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Canadian Manufacturer of Geophysical Instruments since 1976

Case Study:

Ground TEM survey over the Champagne deposit, Qc.

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Geophysicist
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Survey site Localisation

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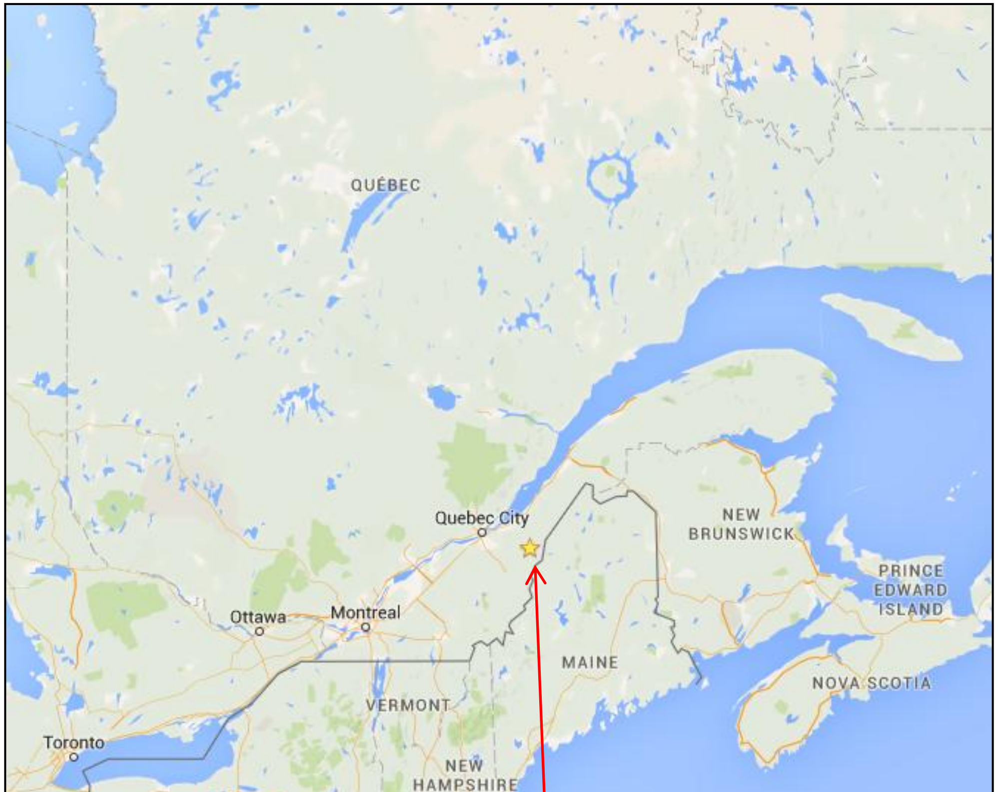
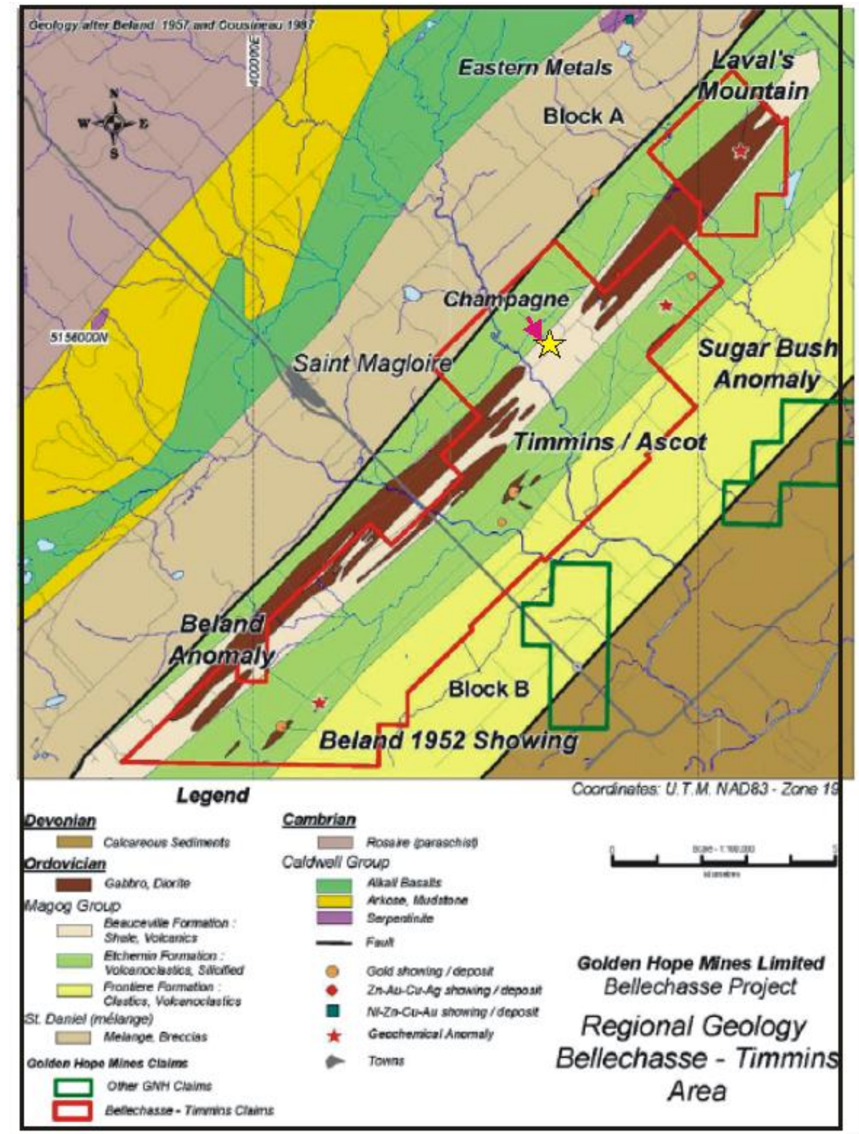


Champagne deposit
Bellechasse Gold Belt
Golden Hope Mine ltd.

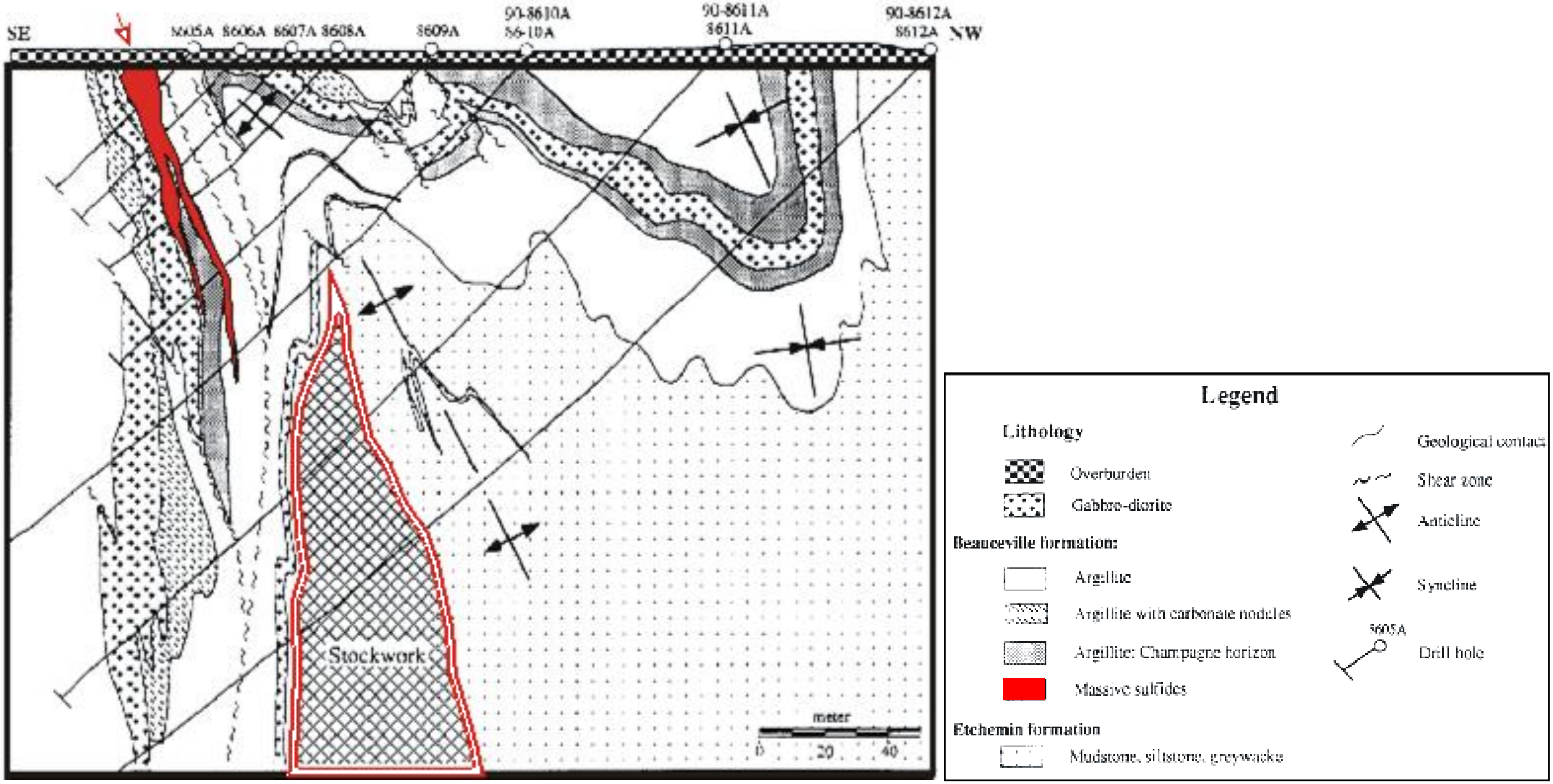


Exploration Target

VMS style Zn-Cu-Pb-rich massive sulphides

Anticipated geophysical signature --> moderate to strong EM Conductor

Target: Massive sulphides



TEM Survey Specifications

CONFIGURATION:

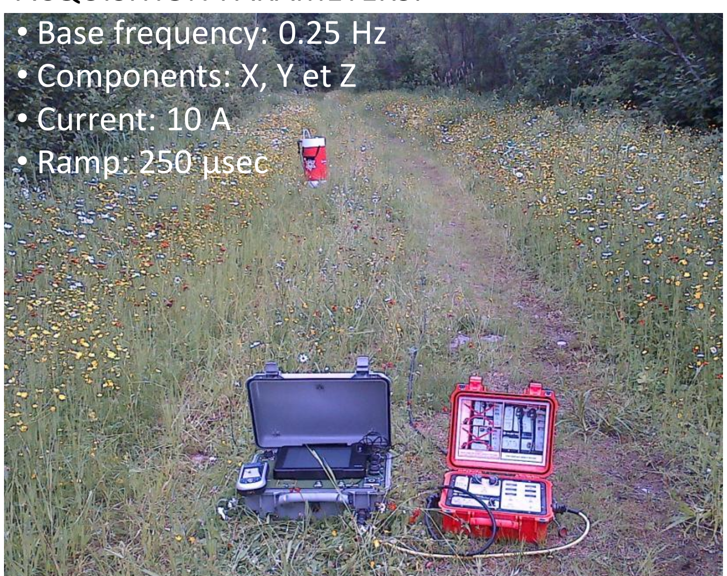
- 200m x 400m Fixed-loop survey, properly located to optimize coupling with the deposit.
- 25m stations spacing yielding an appropriate lateral resolution.

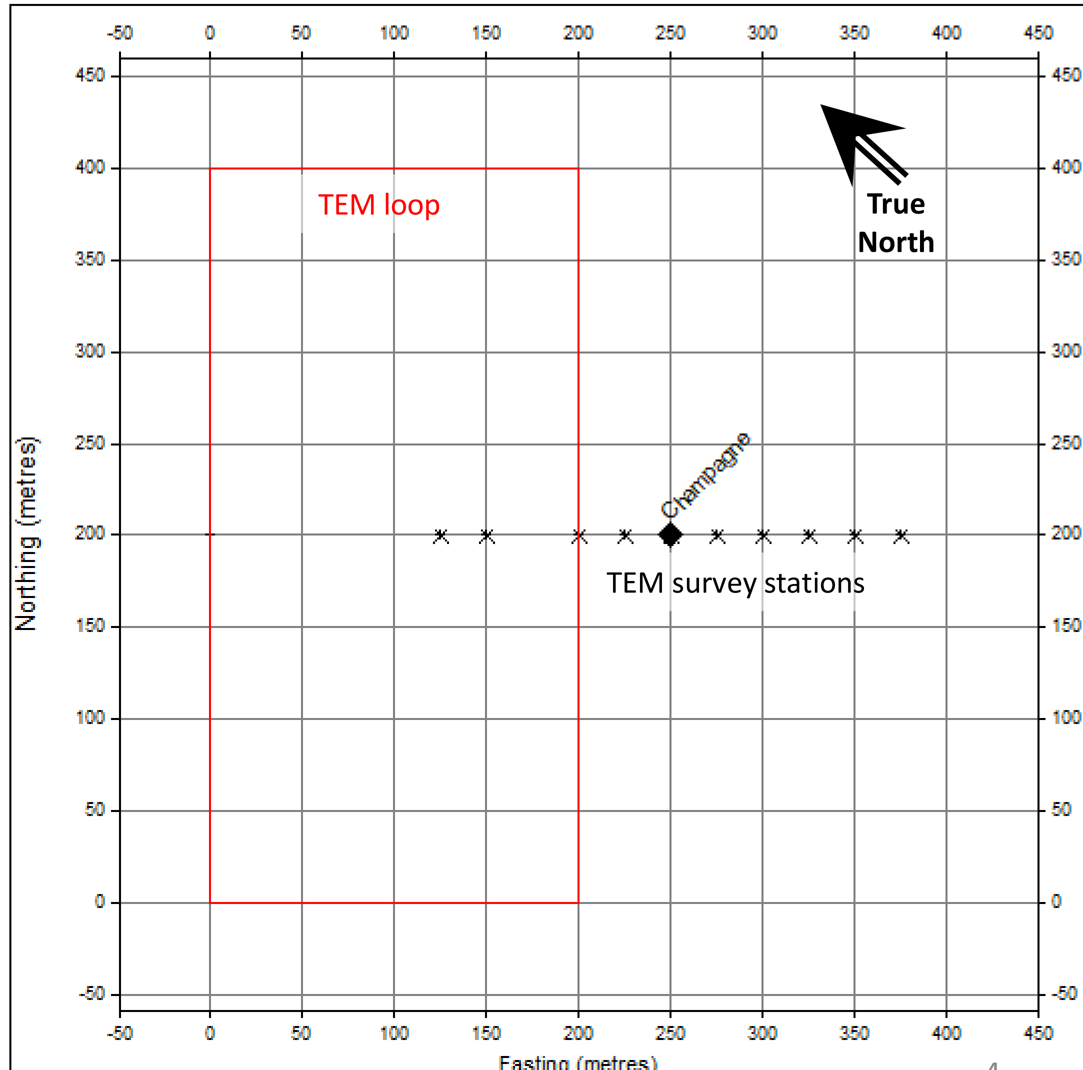
INSTRUMENTATION:

- Receiver: GDD's NordicEM24
- Transmitter: GDD's prototype
- Sensor: Supracon's LT-SQUID

ACQUISITION PARAMETERS:

- Base frequency: 0.25 Hz
- Components: X, Y et Z
- Current: 10 A
- Ramp: 250 µsec

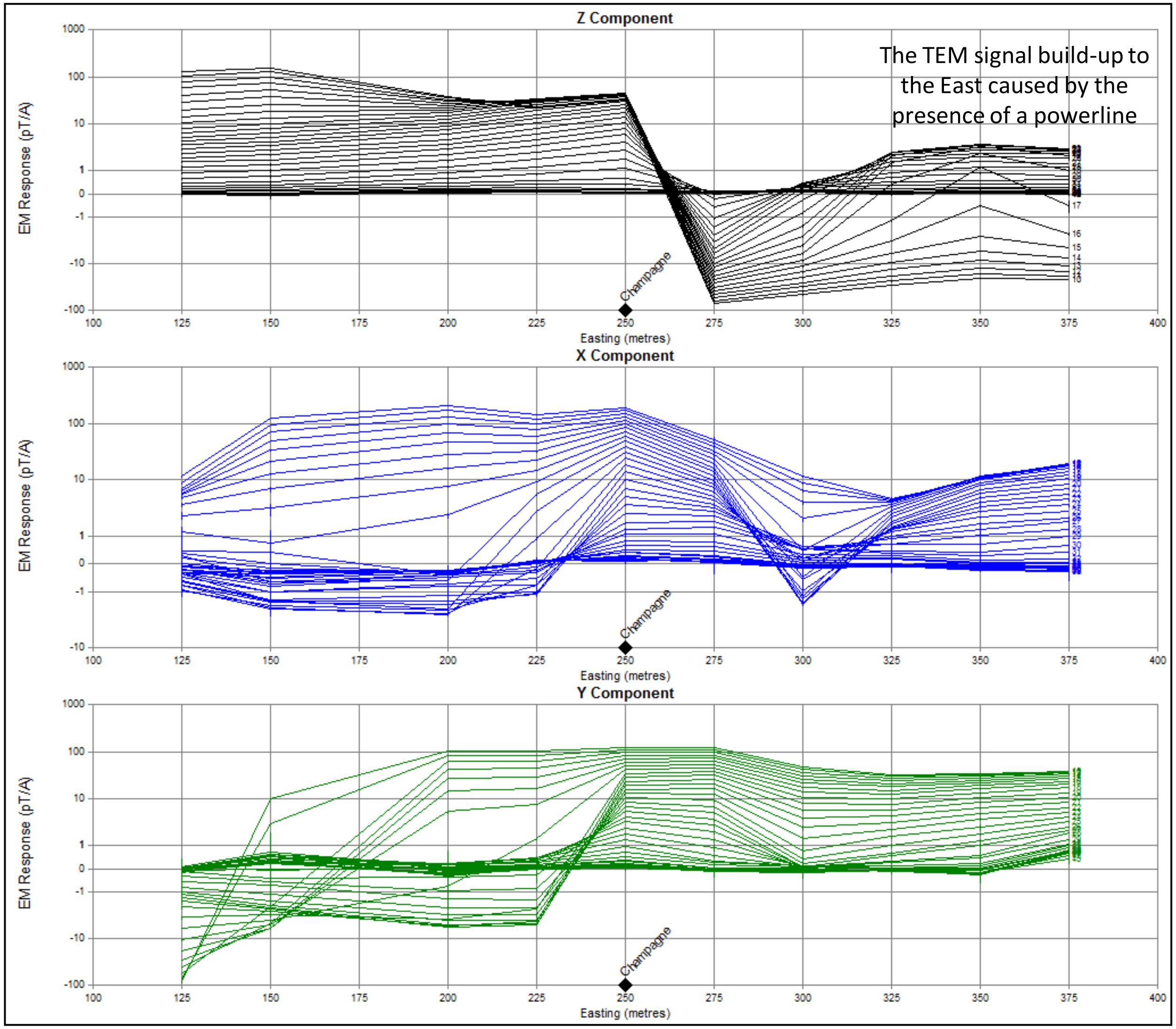




TEM Survey Results

QUALITATIVE INTERPRETATION:

- Anomaly detected at station 250 and characterized by a +/- *cross-over* on Z and by a positive peak on X and Y.
- Conductor steeply dipping to the NW (asymetry).
- Strike length extension is at low angle (~45°) with survey line (signature on the Y component).
- Good quality of conductor with a signature visible down to the late-time channels (down to 150 ms).
- Stacked conductors are suspected according to the presence of two coincident anomalies at station 250 (one with a small and the other with a wider wavelength).

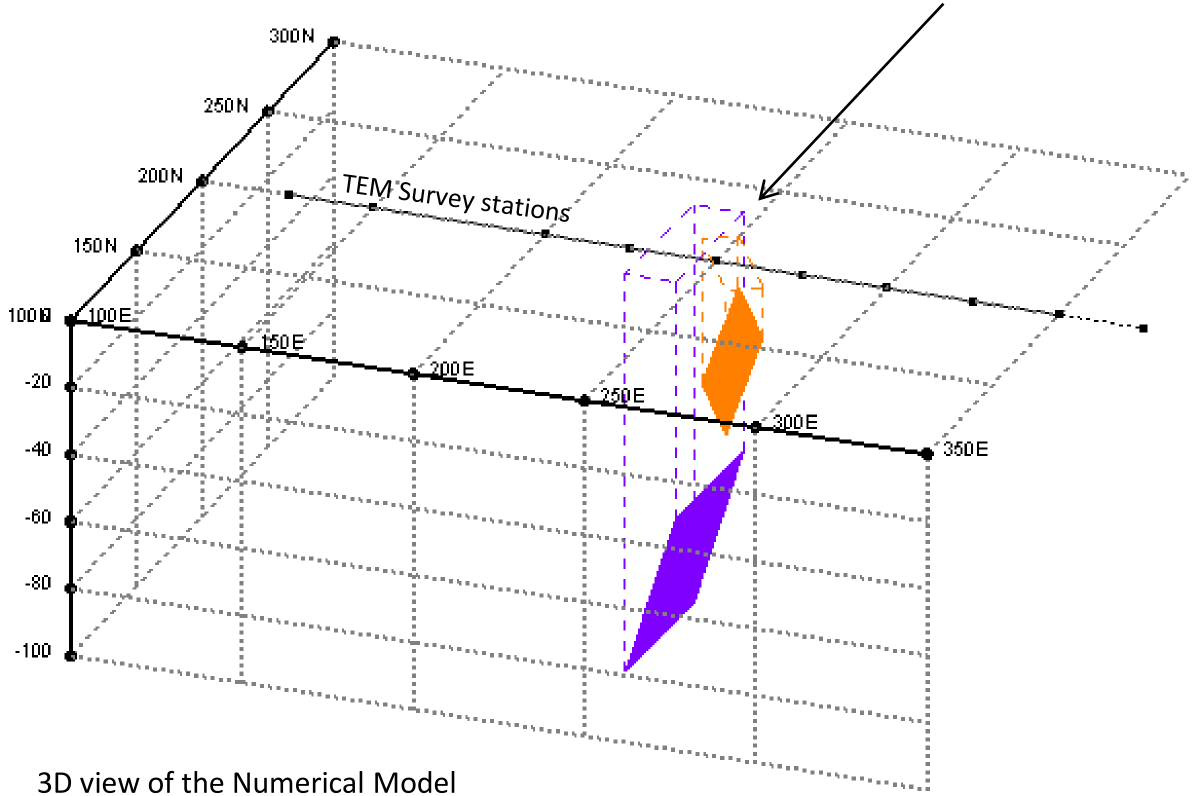


Modelling of TEM Results

QUANTITATIVE INTERPRETATION:

- Numerical modelling consists in mapping the buried geological conductor(s) using homogeneous sheet-like numerical plates of variable geometry and conductance.
- Software used: Maxwell from EMIT®

Numerical plates (2) created to reproduce the TEM survey results over the Champagne deposit.



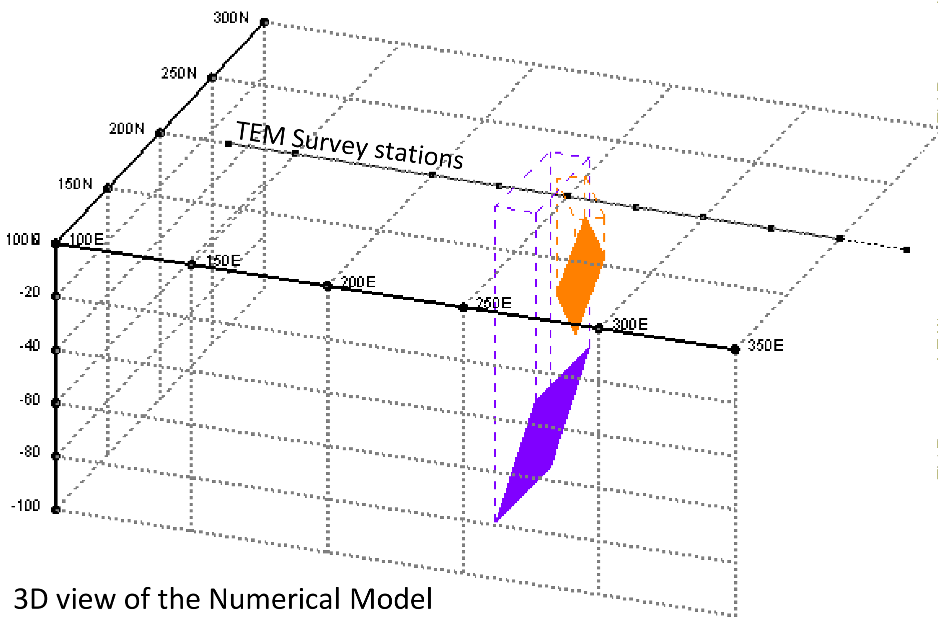
3D view of the Numerical Model

Modelling of TEM Results

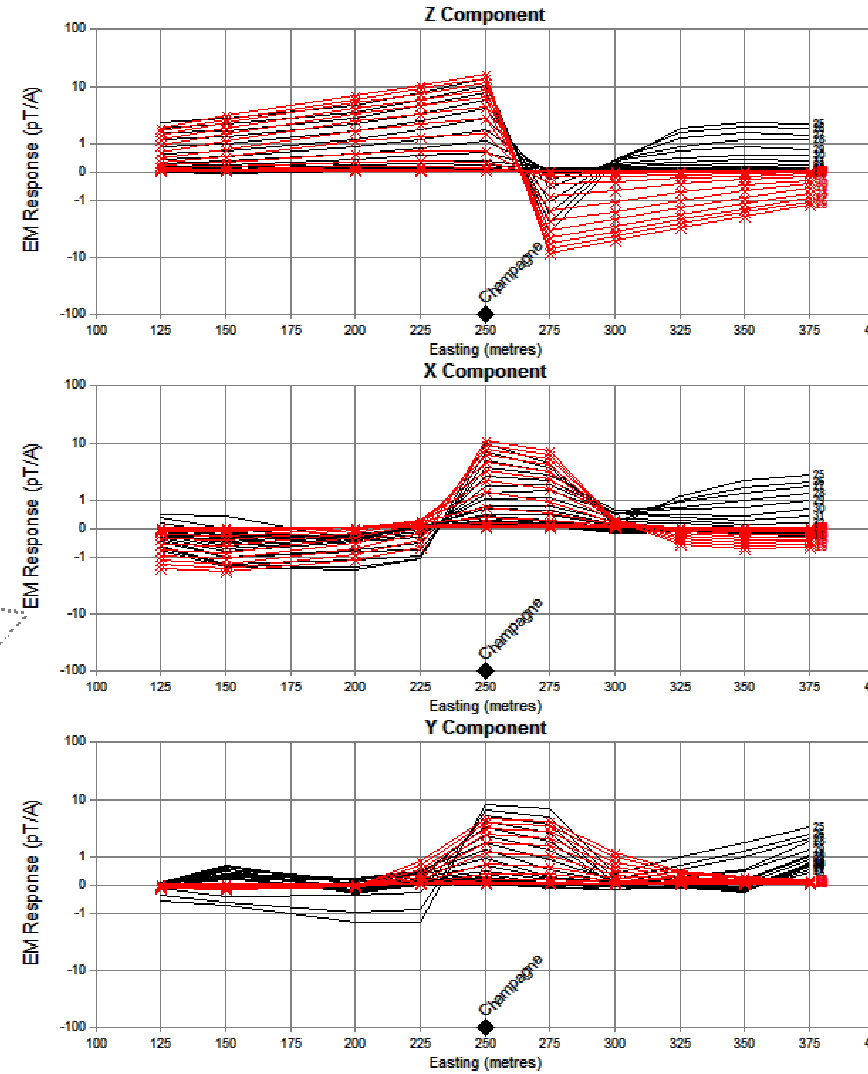
QUANTITATIVE INTERPRETATION:

- The fit between the measured profile (in black) and the one calculated from the numerical modelling (in red) allows validating the quality of the model as a good representation of the buried geological conductive bodies.

- In this case, there is a good correspondence between the measured (in black) and calculated (in red) profiles suggesting that this numerical model is robust. (The powerline could not be modelled explaining the discrepancies to the East of the profiles).



3D view of the Numerical Model



Modelling of TEM Results

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QUANTITATIVE INTERPRETATION:

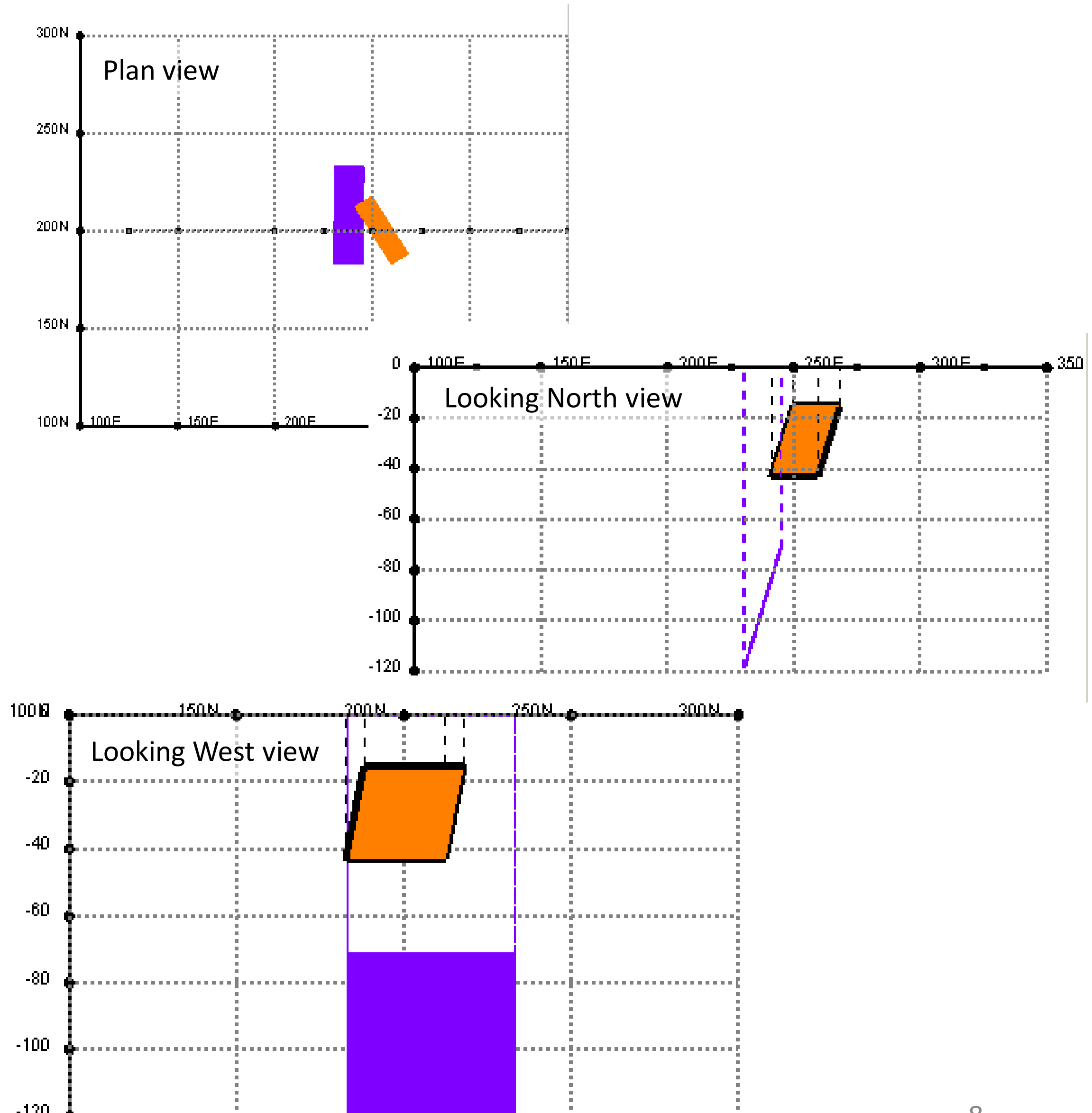
- Numerical plates characteristics:

	Orange Plate	Purple Plate
Depth-to-top	15 m	71 m
Dip	70°	73°
Grid Azimuth	NW-SE	N-S
Real Azimuth	N-S	NE-SW
Strike Length	35 m	50 m
Depth Extent	30 m	50 m
Conductance	9,000S	8,000 S

- Geological translation:

“The numerical plates yield a 3D image of the simplified geometry of the conductive portion of the Champagne deposit.”

“The massive sulphides portion of the Champagne deposit is very conductive with conductance values greater than 5,000 S.“



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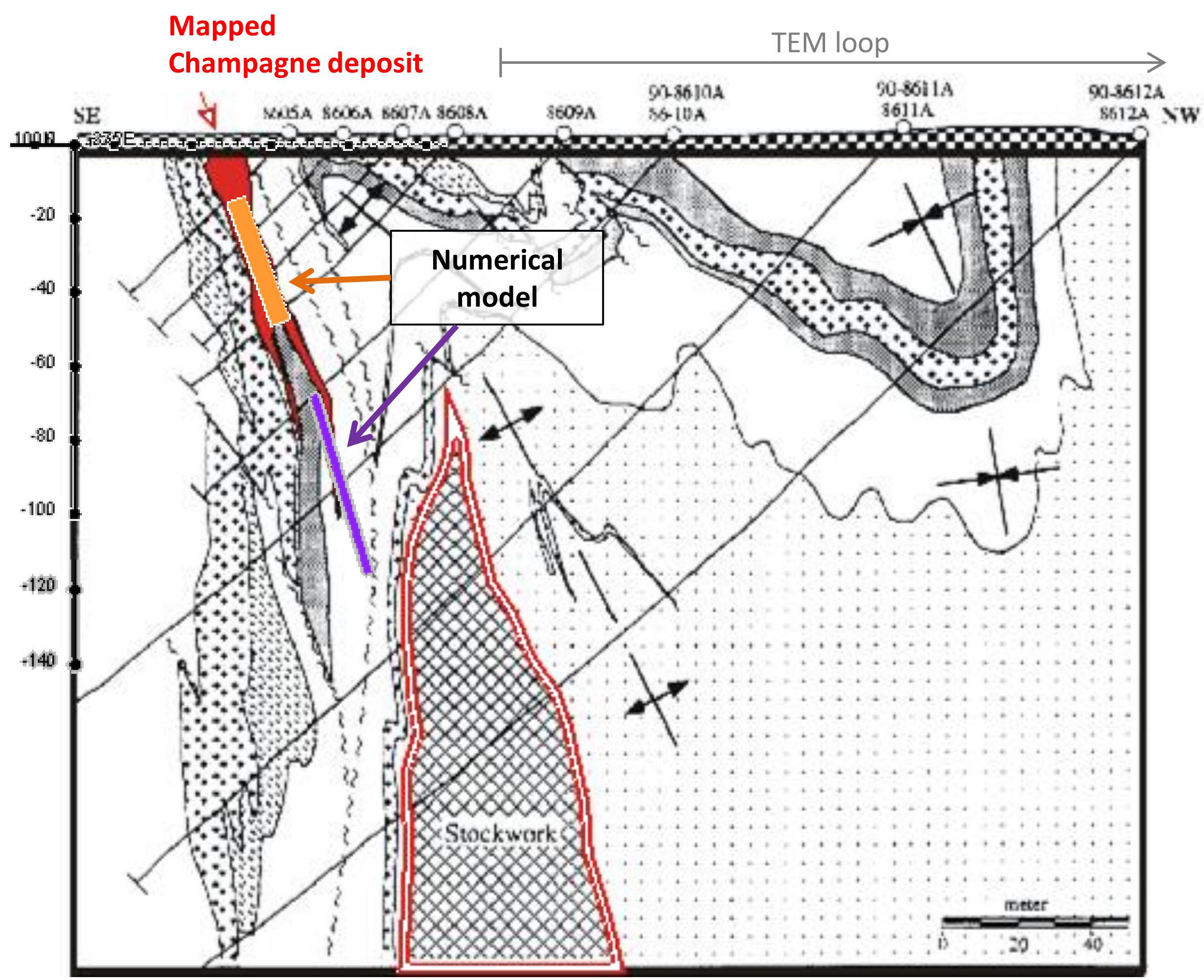
Validation of the TEM model

NUMERICAL MODEL vs GEOLOGICAL SECTION

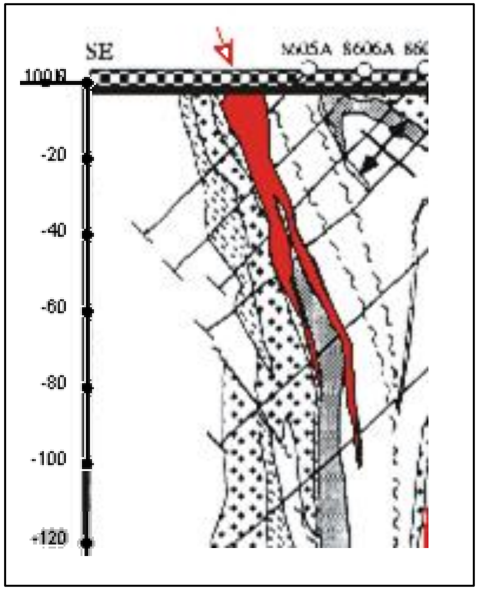
- The TEM survey modelling was carry out without any geological knowledge of the deposit.
- There is an excellent correspondence between the location of the Champagne deposit (in red) and the **Orange plate**.
- The location of the **Purple plate** fits fairly well with the deeper and thinner portion of the MS lens. An additional drillhole located between 90-8610A and 90-8611A would allow validating this part of the model.
- The deposit's dip is well reproduced by both modelled plates.
- The model suggests a disrupted EM conductivity from top to base (2 plates) which does not corresponds necessarily to an ore discontinuity.
- Note that the stockwork has not been modelled even though it is likely detected by this TEM survey (refer to slide 5, anomaly to the NW end, on the early-time channels).



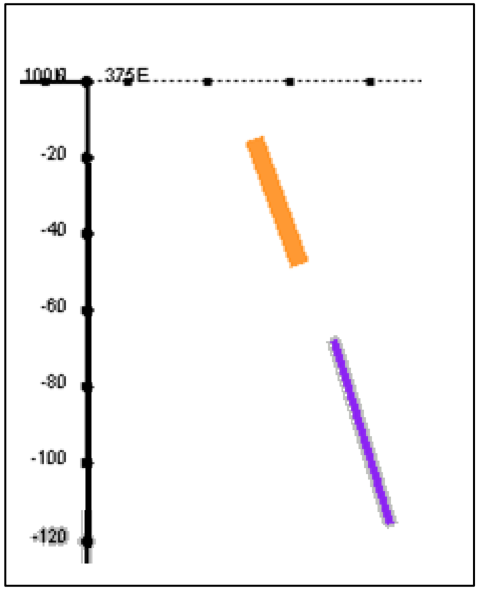
Conclusions

- This case study highlights the efficiency of ground Time-Domain Electro-Magnetics (TEM) geophysical surveys when exploring for **base metals deposits associated to massive sulphides**.

  * The numerical model produced out of the TEM survey corresponds very well with the mapped portion of the Champagne deposit.



Geological cross-section of the Champagne deposit



Numerical modelling resulting for the TEM ground survey over the Champagne deposit

Conclusions

- TEM surveys must be carried out using **appropriate geophysical instruments**, chosen according to field conditions and to technical specifications.

  * For instance, light and portable instruments are best suited for hilly terrains. In addition, according to the exploration target, the type of sensor, the power and base frequency of the TEM transmitter and the capability of the TEM receiver to measured the full waveform at high sampling rate are critical.

- The **TEM survey configuration** is also a key aspect in order to optimize your survey results (type of loop, size and location of loop, station spacing and survey line orientation, …).

- On one hand, most TEM surveys **can be interpreted directly** out of the raw results. On the other hand, quantitative interpretation using numerical modelling is a very accessible way of producing a 3D image of the buried conductors sitting underneath the TEM survey area.

- According to the TEM survey results, **drilling targets can be defined** from either qualitative or quantitative interpretation.

Instrumentation GDD wished to thank Golden Hope Mine ltd. for the permission to publish this case study.