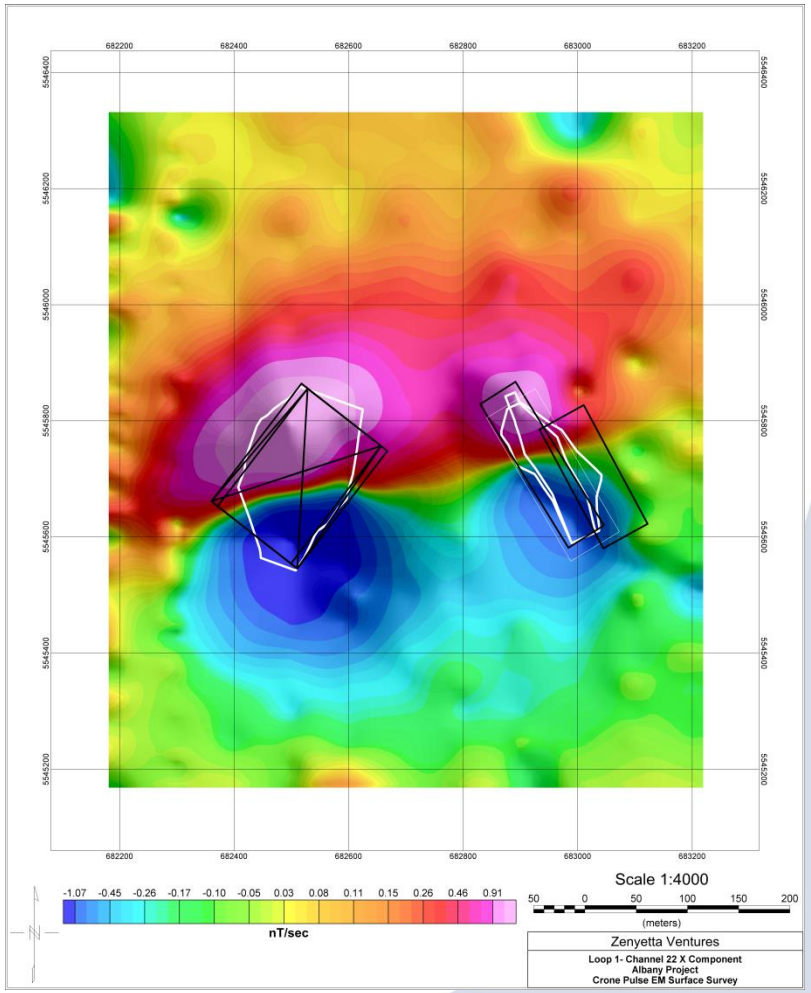
Loop 1- Ch 22, Z Component



Loop 1- Ch 22, X Component



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Late time (Ch 22) Z component provides an approximation of the conductive, top, flat lying surface of the interpreted pipe structure

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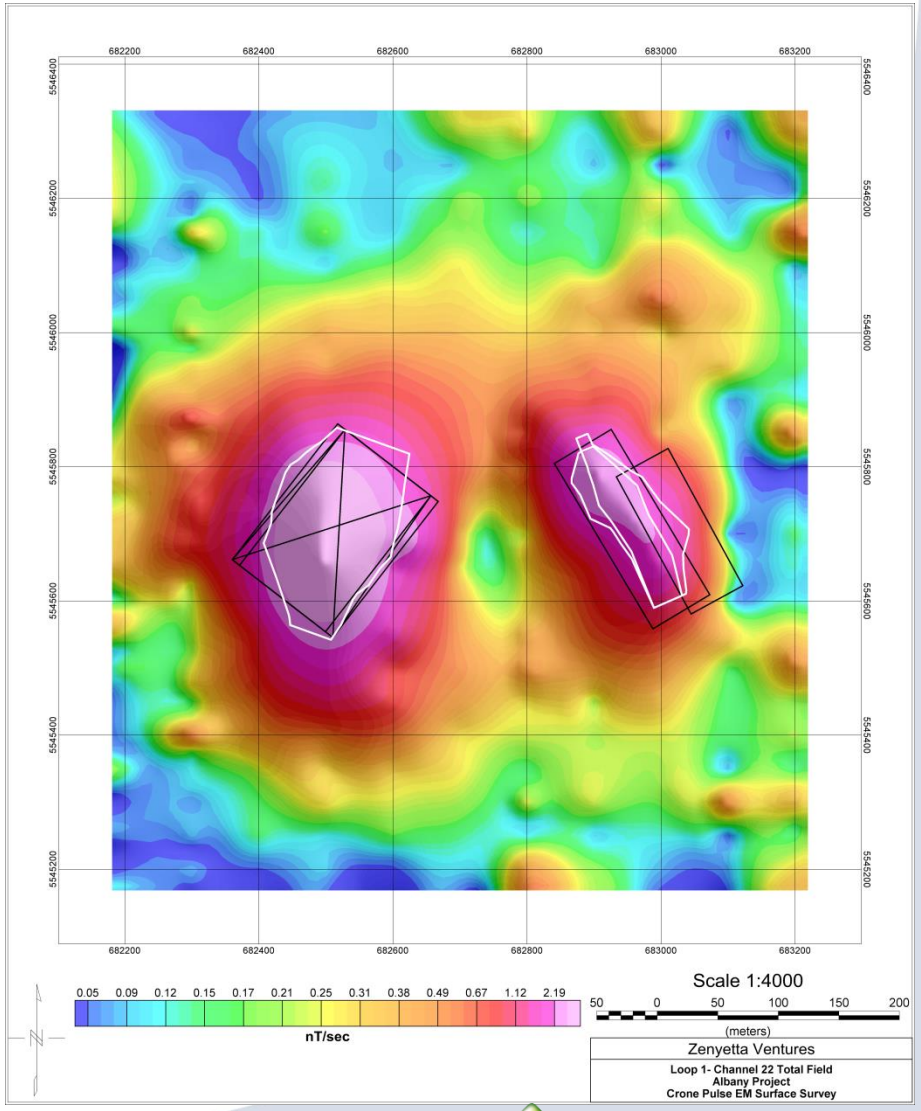
Loop 1- Ch 22, Total Field

- Calculated total field of the X and Z components provides a way of visually interpreting gridded data when there are crossovers
  - Used for illustrative purposes only
  - Modelling is done on component data to improve uniqueness and confidence level
  - Individually gridded products often give much more detailed result
- There is good correlation between the modelled flat-lying thin plates and the surface deposit outline, indicating that the anomalies are produced by the top, flat-lying surface of the conductors.
  - Unable to resolve the depth extent of the conductor, since thin plates provide a good fit to the data



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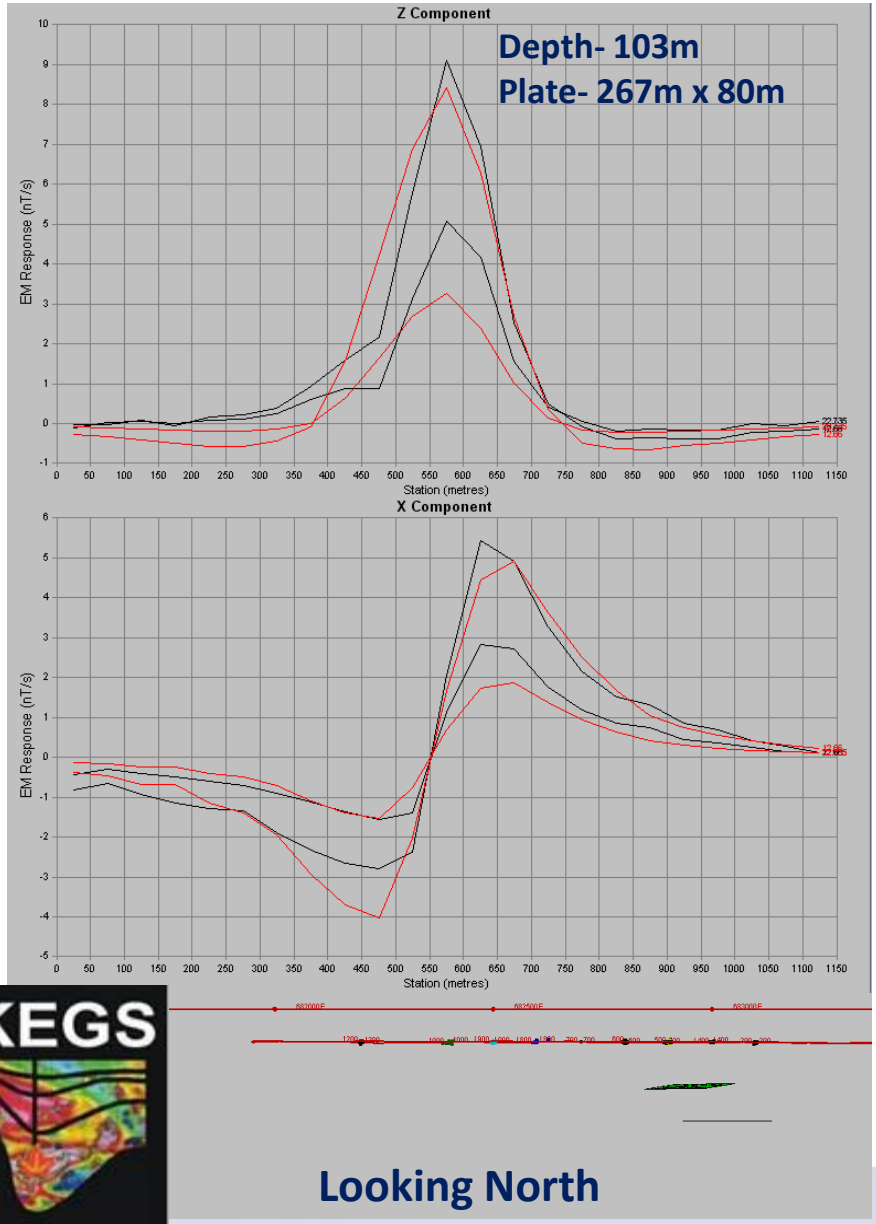
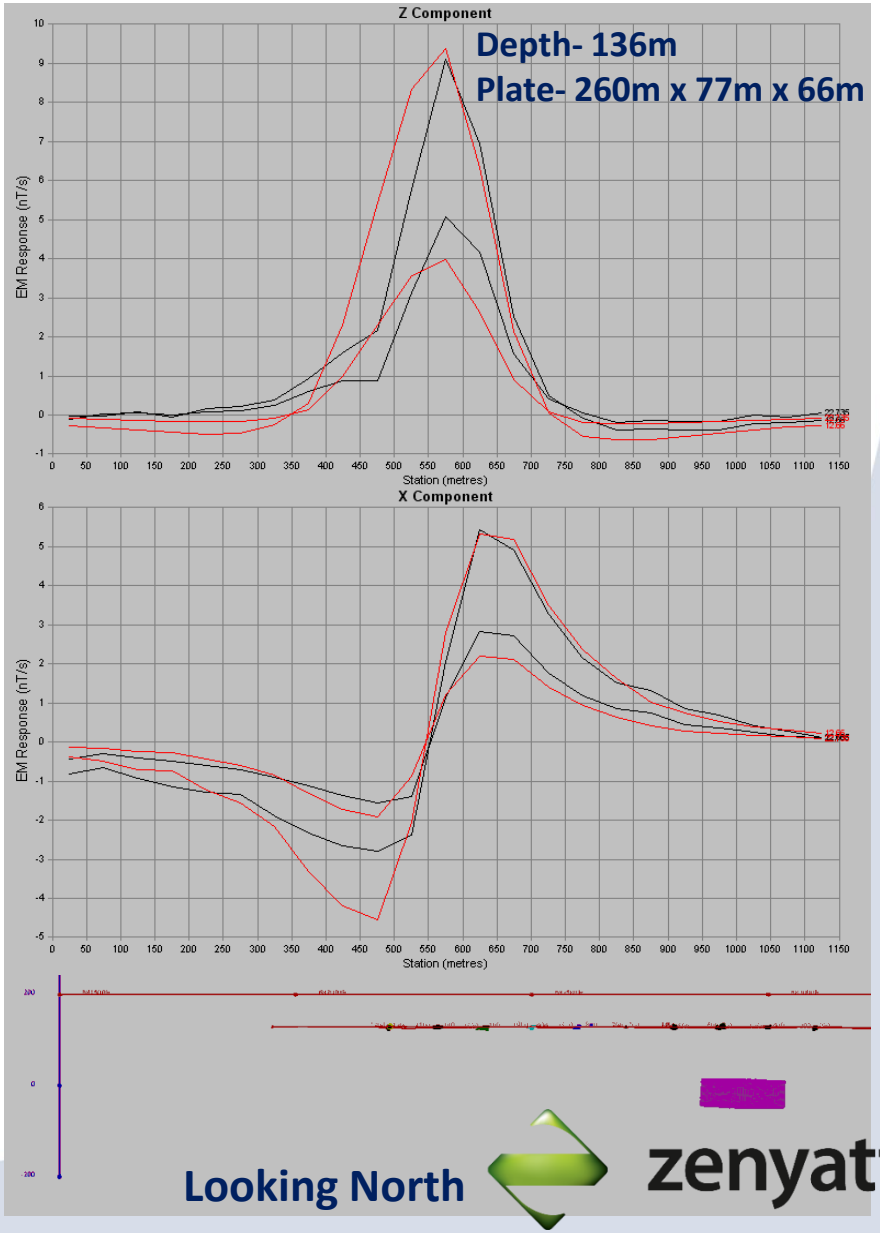
Loop 1- Line 500N, Thin plate Ch 21-22



Looking North

Loop 1- Line 500N, Thick plate Ch 21-22



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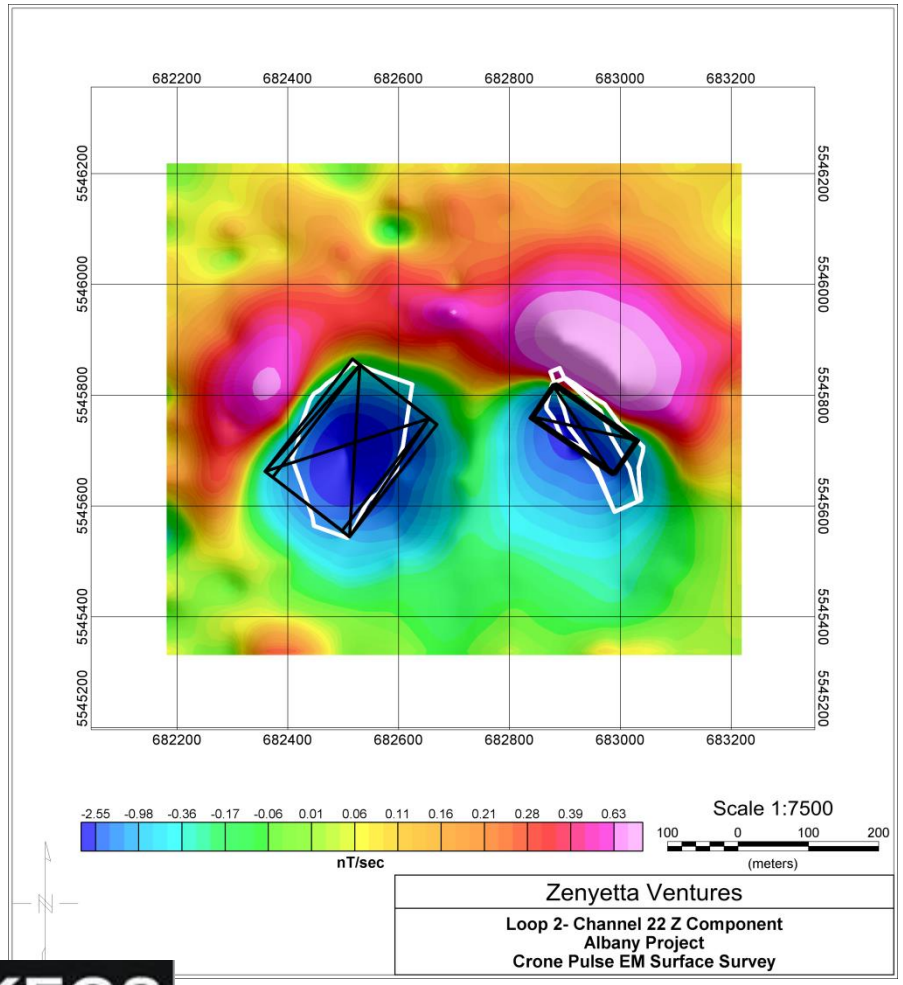
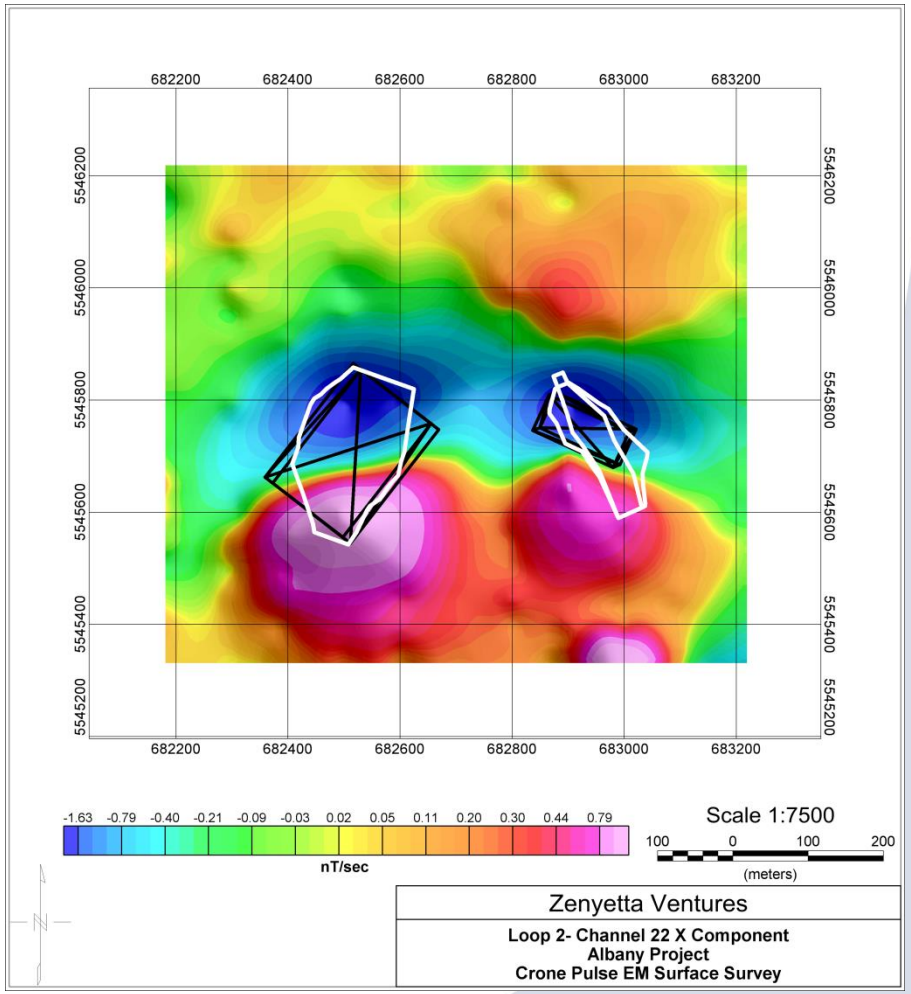
Loop 2- Ch 22, Z Component



Loop 2- Ch 22, X Component



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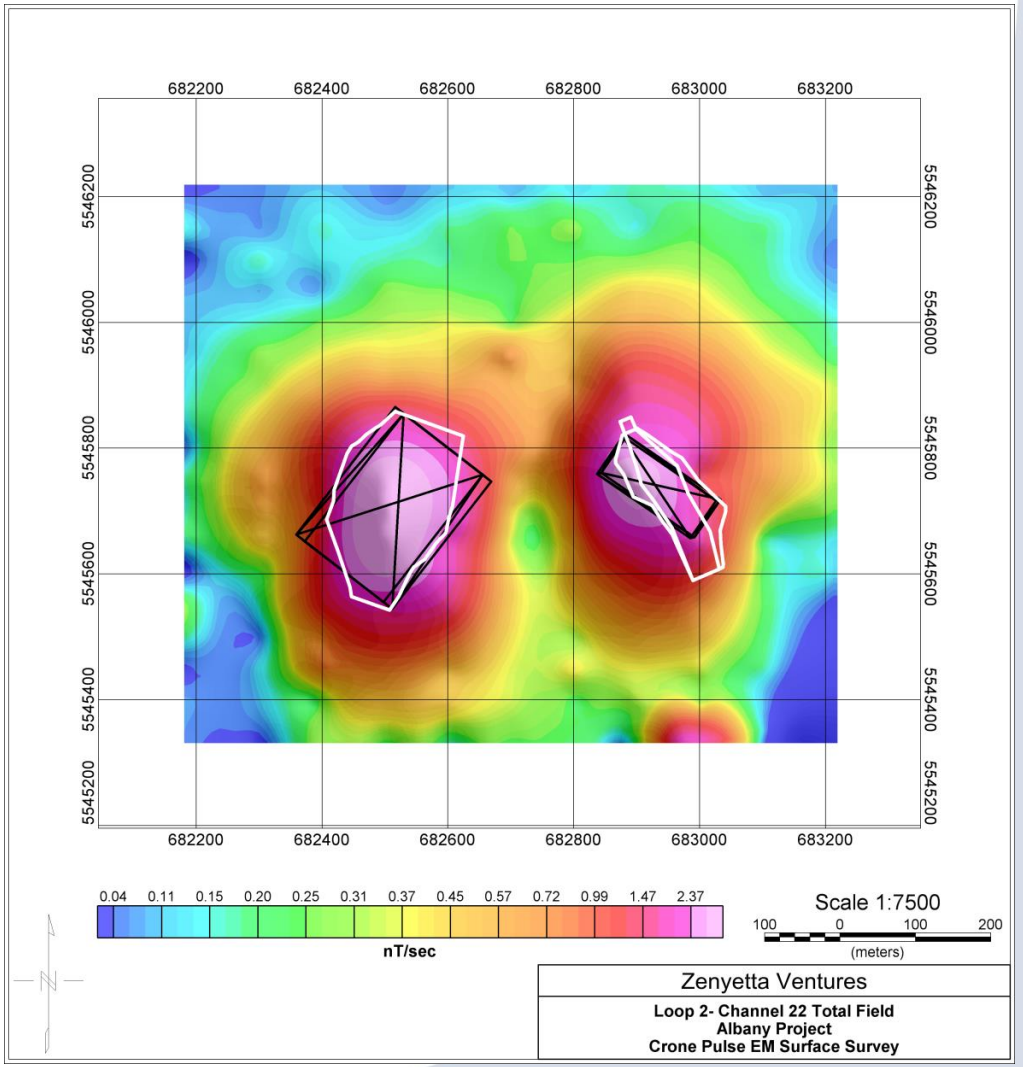
Loop 2- Ch 22, Total Field

- Total field provides an illustrated grid that is easier to interpret

- The offset loop coupled well with the steeply dipping conductor and thick plate models had to be used to fit the data well
- The top surface of the thick plates correlated well with the surface deposit outline
    - A variety of plate thickness values were able to satisfy the model with little change to the fit, indicating that they have potential to be very thick (great depth extent)



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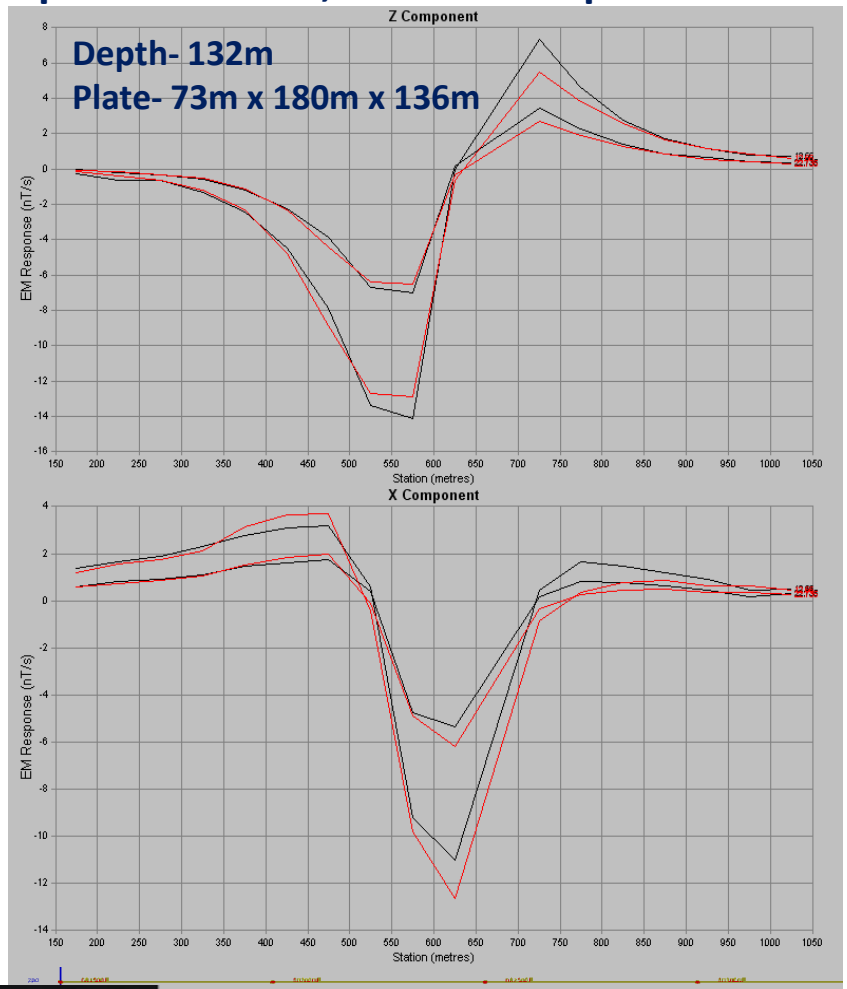
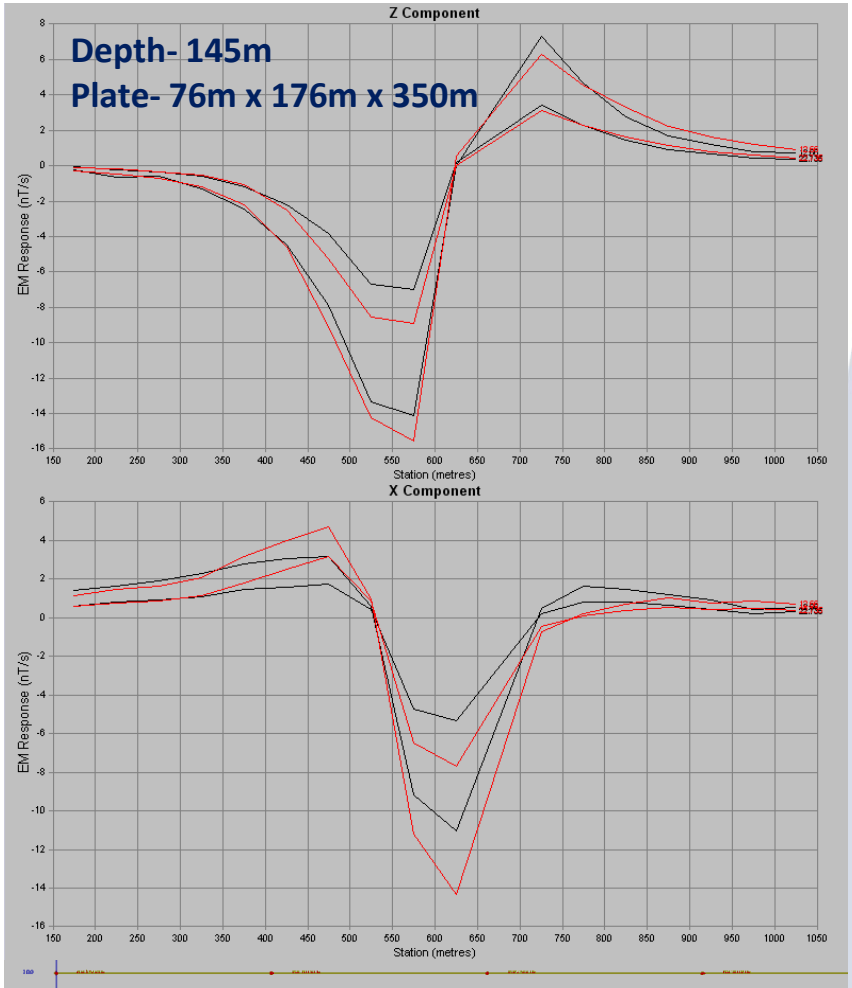
Loop 2- Line 500N, 136m Thick plate Ch 21-22



Looking North

Loop 2- Line 500N, 350m Thick plate Ch 21-22



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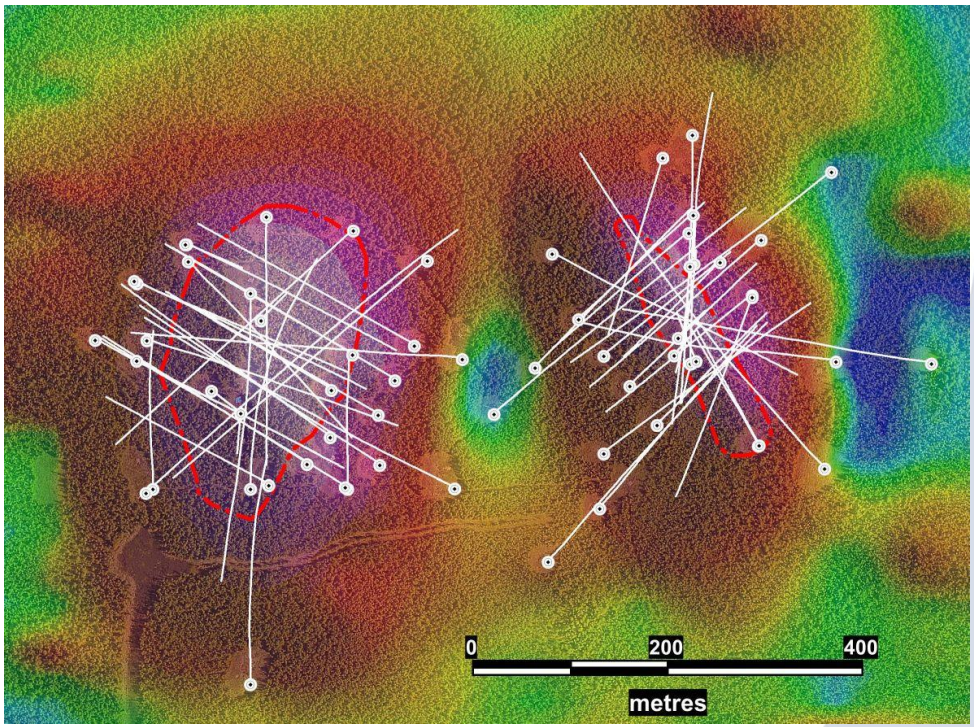
RESULTS

- Western Anomaly
  - Circular-like response
  - Depth of ~100m-120m
  - Tau ~12msec
  - Plate size: ~255m x 185m
  - Conductance: ~440S
  - ~20° dip in the SE direction
  - Unable to resolve depth extent or thickness
- Eastern Anomaly
  - Oval-shaped in the NNW-SSE
  - Tau ~15msec
  - ~125m depth
  - Plate size: ~75m x 180m x 150m-350m
    - Difficult to determine the southern edge from Loop 2
    - Unable to resolve depth extent and thickness of Loop 2 Eastern zone



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CONCLUSIONS

- **Prior to the discovery of the Albany Graphite deposit, the area had been largely unexplored in the past due to thick overburden and Phanerozoic cover rocks overlying the prospective Archean basement rocks.**
- **The ability of modern AEM systems to penetrate the cover has played an important role in further exploring the area.**
- **Despite its large size and favourable high conductivity, the Albany Graphite airborne TDEM anomaly is distinguished by a weak magnetic low response that is consistent with diamagnetic graphite.**
- **This resulted in a lower ranked geophysical target relative to other neighbouring anomalies.**
- **Regardless, the presence of strong AEM anomaly inside a favourable geologic and geophysical structure resulted in it being drill-targeted for nickel sulphides but which instead led to the discovery of this rare igneous-related, hydrothermal graphite deposit.**

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CONCLUSIONS (continued)

- Ground TDEM follow-up was used to constrain the outline and depth extent of the mineralized orebodies.
- Modeling of Loop 1 data indicated the responses of the two zones were dominated by the top-surface of the conductive feature.
- Modeling of Loop 2 data revealed that both the Western and Eastern conductors had the potential for considerable depth extent.
- Overall, the modelled plates from Loop 1 and Loop 2 provided a robust model for targeting purposes. After drilling the first few holes, Zenyatta concludes that the channel 22 contoured plan map of the TDEM data provides a close correspondence to the actual outline of the breccia pipes for drill planning purposes.
- This blind discovery in an underexplored region below extensive cover is testament to the importance of well defined geologic target model and the use of deep penetration airborne and ground-based EM systems.

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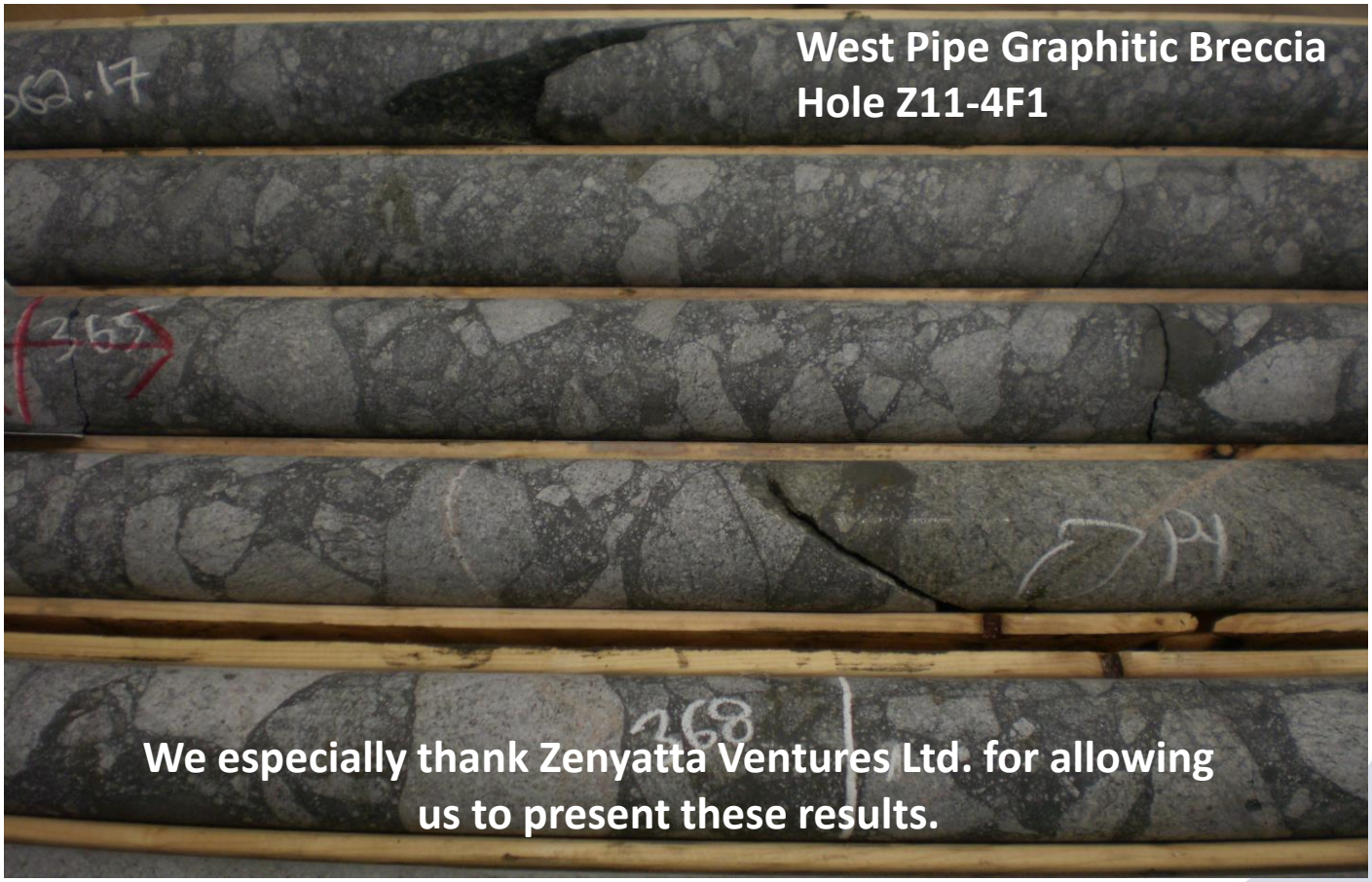
THANK YOU



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