Gold mining in Australia: Overview

Ian Satchwell
8 July 2013
Agenda

- Australian mining geography and economy
  - Focus on Western Australia and the gold industry
- Government in Australia
- Mining and broad-based economic development
- Challenges facing the Australian gold industry
- Mining for development and Africa
Australia – States and Territories, capital cities

- Western Australia
  - Perth
  - Hon Colin Barnett (Premier of Western Australia)
  - Hon Gary Gray (Minister for Resources)
- Northern Territory
- South Australia
  - Adelaide
- Queensland
  - Brisbane
- New South Wales
  - Sydney
- Victoria
  - Melbourne
- Tasmania
  - Hon Julia Gillard (former Prime Minister)
  - Hon Bill Marmion (Minister for Mines and Petroleum)
- Australian Capital Territory
  - Canberra

The map shows the geographical distribution of states and territories within Australia, with respective capital cities and key politicians highlighted. The diagram also includes various government logos and departments from different states and territories, indicating their involvement in mining and development initiatives.
Volumes, prices & values of key exports

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2011-12</th>
<th>2012-13</th>
<th>Volume</th>
<th>World Price</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore and pellets</td>
<td>$53.2b</td>
<td>$63.0b</td>
<td>8%</td>
<td>27%</td>
<td>-16%</td>
</tr>
<tr>
<td>Metallurgical coal</td>
<td>$26.0b</td>
<td>$30.7b</td>
<td>12%</td>
<td>-28%</td>
<td>-15%</td>
</tr>
<tr>
<td>Thermal coal</td>
<td>$19.0b</td>
<td>$17.1b</td>
<td>14%</td>
<td>-11%</td>
<td>11%</td>
</tr>
<tr>
<td>Gold</td>
<td>$16.5b</td>
<td>$15.4b</td>
<td>5%</td>
<td>-4%</td>
<td>7%</td>
</tr>
<tr>
<td>LNG</td>
<td>$16.3b</td>
<td>$12.0b</td>
<td>21%</td>
<td>12%</td>
<td>36%</td>
</tr>
<tr>
<td>Crude oil</td>
<td>$13.3b</td>
<td>$13.3b</td>
<td>3%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Copper</td>
<td>$9.1b</td>
<td>$8.5b</td>
<td>10%</td>
<td>-4%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: BREE
Australia’s engineering and construction challenge – the largest investment wave since the 1800s gold rushes*

WA & NT projects to 2016: USD220 billion+

Queensland projects to 2016: USD100 billion+

Bowen and Surat Basins
Coal, CSG, LNG, infrastructure

Pilbara Region:
LNG, iron ore, infrastructure

Mid West Region
Iron ore, gold, uranium, nickel,

South West Region
Alumina, gold

South Australia projects to 2016
USD10 billion+

*Reserve Bank, Australia
Project pipeline Australia

**Exploration**
- Jinidi Iron ore
- Solomon Hub (stage II) Iron ore
- West Pilbara Iron ore
- Browse LNG
- China Stone Coal

**Publicly Announced** $121–$171+ billion
- Wandoan Coal
- Olympic Dam Copper & Gold
- Carrapateena Copper & Gold
- Anketell Point Port
- Pilbara Independent Rail

**Feasibility Stage**
- Arrow LNG
- Bonaparte FLNG
- Scarborough FLNG
- Roy Hill Iron ore
- Jack Hills (stage II) Iron ore
- Koodaideri Iron ore
- Alpha Coal
- China First Coal
- Carmichael Coal
- Paradise Phosphate

**Committed** $268 billion
- Gorgon LNG
- Ichthys LNG
- Wheatstone LNG
- Jimblebar Iron ore
- Nammuldi expansion Iron ore
- Sino Iron Project Iron ore
- Caval Ridge Coal
- Kestrel Coal
- Cape Lambert Expansion Port
- Hay Point Terminal Port

**Completed** $15 billion
- Brockman 4 Iron ore
- Chichester Hub Iron ore
- Hope Downs 4 Iron ore
- NCIG export terminal Port
- WAIO Inner Harbour Port
- Kipper (stage 1) Gas
- George Fisher Zinc & Lead
- Ensham Coal
- Cadia East Gold
- Argyle underground Diamonds

Source: BREE
# Australian gold production 2011

<table>
<thead>
<tr>
<th>Category</th>
<th>Origin</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine</td>
<td></td>
<td>258.5 t</td>
</tr>
<tr>
<td>Refined primary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian origin</td>
<td></td>
<td>203.9 t</td>
</tr>
<tr>
<td>Overseas origin</td>
<td></td>
<td>67.2 t</td>
</tr>
<tr>
<td>Refined secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian origin</td>
<td></td>
<td>4.0 t</td>
</tr>
<tr>
<td>Overseas origin</td>
<td></td>
<td>44.1 t</td>
</tr>
</tbody>
</table>

Largest markets: UK (87t) India (87t) Thailand (58t)
Gold production Australia and Western Australia
1892-2012

Source: DMP and BREE
Production of selected commodities: Australian, Western Australia, Rest of World, 2011

Source: DMP, BREE and USGS
Western Australia regions

Source: Department of Regional Development and Lands WA
Western Australia’s’s major resources projects

<table>
<thead>
<tr>
<th></th>
<th>2011-12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prospecting Licences</td>
<td>7,265</td>
<td>910</td>
</tr>
<tr>
<td>Exploration Licences</td>
<td>6,969</td>
<td>60,396</td>
</tr>
<tr>
<td>Mining Leases</td>
<td>5,897</td>
<td>2,285</td>
</tr>
<tr>
<td>Other</td>
<td>3,157</td>
<td>5,323</td>
</tr>
<tr>
<td>Mineral Claims &amp; Other 1904 Act</td>
<td>186</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23,474</strong></td>
<td><strong>68,935</strong></td>
</tr>
</tbody>
</table>

~60 operating gold mines
~ 240 total mineral and petroleum operations

Source: Department of Mines and Petroleum WA
### Value of minerals and energy production Western Australia 2011-12 (A$)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Value (A$)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>4,166,813,541</td>
<td>4%</td>
</tr>
<tr>
<td>Alumina</td>
<td>3,950,894,867</td>
<td>3.7%</td>
</tr>
<tr>
<td><strong>Gold</strong></td>
<td><strong>9,350,745,265</strong></td>
<td><strong>8.8%</strong></td>
</tr>
<tr>
<td>Iron ore</td>
<td>61,079,285,549</td>
<td>57.6%</td>
</tr>
<tr>
<td>Nickel</td>
<td>3,716,996,217</td>
<td>3.5%</td>
</tr>
<tr>
<td>Petroleum</td>
<td>23,780,648,746</td>
<td>22.4%</td>
</tr>
<tr>
<td>Condensate</td>
<td>3,842,111,571</td>
<td>3.6%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>1,454,459,941</td>
<td>1.4%</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>7,791,464,150</td>
<td>7.3%</td>
</tr>
<tr>
<td>LPG - Butane and Propane</td>
<td>734,484,653</td>
<td>0.7%</td>
</tr>
<tr>
<td>LNG</td>
<td>9,958,128,430</td>
<td>9.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$106,045,384,184</strong></td>
<td></td>
</tr>
</tbody>
</table>

Gold royalty receipts $218,918,291

### Goldfields-Esperance Region

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Value (A$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>6,038,626,673</td>
</tr>
<tr>
<td>Nickel, Platinum and Palladium</td>
<td>3,003,706,617</td>
</tr>
<tr>
<td>Cobalt and Rare Earths</td>
<td>156,244,249</td>
</tr>
<tr>
<td>Copper</td>
<td>62,186,344</td>
</tr>
<tr>
<td>Spodumene, Tantalite and Zinc</td>
<td>57,660,097</td>
</tr>
<tr>
<td>Silver</td>
<td>37,646,564</td>
</tr>
<tr>
<td>Gypsum and Lime Sand</td>
<td>15,730,488</td>
</tr>
<tr>
<td>Construction Materials and Gems</td>
<td>8,319,580</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$9,380,120,612</strong></td>
</tr>
</tbody>
</table>

Source: Department of Mines and Petroleum WA
Perth Mint Refinery

- Refines total annual production of gold in Australia
  - Plus gold dore from New Zealand, Papua New Guinea, Fiji, Thailand and Malaysia.
  - Plus gold jewellery scrap is also sourced from Asia markets.

- Refinery throughput 300 to 400 tonnes per annum

- Four refining processes:
  - chlorination electrolytic
  - gold refining
  - aqua regia digest refining
  - electrolytic silver refining

- Perth Mint laboratory
  - Fire assaying of gold and silver
  - Supply of bullion assaying consumables
  - Inductively Coupled Plasma Spectrometry analysis

Source: Perth Mint
Source: Department of Mines and Petroleum WA
Minerals and petroleum employment 2011-12
Western Australia (persons and % of total)

<table>
<thead>
<tr>
<th>Mineral Type</th>
<th>Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Ore</td>
<td>37,526</td>
</tr>
<tr>
<td>Alumina</td>
<td>10,247</td>
</tr>
<tr>
<td>Gold</td>
<td>22,439</td>
</tr>
<tr>
<td>Petroleum</td>
<td>8,705</td>
</tr>
<tr>
<td>Nickel</td>
<td>8,798</td>
</tr>
<tr>
<td>Heavy Mineral Sands</td>
<td>2,231</td>
</tr>
<tr>
<td>Other</td>
<td>15,635</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>105,581</strong></td>
</tr>
</tbody>
</table>

Largest gold mine employers

<table>
<thead>
<tr>
<th>Mining Company</th>
<th>Location</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AngloGold Ashanti</td>
<td>Sunrise Dam</td>
<td>1,111</td>
</tr>
<tr>
<td>Kalgoorlie Consolidated Gold Mines</td>
<td>Golden Mile - Super Pit</td>
<td>1,903</td>
</tr>
<tr>
<td>Newcrest Mining</td>
<td>Telfer</td>
<td>2,570</td>
</tr>
<tr>
<td>Newmont Boddington Gold</td>
<td>Boddington</td>
<td>3,402</td>
</tr>
<tr>
<td>St Ives Gold Mining Company</td>
<td>Kambalda/St Ives</td>
<td>1,825</td>
</tr>
</tbody>
</table>

Source: DMP and Petroleum Producing Companies
Agenda

- Australian mining geography and economy
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- Government in Australia
- Mining and economic development
- Challenges facing the Australian gold industry
- Mining for development and Africa
Government in Australia

- Consists of:
  - Commonwealth
  - States (six plus two Territories)
  - Local Government

- Responsibilities:
  - **Commonwealth**: international obligations and treaties; uranium mining; environmental issues of *national significance*; indigenous issues and Native Title; corporations law; tertiary education
  - **States**: mineral leases; environmental approvals and regulation; mining operational aspects (e.g. health and safety); regional planning; infrastructure provision; mineral royalties; education and training; law and order
  - **Local**: provision of services; local planning and approvals
Mining-relevant government departments

- Australian Government
  - Department of Resources, Energy and Tourism
  - Department of Sustainability, Environment, Water, Population and Communities
  - Department of Education, Employment and Workplace Relations (DEEWR)
  - Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE)

- State example - Queensland
  - Department of Natural Resources and Mines
  - Department of Environment and Heritage Protection
  - Department of State Development, Infrastructure and Planning
  - Department of Education, Training and Employment

- State example - Western Australia
  - Department of Mines and Petroleum
  - Department of Environment and Conservation
  - Department of State Development
  - Department of Education
  - Department of Training and Workforce Development
State Governments

- State Government departments are responsible for:
  - policy and regulation relating to mining and energy sectors and support new investment in these industries.
  - promoting exploration and development and overseeing environmental management and health and safety in mining and energy industries.

- State mineral and petroleum legislation provides the legislative framework for exploration, development and mining tenure:
  - exploration permit
  - mineral development licence
  - mining lease
Permits and Leases

- **Exploration permit or licence**
  - allows the holder to undertake exploration activities for a set period.
  - different exploration permits are required for minerals and for coal.

- **Mineral development licence (Queensland example)**
  - allows the holder to undertake geoscientific programs, mining feasibility studies, metallurgical testing and marketing, environmental, engineering and design studies to evaluate the development potential of the defined resource.

- **Mining lease**
  - is granted for mining operations and entitles the holder to machine-mine specified minerals and carry out activities associated with mining or promoting the activity of mining.
  - is not restricted to a maximum term—this is determined in accordance with the amount of reserves identified and the projected mine life.
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• Mining for development and Africa
Mining and related sectors in Australia are bigger than most people think

METS output is growing at 15 to 20% a year
- 4% of national output in 2002-03
- 8.4% in 2011-12

METS contribution to GDP
- 6.7% in 2010-11
- Est. 9.4% in 2012-13

Many METS are knowledge- and technology-intensive

Source: Australian Treasury and Ed Shan / Minerals Council of Australia 2012
Mining and *related sectors* in Australia are bigger than most people think (2)

Gross Value Added – Resource Economy 2011-12
Share of nominal GVA, financial year

- Resource economy accounts for 18% of GVA:
  - 11.5% directly from extraction and processing;
  - 6.5% from other sectors providing inputs

Resource employment by industry 2011-12
Share of total employment, financial year

- Resource economy accounts for 10% of employment:
  - 3.25% directly from extraction and processing;
  - 6.75% from other sectors providing inputs

Source: Rayner and Bishop, Reserve Bank of Australia February 2013
Employment growth: driven by mining, but more than just mining jobs – Western Australia example

Employment growth by industry sector 2010-2020

Australian mining employment multiplier is 3 – 4
Africa 7 – 10

Source: CCIWA: Building Western Australia’s Workforce for Tomorrow, June 2010
Australian Industry Participation in Western Australia resource projects

- Proportional spending on the construction phase of oil & gas projects (but not mining) has shifted towards overseas suppliers over the last 30 years.
- But there continues to be a very high level of Australian industry participation.
- CME/APPEA Local Content Study (2011)¹:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Construction</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>86%</td>
<td>95%</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>58%</td>
<td>83%</td>
</tr>
</tbody>
</table>

- WA State Government Local Content Report – November 2011²

<table>
<thead>
<tr>
<th>Sector</th>
<th>Construction</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining, Oil &amp; Gas</td>
<td>74%</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Publically announced local contracts July 2011 to March 2012 = A$15.5 billion³

Sources:
1: CME/APPEA Local Content Study 2011
3: Media Statement, 8 March 2012, Minister for Commerce, Hon Simon O’Brien
Taking a broad view: indirect and induced benefits

Economic output

**Direct**
- Purchasing expenditure for local goods and services
- Payments to employees

**Local manufacturer or service provider**
- Subsequent backward expenditure for local goods and services along the supply chain
- Income of supply chain employees
- Taxes paid by suppliers to the Government

**Indirect**

**Induced**
- Household consumption as direct and indirect employees spend their income within the local economy

**Local dealer**
- Income of dealer’s employees
- Taxes paid by dealer to the Government
- Household consumption as direct and indirect employees spend their income within the local economy

In Australia, for every $1 of mining revenue, 40¢ is spent on goods and services: Reserve Bank

Adapted from Saipem 2011
Kalgoorlie

- Mining town since 1900s –
  - Hosts gold, nickel sulphide and nickel laterite – long life operations and evolving industry
- Mining is the dominant employer
- Region population 45,000 (including 4,500 Indigenous)
- Initially developed mining services because of remoteness
- Now a net ‘exporter’ of mining services to other locations – approximately 200 manufacturing & services sites
Kalgoorlie factors of success

- Local, long-life customer mining operations
- Good infrastructure: industrial land, roads, energy, water, community infrastructure
- Skilled resident workforce
- Education and training institutions: WA School of Mines, Vocational Training and Education Centre
- Inter-firm networking; minimal government intervention
- Firms cooperate to win large or multidisciplinary contracts
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Challenges facing the Australian gold industry

- High construction and operating costs
  - Competition for labour and other inputs
- Maintaining exploration to grow resources
- Prices are softening
Australian exploration projects

Number of exploration projects by stage of development

Source: Geoscience Australia
Australia’s market share of global production
Change in market share, percent of world production

<table>
<thead>
<tr>
<th>Mineral</th>
<th>1960-2000 - substantial share gains</th>
<th>2000 to 2010 – share loss or stagnation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauxite</td>
<td>38%</td>
<td>-7%</td>
</tr>
<tr>
<td>Uranium</td>
<td>15%</td>
<td>-8%</td>
</tr>
<tr>
<td>Iron ore</td>
<td>15%</td>
<td>-1%</td>
</tr>
<tr>
<td>Nickel</td>
<td>13%</td>
<td>-3%</td>
</tr>
<tr>
<td>Gold</td>
<td>8%</td>
<td>-1%</td>
</tr>
<tr>
<td>Coal*</td>
<td>5%</td>
<td>-1%</td>
</tr>
<tr>
<td>Copper</td>
<td>4%</td>
<td>-1%</td>
</tr>
</tbody>
</table>

Competitiveness of Australian mines – cash operating costs: percent of production by cost curve quartile

<table>
<thead>
<tr>
<th></th>
<th>Copper</th>
<th>Nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1.76</td>
<td>0.47</td>
</tr>
<tr>
<td>2012</td>
<td>2.14</td>
<td>0.48</td>
</tr>
</tbody>
</table>

- **Copper**
  - 2005: 37%
    - 47%
    - 11%
    - 6%
  - 2012: 48%
    - 21%
    - 25%
    - 6%

- **Nickel**
  - 2008: 31%
    - 32%
    - 38%
    - 6%
  - 2012: 42%
    - 39%
    - 19%

Source: AME; Brook Hunt
## Australian resources growth 1977-2010, and world rankings

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Total production</th>
<th>Growth in resources cf. production*</th>
<th>Resources# World ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore</td>
<td>5,000 Mt</td>
<td>6.8x</td>
<td>2</td>
</tr>
<tr>
<td>Black coal</td>
<td>8,000 Mt</td>
<td>22x</td>
<td>5</td>
</tr>
<tr>
<td>Gold</td>
<td>6,000 t</td>
<td>3.2x</td>
<td>1</td>
</tr>
<tr>
<td>Copper</td>
<td>16 Mt</td>
<td>8.3x</td>
<td>3</td>
</tr>
<tr>
<td>Nickel</td>
<td>5 Mt</td>
<td>9.4x</td>
<td>1</td>
</tr>
<tr>
<td>Zinc</td>
<td>31 Mt</td>
<td>2.2x</td>
<td>1</td>
</tr>
</tbody>
</table>

* All categories:- Measured + Indicated + Inferred Resources
# Economic Demonstrated Resources (EDR)

Sources:
- Resources - Geoscience Australia
- Production - Australian Bureau of Agricultural and Resource Economics
Quarterly gold prices

The price of gold had its steepest fall in over 30 years when it plunged 12 per cent in a single week in mid-April 2013: BREE
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Mining for Development Initiative

IM4DC A KEY ELEMENT

MINING FOR DEVELOPMENT

IM4DC  Country/region programs  Extractive Industries Transparency Initiative (EITI)  Government to government partnerships  Community and social development  Advanced degree scholarships
IM4DC

Build *skills* and *capability* within government, universities, research institutions and civil society organisations to bring about:

- **Improved policies, practices and legislation**
- **Improved knowledge of resources base**
- **An ability to continue to build local capacity in mining governance**

How? Short courses, workshops, conferences, study tours, research, fellowships, institutional partnerships
International Mining for Development Centre

IM4DC

BUILDING CAPACITY

The University of Western Australia
Energy and Minerals Institute

IM4DC Board

The University of Queensland
Sustainable Minerals Institute

Australian Government
AusAID Mining for Development Initiative

Delivery Partners

IM4DC

KEY THEMES

Governance and regulation
Community and environmental sustainability
Operational effectiveness

TARGET OUTCOMES

IM4DC alumni and partner institutions achieving transformational change through leadership in mining for development
Leveraging Australia’s Mining Expertise

IM4DC COURSES AND ACTIVITIES

- Geodata
- Minerals and energy policy
- Resource governance
- Licensing and agreements
- Indigenous agreement-making
- Community engagement
- Local content
- Regional development
- Infrastructure planning and delivery
- Revenue design
- Mine waste management
- Mine closure and post mining land use
- Environmental and water management
- Occupational health and safety

Activities cover the mining life cycle and all elements of mining for development
IM4DC Achievements
SUCCESSFUL CAPACITY-BUILDING

900 participants from 36 developing countries

20 action research projects target priority needs

5,000 participant training days boosted mining for development knowledge and expertise

30% female participation in the IM4DC program

11 fellowships hosted in Australia

700+ delegates attended two international conference events
Where IM4DC is working

African countries serviced by IM4DC include:
Congo, Mali, Morocco, Niger, Nigeria, Burkina Faso, Ethiopia, Guinea, Cote d’Ivoire, Gabon, Uganda, South Africa, Kenya, Malawi, Cameroon, Tanzania, Sierra Leone, Senegal, Namibia, Madagascar

Locations of peer partner institutions

Multi year engagement with governments and institutions

Participation in courses, research

Possible future priority engagement