What is the future for Government Geoscience Initiatives in Australia?

Paul Heithersay
SEG International Exchange Lecturer 2014

SMEDG Meeting
Sydney 2014
A global game needs a national approach

- National Depth and cover map
- National map of deep crust and upper mantle
- National distal footprints
- National 4 D Metallogenic Map
- National research network
- Technology transfer process
It’s a three legged race now

Access to capital
Costs escalating
Market driven timeframes

Ok if it is somewhere else
Compliance
Overall Community Benefit

Industry
Government
Community
Land Access

Royalties
Local industry
Regional communities
Facebook
By 2040 China will consume almost 20% of global energy supplies.
Total exploration spend in Australia by State

March 1990 - September 2012

Total Spend (June 2012 A$m)

Expenditure is at an all-time high

Note: Quarterly spend data is reported on an annualised basis

Source: ABS 8412

Percentage of total spend

Note: “Rest of World” refers to Russia, Eastern Europe, Central Asian Republics, Mongolia, Middle East and South West Asia (including India and Pakistan)

Sources: MinEx Consulting estimates, based on data from ABS, NRCan, OECD and MEG

Australia losing market share in traditional metal exploration
Government / Private Drivers of Discovery

**Government**
- Tenure
- Land Access
- Human & Intellectual Capital
  - Education and training
  - R&D – new exploration and processing technologies
- Precompetitive Geoscientific Data and Information
  - Capture and Delivery
  - Value-add Research
  - Underexplored / Covered Regions
  - Targeted Programs

**Private**
- Availability of Finance
- Quality of Exploration
- Quantity of Exploration
- Discovery

Adapted from Derek Carter
Project Pipeline

MAJOR MINES

PROJECTS

PROSPECTS

Government supplied non-rivalled and non-exclusive precompetitive data

Geoscientific Advice / Expertise
Data Capture / Interpretation
Industry Regulation
Project Support / Advice
Minesite Monitoring
Deep Cover Exploration Impediment…
South Australia – the state is covered! (from Carmen Krapf, GSSA)
75% is transported regolith!

<table>
<thead>
<tr>
<th>Regolith Material TRANSPORTED</th>
<th>AREA in sqkm</th>
<th>AREA in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>transported sediments</td>
<td>69304.44</td>
<td>7.05</td>
</tr>
<tr>
<td>aeolian sediments</td>
<td>429955.94</td>
<td>43.76</td>
</tr>
<tr>
<td>alluvial sediments</td>
<td>52894.60</td>
<td>5.38</td>
</tr>
<tr>
<td>colluvial sediments</td>
<td>85602.62</td>
<td>8.71</td>
</tr>
<tr>
<td>sheet flow deposits</td>
<td>53286.47</td>
<td>5.42</td>
</tr>
<tr>
<td>lacustrine sediments</td>
<td>39114.82</td>
<td>3.98</td>
</tr>
<tr>
<td>lacustrine and playa beach sediments</td>
<td>954.26</td>
<td>0.10</td>
</tr>
<tr>
<td>paludal sediments</td>
<td>8036.47</td>
<td>0.82</td>
</tr>
<tr>
<td>coastal sediments</td>
<td>4282.08</td>
<td>0.44</td>
</tr>
<tr>
<td>spring deposits</td>
<td>279.50</td>
<td>0.03</td>
</tr>
<tr>
<td>volcanic materials</td>
<td>78.28</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>SUM TRANSPORTED</strong></td>
<td>743789.47</td>
<td>75.70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regolith Material IN-SITU</th>
<th>AREA in sqkm</th>
<th>AREA in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>fresh to moderately weathered bedrock</td>
<td>43481.04</td>
<td>4.43</td>
</tr>
<tr>
<td>moderately to highly weathered bedrock</td>
<td>90126.05</td>
<td>9.17</td>
</tr>
<tr>
<td>residual material</td>
<td>98452.61</td>
<td>10.02</td>
</tr>
<tr>
<td>soil on bedrock</td>
<td>6709.09</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>SUM IN-SITU</strong></td>
<td>238768.79</td>
<td>24.30</td>
</tr>
</tbody>
</table>
Exploration Challenges…

Covered areas are “under-explored”

Provides unrealised potential / opportunity / new search space

Covered, green-fields, exploration frontiers need help

Need for an effective deep cover exploration method and framework
Precompetitive Geoscience Workflow

Key components resulting in a transformational change in exploration in covered / greenfield regions?

- Characterising cover
- Lithospheric architecture
- 4D geodynamic and metallogenic evolution for ore deposit origins
- Characterising and detecting distal footprints of covered mineral systems
- Cheaper, faster drilling
- Effective data delivery and interpretation
- Develop new and innovative exploration techniques and methodologies
New Data Releases for Pre-Competitive Exploration Workflow…
New Data Releases for Pre-competitive Exploration Workflow

Marree Region

- New edition 1:250k Geology Sheet (White, Sheard & Reid, 2012)
- Prospective for wide range of commodities, especially uranium and base metals
- Most of region has Mesozoic to Recent transported cover (esp. aeolian dunes)
- DMITRE / Geoscience Australia: Frome Airborne Electro-Magnetic (AEM) survey

New Marree Airborne Data Release

- Commenced September 2012
- Cost $810,000 (from 2011/12 PACE Budget)
- 131,437 line km data within 45,000 km²
- 400 m line spacing / 80 m fixed wing flight elevation
- Geoscience Australia conducted tender process and QA/QC
- Public release via SARIG

- Radiometric data
- Magnetic data
SA Radiometrics Coverage…
New Data Releases for Pre-competitive Exploration Workflow

Woomera Prohibited Area (WPA)

- **South Australia Atlas of Geoscience and Mineral Exploration Data – Woomera Prohibited Area within the Gawler Craton**
  - Visual display of current open file exploration data

- **Gawler Craton (WPA) Gravity Survey**
  - Partnership between DMITRE / Geoscience Australia / Department of Defence
  - 34,541 new gravity measurements at 1 km x 1 km resolution, except in the continual use zone of the WPA where resolution is 2 km x 2 km
  - 3,458 repeat stations (QA/QC)
  - ~$2 M from 2012/13 PACE Budget

- **Gawler Craton (WPA) Reprocessed and Recompiled Magnetics Data**
  - Addition of 2000-2007 open file data
  - GSSA reprocessing
  - Compliments Gravity Survey Data
  - Valuable mineral system targeting data, especially for IOCG systems
South Australia Atlas of Geoscience and Mineral Exploration Data – Woomera Prohibited Area within the Gawler Craton

63 key maps and images!

- Land Access & Administration
- Geology
- Geophysics
- Drillholes & Rock Samples
- Remote Sensing
- Historic Exploration

Now available on SARIG!!!
Regional Mineral System Drilling...
PACE Collaborative Drilling

8.8M Government spend leveraged over $24M from industry

New assay results; downhole logs; petrophysics; geophysics;

PLUS follow-up programs and further investment

<table>
<thead>
<tr>
<th>Round</th>
<th>Holes</th>
<th>m</th>
<th>DDH Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>353</td>
<td>21,469</td>
<td>4,016</td>
</tr>
<tr>
<td>2</td>
<td>1291</td>
<td>96,036</td>
<td>20,044</td>
</tr>
<tr>
<td>3</td>
<td>566</td>
<td>54,377</td>
<td>5,576</td>
</tr>
<tr>
<td>4</td>
<td>590</td>
<td>35,049</td>
<td>9,959</td>
</tr>
<tr>
<td>5</td>
<td>369</td>
<td>50,031</td>
<td>11,055</td>
</tr>
<tr>
<td>6</td>
<td>447</td>
<td>38,848</td>
<td>5,916</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3616</td>
<td>295.8km</td>
<td>56.6km</td>
</tr>
</tbody>
</table>

plus

OPAL   1183  19,181
GOMA   4     1,084   160.6m
Technologies will enable ‘Prospecting Drilling’
• IOCGs, Gawler Craton, SA
• Drill through deep cover based on grav & mag anomalies alone
• Many false +ves
• Many anomalies tested by one hole
• Sparse data collected with little knowledge to inform follow-up drilling
Deep Exploration: Prospecting Drilling

- Build out from initial targets using 5-10 km coiled tubing drilling array and resampling prior holes for consistent geochemical data
- Downhole & lab-at-rig tools define petrophysics and geochemical halos real-time
- Anomalies re-modelled and followed up during same campaign
- Targets based on broad bandwidth of geophysical and geochemical data reduces false +ves and allows recognition of new deposit types
- Start to map entire mineralising system with regional scale vector potential
Mapping buried mineral systems: enlarging buried target and provides framework for next drillhole

**Emmie Bluff 3D Model**
Copper Shell (0.8%)

Key
- Hematite
- Magnetite
- Hematite – Magnetite
- Albite
- K-Feldspar
- Sericite
- Sericite – Chlorite
- Chlorite
- Copper Shell

500 m x 500 m x 10 m cell size
10x vertical exaggeration
Geochemically rank samples – in “real time” using Lab-at-Rig
Regolith Geochemical Challenge from Drilling: Proximity to Minerals Systems from results within the cover

Transported cover

Far miss

E.g. 200 to 400 m thick

Near miss

Direct hit

Ground surface

Samples

1000 m

250 m

50 m

GOSSAN

ORE DEPOSIT

Weathering front

Not to scale

From R E Smith & B Singh, 2007
Mineral System Drilling Vision

PACE-type Contract to drill 130,000m on a 10km x 10km array through cover for basement and/or unconformity sample

$50/m = $6.5M
(excluding where basement > 1km)

PACE Frontiers: $2.0M
(2014-15 FY)

$200/m = 10,000m drilling
average hole ~ 500m = ~20 holes

+ plus industry co-investment opportunities
Regional Deep Cover Workflows – Eastern Gawler Craton

- Atlas of Open File Resources
- Enhanced Gravity and Magnetics Data
- Hardrock Seismic Pilot Study (HiSeis)
- Ongoing Magnetotelluric surveys (University of Adelaide)
- Alteration Characterisation (GSSA Geochemistry and HyLogger)
- Geochemistry / Biogeochemistry Pilot Study (GSSA)
- Regional Exploration Virtual Laboratory (REVL) (CSIRO)
- Regional Mineral System Drilling (2015 – DET CRC and collaborators)

- Extension and Application to northern Curnamona Province…
Western Gawler Craton – Eucla Basin....
Western Gawler / Eucla Basin Continental Seismic Transect

- WA SA border eastwards to Tarcoola

- Completed!

- Funding
  - $1.75M PACE
  - $0.5M GA
  - $1.0M AusScope
  - GSWA paying for mobilisation / de-mobilisation

- Across a major continental geological frontier....
Western Gawler Craton / Eucla Basin Magnetotellurics

- Collaboration with University of Adelaide (Graham Heinson)
- SA currently has greatest number of MT station data points in Australia
- This will maintain SA’s leading edge in MT data coverage and interpretation of conductivity / resistivity of crustal profiles
- PACE funded. 2014-15 data acquisition
Western Gawler / Eucla Basin Airborne Survey (TMI backdrop)

Poor data coverage and density

Coompana Anomaly
2. Western Gawler / Eucla Basin Regional Geophysics

SA airborne geophysical surveys (from SARIG)

Older airborne surveys
1600-3000 m line spacings
Emerging Integrated Pre-competitive Geoscience workflow in Western Gawler – Eucla Basin

Regional Seismic Line (2013-14)
Regional MT (2014)
Airborne Geophysics (2014)
Regional Geochemistry (2013 – 15)
Regional Drilling

Regional Geology Data and Information

Data and Information Delivery
Free Smartphone App for South Australia Mining Investors...

“The South Australia Mining App will become your go-to guide for resources investment. With real-time data at your fingertips, investing in South Australia has never been so easy.”

Hon. Tom Koutsantonis MP
Minister for Mineral Resources and Energy

www.southaustraliaming.sa.gov.au
Community Engagement Strategy
Informed stakeholders

Understanding dryland farming
Information for mineral explorers in South Australia

Understanding mineral exploration

Local: Mining
Decreasing Land Usage
Decreasing Environmental Disturbance

Regional: Exploration
The objectives of the program include:

- Demonstrating the values and benefits of a shared commitment to multiple land use by modelling the program on the proposed National Multiple Land Use Framework

- Build capacity of Eyre Peninsula communities, farming businesses and local industries to enable them to respond to changes brought on by exploration programs in the region and potential mining developments.

- Provide local agribusinesses with the tools and support needed to fully understand and realise the opportunities for their businesses by working collaboratively with the explorers and potential mine developers.

- Equip landowners with the knowledge and understanding required to effectively participate in the land access negotiation process.
Future Farm Landscape Workshops

- Targeted workshops for landholders
- Identify profitability (H/L/M) across the farm landscape and risk areas.
- This is then overlaid with potential impacts from exploration, mining or associated infrastructure to determine priority actions required to ensure long-term viability of the farming enterprise.
### Policy Potential Index - Global

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nevada</td>
<td>Nevada</td>
<td>Nevada</td>
<td>Manitoba</td>
<td>Quebec</td>
<td>Quebec</td>
<td>Quebec</td>
<td>Alberta</td>
<td>Alberta</td>
<td>New Brunswick</td>
<td>Finland</td>
</tr>
<tr>
<td>2</td>
<td>Chile</td>
<td>Ireland</td>
<td>Alberta</td>
<td>Alberta</td>
<td>Nevada</td>
<td>Wyoming</td>
<td>New Brunswick</td>
<td>Finland</td>
<td>Nevada</td>
<td>Finland</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>South Australia</td>
<td>Manitoba</td>
<td>Manitoba</td>
<td>Nevada</td>
<td>Finland</td>
<td>Nevada</td>
<td>Finland</td>
<td>Quebec</td>
<td>Saskatchewan</td>
<td>Alberta</td>
<td>Alberta</td>
</tr>
<tr>
<td>4</td>
<td>Tasmania</td>
<td>Utah</td>
<td>Chile</td>
<td>Utah</td>
<td>Alberta</td>
<td>Alberta</td>
<td>Alberta</td>
<td>Yukon</td>
<td>Quebec</td>
<td>Wyoming</td>
<td>New Brunswick</td>
</tr>
<tr>
<td>5</td>
<td>New South Wales</td>
<td>Saskatchewan</td>
<td>Quebec</td>
<td>Manitoba</td>
<td>Newfoundland and Labrador</td>
<td>Nevada</td>
<td>Saskatchewan</td>
<td>Finland</td>
<td>Quebec</td>
<td>Wyoming</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Manitoba</td>
<td>Spain</td>
<td>Mexico</td>
<td>New Brunswick</td>
<td>Chile</td>
<td>New Brunswick</td>
<td>Saskatchewan</td>
<td>Chile</td>
<td>Utah</td>
<td>Saskatchewan</td>
<td>Ireland</td>
</tr>
<tr>
<td>7</td>
<td>Alberta</td>
<td>Quebec</td>
<td>Saskatchewan</td>
<td>Quebec</td>
<td>Utah</td>
<td>Manitoba</td>
<td>Chile</td>
<td>Newfoundland and Labrador</td>
<td>Sweden</td>
<td>Sweden</td>
<td>Nevada</td>
</tr>
<tr>
<td>8</td>
<td>Quebec</td>
<td>Ontario</td>
<td>Arizona</td>
<td>Queensland</td>
<td>Wyoming</td>
<td>Chile</td>
<td>Newfoundland and Labrador</td>
<td>Botswana</td>
<td>Chile</td>
<td>Nevada</td>
<td>Yukon</td>
</tr>
<tr>
<td>9</td>
<td>Queensland</td>
<td>Alberta</td>
<td>Ontario</td>
<td>Tasmania</td>
<td>Ireland</td>
<td>Saskatchewan</td>
<td>Manitoba</td>
<td>Alaska</td>
<td>Minnesota</td>
<td>Ireland</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Saskatchewan</td>
<td>Tasmania</td>
<td>Utah</td>
<td>Saskatchewan</td>
<td>Sweden</td>
<td>Ontario</td>
<td>Newfoundland and Labrador</td>
<td>Ontario</td>
<td>Wyoming</td>
<td>Yukon</td>
<td>Norway</td>
</tr>
<tr>
<td>11</td>
<td>Brazil</td>
<td>Arizona</td>
<td>Western Australia</td>
<td>Yukon</td>
<td>Botswana</td>
<td>Utah</td>
<td>Yukon</td>
<td>Manitoba</td>
<td>South Australia</td>
<td>Western Australia</td>
<td>Nova Scotia</td>
</tr>
<tr>
<td>12</td>
<td>Northern Territory</td>
<td>Western Australia</td>
<td>New South Wales</td>
<td>Victoria</td>
<td>Saskatchewan</td>
<td>Nova Scotia</td>
<td>Sweden</td>
<td>Wyoming</td>
<td>Oregon</td>
<td>Greenland</td>
<td>Western Australia</td>
</tr>
<tr>
<td>13</td>
<td>Victoria</td>
<td>Idaho</td>
<td>Alaska</td>
<td>New Mexico</td>
<td>New Brunswick</td>
<td>Sweden</td>
<td>Wyoming</td>
<td>Utah</td>
<td>Newfoundland and Labrador</td>
<td>Ontario</td>
<td>Saskatchewan</td>
</tr>
<tr>
<td>14</td>
<td>New Brunswick</td>
<td>Chile</td>
<td>New South Wales</td>
<td>Arizona</td>
<td>Finland</td>
<td>Northern Territory</td>
<td>Mexico</td>
<td>Botswana</td>
<td>Greenland</td>
<td>Western Australia</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Western Australia</td>
<td>South Australia</td>
<td>Tasmania</td>
<td>Northern Territory</td>
<td>Yukon</td>
<td>Utah</td>
<td>South Australia</td>
<td>Yukon</td>
<td>Nova Scotia</td>
<td>Western Australia</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Ontario</td>
<td>New Brunswick</td>
<td>Ireland</td>
<td>Wyoming</td>
<td>Yukon</td>
<td>Nova Scotia</td>
<td>Peru</td>
<td>Ireland</td>
<td>Newfoundland and Labrador</td>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Ireland</td>
<td>Mexico</td>
<td>Finland</td>
<td>Nova Scotia</td>
<td>Nova Scotia</td>
<td>Alaska</td>
<td>Ireland</td>
<td>Arizona</td>
<td>Western Australia</td>
<td>Botswana</td>
<td>Botswana</td>
</tr>
<tr>
<td>18</td>
<td>Nova Scotia</td>
<td>Queensland</td>
<td>New Brunswick</td>
<td>Western Australia</td>
<td>Ontario</td>
<td>Botswana</td>
<td>Alaska</td>
<td>Colombia</td>
<td>Ontario</td>
<td>Chile</td>
<td>Newfoundland and Labrador</td>
</tr>
<tr>
<td>19</td>
<td>Mexico</td>
<td>New South Wales</td>
<td>Brazil</td>
<td>Ontario</td>
<td>British Columbia</td>
<td>Norway</td>
<td>Western Australia</td>
<td>Brazil</td>
<td>Nova Scotia</td>
<td>Alaska</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Peru</td>
<td>India</td>
<td>Northern Territory</td>
<td>Arizona</td>
<td>Tasmania</td>
<td>Northern Territory</td>
<td>New South Wales</td>
<td>Ontario</td>
<td>New South Wales</td>
<td>Manitoba</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Argentina</td>
<td>Wyoming</td>
<td>Yukon</td>
<td>Spain</td>
<td>Northern Territory</td>
<td>Western Australia</td>
<td>Botswana</td>
<td>Ghana</td>
<td>Alaska</td>
<td>Utah</td>
<td>Manitoba</td>
</tr>
<tr>
<td>22</td>
<td>Bolivia</td>
<td>Sweden</td>
<td>Wyoming</td>
<td>Newfoundland and Labrador</td>
<td>Newfoundland and Labrador</td>
<td>Spain</td>
<td>Ontario</td>
<td>Nunavut</td>
<td>Norway</td>
<td>Minnesota</td>
<td>Northern Territory</td>
</tr>
<tr>
<td>23</td>
<td>Turkey</td>
<td>Victoria</td>
<td>British Columbia</td>
<td>Idaho</td>
<td>Ghana</td>
<td>New South Wales</td>
<td>Tasmania</td>
<td>Tanzania</td>
<td>New Brunswick</td>
<td>Michigan</td>
<td>Chile</td>
</tr>
<tr>
<td>24</td>
<td>Alaska</td>
<td>Finland</td>
<td>Argentina</td>
<td>South Dakota</td>
<td>Mexico</td>
<td>British Columbia</td>
<td>Queensland</td>
<td>Namibia</td>
<td>Burkina Faso</td>
<td>Norway</td>
<td>Victoria</td>
</tr>
<tr>
<td>25</td>
<td>New Zealand</td>
<td>Northern Territory</td>
<td>Turkey</td>
<td>Alaska</td>
<td>Western Australia</td>
<td>Queensland</td>
<td>Arizona</td>
<td>New Zealand</td>
<td>Arizona</td>
<td>Alaska</td>
<td>Morocco</td>
</tr>
</tbody>
</table>
## Mineral Potential Index - Global

### 2003/04 to 2013/14

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Russia</td>
<td>Nevada</td>
<td>Chile</td>
<td>Nevada</td>
<td>Mexico</td>
<td>Chile</td>
<td>Nevada</td>
<td>Chile</td>
<td>Botswana</td>
<td>Greenland</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Western Australia</td>
<td>Chile</td>
<td>Nevada</td>
<td>Quebec</td>
<td>Quebec</td>
<td>Quebec</td>
<td>Chile</td>
<td>Quebec</td>
<td>Greenland</td>
<td>Finland</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Peru</td>
<td>Quebec</td>
<td>Mongolia</td>
<td>Western Australia</td>
<td>Chile</td>
<td>Finland</td>
<td>Quebec</td>
<td>Saskatchewan</td>
<td>Yukon</td>
<td>Sweden</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chile</td>
<td>Western Australia</td>
<td>Quebec</td>
<td>Burkina Faso</td>
<td>Nevada</td>
<td>Burkina Faso</td>
<td>Nevada</td>
<td>Saskatchewan</td>
<td>Nevada</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Nevada</td>
<td>Mexico</td>
<td>Mali</td>
<td>Queensland</td>
<td>South Australia</td>
<td>Saskatchewan</td>
<td>Mexico</td>
<td>Greenland</td>
<td>Chile</td>
<td>Saskatchewan</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Indonesia</td>
<td>Tasmania</td>
<td>Northern Territory</td>
<td>Finland</td>
<td>Sweden</td>
<td>Saskatchewan</td>
<td>Burkina Faso</td>
<td>Alaska</td>
<td>Alaska</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Quebec</td>
<td>Finland</td>
<td>Guinea</td>
<td>Ontario</td>
<td>Manitoba</td>
<td>Western Australia</td>
<td>Botswana</td>
<td>Botswana</td>
<td>Nevada</td>
<td>Yukon</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ontario</td>
<td>Northern Territory</td>
<td>Mexico</td>
<td>Chile</td>
<td>Nevada</td>
<td>Ontario</td>
<td>Mexico</td>
<td>Alaska</td>
<td>Alaska</td>
<td>Quebec</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Northwest Territories</td>
<td>Brazil</td>
<td>Ontario</td>
<td>Alberta</td>
<td>Ghana</td>
<td>Mexico</td>
<td>Alaska</td>
<td>Alaska</td>
<td>Quebec</td>
<td>Western Australia</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Brazil</td>
<td>Ontario</td>
<td>Western Australia</td>
<td>Alaska</td>
<td>Ireland</td>
<td>South Australia</td>
<td>Mali</td>
<td>Papua New Guinea</td>
<td>Western Australia</td>
<td>Northern Territory</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>South Africa</td>
<td>Queensland</td>
<td>Saskatchewan</td>
<td>Brazil</td>
<td>Saskatchewan</td>
<td>Peru</td>
<td>Yukon</td>
<td>Yukon</td>
<td>Manitoba</td>
<td>Chile</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Alaska</td>
<td>Mali</td>
<td>Botswana</td>
<td>Manitoba</td>
<td>Mali</td>
<td>Western Australia</td>
<td>New South Wales</td>
<td>Peru</td>
<td>Finland</td>
<td>Wyoming</td>
<td>New Brunswick</td>
</tr>
<tr>
<td>13</td>
<td>Mexico</td>
<td>New South Wales</td>
<td>Brazil</td>
<td>Finland</td>
<td>Yukon</td>
<td>Queensland</td>
<td>Brazil</td>
<td>Utah</td>
<td>Burkina Faso</td>
<td>Utah</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Northern Territory</td>
<td>Manitoba</td>
<td>Burkin Faso</td>
<td>Yukon</td>
<td>Namibia</td>
<td>Ghana</td>
<td>Alaska</td>
<td>Finland</td>
<td>Sweden</td>
<td>Newfoundland and Labrador</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>DRC Congo</td>
<td>Mongolia</td>
<td>Manitoba</td>
<td>Newfoundland and Labrador</td>
<td>Ontario</td>
<td>Wyoming</td>
<td>South Australia</td>
<td>Mexico</td>
<td>Utah</td>
<td>Arizona</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Nunavut</td>
<td>Tanzania</td>
<td>Argentina</td>
<td>New South Wales</td>
<td>Wyoming</td>
<td>Newfoundland and Labrador</td>
<td>Utah</td>
<td>Colombia</td>
<td>Papua New Guinea</td>
<td>Botswana</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>British Columbia</td>
<td>Ghana</td>
<td>Tanzania</td>
<td>New Mexico</td>
<td>Peru</td>
<td>Botswana</td>
<td>Newfoundland and Labrador</td>
<td>Manitoba</td>
<td>Ghana</td>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>China</td>
<td>South Australia</td>
<td>Arizona</td>
<td>Saskatchewan</td>
<td>New Zealand</td>
<td>Newfoundland and Labrador</td>
<td>Turkey</td>
<td>Ghana</td>
<td>Brazil</td>
<td>Alberta</td>
<td>Northwest Territories</td>
</tr>
<tr>
<td>19</td>
<td>Ghana</td>
<td>Peru</td>
<td>Queensland</td>
<td>Ghana</td>
<td>Queensland</td>
<td>Northern Territory</td>
<td>Western Australia</td>
<td>Ontario</td>
<td>Finland</td>
<td>Guyana</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Philippines</td>
<td>China</td>
<td>Turkey</td>
<td>Mexico</td>
<td>Zambia</td>
<td>Burkina Faso</td>
<td>Turkey</td>
<td>Wyoming</td>
<td>Sweden</td>
<td>South Australia</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Kazakhstan</td>
<td>Nunavut</td>
<td>Alberta</td>
<td>Arizona</td>
<td>Northern Territory</td>
<td>Brazil</td>
<td>Queensland</td>
<td>Mali</td>
<td>Mexico</td>
<td>Norway</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Newfoundland and Labrador</td>
<td>Spain</td>
<td>Finland</td>
<td>Tanzania</td>
<td>Brazil</td>
<td>Tanzania</td>
<td>Manitoba</td>
<td>Peru</td>
<td>Northern Territory</td>
<td>Turkey</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Queensland</td>
<td>Victoria</td>
<td>New South Wales</td>
<td>Wyoming</td>
<td>Alberta</td>
<td>Zambia</td>
<td>Wyoming</td>
<td>Tanzania</td>
<td>Ontario</td>
<td>Ghana</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Argentina</td>
<td>Sweden</td>
<td>Northern Territory</td>
<td>Nunavut</td>
<td>New Brunswick</td>
<td>New Brunswick</td>
<td>Namibia</td>
<td>Ghana</td>
<td>New Mexico</td>
<td>Alberta</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>New South Wales</td>
<td>Botswana</td>
<td>Utah</td>
<td>Utah</td>
<td>Tanzania</td>
<td>Tasmania</td>
<td>Colombia</td>
<td>Newfoundland and Labrador</td>
<td>Tanzania</td>
<td>Queensland</td>
<td></td>
</tr>
</tbody>
</table>

### RANKING TOP 25

**2004 PACE**

**2009 WA EIS Scheme**

- **Western Australia**
- **South Australia**
- **Canada**
- **USA**
- **Australia**
- **Russia**
- **Brazil**
- **Peru**
- **Argentina**
- **Chile**
- **Mexico**
- **India**
- **Zimbabwe**
- **Venezuela**
- **Arizona**
- **Indonesia**
- **Manitoba**

---

**Notes:**

- Ranks are based on the Mineral Potential Index (MPI) calculated for each jurisdiction.
- The MPI takes into account various factors such as geology, mineral potential, infrastructure, policy, and market conditions.
- Jurisdictions are ranked annually from 2003/04 to 2013/14.
- The top 25 jurisdictions are highlighted in the chart.

---

**Legend:**

- **SA:** South Australia
- **WA:** Western Australia
Government Exploration Initiatives Expenditure by State in Australia 2003-04 to 2012-13
# Policy Potential Index – Australia

## South Australian Mineral Exploration and PACE Expenditure 2003/04 to 2012/13

<table>
<thead>
<tr>
<th>Year</th>
<th>Exploration Expenditure (million)</th>
<th>PACE Expenditure (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>41.7</td>
<td>5.6</td>
</tr>
<tr>
<td>2004-05</td>
<td>66.8</td>
<td>5.6</td>
</tr>
<tr>
<td>2005-06</td>
<td>146.5</td>
<td>5.75</td>
</tr>
<tr>
<td>2006-07</td>
<td>260.8</td>
<td>5.6</td>
</tr>
<tr>
<td>2007-08</td>
<td>355.2</td>
<td>3.1</td>
</tr>
<tr>
<td>2008-09</td>
<td>220.8</td>
<td>3.65</td>
</tr>
<tr>
<td>2009-10</td>
<td>167.9</td>
<td>3.6</td>
</tr>
<tr>
<td>2010-11</td>
<td>254.7</td>
<td>6</td>
</tr>
<tr>
<td>2011-12</td>
<td>328.4</td>
<td>3</td>
</tr>
<tr>
<td>2012-13</td>
<td>230.4</td>
<td>5</td>
</tr>
</tbody>
</table>

## Table: AUSTRALIA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>South Australia (3/53)</td>
<td>Tasmania (10/64)</td>
<td>Western Australia (11/64)</td>
<td>South Australia (5/65)</td>
<td>South Australia (15/68)</td>
<td>South Australia (16/71)</td>
<td>South Australia (10/72)</td>
<td>South Australia (15/51)</td>
<td>South Australia (11/79)</td>
<td>Northern Territory (11/93)</td>
<td>Western Australia (15/96)</td>
</tr>
<tr>
<td>2</td>
<td>Tasmania (1/53)</td>
<td>Western Australia (12/64)</td>
<td>New South Wales (12/64)</td>
<td>Queensland (8/65)</td>
<td>Tasmania (20/68)</td>
<td>Northern Territory (20/71)</td>
<td>Northern Territory (14/72)</td>
<td>Western Australia (28/53)</td>
<td>Western Australia (17/79)</td>
<td>Western Australia (12/93)</td>
<td>Western Australia (20/96)</td>
</tr>
<tr>
<td>3</td>
<td>New South Wales (3/53)</td>
<td>South Australia (15/64)</td>
<td>South Australia (14/64)</td>
<td>Tasmania (9/65)</td>
<td>Northern Territory (21/68)</td>
<td>Western Australia (21/71)</td>
<td>Western Australia (19/72)</td>
<td>Western Australia (29/53)</td>
<td>New South Wales (20/79)</td>
<td>South Australia (19/93)</td>
<td>Northern Territory (22/96)</td>
</tr>
<tr>
<td>4</td>
<td>Queensland (9/53)</td>
<td>Queensland (18/64)</td>
<td>Tasmania (15/64)</td>
<td>Victoria (12/65)</td>
<td>Western Australia (25/68)</td>
<td>New South Wales (23/71)</td>
<td>New South Wales (20/72)</td>
<td>Queensland (13/53)</td>
<td>Northern Territory (27/79)</td>
<td>Queensland (28/93)</td>
<td>Victoria (24/96)</td>
</tr>
<tr>
<td>7</td>
<td>Western Australia (13/53)</td>
<td>Northern Territory (25/64)</td>
<td>Victoria (30/64)</td>
<td>Western Australia (18/65)</td>
<td>Queensland (30/68)</td>
<td>Tasmania (31/71)</td>
<td>Victoria (30/72)</td>
<td>Tasmania (42/53)</td>
<td>Queensland (38/79)</td>
<td>Victoria (44/93)</td>
<td>Tasmania (49/96)</td>
</tr>
</tbody>
</table>
A global game needs a national approach

National Depth and cover map
National map of deep crust and upper mantle
National distal footprints
National 4 D Metallogenic Map
Nation research network
Technology transfer process
National Priorities for Earth Science

National Mineral Exploration Strategy...

Pre-competitive Geoscientific Information...
“Auscope “Exploratorium”
AuScope Infrastructure System for National Data and Integration

a combination of research infrastructure and applied science infrastructure

AuScope Model

Earth Imaging
Geodetic data
Composition & Evolution

National Geospatial Reference Framework
AuScope National Geo Transect Program
Materials & Properties (Virtual Core Library)

AuScope Grid Storage Management Access Interoperability

AuScope Simulation, Analysis, Modelling (SAM)

Earth Model

Industry Portal
Research Portal
Policy Portal
Education Portal

Models and concepts for the Australian Continent

Physical equipment and datasets
National spatial framework
Grid computing infrastructure to access data
Software for analysis and modelling
It’s a three legged race now

Access to capital
Costs escalating
Market driven timeframes

Ok if it is somewhere else
Compliance
Overall Community Benefit
GUIDING PRINCIPLES

Co-ordinated preparation informed by effective planning

Co-existence

Best use of land resources

Leadership, facilitation & co-ordination

Strong community & industry leadership

Inter & Intra Govt Co-ordination

Engagement

Industry

Peak Bodies

Interest Groups

Partnerships

Valued Resource Firm

Proactive Community

Empowered Individual Land Holders

Education

Informed Media

Informed Public

Informed Industry

Planning

Strategic Regional Planning

Monitoring and reporting

Public Disclosure

Project consultation, assessments & approvals

Genuine

Cumulative

Risk Based

Monitoring and reporting

Public Disclosure

Applied learning

On-going monitoring, evaluation and reporting of individual licenced developments

Co-ordinated approach to social, environmental and economic research into cumulative impacts

Sharing and collaboration

Sharing govt held land & property data

Multi-lateral collaboration

Evidence based, open and transparent decision making

Efficient processes

Accessible relevant information

Desired framework outcomes

Shared commitment to enabling multiple land use

Better informed public discourse

Better outcomes for communities & land holders

Merit based access to land
Conclusion

• Australia has a the grand challenge supplying food and resources to the world
• Australia is losing global market position in exploration expenditure
• It’s a global game and needs a national approach
• It’s a three legged race now