Eucla Basement Stratigraphic Drilling – Results Release

Welcome and Introduction

Ian Tyler
Assistant Director Geoscience Mapping
Geological Survey of WA
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
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
The crust between the WAC and the NAC and the SAC
1415–1407 Ma
Sampled and analysed in 2003 from Helix drill holes LNGD-0001 and LNGD-0002
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
Eucla–Gawler deep seismic reflection and MT 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)**

<table>
<thead>
<tr>
<th>2013 Hole ID</th>
<th>Location</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
<th>Drilled depth to basement (m)</th>
<th>Azimuth</th>
<th>Inclination (degrees)</th>
<th>Collar (m)</th>
<th>PQ basin cover core (m)</th>
<th>HQ basin cover core (m)</th>
<th>HQ basement core (m)</th>
<th>Total depth of hole (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR004</td>
<td>Northwest of Eucla</td>
<td>128.553960</td>
<td>-31.280080</td>
<td>52</td>
<td>457543</td>
<td>6539272</td>
<td>389.90</td>
<td>70</td>
<td>-80</td>
<td>137.7 (RC)</td>
<td>229.00</td>
<td>17.50</td>
<td>180.50</td>
<td>570.40</td>
</tr>
<tr>
<td>FOR011</td>
<td>North-northeast of Forrest</td>
<td>128.175830</td>
<td>-30.617160</td>
<td>52</td>
<td>421008</td>
<td>6612536</td>
<td>284.87</td>
<td>10</td>
<td>-80</td>
<td>88.6 (RC)</td>
<td>196.50</td>
<td>None</td>
<td>215.00</td>
<td>500.10</td>
</tr>
<tr>
<td>FOR010</td>
<td>Northeast of Forrest</td>
<td>128.366040</td>
<td>-30.518600</td>
<td>52</td>
<td>439178</td>
<td>6623578</td>
<td>357.60</td>
<td>140</td>
<td>-80</td>
<td>227 (RC)</td>
<td>None</td>
<td>130.60</td>
<td>170.20</td>
<td>527.80</td>
</tr>
<tr>
<td>MAD014</td>
<td>North of Loongana</td>
<td>127.085710</td>
<td>-30.478610</td>
<td>52</td>
<td>316247</td>
<td>6626622</td>
<td>250.00</td>
<td>340</td>
<td>-80</td>
<td>270 (RC)</td>
<td>None</td>
<td>None</td>
<td>189.40</td>
<td>459.50</td>
</tr>
<tr>
<td>MAD002</td>
<td>Near Gunnadorrah homestead</td>
<td>125.831450</td>
<td>-30.975750</td>
<td>51</td>
<td>770428</td>
<td>6569645</td>
<td>389.10</td>
<td>290</td>
<td>-80</td>
<td>389.1 (MR)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>202.50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2014 Hole_ID</th>
<th>Location</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Zone</th>
<th>Easting</th>
<th>Northing</th>
<th>Drilled depth to basement (m)</th>
<th>Azimuth</th>
<th>Inclination (degrees)</th>
<th>Collar (m)</th>
<th>PQ basin cover core (m)</th>
<th>HQ basin cover core (m)</th>
<th>HQ basement core (m)</th>
<th>Total depth of hole (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAD011</td>
<td>Southeast of Lonngana.</td>
<td>127.123210</td>
<td>-31.029953</td>
<td>52</td>
<td>320871</td>
<td>6556566</td>
<td>440.40</td>
<td>140</td>
<td>-75</td>
<td>440.40</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>200.75</td>
</tr>
<tr>
<td>FOR012</td>
<td>Forrest-Mundrabilla Track</td>
<td>127.985770</td>
<td>-31.300655</td>
<td>52</td>
<td>403478</td>
<td>6536633</td>
<td>310.10</td>
<td>150</td>
<td>-75</td>
<td>310.10</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>200.50</td>
</tr>
<tr>
<td>FOR008</td>
<td>East of Reid</td>
<td>126.686140</td>
<td>-30.829034</td>
<td>52</td>
<td>469984</td>
<td>6589303</td>
<td>383.75</td>
<td>105</td>
<td>-75</td>
<td>383.75</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>201.70</td>
</tr>
</tbody>
</table>
The Madura Province is a late Paleo- to Mesoproterozoic ophiolite! No Archean
# Eucla Basement Stratigraphic Drilling – Program

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

* 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

  - 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

Contact
Department of State Development
Dr Ran Dutch, Principal Geologist, Geological Survey of South Australia
T 461 (8) 8463 3042  E ran.dutch@sa.gov.au

www.minerals.statedevelopment.sa.gov.au