The Geophysical Characteristics of the Trilogy Massive Sulphide Deposit, Ravensthorpe, Western Australia

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Presentation Outline

- Discovery History
- Geological Overview
- Previous Exploration
- Petrophysical Analysis
- Geophysical Surveys
- Geophysical Modelling
- Deposit Characteristics
- Conclusions
• Historically, the exploration focus in the Ravensthorpe region has been for gold and copper mineralisation, and more recently for nickel within the greenstones.

• In 1997 HGAL discovered massive sulphide mineralisation in the Proterozoic metasedimentary Mount Barren Group, namely the Trilogy Deposit.

• Discovered during drilling of gold soil geochemical anomalism thought to be derived from greenstones in the underlying Archaean basement.
• Discovery spawned an Exploration revival in the Ravensthorpe region.

• Being the first deposit of this type discovered in the region, very little was known about its geophysical characteristics.
Location of the Trilogy Deposit, Kundip, Ravensthorpe
Regional Geology

Proterozoic Dyke / Fracture Set
Proterozoic Mount Barren Group
Metabasalt
Komatiite / basalt
Undifferentiated ultramafic
Metasedimentary units
Banded Iron Formation
Chert
Conglomerate
Metagabbro
Calcalkaline metavolcanics -andesitic to rhyolite
Ravensthorpe Tonalite / granodiorite
Adamellite
Mine
Aeromagnetic Overview

10km

Trilogy
Stratigraphic Profile

- Mainly metapelite (phyllite, shale) and hemipelite with local accumulation of dolomite and muddy dolomite west-southwest of Kundip
- Massive to bedded orthoquartzite
- Dolomite, locally oolitic; stromatolites or ripple marks near base of unit
- Grit; compositionally similar to underlying conglomerate
- Conglomerate containing clasts mainly of quartzite, chert and banded iron-formation
- Manyutup Tonalite

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Triology

- KYBULUP SCHIST
- KUNDIP QUARTZITE
- STEERE FORMATION
- ARCHAEAN

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metres
4.30 Mt of ore containing
• 52,500 t Cu
• 149,000 oz Au
• 7.76 Moz Ag
• 76,400 t Pb
• 51,500 t Zn

(King, 2001)
Previous Exploration

MMI Gold Soil Geochemistry

- Responsible for the discovery of the Trilogy Deposit
- Three Au highs defined, all related to the Trilogy mineralisation
- Au anomalism 20 times that of background
- Conventional soils would have identified the dispersion halo around Trilogy
<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Specific Gravity (g/cc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kundip Quartzite</td>
<td>2.67</td>
</tr>
<tr>
<td>Mount Barren Serecite Schist</td>
<td>2.7</td>
</tr>
<tr>
<td>Graphitic Phyllite/Siltstone</td>
<td>2.67-2.72</td>
</tr>
<tr>
<td>Silicified Graphitic Phyllite/Shale/Sandstone</td>
<td>2.66-2.85</td>
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<tr>
<td>Massive Cu-Pb-Zn mineralisation</td>
<td>3.75</td>
</tr>
<tr>
<td>Magnetite/Pyrrhotite/Pyrite Breccia</td>
<td>3.17</td>
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</tbody>
</table>
Magnetic Susceptibility

Magnetic Susceptibility x10^-6 (SI)

Depth (m)

Mineralised Zone
<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Log Avg Resistivity (ohm.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kundip Quartzite</td>
<td>20000</td>
</tr>
<tr>
<td>Mount Barren Serecite Schist</td>
<td>n/a</td>
</tr>
<tr>
<td>Graphitic Phyllite/Siltstone</td>
<td>10-800</td>
</tr>
<tr>
<td>Silicified Graphitic Phyllite/Shale/Sandstone</td>
<td>35000-75000</td>
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<tr>
<td>Massive Cu-Pb-Zn mineralisation</td>
<td>0.01</td>
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<tr>
<td>Magnetite/Pyrrhotite/Pyrite Breccia</td>
<td>n/a</td>
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</table>
### Airborne EM Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>AEM System:</td>
<td>Questem 450</td>
</tr>
<tr>
<td>Line Spacing:</td>
<td>200m</td>
</tr>
<tr>
<td>Line Direction:</td>
<td>135/315 degrees</td>
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<tr>
<td>Survey Height:</td>
<td>120m</td>
</tr>
<tr>
<td>Base Frequency:</td>
<td>25Hz</td>
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</tbody>
</table>

All other specifications are as standard for the Questem 450.
Airborne EM Results

Log-Linear AEM Profile over the Trilogy mineralisation

Channel 15 - 14.359 msec centre
units = ppm
Regional overview of Airborne EM

Trilogy is not the most conductive anomaly defined from the AEM survey.

Channel 15 - 14.359 msec centre units = ppm
## Ground EM Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver Instrument</td>
<td>SIROTEM MkIII</td>
</tr>
<tr>
<td>Receiver Coil</td>
<td>RVR-2E</td>
</tr>
<tr>
<td>Receiver Frequency</td>
<td>Composite times</td>
</tr>
<tr>
<td>Components recorded</td>
<td>Z</td>
</tr>
<tr>
<td>Transmitter</td>
<td>SATX medium power tx</td>
</tr>
<tr>
<td>Transmitter Area</td>
<td>12800 sq m</td>
</tr>
<tr>
<td></td>
<td>(80x80m loop, 2 turns)</td>
</tr>
<tr>
<td>Station Spacing</td>
<td>40m and 80m</td>
</tr>
<tr>
<td>Line Spacing</td>
<td>80m</td>
</tr>
</tbody>
</table>
Ground EM Results

Linear-Linear profile over the Trilogy Mineralisation

Exponential Decay
Line 12840, Station 10400
$\tau = 15.8$
Intercept = 236.334
RMS Fit = 99.93%
Channel 25 - 14.225 msec centre
units = uV/A
Airborne Total Magnetic Intensity
Low level fixed wing
units = nT
Ultra-Detailed Radiometrics

Airborne Radiometric Total Count
Low level fixed wing
Crystal Volume: 33.6l
units = counts/sec
Detailed Gravity

Residual Gravity
1st order polynomial defined regional units = gu
Trilogy Cross Section

- Weathered Phyllite
- Silicified Phyllite
- Carbonaceous Phyllite
- Massive Pb-Zn mineralisation
- Cu-Au stringer mineralisation

Scale: 100m
Gravity Modelling

Z unit = mgal

Legend
+ Bouguer Anomaly
pink Regional Field
blue Model Data

Oxidised Surface Layer = 2.6 g/cc

Pb-Zn Mineralisation = 3.3 g/cc
Silicified Phyllite = 2.71 g/cc

Background (phyllite) = 2.68 g/cc
Ground EM Modelling

Field Data - black (every 5th channel blue)
Model Data - red (every 5th channel green)

Background = 7 ohm.m
Mineralisation = 600 S
Conclusions/Exploration Strategy

• The Trilogy deposit represents a challenging regional exploration target due to the relatively small size of the mineralised system and the conductive nature of the phyllite host material.

• A combination of airborne EM with followup detailed gravity and ground EM have proven to be the most effective geophysical methods in locating Trilogy style mineralisation in the Mount Barren Basin.
Acknowledgments

- Contributions of all personnel involved in the discovery and subsequent delineation of Trilogy

- Homestake Gold and Paul Wilkes in collaboration with the CRCAMET for financial support

- Tectonic Resources for allowing us to present this paper