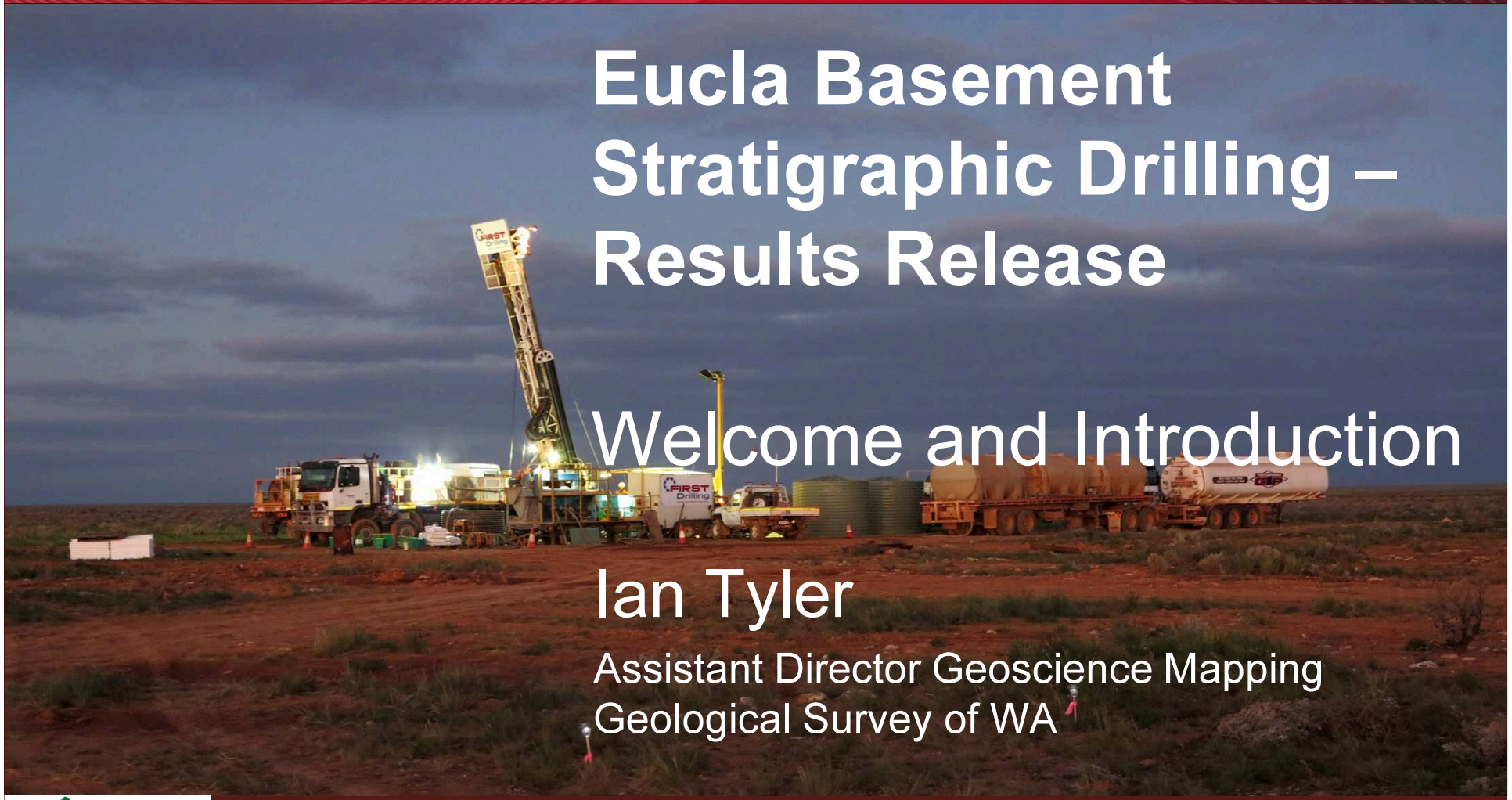
Government of **Western Australia**
Department of **Mines and Petroleum**



Eucla Basement Stratigraphic Drilling – Results Release

Welcome and Introduction

Ian Tyler

Assistant Director Geoscience Mapping
Geological Survey of WA

EXPLORATION INCENTIVE SCHEME

Geological Survey of Western Australia

Role of Government geoscience: Change perceptions and reduce risk

- Exploration concentrates in areas of known prospectivity
  - Majority of ore bodies discovered over 20 years ago
- Encourage exploration in under-explored regions: Greenfields
  - Exploration under regolith and thin sedimentary basin cover
    - Tropicana (Au) – Albany-Fraser Orogen
    - Nova (Ni-Cu) – Albany-Fraser Orogen

UNCOVER
AUSTRALIAN EXPLORATION GEOSCIENCE RESEARCH

Ongoing GSWA geoscience mapping program

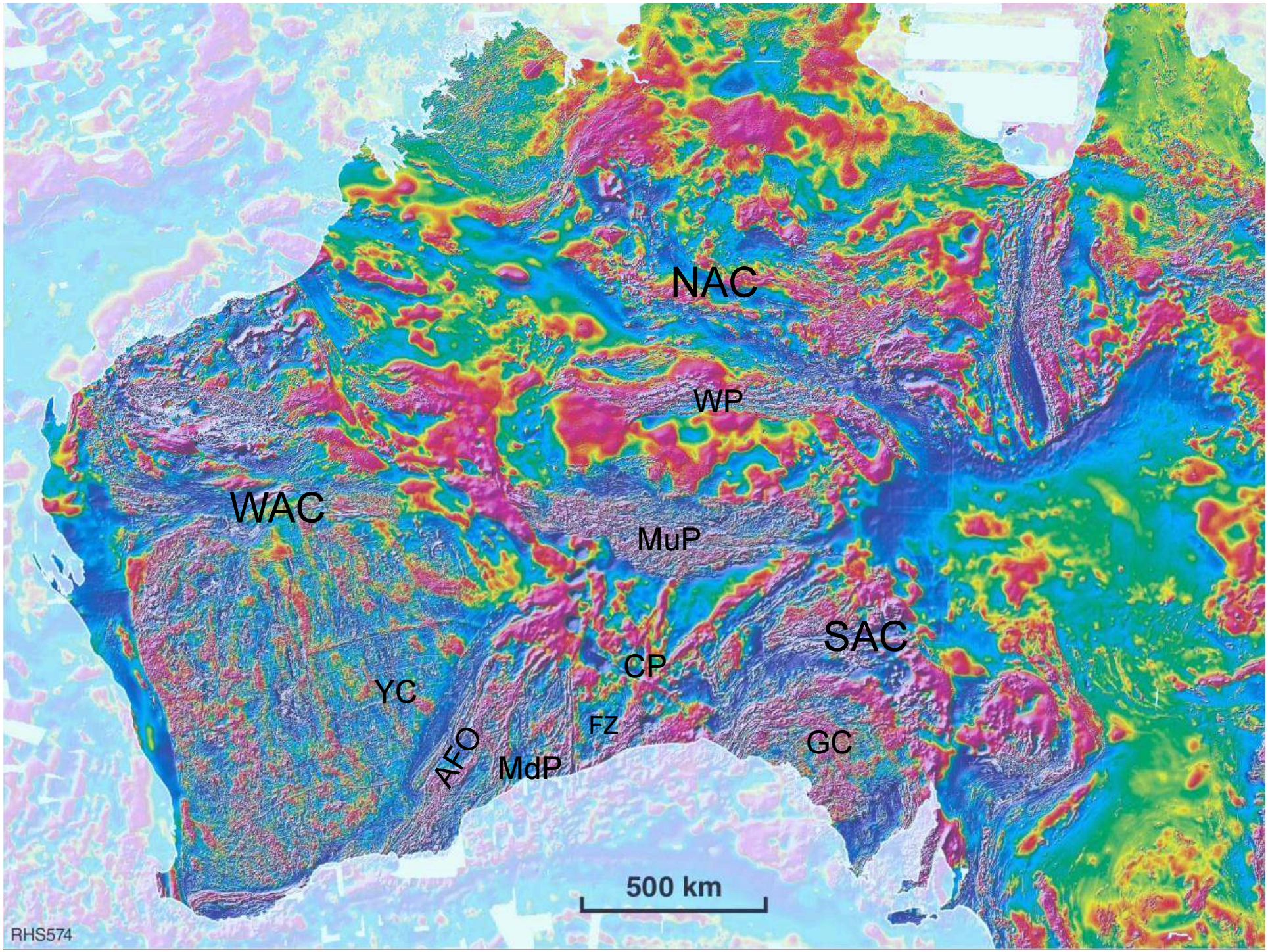
- Geodynamic setting and geological history
  - Integrate geological mapping, geophysics, geochemistry, geochronology, structure, metamorphism and mineral deposits
    - Tectonic unit-based seamless interpreted bedrock geology maps
  - Mineral Systems
  - Setting changes with time
    - reactivation
    - Mineral systems change

Exploration Incentive Scheme (EIS)

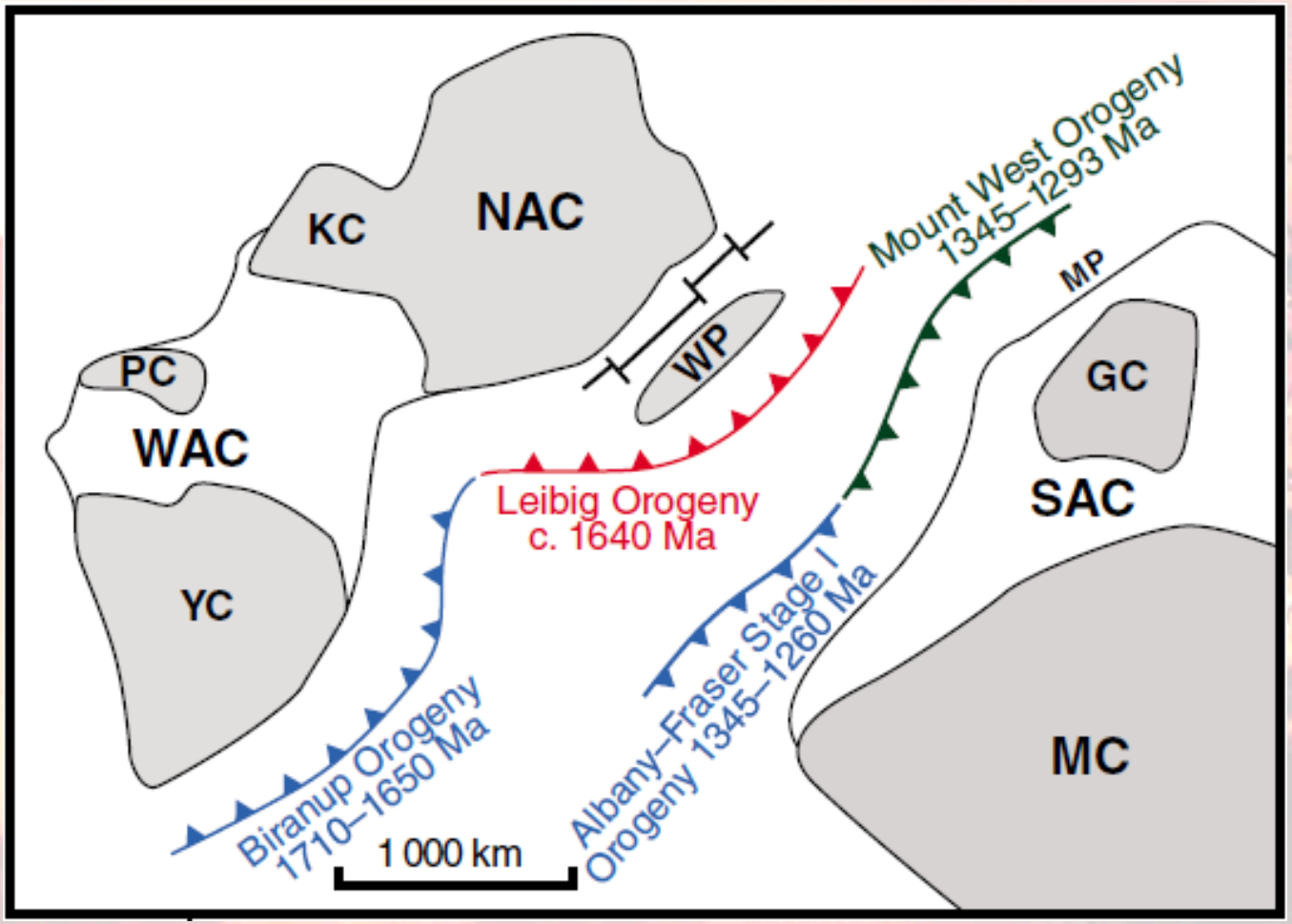
- Architecture and 4D (3D + time)
  - Crustal-scale 2D and 3D models
    - Integrate robust interpreted bedrock geology maps with deep seismic, MT, magnetics and gravity
    - Fossil arcs, suture zones and mantle tapping structures — Mineral Systems
  - 4D
    - Development through time
      - Geochronology and isotopes
- Innovative Drilling
  - Co-funded drilling
  - Stratigraphic drilling

Key mineral exploration-related expenditure during EIS1 and 1A

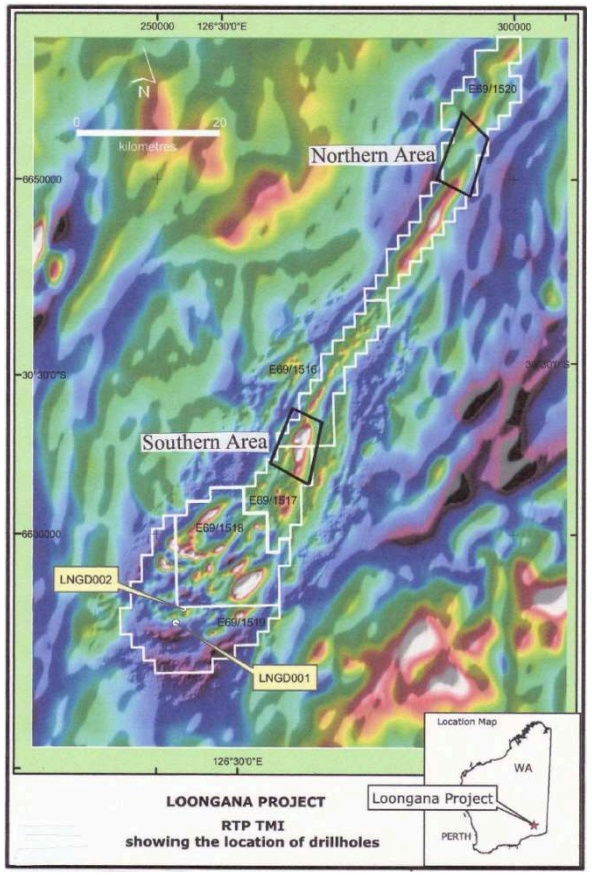
- Co-funded Drilling: $19.6 million
- Eucla Stratigraphic drilling: $3.6 million
- Geophysical programs: $48.5 million
  - Magnetics, radiometrics and AEM: $26 million
  - Deep crustal seismic (active and passive): $16 million
  - Gravity: $6.5 million
- Strategic Research: $5 million
  - MERIWA/MRIWA $1.75 million


NAC
WP
WAC
MuP
SAC
CP
YC
FZ
AFO
MdP
GC
500 km
RHS574

The crust between the WAC and the NAC and the SAC



Helix Resources Limited/JA Bunting and Associates Loonganna Project



1415–1407 Ma

GSWA U–Pb zircon geochronology:
DR Nelson, 2005.
Sampled and analysed in 2003 from Helix drill holes LNGD-0001 and LNGD-0002

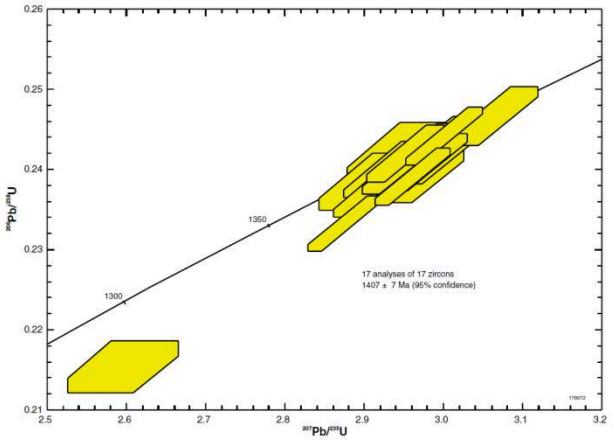


Figure 2. Concordia plot for sample 178072: tonalitic gneiss, Haig Cave

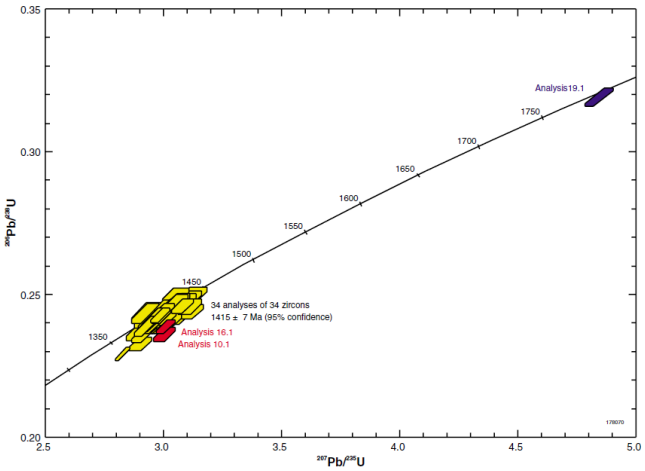


Figure 2. Concordia plot for sample 178070: amphibolite, Haig Cave

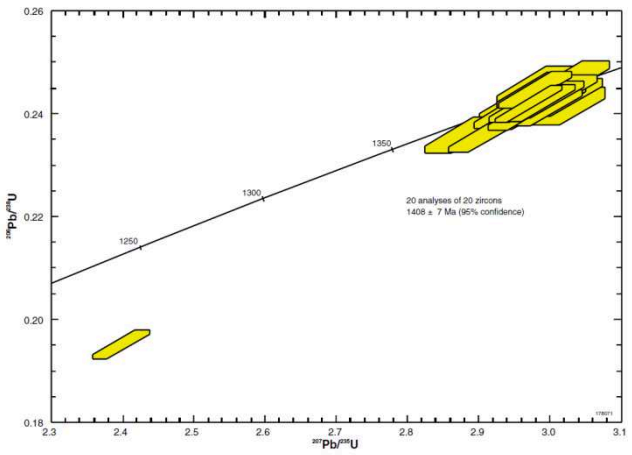
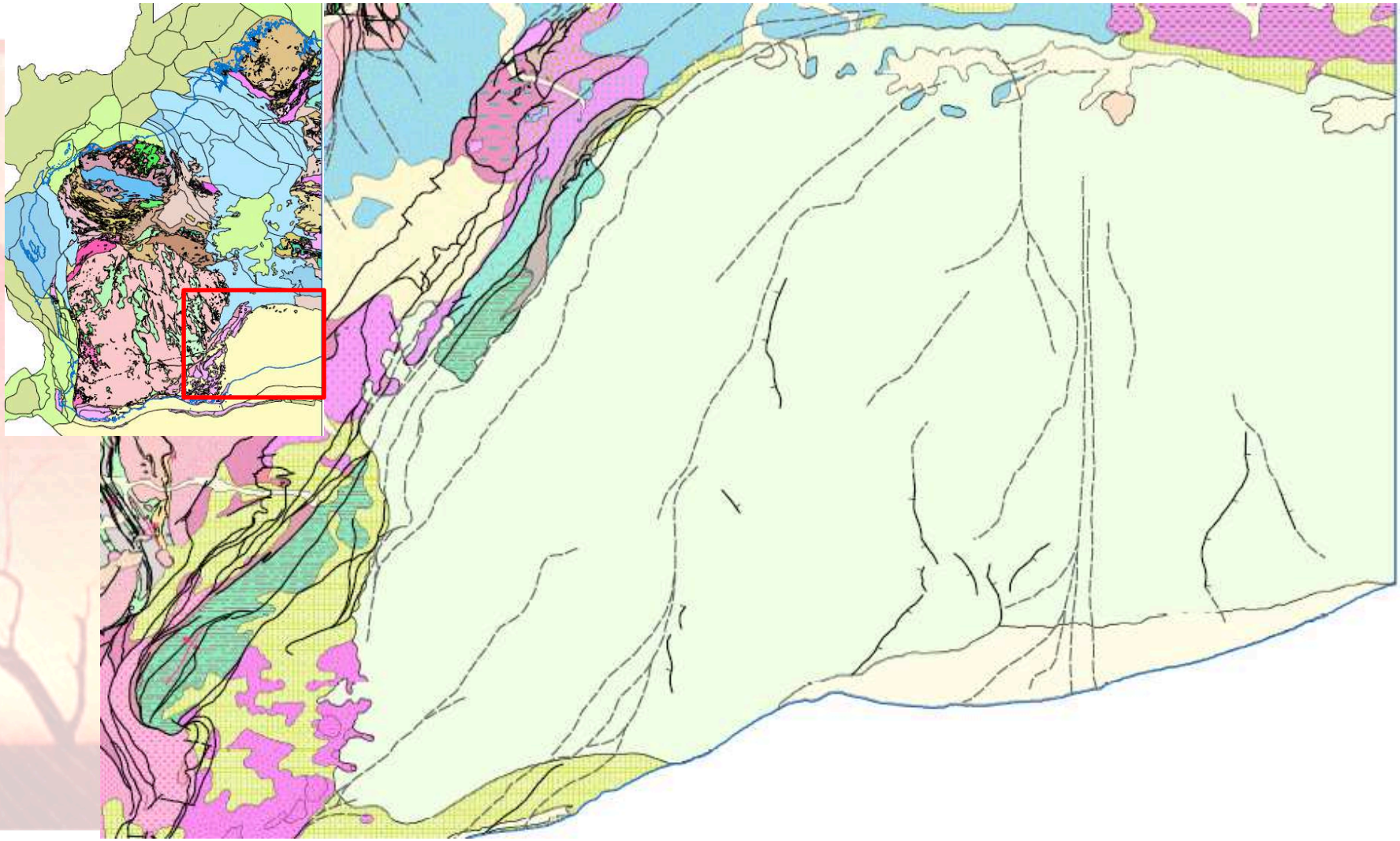


Figure 2. Concordia plot for sample 178071: recrystallized biotite microtonalite, Haig Cave

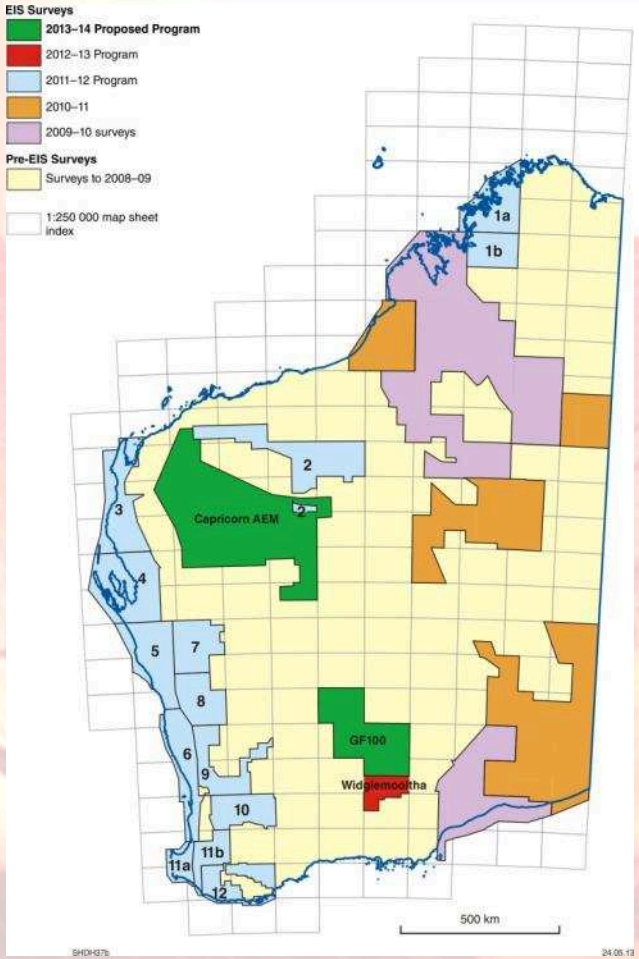
The Bight and Eucla Basins cover Proterozoic basement

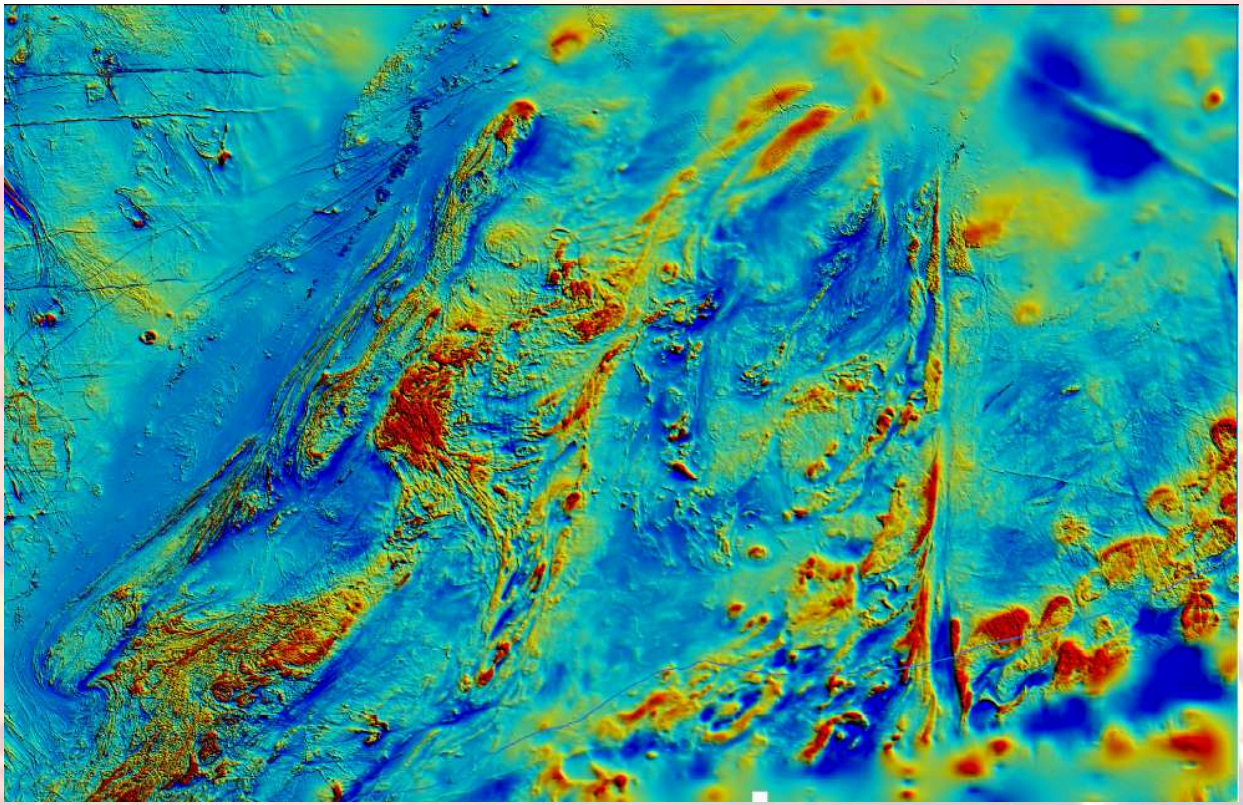


The Bight and Eucla Basins cover Proterozoic basement

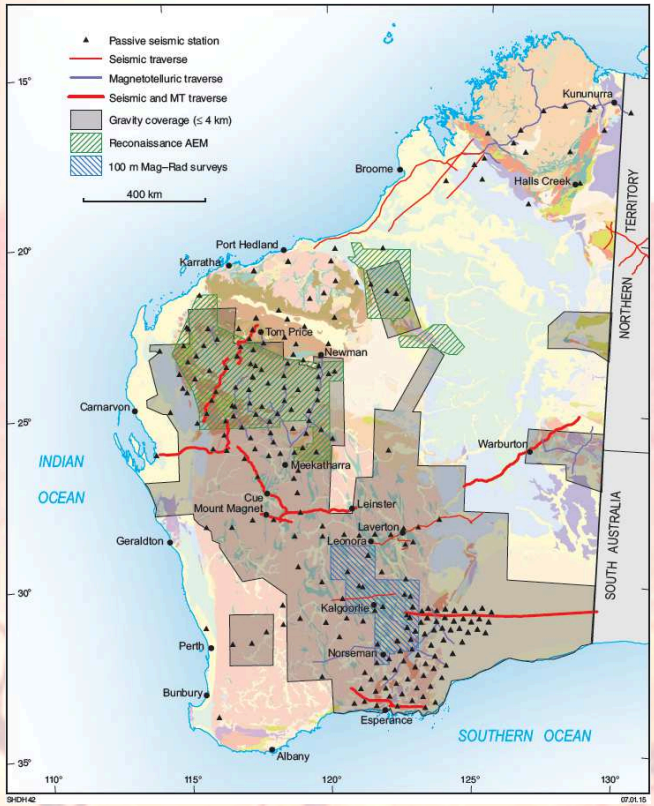
- EIS datasets:
  - Airborne magnetics and radiometrics
    - 200 and 400 metre line spacing
  - Ground gravity
    - 2.5 km stations
  - Deep crustal seismic and magnetotelluric surveys
    - Albany–Fraser and Eucla–Gawler
  - Industry Co-funded and GSWA stratigraphic drilling
    - Lithology, structure, geochemistry, geochronology and isotopes

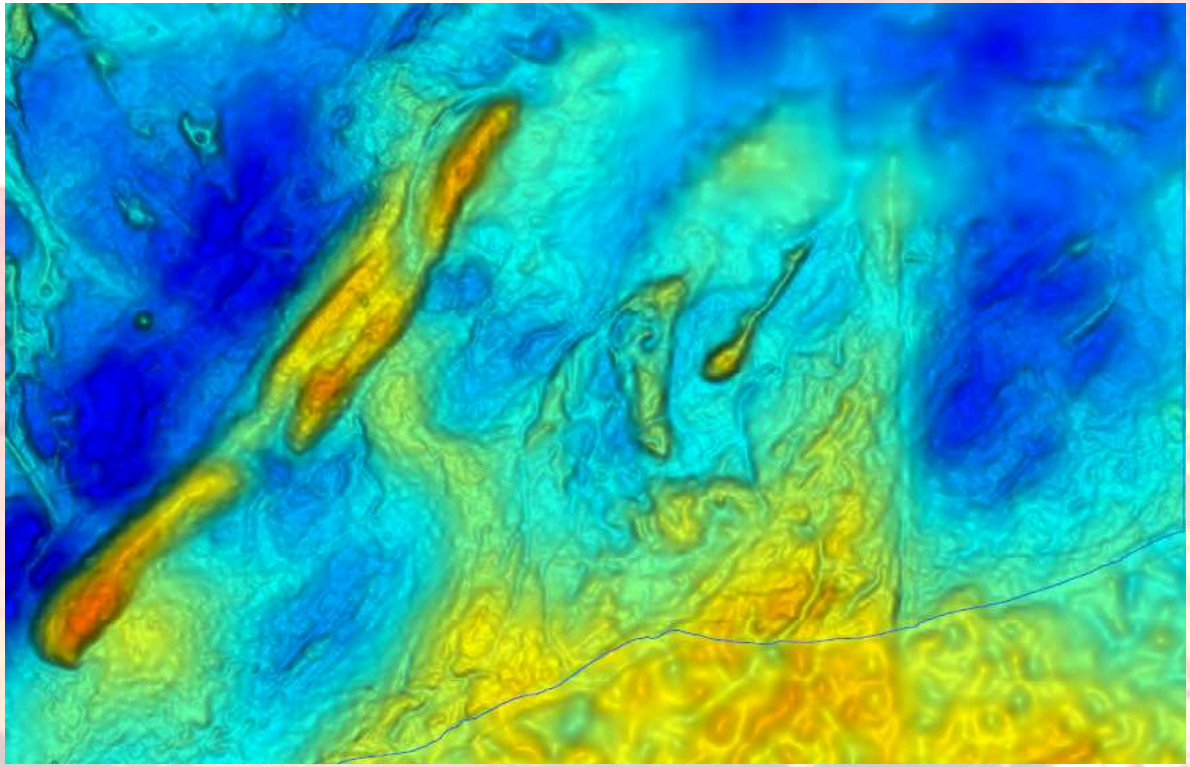
Airborne magnetics





Ground gravity: 2.5 km spacing (onshore)

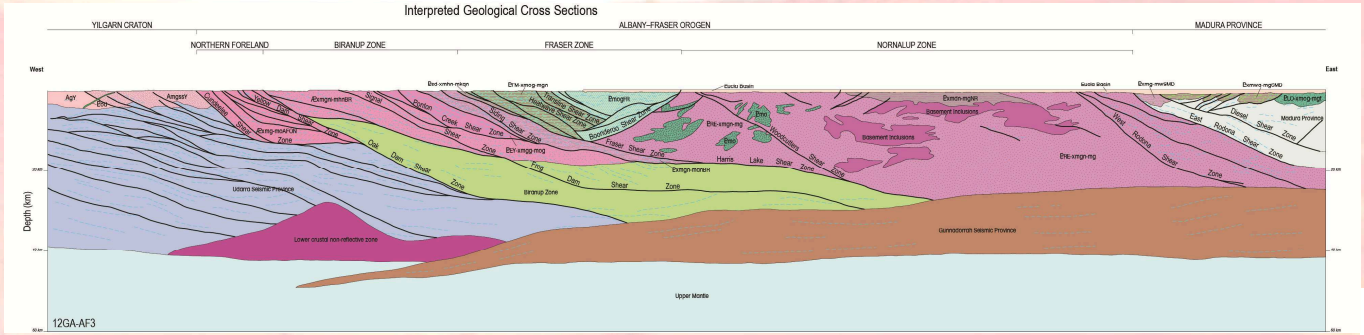




Deep crustal seismic reflection and MT surveys

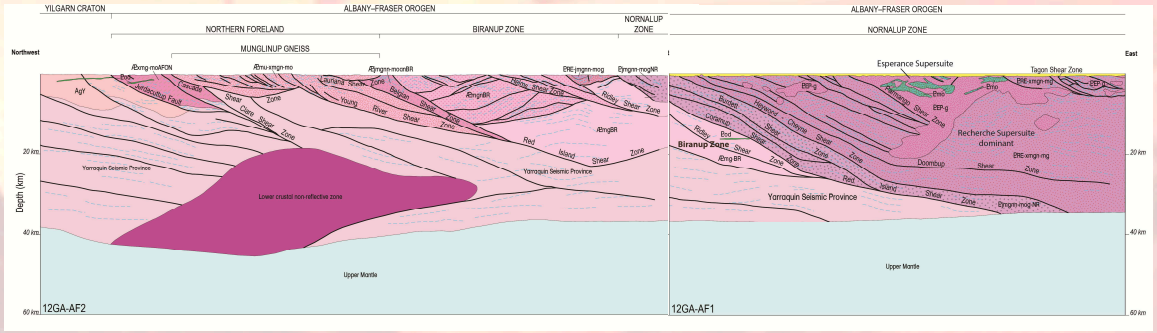
- Albany–Fraser Orogen interpreted cross sections

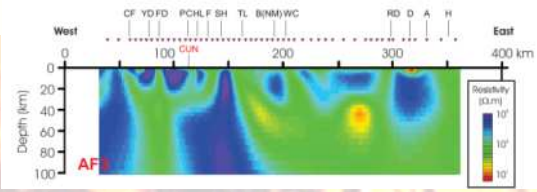
12GA–AF3



12GA–AF2

12GA–AF1

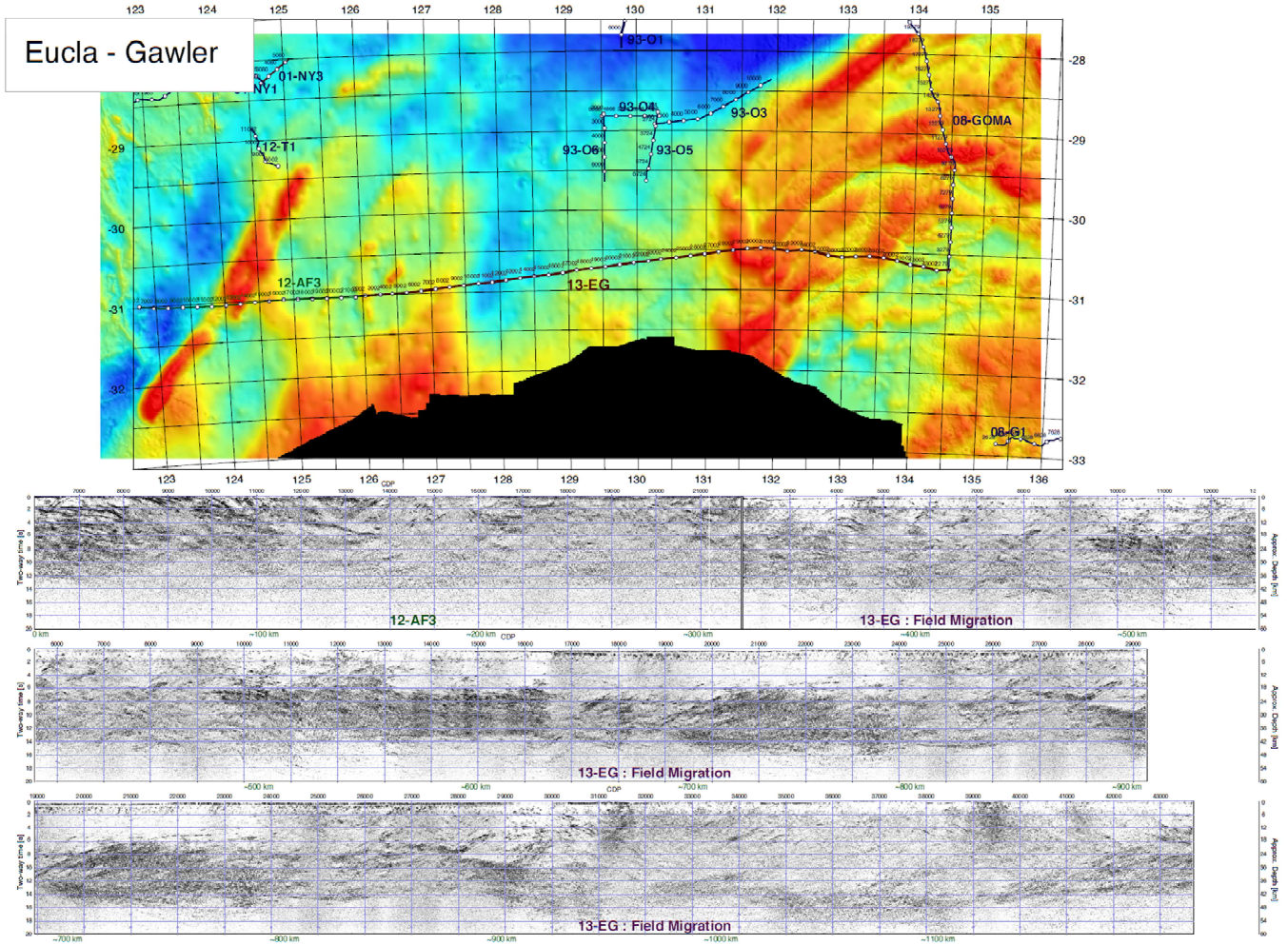


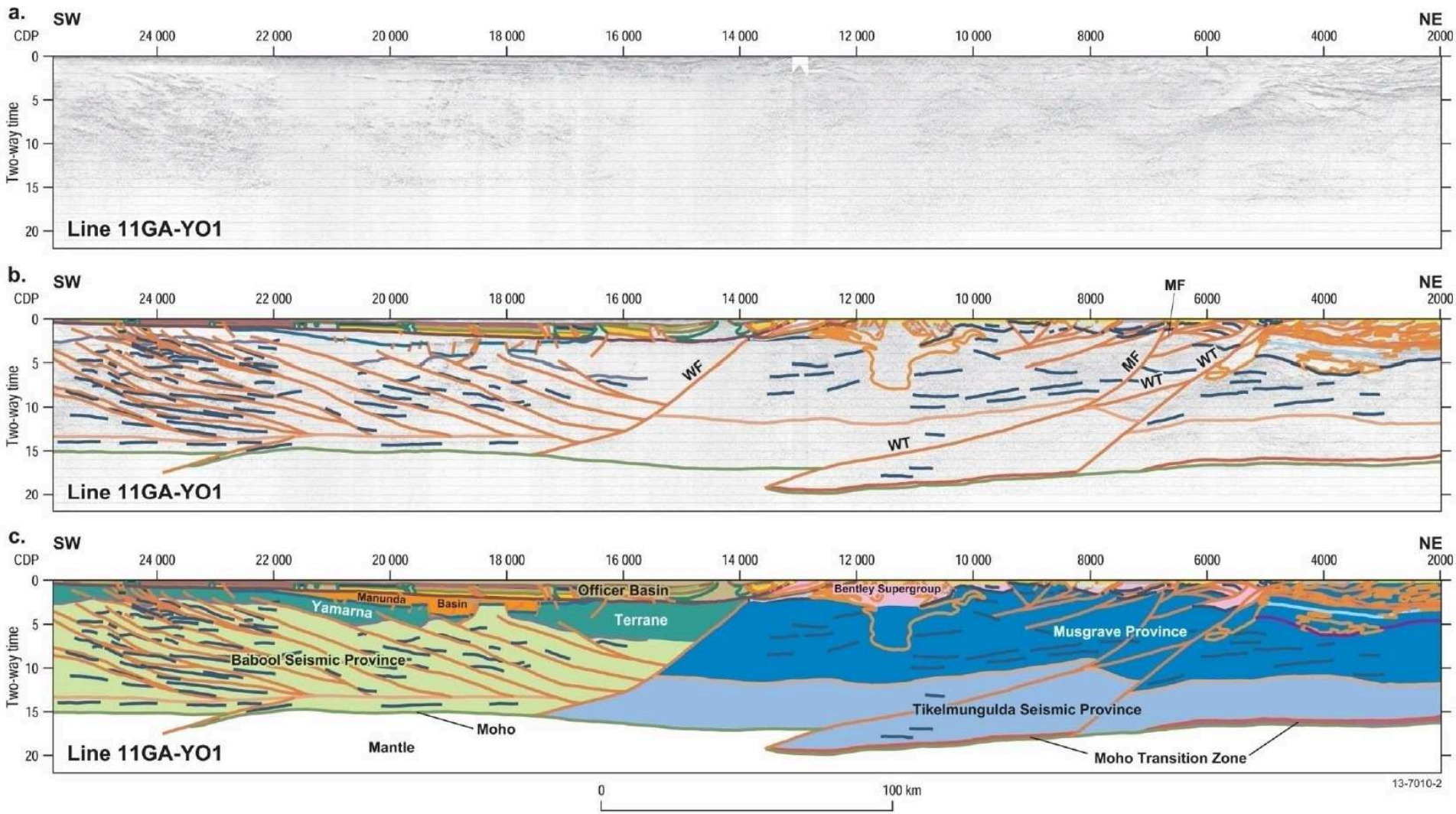


Centre for EXPLORATION TARGETING

Australian Government
Geoscience Australia

Eucla–Gawler deep seismic reflection and MT line

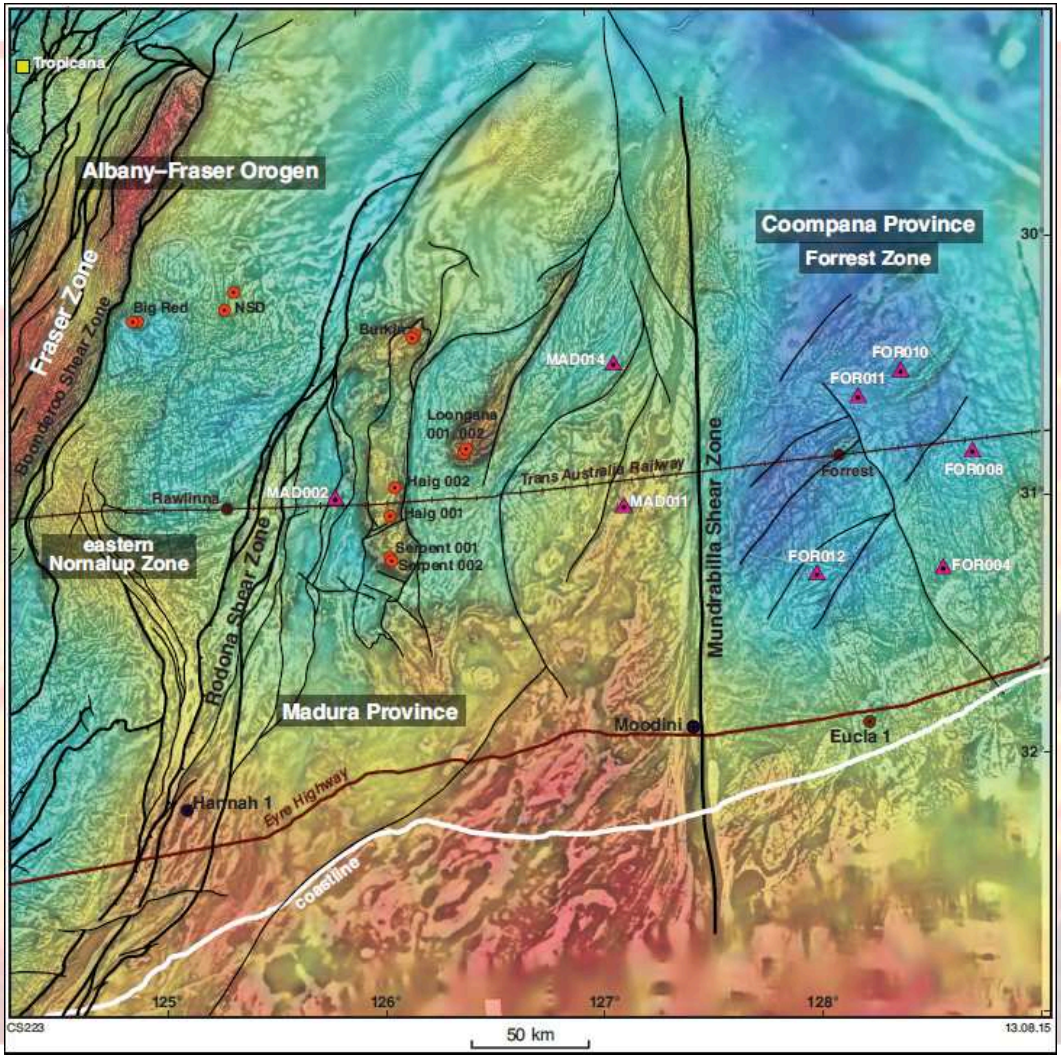



a.
SW
NE
CDP
24 000
22 000
20 000
18 000
16 000
14 000
12 000
10 000
8000
6000
4000
2000
Two-way time
0
5
10
15
20
Line 11GA-YO1
b.
SW
NE
MF
WF
MF
WT
WT
WT
Line 11GA-YO1
c.
SW
NE
Officer Basin
Bentley Supergroup
Manunda
Basin
Yamarna
Terrane
Musgrave Province
Babool Seismic Province
Tikelmungulda Seismic Province
Moho
Mantle
Moho Transition Zone
Line 11GA-YO1
0
100 km
13-7010-2
Officer Basic Seismic Horizon Colours
Base Cenozoic
Base Lennis Sandstone
Base Table Hill Volcanics
Base Wahlgu Formation
Base Steptoe Formation
Base Kanpa Formation
Base Hussar Formation
Intra Browne Formation 2
Intra Browne Formation 1
Base Officer Basin
Salt
Base Mesoproterozoic metasedimentary rocks
Musgrave Province
Base Permian or Cambrian sedimentary rocks
Base Mission Group
Base Cassidy Group
Base Pussy Cat Group
Base Palgrave Group and equivalents
Base Bentley Supergroup
Layered intrusion
Fault
WF Windularra Fault
MF Mitika Fault
WT Woodroffe Thrust
General
Base Cenozoic/regolith
Base mafic rocks
Base nonreflective upper crust in Yilgarn Craton
Base upper crust
Base middle crust
Top moho transition zone
Moho
Fault
Granite
Dyke/sill
Form line

Eucla Basement Stratigraphic Drilling: Objectives

- High quality, oriented drill core
  - detailed logging, structural analysis, petrography, geochronology, geochemistry and isotope analysis
    - Musgrave Province and Albany–Fraser Orogen projects as templates
- Regional mapping under cover
  - Geological evolution of the basement provinces beneath the Nullarbor — link Albany–Fraser Orogen, Musgrave Province and Gawler Craton
- Mineral system studies to provide insight into prospectivity
- Provide geological context rather than just geophysical targets

Eucla Basement Stratigraphic Drilling



Eucla Basement co-funded Drilling

- Richmond Mining/MRG Metals
  - Loongana prospect
- Teck Australia
  - Haig and Serpent prospects
- Gunson Resources
  - Burkin prospect
- Venus Resources
  - Moodini prospect

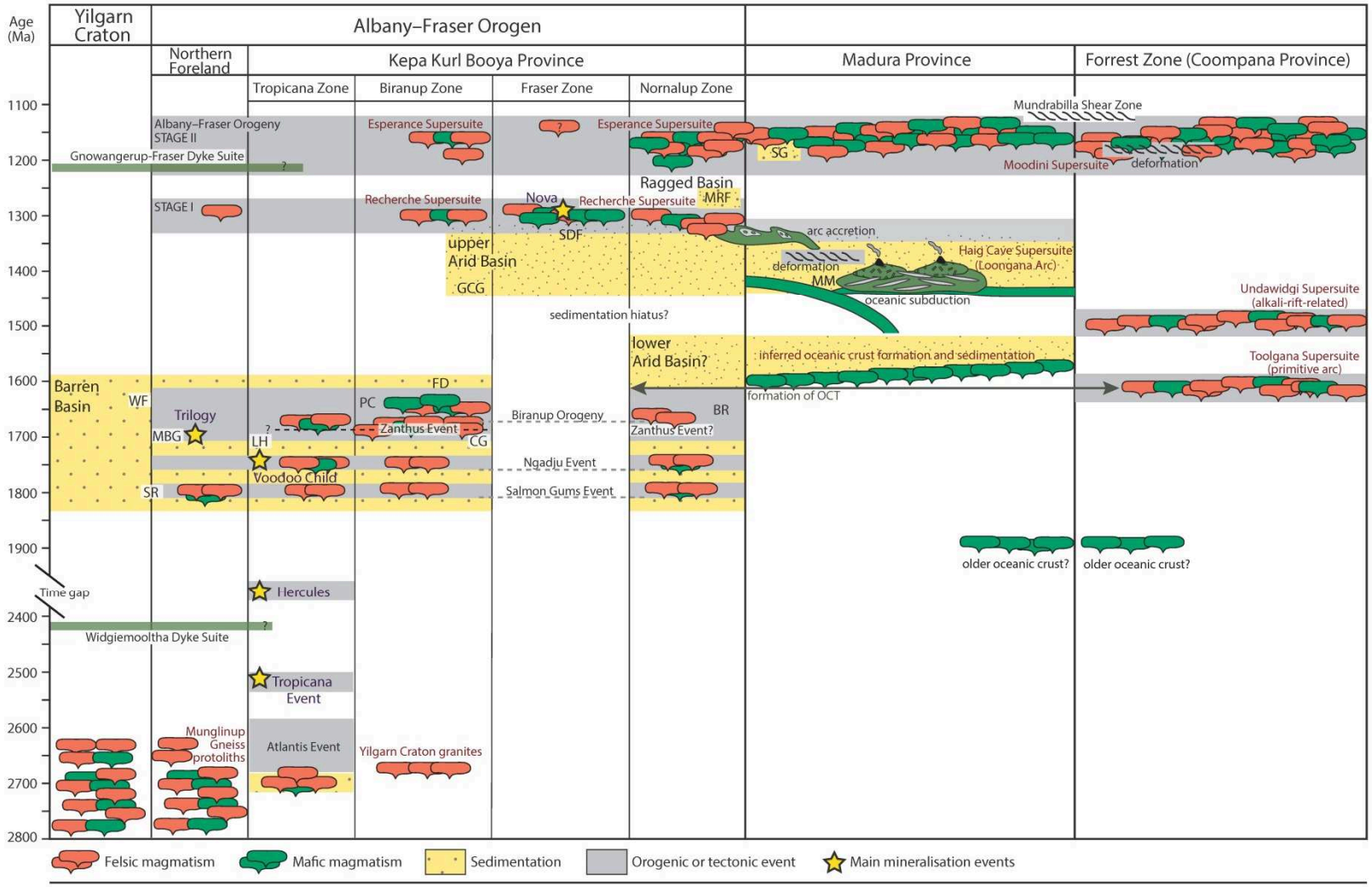
Eucla Basement Stratigraphic Drilling

- 2013 (5 holes), 2014 (3 holes)
- Madura Province (3 drill holes)
- Forrest Zone of the Coompana Province (5 drill holes)
  - Previously ‘unseen’
- 1560 m of HQ diamond core of Proterozoic basement
- 425 m PQ diamond core for Eucla Basin cover (2 drill holes)
- 130 m HQ diamond core for Eucla Basin cover (1 drill hole)

2013 Hole ID	Location	Longitude	Latitude	Zone	Easting	Northing	Drilled depth to basement (m)	Azimuth	Inclination (degrees)	Collar (m)	PQ basin cover core (m)	HQ basin cover core (m)	HQ basement core (m)	Total depth of hole (m)
FOR004	Northwest of Eucla	128.553960	-31.280080	52	457543	6539272	389.90	70	-80	137.7 (RC)	229.00	17.50	180.50	570.40
FOR011	North-northeast of Forrest	128.175830	-30.617160	52	421006	6612536	284.87	10	-80	88.6 (RC)	196.50	None	215.00	500.10
FOR010	Northeast of Forrest	128.366040	-30.518600	52	439176	6623576	357.60	140	-80	227 (RC)	None	130.60	170.20	527.80
MAD014	North of Loongana	127.085710	-30.478610	52	316247	6626622	250.00	340	-80	270 (RC)	None	None	189.40	459.50
MAD002	Near Gunnadorrah homestead	125.831450	-30.975750	51	770428	6569645	389.10	290	-80	389.1 (MR)	None	None	202.50	591.60

2014 Hole_ID	Location	Longitude	Latitude	Zone	Easting	Northing	Drilled depth to basement (m)	Azimuth	Inclination (degrees)	Collar (m) All MR	PQ basin cover core (m)	HQ basin cover core (m)	HQ basement core (m)	Total depth of hole (m)
MAD011	Southeast of Lonngana.	127.123210	-31.029953	52	320871	6565566	440.40	140	-75	440.40	None	None	200.75	641.15
FOR012	Forrest-Mundrabilla Track	127.985770	-31.300655	52	403478	6536633	310.10	150	-75	310.10	None	None	200.50	510.60
FOR008	East of Reid	128.686140	-30.829034	52	469984	6589303	383.75	105	-75	383.75	None	None	201.70	585.45

The Madura Province is a late Paleo- to Mesoproterozoic ophiolite! No Archean



Eucla Basement Stratigraphic Drilling – Program

09:00–09:20	Welcome and introduction	Ian Tyler (GSWA)
	Session 1: The cover – Eucla and Bight Basins	
09:20–09:45	Cenozoic records of dynamic topography, neotectonics and eustasy from the Eucla Basin	Mick O'Leary (Curtin University)
09:45–10:10	Provenance and stratigraphy of clastic Madura Shelf sediments: new age constraints and insights into the evolution of the Bight Basin system	Milo Barham (Curtin University)
10:10–10:40	Drilling techniques – getting through complex cover to basement	Paul Mander (First Drilling)
10:40–11:10	Morning tea*	
	Session 2: Madura Province	
11:10–11:40	Lithological characteristics and structural evolution	Catherine Spaggiari (GSWA)
11:40–12:00	U–Pb Geochronology	Michael Wingate (GSWA)
12:00–12:30	Geochemistry and petrogenesis	Hugh Smithies (GSWA)
12:30–12:50	Isotopes and crustal evolution	Chris Kirkland (Curtin University)
12:50–14:00	Lunch*	
	Session 3: Forrest Zone, Coompana Province	
14:00–14:30	Lithological characteristics and structural evolution	Catherine Spaggiari (GSWA)
14:30–14:50	U–Pb Geochronology	Michael Wingate (GSWA)
14:50–15:20	Geochemistry and petrogenesis	Hugh Smithies (GSWA)
15:20–15:40	Isotopes and crustal evolution	Chris Kirkland (Curtin University)
15:40–16:00	Afternoon tea*	
	Session 4: Understanding deep space from the Albany–Fraser Orogen to the border	
16:00–16:30	Implications for geodynamics and mineral prospectivity	Catherine Spaggiari (GSWA)
16:30–17:00	Discussion and concluding remarks	Ian Tyler (GSWA)

*** Morning tea, lunch and afternoon tea will be provided**

Eucla Basement Stratigraphic Drilling

- Representative cores will be available for public viewing with GSWA staff on Monday 14 September between the hours of 9:00 am and 4:00 pm, at the Perth Core Library, 37 Harris Street, Carlisle.
  - Register your interest with Deenikka at the desk
- Section 19s over drill holes will be lifted on 30 September.

Eucla Basement Stratigraphic Drilling

- On the website http://www.dmp.wa.gov.au/21634.aspx
  - Abstract volume and graphic logs
  - PowerPoints
  - Geochemical data, including Nd isotope data
  - U-Pb zircon geochronology and Hf isotope data on GeoVIEW.WA as available
- Still to come in 2015–16:
  - GSWA Report: Eucla Basement Stratigraphic Drilling
  - Eucla–Gawler deep crustal seismic reflection survey
    - GSWA Open Day
    - Australian Earth Science Convention Adelaide 26–30 June 2016

What lies beneath the **western Gawler Craton?**

A free workshop of the latest insights from deep seismic and magnetotelluric profiling.

In 2013, Geoscience Australia together with the Geological Survey of South Australia (through *PACE* Frontiers), the Geological Survey of Western Australia and AuScope acquired a new crustal seismic and magnetotelluric profile along the transcontinental railway from Haig in WA to Tarcoola in SA (13GA-EG1).

This half day workshop will present a series of talks from the Geological Survey of South Australia, Geoscience Australia and the Australian National University on all aspects of the data processing, geological background, potential field and magnetotelluric modelling and new interpretations from the western Gawler Craton section of the 13GA-EG1 line.

Workshop

DATE 10th December 2015
WHEN 12:30-5:00pm
WHERE Training rooms,
Level 7, 101 Grenfell Street,
Adelaide SA 5000

Afternoon tea included

Report book of extended abstracts to be provided

Workshop topics include

- Seismic processing
- Background geology and new results
- Lithosphere in the neighbourhood
- Potential field inversions and forward modelling
- Magnetotelluric modelling
- Description of seismic interpretation
- Geological implications and interpretations

Limited seating, bookings essential
www.minerals.statedevelopment.sa.gov.au/gssa/wgc_workshop

PACE FRONTIERS

AuScope

Australian Government
Geoscience Australia

Contact

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