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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.

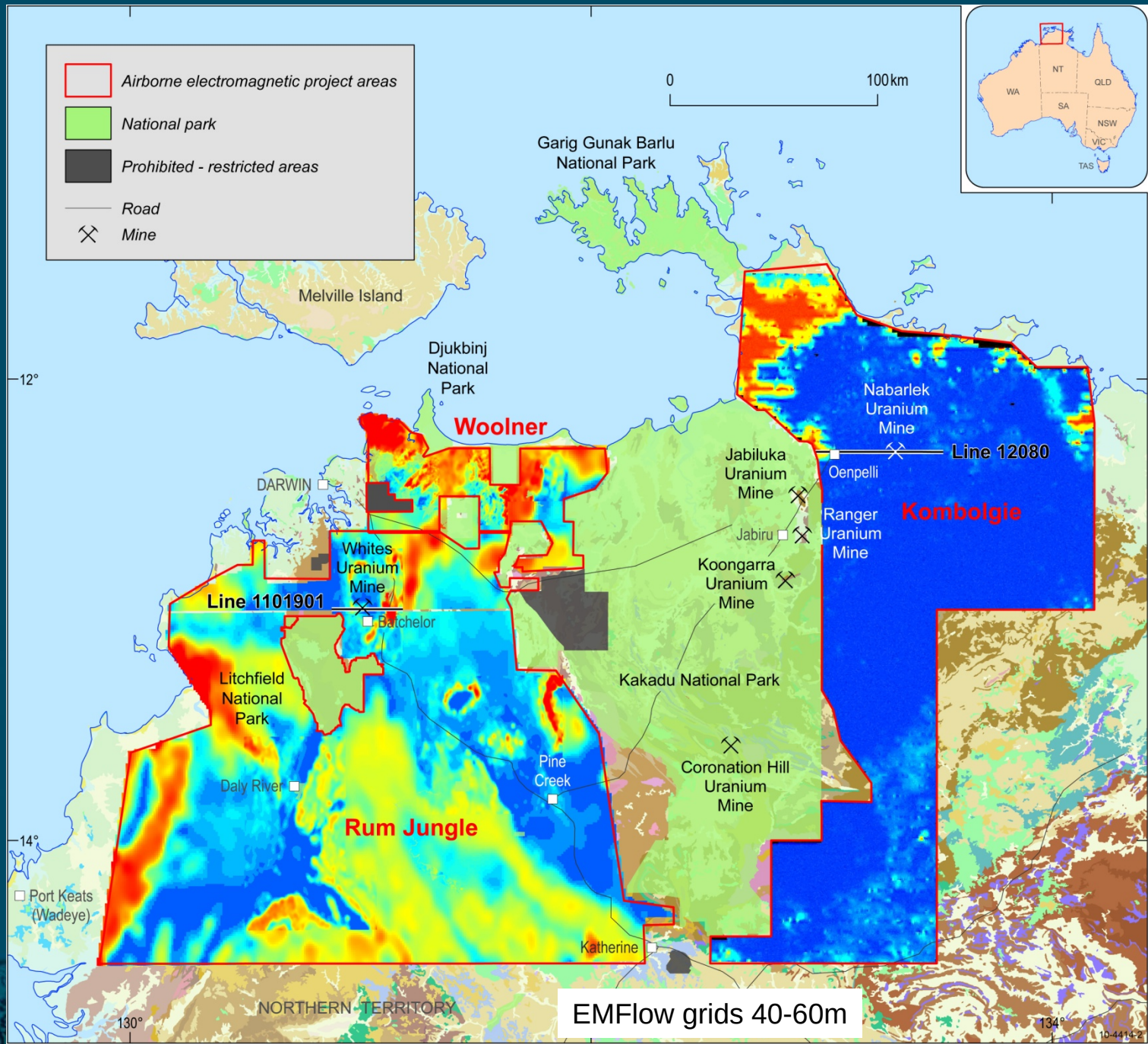
Survey location

GA Funded
19 500 line km

Industry Funded
10 400 line km

Total
~ 30 000 line km

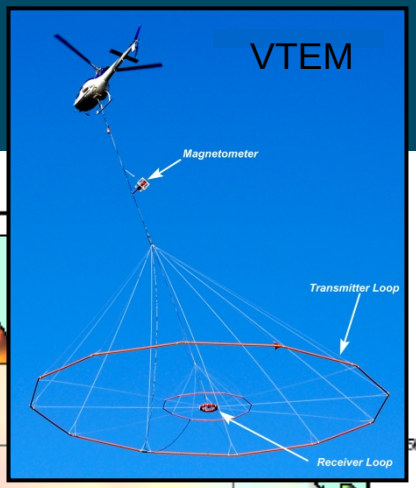
Area
75 000 km²



AGES March 2010

Survey design

GA 5km lines provides regional perspective



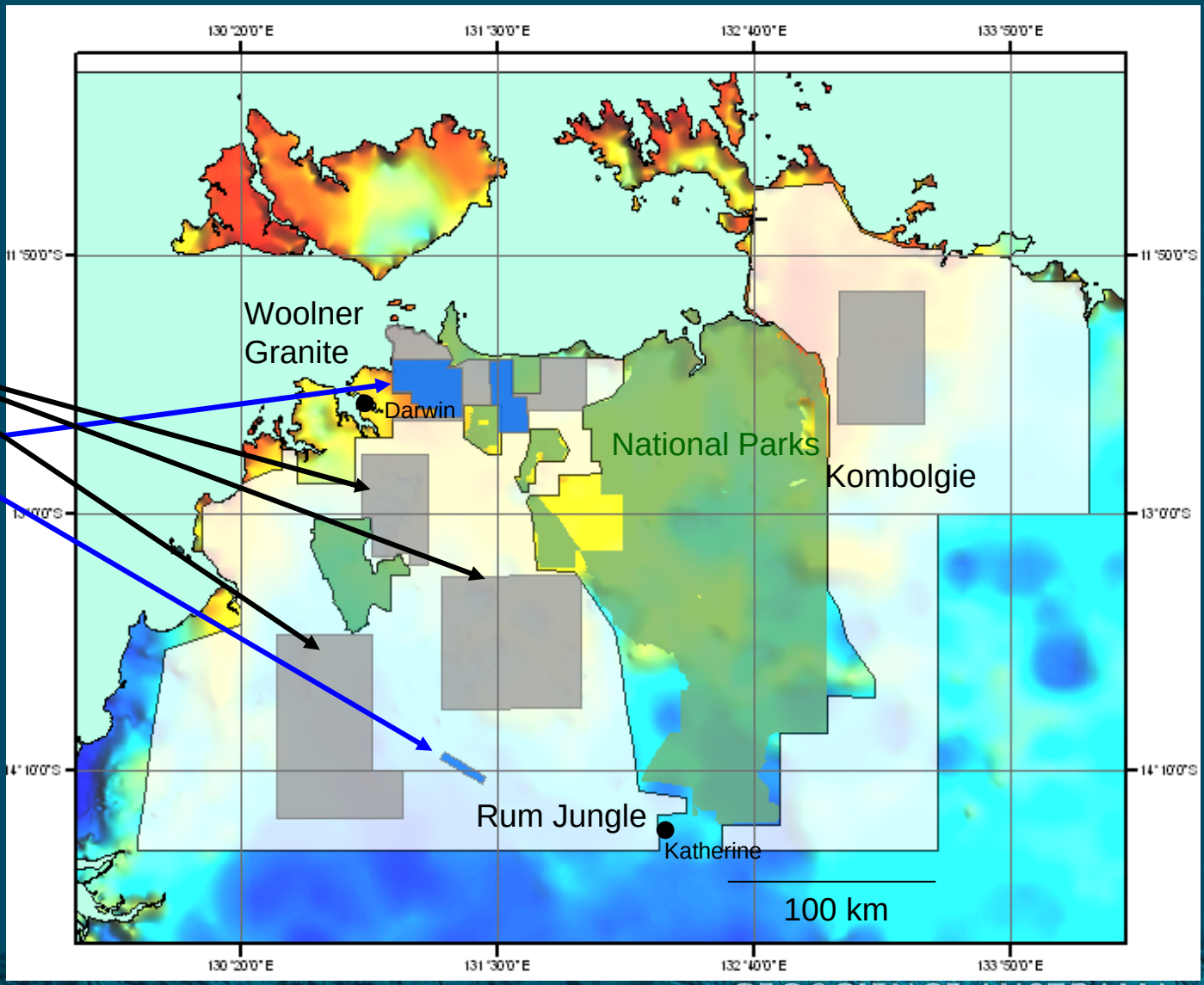
Survey design

GA 5km lines provides regional perspective

GA 1.666 km lines

NRETAS 555m lines

Detail for mineral systems analysis



Survey design

GA 5km lines provides regional perspective

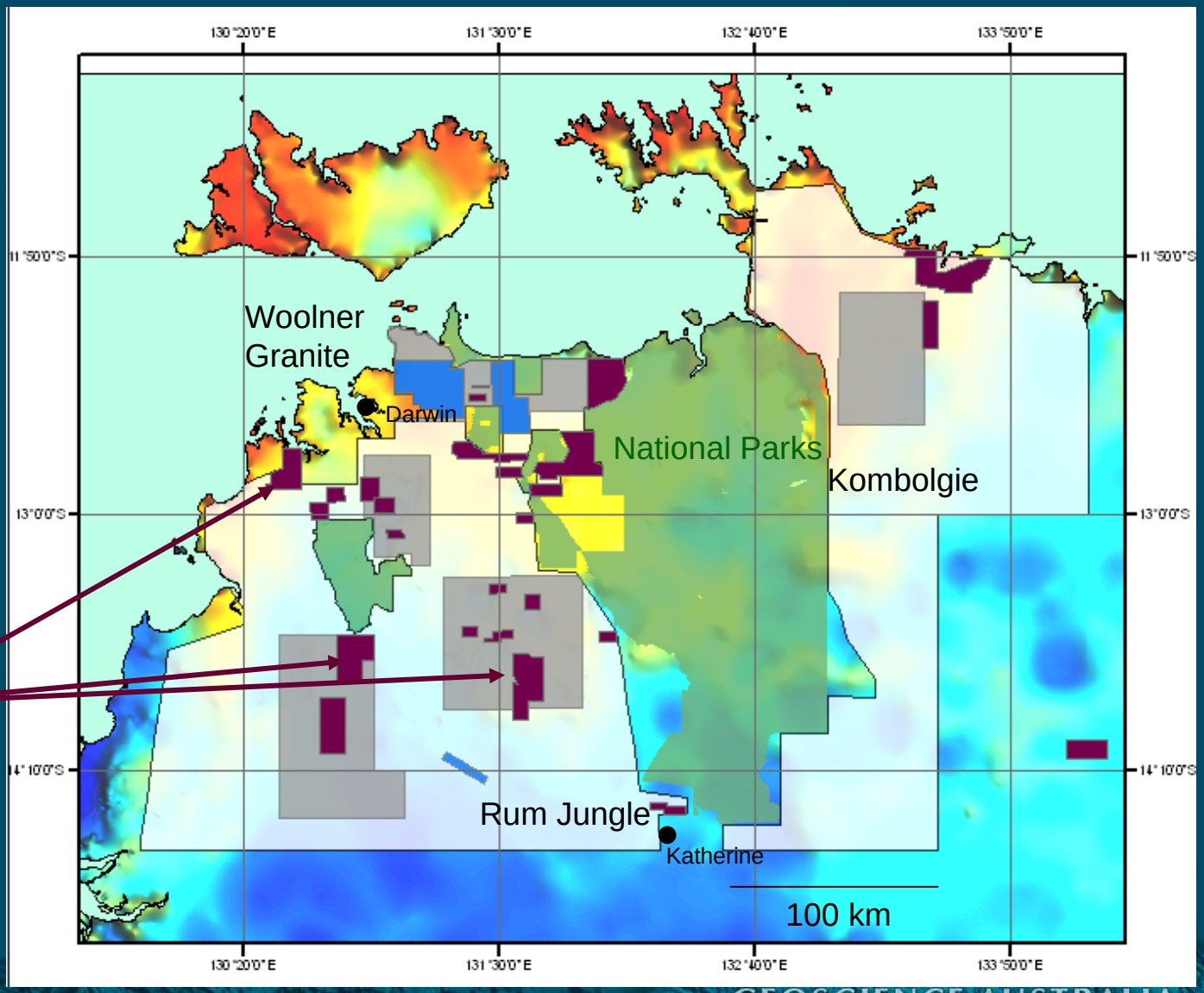
GA 1.666 km lines

NRETAS 555m lines

Detail for mineral systems analysis

Company infill various spacings 200-1000m

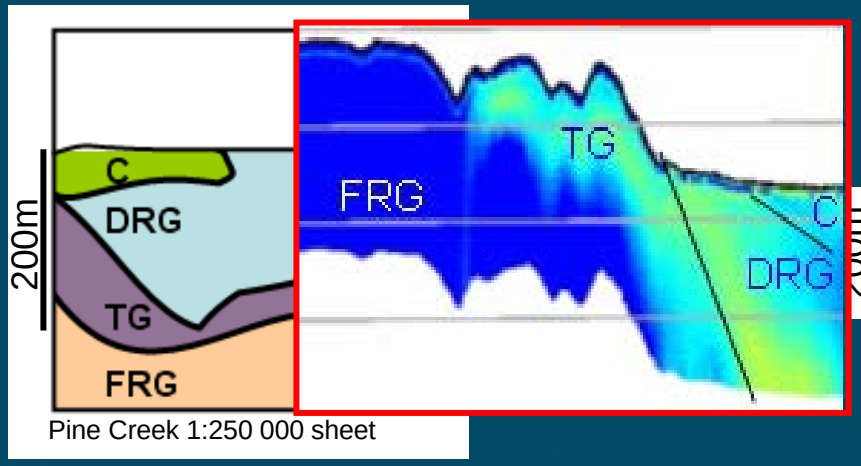
Tenement scale/ deposit mapping



Modelling

Q. Can we detect the targets?

Geological Model
Tolmer Group /
Finness River Unconformity



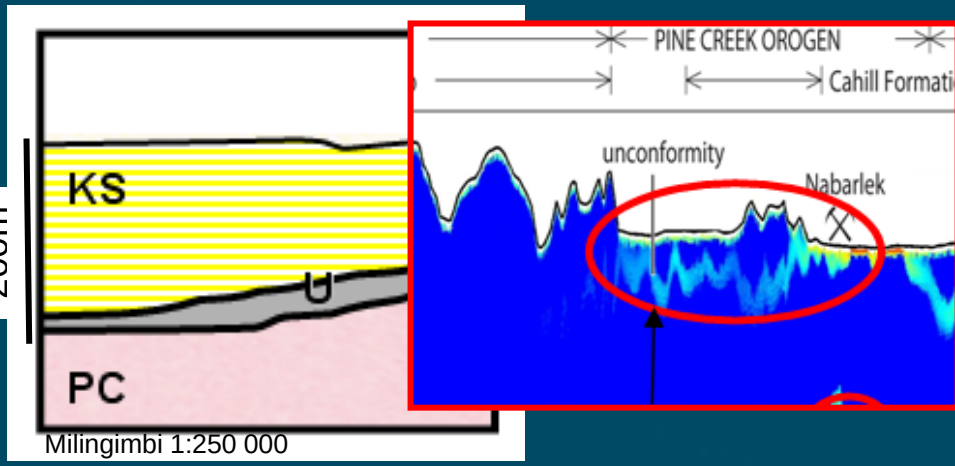
Pine Creek 1:250 000 sheet

Daly River Group
Tolmer Group
Finniss River Group

Tempest

RUM JUNGLE
Survey Data

Geological Model
Kombolgie/
PCO unconformity



Milingimbi 1:250 000

Kombolgie Subgroup

Pine Creek Orogen

VTEM

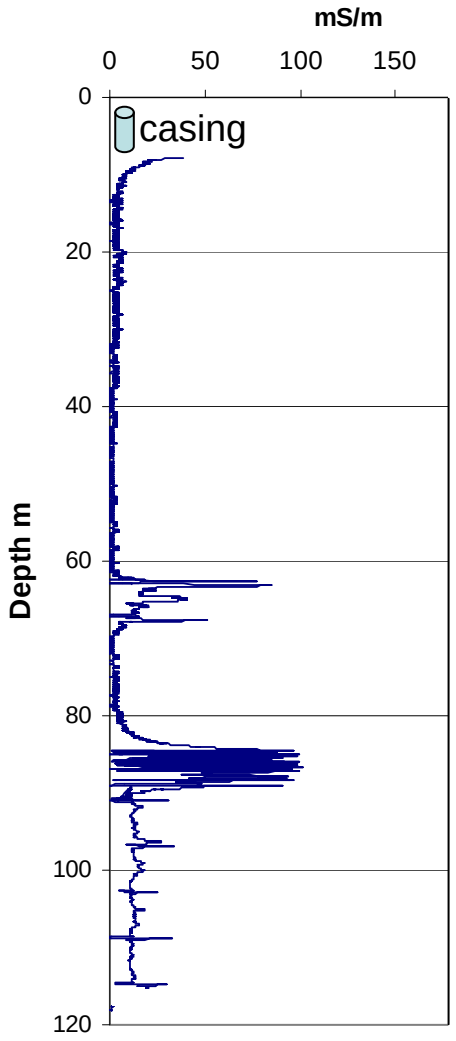
KOMBOLGIE
Survey Data

Induction Conductivity Logging

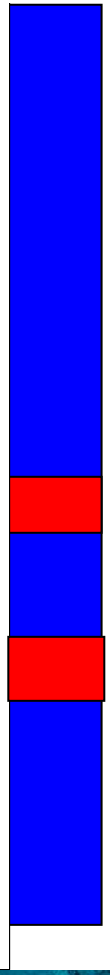
Feed into forward models
Ground truth AEM results
Use for geological interpretation

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

Conductivity log for RN20565



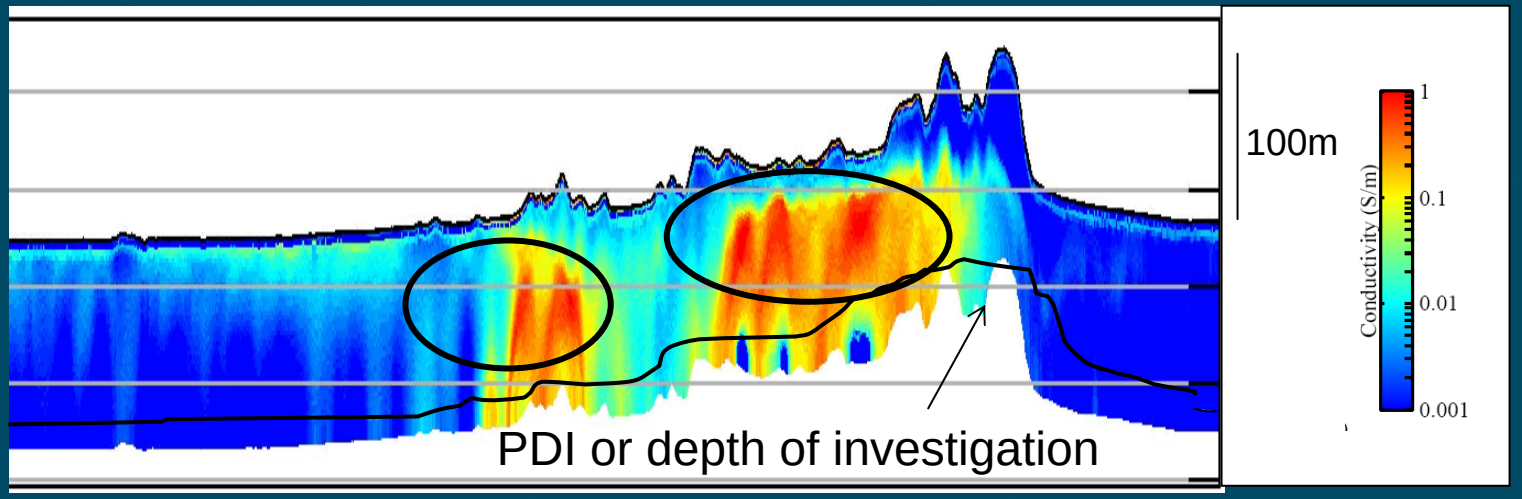
Rx Property
Resistive
Conductive



GA sample by sample LEI CDI compared to EMFlow CDI

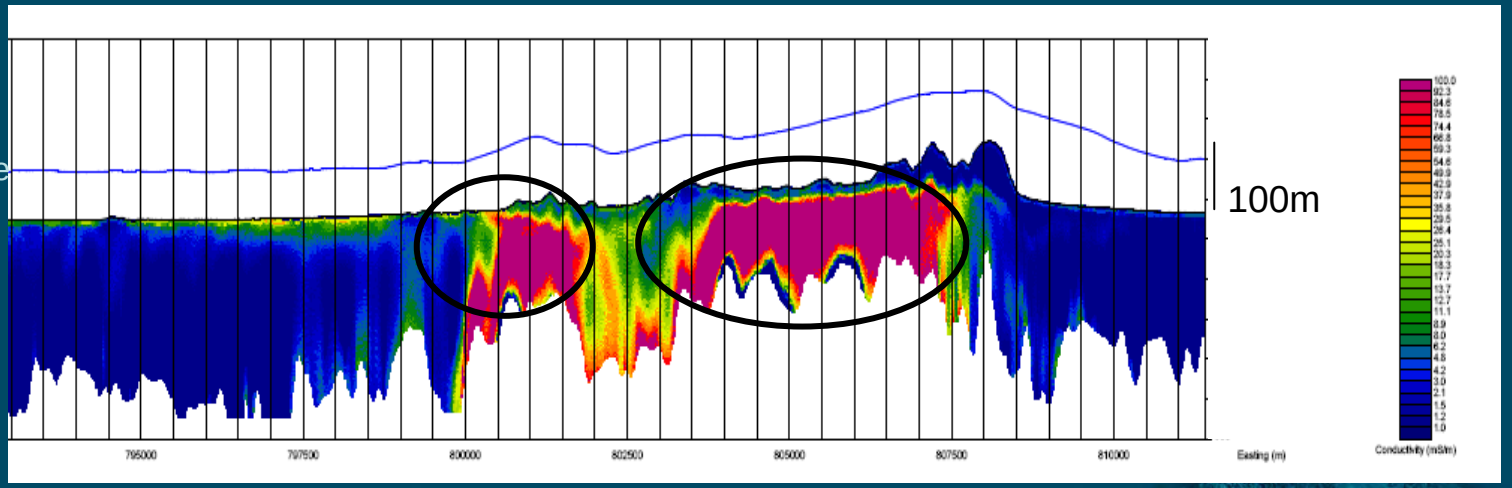
Rum Jungle Tempest data CDI cross-sections

GA LEI



Tx altitude

EMFLOW



15km

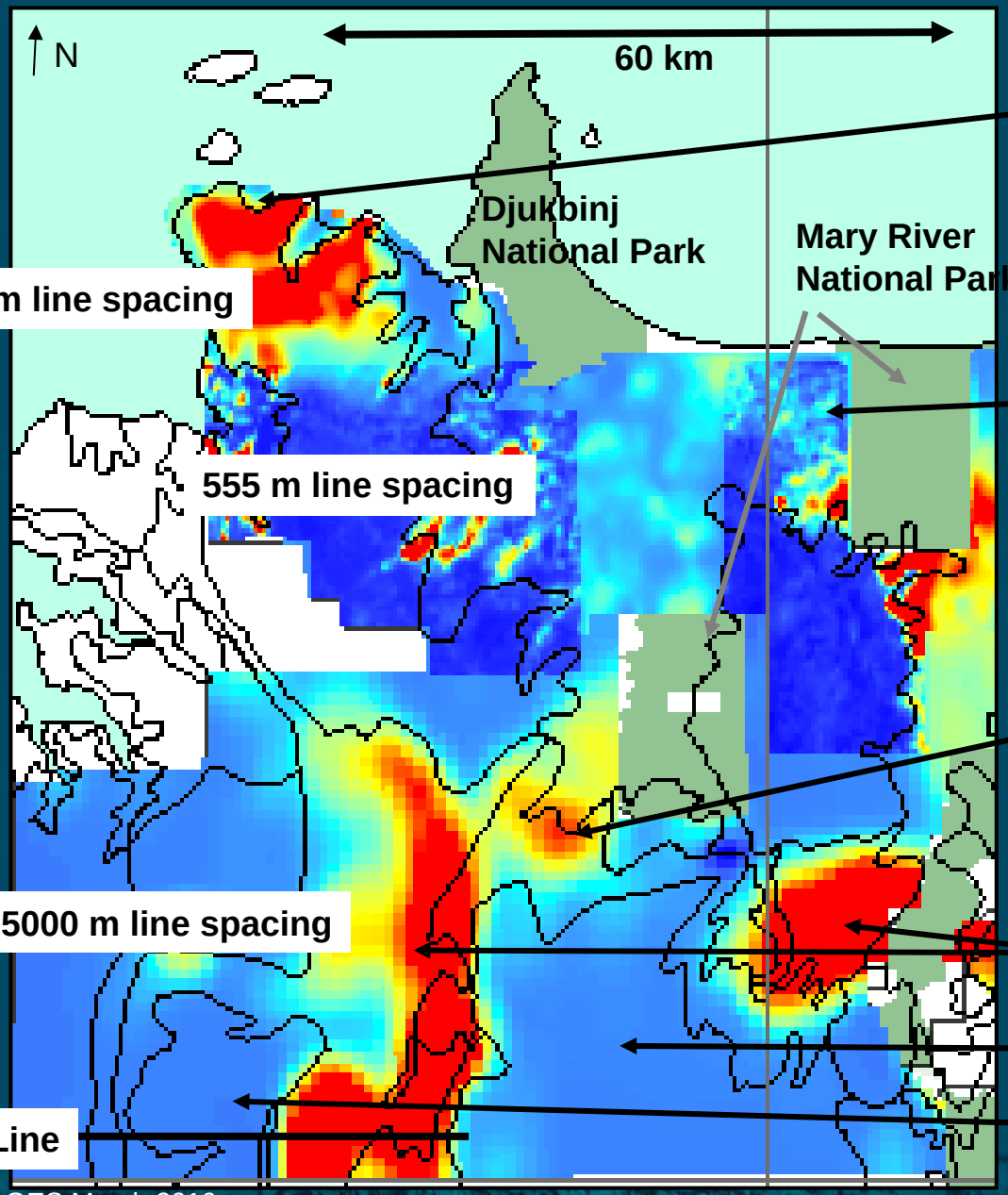
'But the truth is in the drilling'

Woolner Granite and Rum Jungle

TEMPEST

Woolner/Rum Jungle	
Contractor	Fugro TEMPEST
Flying Completed	24th May 09
Line spacing	1666m 5000m (GA lines) 200m - 1000m (infill company lines)
Coverage	44 689 km^2
Total Line kilometers	20 820 km
Number of infill companies	Eight infill companies

Woolner Granite Tempest EMFlow 60 - 100m, various line spacing



Coastal Plain

Money Shoal Basin

South Alligator Group

Mt Partridge Group

Finniss River Group

Rum Jungle Complex

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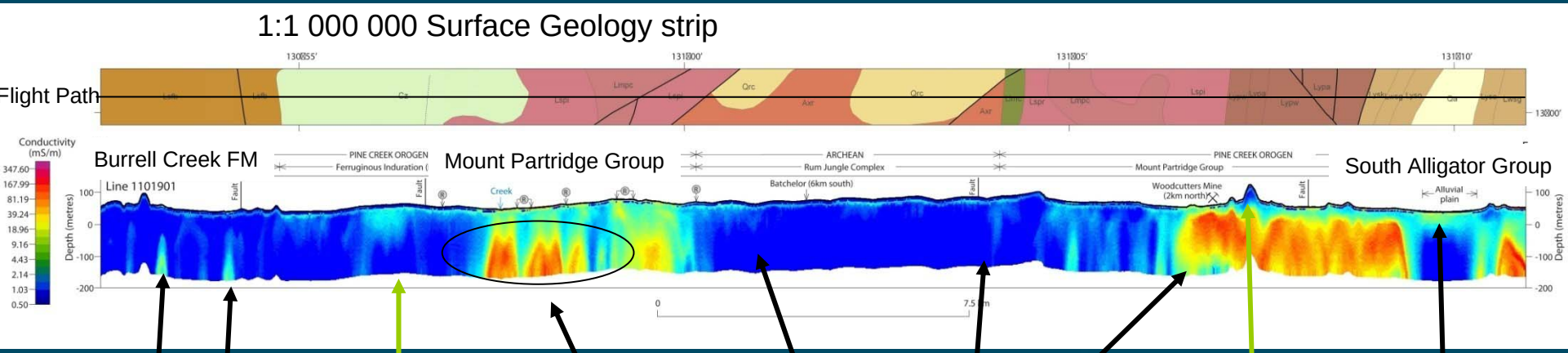
Preliminary GA sample by sample LEI cross-section TEMPEST data



Bottom Surface no data

Basement conductor

Rum Jungle Complex

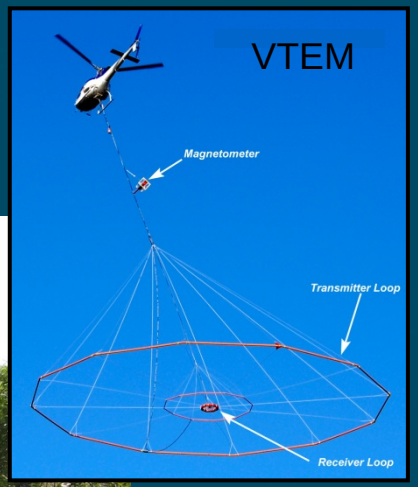
Alluvial Plain

Isoclinal folding in Mount Partridge Group

Top Surface is Surface Topography

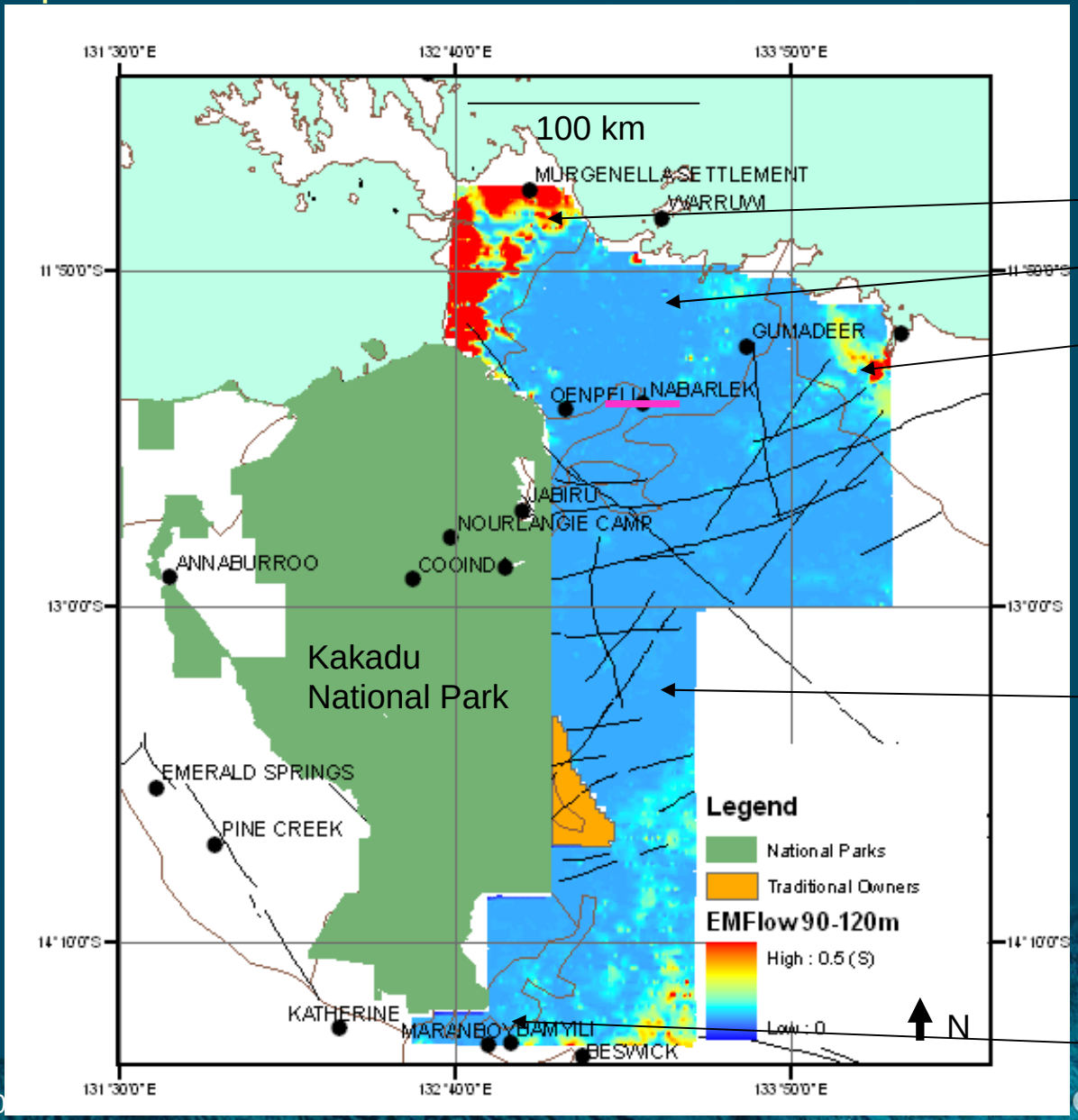
Note: The PDI (depth of investigation) is deeper than 200m

Kombolgie survey area

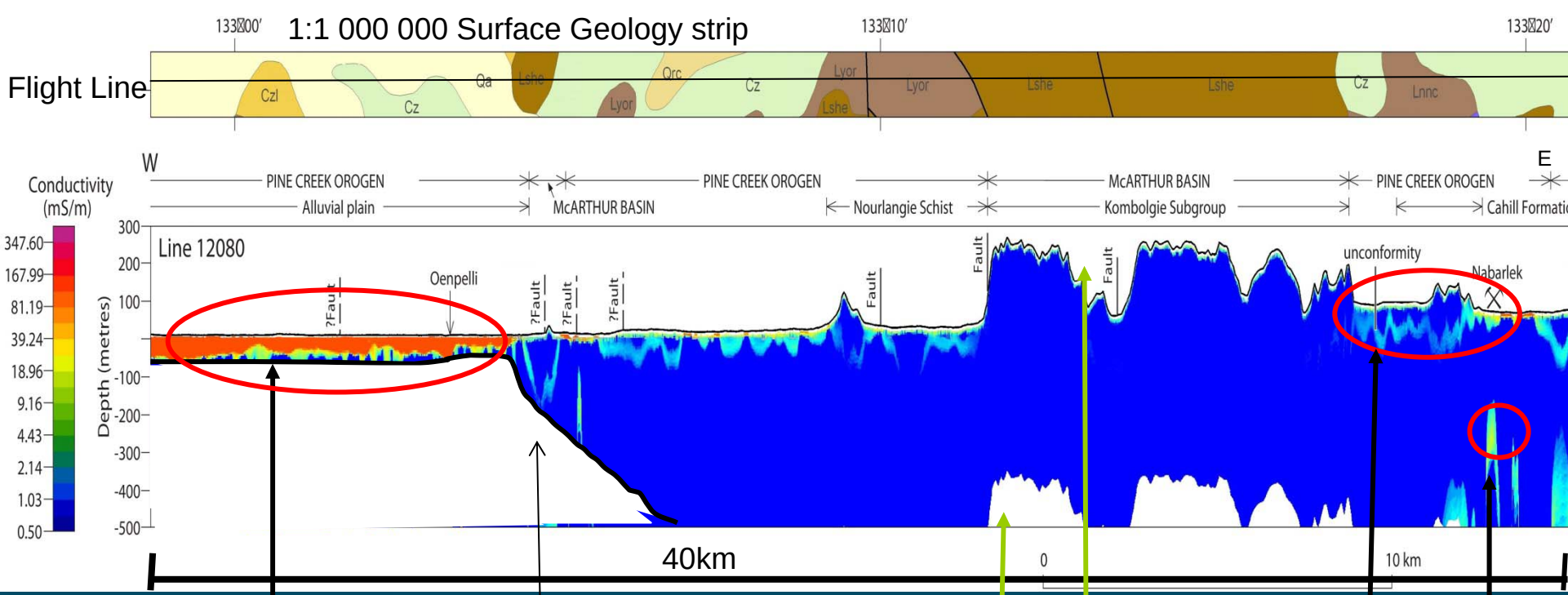


Kombolgie	
Contractor	Geotech VTEM
Flying Completed	22nd November 2008
Test flying completed	2nd April 09
Line spacing	1666m 5000m (GA lines)
	200m - 1000m (infill company lines)
Coverage	30 710km^2
Total Line kilometers	9 350 km
Number of infill companies	Two infill companies

Kombolgie EMFLOW Conductivity transformation (plan view)
90 – 120 metre depth slice



EMFLOW cross-section from the Kombolgie VTEM Survey



Coastal Plain

PDI (depth of investigation)

Bottom surface no data

Surface Topography

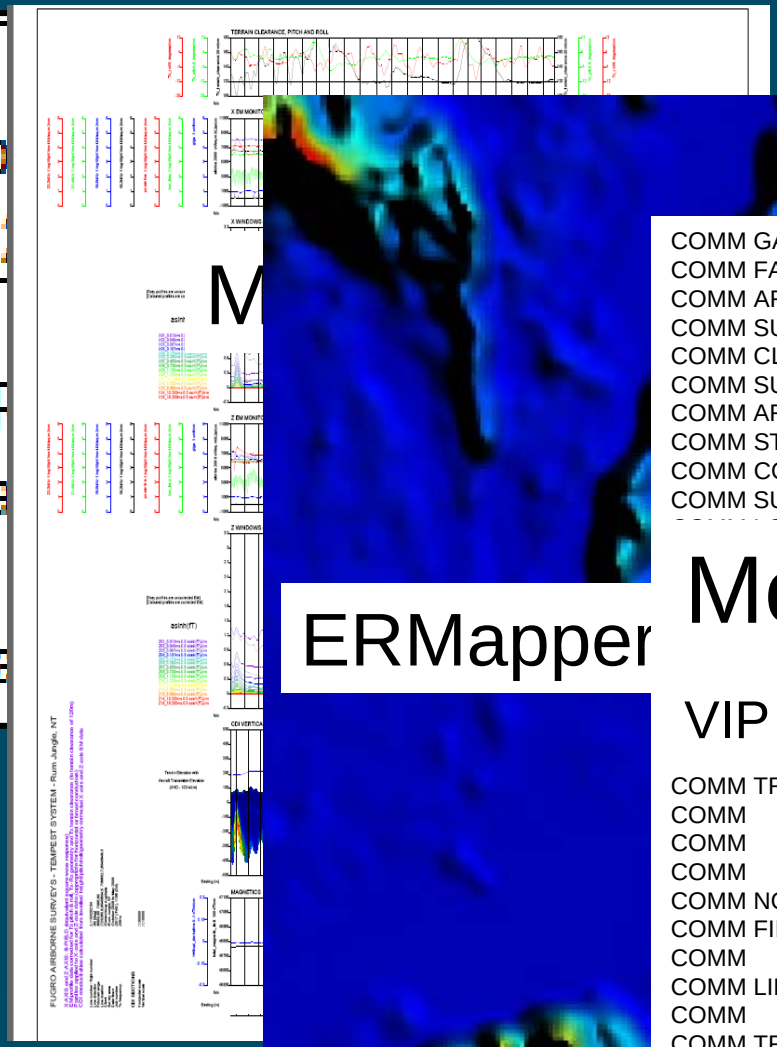
Zone of alteration around unconformity

Basement conductor

Products

Phase 1
Contracto
Released

Logistics R
ASCII data
Multiplots
Gridded da



ERMapper

COMM GA PROJECT NUMBER 1196
COMM FAS PROJECT NUMBER 2017
COMM AREA NUMBER: 1
COMM SURVEY COMPANY: Fugro Airborne Surveys
COMM CLIENT: Geoscience Australia
COMM SURVEY TYPE: 25Hz TEMPEST Survey
COMM AREA NAME: Rum Jungle
COMM STATE: NT
COMM COUNTRY: Australia
COMM SURVEY FLOWN: October 2008 to May 2009

Metadata

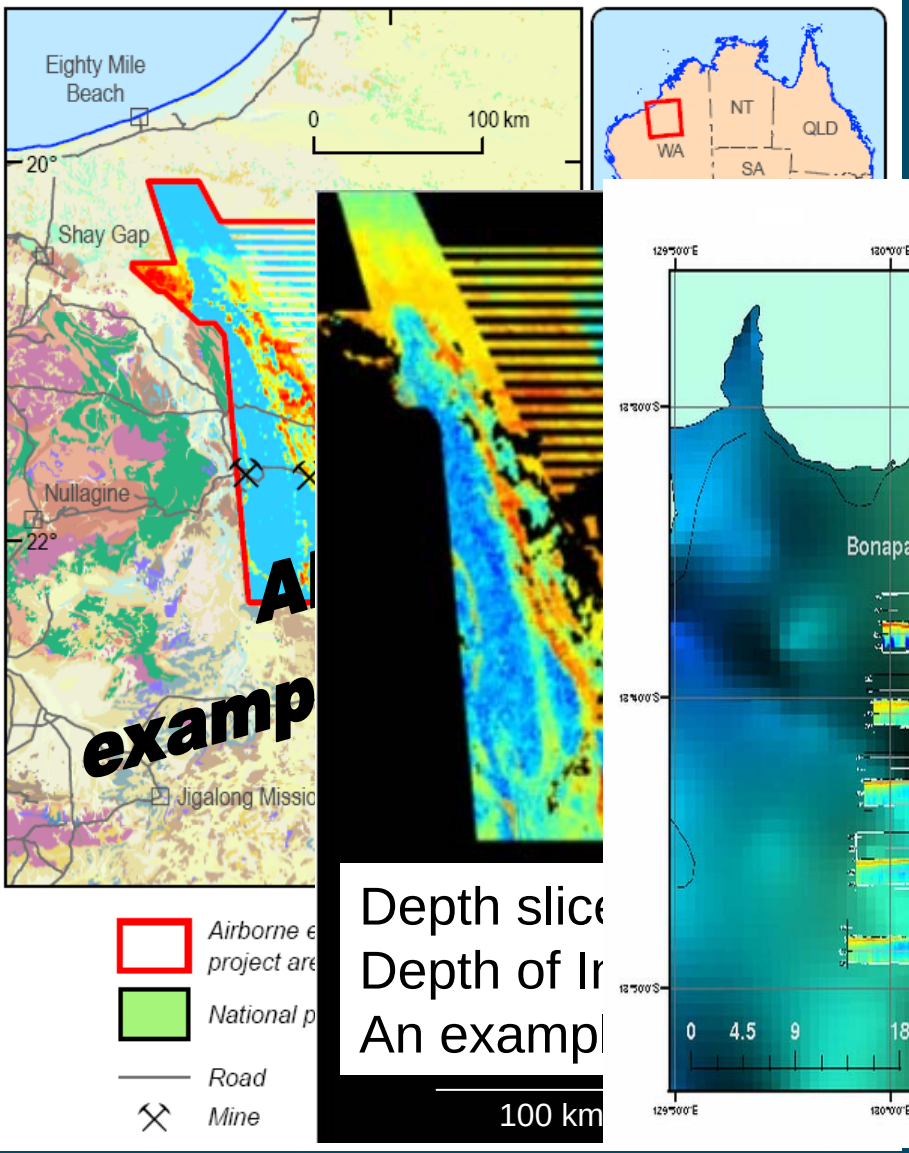
VIP for data exchange and archiving

COMM TRAVERSE LINE DIRECTION:
COMM ALL AREAS EXCEPT DALY RIVER AND RJ6: 090-270 deg
COMM DALY RIVER: 124-304 deg
COMM RJ6: 000-180 deg
COMM NOMINAL TERRAIN CLEARANCE: 120 m
COMM FINAL LINE KILOMETRES: 11242 km
COMM
COMM LINE NUMBERING
COMM
COMM TRAVERSE LINE NUMBERS:
COMM Lines flown with PDAS Acquisition System: 10010 - 13000
COMM Lines flown with FASDAS Acquisition System: 1001601 - 1005601
COMM 1102202 - 1103401
COMM 1200103 - 1205501
COMM 2400101 - 2404301
COMM 2500201 - 2505301
COMM 3200201 - 3201501
COMM 3400101 - 3401501

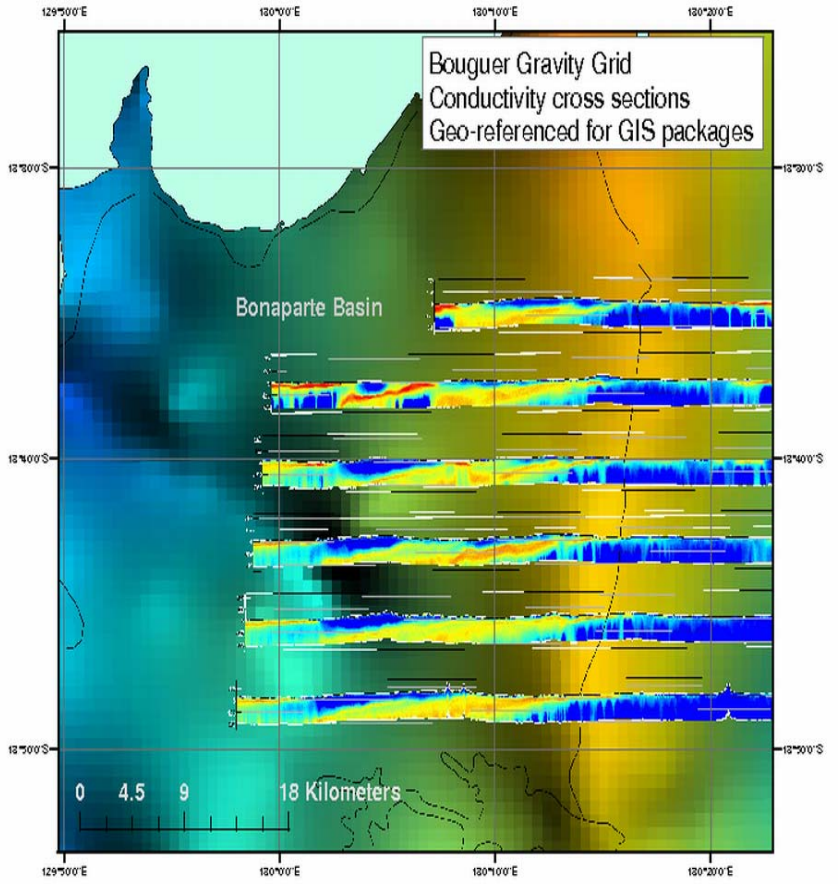
Products

Phase 2
GA LEI and enhanc
July 2010

ASCII data conducta
ASCII data Depth sli
ASCII data Elevation
Grid of Total Conduc
Grids of Elevation (S
Grids Depth slices (T
AEM Go Map
Geo-referenced CDI
Basement Anomaly



Pine Creek AEM



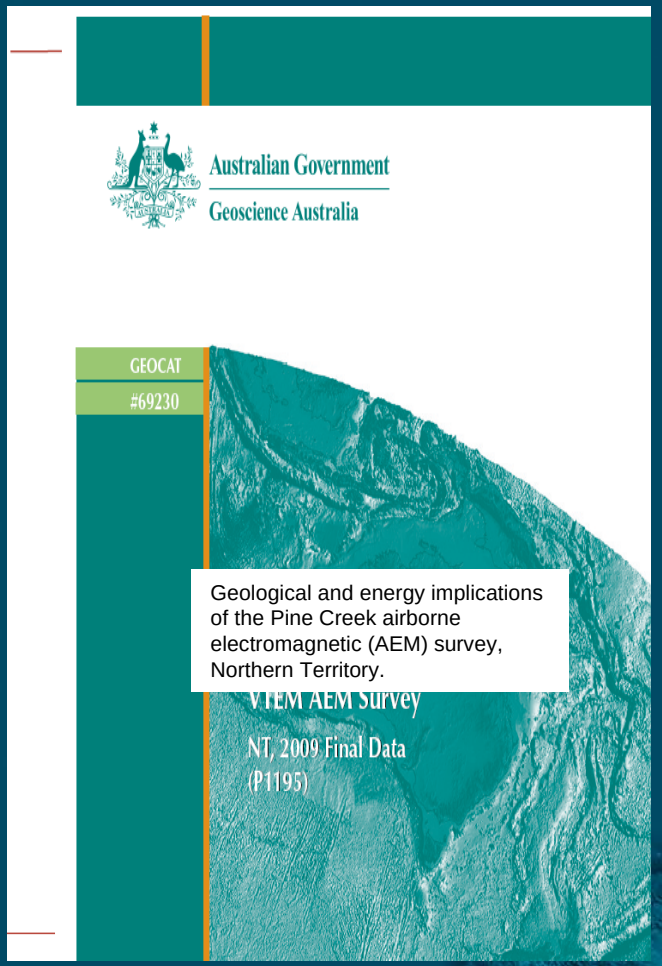
… and metadata

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



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.

www.ga.gov.au/minerals/research/national/aem/

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  - Geothermal Energy Project
  - National Geochemical Survey of Australia
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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.

AEM project areas
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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 promoting 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)

aem@ga.gov.au

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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Camilla Sorensen and Jon Sumner (conductivity logging)
Cameco Australia
Crossland Uranium Mines Ltd.
Energy Resources of Australia Ltd.
Hapsburg Exploration Pty. Ltd.
National Water Commission
Natural Resources, Environment, The Arts and Sport
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