Reducing exploration risk and promoting exploration: Pine Creek AEM survey, Northern Territory

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Onshore Energy and Minerals Division
Objectives

To reduce exploration risk and encourage exploration in the region by mapping, under cover, in areas where gravity and magnetics are quiet for example

- Conductive units within the Pine Creek Orogen (PCO) sequence
- Kombolgie Sandstone / PCO unconformity
- Litchfield Complex
- Woolner Granite
- Koolpinya Dolomite
- Tolmer Group / Finniss River Group
- Roper Group

Mapping these targets reduces exploration risk and encourages exploration in the region.
Survey location

GA Funded
19 500 line km

Industry Funded
10 400 line km

Total
~ 30 000 line km

Area
75 000 km²
Survey design

GA 5km lines provides regional perspective
Survey design

GA 1.666 km lines
NRETAS 555m lines
Detail for minerals systems analysis

GA 5km lines provides regional perspective
Survey design

GA 5km lines provides regional perspective

GA 1.666 km lines
NRETAS 555m lines
Detail for mineral systems analysis

Company infill various spacings 200-1000m
Tenement scale/ deposit mapping

AGES March 2010
Modelling

Q. Can we detect the targets?

Geological Model
Tolmer Group / Finness River Unconformity

Geological Model
Kombolgie / PCO unconformity

Daly River Group
Tolmer Group
Finniss River Group

Tempest
RUM JUNGLE
Survey Data

Kombolgie Subgroup
Pine Creek Orogen

VTEM
KOMBOLGIE
Survey Data
Induction Conductivity Logging

Feed into forward models
Ground truth AEM results
Use for geological interpretation

Drillers log for RN20565
7-24m Grey Dolomite
24-55 Grey/Brown Dolomite
55-110 Grey Dolomite

Conductivity log for RN20565

Rx Property
Resistive
Conductive
GA sample by sample LEI CDI compared to EMFlow CDI
Rum Jungle Tempest data CDI cross-sections

PDI or depth of investigation

15km

‘But the truth is in the drilling’
## Woolner/Rum Jungle

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>Fugro TEMPEST</td>
</tr>
<tr>
<td>Flying Completed</td>
<td>24th May 09</td>
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<tr>
<td>Line spacing</td>
<td>1666m 5000m (GA lines)</td>
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<tr>
<td></td>
<td>200m - 1000m (infill company lines)</td>
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<tr>
<td>Coverage</td>
<td>44 689 km²</td>
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<tr>
<td>Total Line kilometers</td>
<td>20 820 km</td>
</tr>
<tr>
<td>Number of infill companies</td>
<td>Eight infill companies</td>
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</table>
Woolner Granite Tempest EMFlow 60 - 100m, various line spacing

- 1666 m line spacing
- 555 m line spacing
- 5000 m line spacing

- Coastal Plain
- Djukbinj National Park
- Mary River National Park
- Money Shoal Basin
- South Alligator Group
- Mt Partridge Group
- Finniss River Group
- Rum Jungle Complex
- Flight Line
Preliminary GA sample by sample LEI cross-section TEMPEST data

1:1 000 000 Surface Geology strip

Flight Path

- Burrell Creek FM
- Mount Partridge Group
- South Alligator Group

Conductivity (mS/m)

- Bottom Surface
  - no data
- Basement conductor
- Isoclinal folding in Mount Partridge Group
- Rum Jungle Complex
- Alluvial Plain
- Top Surface is Surface Topography

Note: The PDI (depth of investigation) is deeper than 200m

AGES March 2010
Kombolgie survey area

<table>
<thead>
<tr>
<th>Kombolgie</th>
<th>Geotech VTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>Geotech VTEM</td>
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<tr>
<td>Flying Completed</td>
<td>22nd November 2008</td>
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<tr>
<td>Test flying completed</td>
<td>2nd April 09</td>
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<td>Line spacing</td>
<td>1666m 5000m (GA lines) 200m - 1000m (infill company lines)</td>
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<tr>
<td>Coverage</td>
<td>30 710km²</td>
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<tr>
<td>Total Line kilometers</td>
<td>9 350 km</td>
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<tr>
<td>Number of infill companies</td>
<td>Two infill companies</td>
</tr>
</tbody>
</table>
Kombolgie EMFLOW Conductivity transformation (plan view)
90 – 120 metre depth slice

Legend
- National Parks
- Traditional Owners
- EMFlow 90-120m
  - High: 0.5 (S)

Money Shoal Basin
Pine Creek Orogen
Arafura Basin
McArthur Basin
Dunmarra Basin
Kakadu National Park

100 km
EMFLOW cross-section from the Kombolgie VTEM Survey

Coastal Plain

PDI (depth of investigation)

Bottom surface no data

Zone of alteration around unconformity

Surface Topography

Basement conductor

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Phase 2
GA LEI and enhancing
July 2010

ASCII data conducted
ASCII data Depth slice
ASCII data Elevation
Grids of Total Conductivity
Grids of Elevation (SRTM)
Grids Depth slices (SRTM)
AEM Go Map
Geo-referenced CDI
Basement Anomaly

Products

Pine Creek AEM

Depth slice grids
Depth of Investigation blanked out
An example from Paterson

100 km

Bouguer Gravity Grid
Conductivity cross sections
Geo-referenced for GIS packages

... and metadata
Pine Creek AEM Workshop to be held in Darwin during 2011

Interpretation Report

Early 2011

Geological Summary
Geophysical Summary
Uranium Systems Summary
Other Mineral Systems
Implications for Exploration

Geological and energy implications of the Pine Creek airborne electromagnetic (AEM) survey, Northern Territory.

VTEM AEM Survey
NT, 2009 Final Data
P11931
Summary

The Pine Creek AEM survey provides a regional picture by successfully mapping subsurface information through cover.

GA’s integrated approach to the interpretation has led to an improved understanding of uranium mineral systems in the Pine Creek area.

AEM can reduce exploration risks when used as a mapping tool.
Airborne Electromagnetics Project

Overview

Under the Australian Government’s Onshore Energy Security Program, Airborne Electromagnetic (AEM) data are being acquired in areas considered to have potential for uranium or thorium mineralisation.

The surveys, which are part of the Airborne Electromagnetic Acquisition and Interpretation project, are designed to reveal new information about regions by acquiring the AEM data at line spacings of one to six kilometres over relatively large areas. The improved understanding of the regional geology resulting from the surveys will be of considerable benefit to mining and mineral exploration companies, who can obtain more detailed data over a specific area of interest by contributing additional funds to the acquisition cost.

As a result of reviews of AEM system capabilities and relevance to energy commodities, acquisition is directed principally at providing geophysical and inferred geological insights in areas considered to be prospective for unconformity related and palaeochannel hosted uranium.

As well as enhancing the search for uranium and other energy sources, the survey results will be relevant in exploration for a variety of commodities and other resources, including groundwater. The program is aimed at reducing exploration risk and prompting exploration activity. Three priority projects emerged from mineral systems analysis and discussions with the State and Northern Territory Geological Surveys. They are:

1. Paterson Province (Western Australia)
2. Pine Creek (Northern Territory)
3. Frome Embayment - Murray Basin (South Australia)

Status

The objectives and status of the three priority projects are:

Project 1 - Paterson Province, Western Australia

The Paterson project is centred on the Kintyre uranium deposit and covers much of the surrounding exposed and near surface Paleoproterozoic Era Rudall Complex which in the surrounding area is unconformably overlain by Neoproterozoic Era sediments of the Yeneena Basin.

Data availability

- Regional data for Paterson South TEMPEST AEM Survey consisting of one kilometre (west) and two kilometre (east) line spacings are available as a free data download or from the Geoscience Australia Sales Centre.
- Regional data for Paterson North TEMPEST AEM Survey consisting of one kilometre, two kilometre and six kilometre line spacings are available as a free data download or from the Geoscience Australia Sales Centre.
Acknowledgements

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Northern Land Council
Northern Territory Geological Survey
Rio Tinto Exploration Pty. Ltd.
Rum Jungle Uranium
Southern Uranium Ltd.
Thundelarra Exploration
United Uranium Ltd.
URANEX NL