Australia’s Mineral Resources: A New Era of Exploration and Development

Dr James Johnson
Chief
Onshore Energy and Minerals Division
Geoscience Australia
### Australia’s Mineral Production and Endowment

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Production Rank</th>
<th>Resource Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauxite</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Black Coal</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Copper</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Diamonds (Industrial)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Lead</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Manganese Ore</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Nickel</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Rutile</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Silver</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Tantalum</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Uranium</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Zinc</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Zircon</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Australia’s Mineral Industry
Built on a Strong Resource Base

• Japan is a major market for Australian resources
• Major expansion in capacity - more than 41 advanced mining projects with planned capital expenditure of A$22.8 billion (Source: Australian Bureau of Agricultural and Resource Economics, ABARE)
• Australia’s diversified mineral exports underpinned by a strong resources base
• Exploration has maintained and grown resources, despite major increases in production
• Exploration opportunities with high potential for new discoveries in greenfields and brownfields provinces
Advanced Projects

- Record A$22 billion CAPEX on new mineral and energy projects in 2006-07
  - may be $30 billion in 2007-08

- 91 advanced stage projects worth A$57.9 billion
  - with 41 minerals projects (excl coal, oil and gas)

- Further 132 early stage mineral projects (excl coal, oil and gas)
  - including Olympic Dam expansion and more than 30 other base metal projects

Source: ABARE
Australian Mine Production (Cu, Zn, Ni)

Source: ABARE

Olympic Dam expansion from 2014
Australian Mine Production (Fe, Coal)

- Iron ore
- Metalurgical Coal
- Thermal Coal

Year (ending 30 June)

Source: ABARE
Australia’s Iron Ore Industry

- Iron Ore exports in 2006-07 = 257 million tonnes
- Major expansion phase with A$12 billion in capital expenditure for new mines, rail and port facilities in Western Australia
- New developments in South Australia, Northern Territory

Unloading facilities under construction, Pilbara project, Fortescue Metals Group presentation 2007
Australian Iron Ore Exploration

Over 200 projects ~48% at grassroots stage

- Record exploration
- Large range of ore types: high-grade hematite, magnetite, hematite-goethite, channel iron, detrital hematite

Source: Intierra

Over 200 projects ~48% at grassroots stage

Selected iron ore exploration projects
Australia’s Copper Industry

• Exports in 2006-07 = 1.51 Mt copper*
• A$1.4 billion capital expenditure in new mines & expansions
  – Prominent Hill, 90 kt Cu* pa, start 2008
• Proposed A$6 billion expansion at Olympic Dam – 267kt pa 2014
  – New resource 67.3 Mt Cu, 2.24 Mt U₃O₈, 2,480 t Au, 12,458 t Ag

*pit development at Prominent Hill project (Oxiana Ltd)
Advanced and Proposed Copper Projects

- Advanced
- Potential
Australian Copper Exploration

Over 770 projects ~ 48% at grassroots stage

- High level of exploration
- Strong interest in IOCG deposits (SA, Qld, NT)
- Also VMS, porphyry deposits

Source: Intierra

Selected copper exploration prospects
Australia’s Nickel Industry

• Exports = 215 kt Ni* in 2006-07
• More than A$3 billion in capital expenditure for new nickel projects
  – Will increase annual production by up to 80 kt Ni
  – Largest is Ravensthorpe (BHPB) to produce 50 kt Ni pa

*nickel content of all products
Australian Nickel Exploration

Over 500 projects ~43% at grassroots stage

Source: Intierra

Sulphide and laterite targets

Large areas of prospective Proterozoic mafic-ultramafic rocks under-explored
Australia’s Zinc-Lead Industry

• Exports 2006-07 = 2 Mt Zn*; 0.4 Mt Pb*
• Five advanced mining projects with capital expenditure of A$450 million

*concentrates
Australian Zinc-Lead Exploration

Over 530 projects ~48% at grassroots stage

High levels of exploration
Wide variety of deposit types
Mt Isa, Broken Hill, VMS, MVT
World-class deposits

Source: Intierra
Australia’s Uranium Industry

- Exports 2006-07 = 9,519 t U₃O₈
- Australia has 27 per cent of world’s uranium recoverable at less than US$80 per kg
- Honeymoon & Ranger (laterite) will add 800 t U₃O₈ to production and 10 projects at less advanced stage
- Proposed A$6 billion Olympic Dam expansion (2013?) to produce 15 kt U₃O₈ (World’s largest uranium resource)
Australian Uranium Exploration

Over 750 projects ~77% at grassroots stage

Major increase in exploration in past 2 years (SA, NT, Qld, WA)

More than 200 companies exploring

Source: Intierra
Rare Earth Element Projects and Prospects

Mt Weld pit. Lynas Corporation
Molybdenum Deposits and Prospects
Australia’s Exploration Potential

- Australia has very large mineral endowment
- Opportunities exist for further discoveries:
  - Existing terranes where only top 100 m explored
  - Margins of mineral provinces under thin cover
  - Frontier terranes where mineralisation is found in outcrop
- Diversity of commodities, mineralisation styles, terranes
- Joint Ventures are available, entry level grassroots exploration
Government Geoscience Programs To Reduce Exploration Risk

- Government assistance including advice and pre-competitive geoscience information; including
  - New geological maps
  - New generation regional datasets
  - On-line geoscience information
  - 3D geological models of mineral province based on deep crustal seismic surveys
  - Improved understanding of why deposits are where they are

- Facilitates improved target selection
- Reduced risk for explorers
Summary

• Australia has a rich, diverse mineral endowment and is a major reliable supplier of resources to the world
• Australia has a world-class resource base which, continues to grow by discovery, while production increases
• Government programs reduce risks for explorers and there is leading-edge science supporting resource exploration
• Strong exploration programs and a large number of exploration projects exist in highly prospective provinces
• Continued encouraging exploration results

• Opportunities for Japan to invest in exploration
• Australia to continue as a major supplier of resources