Minerals supply for new technology and world development: Dr Andrew Heap, Geoscience Australia

Queensland Resources and investment overview: Mr Tony Knight, Geological Survey of Queensland

Resources sector overview and investment opportunities in Australia’s Northern Territory: Ms Dorothy Close, Director Regional Geoscience, Northern Territory Government

Western Australia, the Source of Japan’s Critical Minerals: Dr Gaomai Trench, Department of Mines, Industry Regulation and Safety

Australia Minerals, realise the opportunity: Mr Rohan Cobcroft, Geological Survey of South Australia

Minerals investment opportunities in Tasmania: Dr Andrew McNeill, Mineral Resources Tasmania
Minerals supply for new technology and world development

Dr Andrew Heap, Geoscience Australia
A Strong Australian Resources Sector – a Government Focus

Major Markets for Australian Mineral and Energy Exports 2018 (A$ billion)

82% A$249 b

8% A$144 b

>1% Direct

72% A$249 b

EU  INDIA  SOUTH KOREA  JAPAN  CHINA

Export Goods

GDP

Employment

AUSTRALIA MINERALS
# Australia: a Wealth of Resources

Australia is a Mining Nation

## Exploration

**Production, resources and exploration**

**Resources (demonstrated and inferred) and exploration**

**Critical Minerals**

- **Hydrogen** (H)
- **Lithium** (Li)
- **Beryllium** (Be)
- **Sodium** (Na)
- **Magnesium** (Mg)
- **Potassium** (K)
- **Calcium** (Ca)
- **Scandium** (Sc)
- **Titanium** (Ti)
- **Vanadium** (V)
- **Chromium** (Cr)
- **Manganese** (Mn)
- **Iron** (Fe)
- **Cobalt** (Co)
- **Nickel** (Ni)
- **Copper** (Cu)
- **Zinc** (Zn)
- **Germanium** (Ge)
- **Arsenic** (As)
- **Selenium** (Se)
- **Tellurium** (Te)
- **Iodine** (I)
- **Xenon** (Xe)

- **Lanthanides**
- **Actinides**
- **Thorium** (Th)
- **Protactinium** (Pa)
- **Uranium** (U)

**300+**
Australia is a Mining Nation

Australia: a Wealth of Resources

| 1 | H | Hydrogen | Production, resources and exploration |
| 2 | He | Helium |
| 3 | Be | Beryllium | Exploration |
| 4 | B | Boron |
| 5 | C | Carbon | Resources (demonstrated and inferred) and exploration |
| 6 | N | Nitrogen |
| 7 | O | Oxygen |
| 8 | F | Fluorine |
| 9 | Ne | Neon |
| 10 | Si | Silicon |
| 11 | Na | Sodium |
| 12 | Al | Aluminium |
| 13 | P | Phosphorus |
| 14 | S | Sulfur |
| 15 | Cl | Chlorine |
| 16 | Ar | Argon |
| 17 | K | Potassium |
| 18 | Ca | Calcium |
| 19 | Sc | Scandium |
| 20 | Ti | Titanium |
| 21 | V | Vanadium |
| 22 | Cr | Chromium |
| 23 | Mn | Manganese |
| 24 | Fe | Iron |
| 25 | Co | Cobalt |
| 26 | Ni | Nickel |
| 27 | Cu | Copper |
| 28 | Zn | Zinc |
| 29 | Ga | Gallium |
| 30 | Ge | Germanium |
| 31 | As | Arsenic |
| 32 | Se | Selenium |
| 33 | Br | Bromine |
| 34 | Kr | Krypton |
| 35 | Rb | Rubidium |
| 36 | Sr | Strontium |
| 37 | Y | Yttrium |
| 38 | Zr | Zirconium |
| 39 | Nb | Niobium |
| 40 | Mo | Molybdenum |
| 41 | Tc | Technetium |
| 42 | Ru | Ruthenium |
| 43 | Rh | Rhodium |
| 44 | Pd | Palladium |
| 45 | Ag | Silver |
| 46 | Cd | Cadmium |
| 47 | In | Indium |
| 48 | Sn | Tin |
| 49 | Sb | Antimony |
| 50 | Te | Tellurium |
| 51 | I | Iodine |
| 52 | Xe | Xenon |
| 53 | Cs | Caesium |
| 54 | Ba | Barium |
| 55 | La | Lanthanum |
| 56 | Ce | Cerium |
| 57 | Pr | Praseodymium |
| 58 | Nd | Neodymium |
| 59 | Pm | Promethium |
| 60 | Sm | Samarium |
| 61 | Eu | Europium |
| 62 | Gd | Gadolinium |
| 63 | Tb | Terbium |
| 64 | Dy | Dysprosium |
| 65 | Ho | Holmium |
| 66 | Er | Erbium |
| 67 | Tm | Thulium |
| 68 | Yb | Ytterbium |
| 69 | Lu | Lutetium |
| 70 | Hf | Hafnium |
| 71 | Ta | Tantalum |
| 72 | Re | Rhenium |
| 73 | Os | Osmium |
| 74 | Ir | Iridium |
| 75 | Pt | Platinum |
| 76 | Au | Gold |
| 77 | Hg | Mercury |
| 78 | Tl | Thallium |
| 79 | Pb | Lead |
| 80 | Bi | Bismuth |
| 81 | Po | Polonium |
| 82 | At | Astatine |
| 83 | Rn | Radon |
| 84 | Fr | Francium |
| 85 | Ra | Radium |
| 86 | Ac | Actinium |
| 87 | Th | Thorium |
| 88 | U | Uranium |
| 89 | Np | Neptunium |
| 90 | Pu | Plutonium |
| 91 | Am | Americium |
| 92 | Cm | Curium |
| 93 | Bk | Berkelium |
| 94 | Cf | Californium |
| 95 | Es | Erbium |
| 96 | Fm | Mendelevium |
| 97 | Md | Mendeleevium |
| 98 | No | Lutetium |

Australia has a wealth of resources, including minerals and metals that are critical for various industries. The country is known for its rich mining sector, which includes gold, iron ore, copper, and coal. The mining industry is a significant contributor to the country's economy, and Australia is one of the world's leading producers of these minerals.
Australia: a Wealth of Resources

Australia is a Mining Nation

Production, resources and exploration

Resources (demonstrated and inferred) and exploration

Production, resources and exploration

Exploration

Critical Minerals

AUSTRALIA MINERALS

300+
New Energy Systems and Technologies

Increase in world production of selected battery minerals from 2000 to 2017

Cobalt: 330%
Lithium: 307%
Manganese: 220%
Graphite: 210%
Vanadium: 186%
Nickel: 168%

Source: Critical Minerals in Australia, Mudd et al, 2019
Copper Demand Increasing

Similar trends for other minerals

Cumulative copper production for all history (1000 BC to 2016 AD) = 687 Mt Cu

Forecast cumulative demand over next 26 years (2017-2042) = 689 Mt Cu

Historic Demand
Average growth rate of 3.2% pa over last 25 years

Forecast Demand
Based on 1.8% pa growth

Source: MinEX Consulting © June 2017 based on historical data from USGS and the Australian Department of Industry
Critical Minerals Opportunities in Australia
Growth for Major Commodities

Sn to Al
32% to 148%
2010 - 2017

Copper for future transport

25 kg
50 kg
75 kg
Geoscience Data to Aid Resources

80% More to Explore

Geophysical Acquisition Programs, current activities
- Airborne magnetic and radiometric survey
- Gravity survey
- Airborne electromagnetic survey
- Magnetotelluric survey
- Airborne test site
  - AEM survey, Thomson
  - Gravity survey, Thomson
  - Seismic reflection survey, Lachlan
    - AusLAMP survey, completed and in progress
    - AusLAMP survey, planned

NOTE: The grayscale background represents aeromagnetic data (0.5 first vertical derivative of total magnetic intensity).
Exploring for the Future ($100.5 million, 2016–2020)

Current and planned EFTF activities (September 2019)

1. Groundwater survey, East Kimberley
2. Groundwater survey, Northern Stuart Corridor
3. Groundwater survey, Southern Stuart Corridor
4. Groundwater survey, Upper Burdekin
5. AusAEM survey, Tanami to Pilibara
6. Geophysical surveys and stratigraphic drilling, East Tennant
7. AusARRAY survey, west Alice Springs
8. Hydrogeochemistry sampling, Tennant Creek and South Nicholson
9. AusLAMP survey, west Alice Springs
10. Seismic survey, Kidson Sub-basin
11. Solid geology mapping, northern Australia wide
12. Isotopic Atlas of northern Australia
13. Seismic survey, Barkly region
14. Waukarly early stratigraphic drilling
15. Ground gravity survey, Southwest McArthur Basin
16. Proposed stratigraphic drilling, South Nicholson
Base-Metal Deposits Related to Deep-Earth Boundaries

Source: Czarnota et al. http://doi.org/10.31223/osf.io/2kjvc
Better Focus for Mineral Exploration

Net Present Day Value (AUD$M) of Tennant Creek-style IOCG deposit (4 Mt @ 2% Cu, 3 g/t Au)
World’s Largest Airborne Electromagnetic Survey (AusAEM)

![Map showing AusAEM survey areas](map.png)

- Eromanga Basin
- Mount Isa Inlier
- Tanami Fault
Decision Support and Assessment Tools

Exploring for the Future (Beta)

eftf.ga.gov.au
New Value in Northern Australia

eftf.ga.gov.au

Pennant Resources (DGR Global)
Strategic Energy Resources
Inca Minerals

Laramide Resources

Castillo Copper

Anglo American

AUSTRALIA MINERALS
Summary of Opportunities

- Australia is very prospective for a wide range of minerals.
- Australia is a reliable and responsible supplier of minerals to the world.
- Australians are expert miners and there are many opportunities to discover and develop new deposits that will meet increased mineral demand in the future.
- Geoscience Australia is helping to target investment with its world-leading, geoscience data acquisition programs across the country.
- Geoscience Australia provides easy access to the data with innovative tools to aid decision making.
Australia Minerals
www.australiaminerals.gov.au

- Australia Minerals: Australia’s geological agencies working together to attract minerals investment.
  - Expert scientists and regulators who understand Australia
  - Trade and investment specialists that can connect you with the
  - Right people and projects

- Australia Minerals builds on Australia’s reputation for successful mineral discovery and mining and makes it easier to invest.
Queensland Resources and investment overview

Tony Knight
Chief Government Geologist
Department of Natural Resources, Mines and Energy
October 2019
Queensland
Our advantage

• Outstanding mineral & energy endowment
• Long-standing & reliable supplier
• Strong infrastructure network
• Efficient & advanced operations
• Strong research & development capacity
• Ethical supply credentials
Queensland Resource Endowment

Industrial
- Base & precious metals
- Metallurgical coal
- Bauxite

Energy
- Thermal coal
- Gas
- LNG

Technology
- Cobalt
- Vanadium
- Rare Earth Elements
- ....many “Critical Minerals”
Queensland
Industrial - Base & Precious metals

Copper, Lead, Zinc (Mount Isa – North West Minerals Province)
- 0.38 Mt Cu, 0.54 Mt Pb, 1.30 Mt Zn produced in Qld, 2017-2018
  - Mostly derived from the North West Minerals Province
- Glencore (Mt Isa, Ernest Henry) and South 32 (Cannington)
- 93,800 km$^2$ of granted exploration tenure throughout the area (29% of Province)

Gold and Silver
- Gold – 24.6 tonnes Au produced in Qld, 2017-2018
  - Mount Carlton, Mount Rawdon, Ernest Henry (Evolution), Ravenswood (Resolute)
- Silver – Cannington (South 32) 17.38 tonnes Ag in 17-18
Queensland

Industrial – Coking coal & bauxite

**Metallurgical coal (Bowen Basin)**
- 147 projects currently on foot (96 hard coking, 30 PCI, 21 thermal)
- Major new developments >5Mtpa saleable product – Olive Downs, Winchester South, Byerwen, Saraji East...
- Fort Cooper Coal Measures being trialled as new coking coal resource

**Bauxite**
- Amrun project to increase Rio Tinto Weipa output by 10 Mtpa (to 35 Mtpa)
- Bauxite Hills project - Metro Mining – increasing to 6 Mtpa by 2021
Queensland

Energy

**Thermal coal**
- **Surat Basin** - 14 projects on foot
  - Cameby Downs approved, New Acland awaiting decision
- **Galilee Basin** - 17 projects on foot
  - Adani approved, other projects now likely to be advanced

**Gas**
- Qld releasing more land for exploration and development
- Government focus on increasing supply to domestic and export markets
- Strong interest from industry explorers

**LNG export**
- Export volumes forecast to increase
- Qld now connected to Northern Territory (via Jemena pipeline)
Queensland
Technology minerals

**Renewable energy minerals**
- Advanced projects – cobalt, vanadium, graphite, nickel
- Federal & State Government focus on developing new supply chains
- Strong interest from industry explorers
- Ethical supply source

**Advanced technology minerals**
- Strong potential to expand production of molybdenum, scandium, tungsten etc
- Known REE resources ripe for development and strong pipeline of greenfields projects
# Australia Minerals

## Queensland

### Renewable energy minerals

<table>
<thead>
<tr>
<th>Element</th>
<th>Mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag</td>
<td>Silver</td>
</tr>
<tr>
<td>Al</td>
<td>Aluminium</td>
</tr>
<tr>
<td>C</td>
<td>Graphite</td>
</tr>
<tr>
<td>Cd</td>
<td>Cadmium</td>
</tr>
<tr>
<td>Co</td>
<td>Cobalt</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
</tr>
<tr>
<td>Fe</td>
<td>Iron</td>
</tr>
<tr>
<td>Ga</td>
<td>Gallium</td>
</tr>
<tr>
<td>Ge</td>
<td>Germanium</td>
</tr>
<tr>
<td>In</td>
<td>Indium</td>
</tr>
<tr>
<td>Li</td>
<td>Lithium</td>
</tr>
<tr>
<td>Mn</td>
<td>Manganese</td>
</tr>
<tr>
<td>Mo</td>
<td>Molybdenum</td>
</tr>
<tr>
<td>Ni</td>
<td>Nickel</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
</tr>
<tr>
<td>REE</td>
<td>Rare Earth Elements</td>
</tr>
<tr>
<td>Sc</td>
<td>Scandium</td>
</tr>
<tr>
<td>Se</td>
<td>Selenium</td>
</tr>
<tr>
<td>Si</td>
<td>Silicon</td>
</tr>
<tr>
<td>Sn</td>
<td>Tin</td>
</tr>
<tr>
<td>Te</td>
<td>Tellurium</td>
</tr>
<tr>
<td>Ti</td>
<td>Titanium</td>
</tr>
<tr>
<td>V</td>
<td>Vanadium</td>
</tr>
<tr>
<td>W</td>
<td>Tungsten</td>
</tr>
<tr>
<td>Y</td>
<td>Yttrium</td>
</tr>
<tr>
<td>Zn</td>
<td>Zinc</td>
</tr>
</tbody>
</table>

Known resource in Qld
Queensland’s Technology Metal Endowment

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Contained metal (tonnes)</th>
<th>JORC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina</td>
<td>3,596,160,440</td>
<td>✓</td>
</tr>
<tr>
<td>Cobalt</td>
<td>199,690</td>
<td>✓</td>
</tr>
<tr>
<td>Copper</td>
<td>18,260,175</td>
<td>✓</td>
</tr>
<tr>
<td>Graphite</td>
<td>2,321,200</td>
<td>✓</td>
</tr>
<tr>
<td>Indium</td>
<td>6.7</td>
<td>Historical</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>1,069,830</td>
<td>✓</td>
</tr>
<tr>
<td>Nickel</td>
<td>1,200,520</td>
<td>✓</td>
</tr>
<tr>
<td>REE + Yttrium</td>
<td>320,060*</td>
<td>Mixed</td>
</tr>
<tr>
<td>Rhenium</td>
<td>245</td>
<td>✓</td>
</tr>
<tr>
<td>Scandium</td>
<td>5,505</td>
<td>✓</td>
</tr>
<tr>
<td>Tin</td>
<td>61,720</td>
<td>✓</td>
</tr>
<tr>
<td>Tungsten</td>
<td>129,240</td>
<td>✓</td>
</tr>
<tr>
<td>Vanadium</td>
<td>15,987,330</td>
<td>✓</td>
</tr>
<tr>
<td>Zinc</td>
<td>60,038,600</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Includes non-JORC estimate of up to 200,000 tonnes REE in tailings at Mary Kathleen
Queensland
Technology minerals – Research and Development

Defining new opportunities

• REE in phosphates
  – Qld has 1500Mt phosphate resources
  – Some deposits with REE (Korella), but unknown for most

• Joint research program with James Cook University to understand REE in sedimentary basins

• Cobalt in copper mine tailings
  – Qld’s giant Cu deposits have Co affinities (e.g. Mt Isa), but Co is not currently produced
Queensland
Technology minerals – Strategy and Policy

**Government**
- Qld’s Critical Minerals Action Plan in development
  - Establishing new supply chains
  - Identification of opportunities for investment
  - Analyse barriers to development and production
- Qld leads the COAG sub-group on critical minerals
- Qld Minerals R&D Roadmap

**Support for Industry**
- Collaborative Exploration Initiative Funding for critical minerals projects
- Data-driven exploration initiatives
  - Data 61 machine learning exploration trial
  - GSQ’s world-leading data modernisation project and data lake
- Streamlining of regulatory processes
- ‘Fast-track’ process for critical minerals projects
INDICATIVE TIMELINES

**MYFER**

**BETTER DATA AND R&D**
- Mine data to find new deposits
- Break down barriers to data

**MORE EXPLORATION**
- Hidden value
- Phosphate deposits

**NEW PROJECTS SOONER**
- Bring forward high potential projects
- Queensland - the new destination for new economy minerals

**BUDGET 2020-21**
- Evidence-based projects & policy development
- Maximise Industry-government collaborative exploration
- Targeting strategic and ethical investors

**Data Lake Complete**
- Geoscience data modernisation project (Data Lake)
- Analyse project pipeline to determine government's future role
- Old mines, new minerals

**LATE 2019**

**MID 2020**

**LATE 2020**

NEW PROJECTS SOONER:
- Evidence-based projects & policy development
- Analyse project pipeline to determine government's future role
- Targeting strategic and ethical investors

MORE EXPLORATION:
- Hidden value
- Phosphate deposits
- Maximise Industry-government collaborative exploration
- Old mines, new minerals

BETTER DATA AND R&D:
- Mine data to find new deposits
- Break down barriers to data
- Geoscience data modernisation project (Data Lake)
Queensland

674 resource companies listed on the Australian Stock Exchange - Q2, 2019

<table>
<thead>
<tr>
<th>Market Cap $M</th>
<th>Gross Cash $M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Q2 19</td>
</tr>
<tr>
<td>&gt; $100M</td>
<td>71</td>
</tr>
<tr>
<td>$50 - $100M</td>
<td>59</td>
</tr>
<tr>
<td>$20 - $50M</td>
<td>129</td>
</tr>
<tr>
<td>$10 - $20M</td>
<td>110</td>
</tr>
<tr>
<td>$5 - $10M</td>
<td>125</td>
</tr>
<tr>
<td>$2 - $5M</td>
<td>135</td>
</tr>
<tr>
<td>&lt; $2M</td>
<td>54</td>
</tr>
</tbody>
</table>

“Micro-cap” juniors dominate the sector:
• 553 – 82% - have market capitalisation of less than $50 million, and
• 550 – 82% - have less than $5M cash on hand

Queensland

Mineral Explorers in Queensland

- **Majors**: 7 companies (> $10 billion market cap)
- **Mid tier**: 9 companies ($10 billion - $100 million market cap)
- **Juniors**: ~530 entities ($100 million to $0 market cap, incl unlisted)
Queensland

Majors:
- Glencore, Anglo American, Rio Tinto, South 32, Newcrest
- Established capability, business developers

Mid-caps:
- Oz Minerals, New Century, Evolution…
- Innovative and active business developers

Juniors (<$100M)
- 97% Qld exploration companies
- Rich source of opportunity
- Need investor/customer support
Queensland

New Opportunity:
• Most promising former mine sites with significant remaining mineral endowment

• Holders looking for partners to re-commercialise

<table>
<thead>
<tr>
<th>Site</th>
<th>Commodity</th>
<th>Existing Resource</th>
<th>JORC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolfram Camp</td>
<td>W, Mo</td>
<td>2.4Mt @ 0.3 % WO₃, 0.08 % MoS₂</td>
<td>✓</td>
</tr>
<tr>
<td>Baal Gammon</td>
<td>Ag, Cu, (Sn, In)</td>
<td>2Mt @ 33 g/t Ag, 0.8 % Cu</td>
<td>✓</td>
</tr>
<tr>
<td>Mount Morgan</td>
<td>Au, Cu</td>
<td>9.9Mt @ 1.19 g/t Au, 0.16 % Cu</td>
<td>✓</td>
</tr>
<tr>
<td>Horn Island</td>
<td>Au</td>
<td>7.96 Mt @ 1.9 g/t Au</td>
<td>✓</td>
</tr>
<tr>
<td>Mount Chalmers</td>
<td>Cu, Ag, Zn, Pb, Au</td>
<td>3.55Mt @ 1.26 % Cu, 8.49 g/t Ag, 0.85 g/t Au and 2.88Mt @ 0.5 % Zn, 0.2 % Pb</td>
<td>✓</td>
</tr>
<tr>
<td>Greenvale Nickel</td>
<td>Ni, Co, Sc</td>
<td>89Mt @ 0.58 % Ni, 0.07 % Co</td>
<td>✓</td>
</tr>
<tr>
<td>Mary Kathleen</td>
<td>U, REE</td>
<td>5.5-7.5Mt @ 2-4 % LREO, 0.006-0.012 % U₃O₈, 0.015-0.03 % ThO₂</td>
<td>×</td>
</tr>
<tr>
<td>Ruddygore</td>
<td>Cu</td>
<td>10Mt @ 0.4 % Cu</td>
<td>×</td>
</tr>
<tr>
<td>Mount Oxide</td>
<td>Cu, Co</td>
<td>15.9Mt @ 1.4 % Cu, 8.3 g/t Ag and 4.5Mt @ 0.14 % Co</td>
<td>✓</td>
</tr>
</tbody>
</table>
Queensland

- Multiple avenues & events to connect to explorers, developers and service providers in Queensland

- Queensland cooperative agreement with JOGMEC renewed 2019

- Peak Bodies:
  - Queensland Resources Council
  - Queensland Exploration Council
  - Association of Mining and Exploration Companies
Queensland – coal overview

- There are 3 main coal basins in Queensland:
  - Bowen Basin
  - Surat Basin
  - Galilee Basin

- There are ~30 advanced coal projects in Queensland:
  - 20 Greenfields or new projects
  - 10 Brownfields extensions or expansions
  - 25 are in the Bowen Basin.
# Queensland coal – all projects

<table>
<thead>
<tr>
<th>Basin</th>
<th>No. of projects</th>
<th>Coal type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowen</td>
<td>147</td>
<td>Met, PCI and Thermal</td>
<td></td>
</tr>
<tr>
<td>Callide</td>
<td>1</td>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Clarence Moreton</td>
<td>2</td>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Galilee</td>
<td>16</td>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Laura</td>
<td>1</td>
<td>Met</td>
<td>Coastal location</td>
</tr>
<tr>
<td>Maryborough</td>
<td>1</td>
<td>Met</td>
<td>Coastal location</td>
</tr>
<tr>
<td>Moorlands</td>
<td>2</td>
<td>Thermal</td>
<td>Blair Athol equivalent</td>
</tr>
<tr>
<td>Mulgildie</td>
<td>2</td>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Surat</td>
<td>14</td>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Styx</td>
<td>3</td>
<td>Met</td>
<td>Coastal location</td>
</tr>
</tbody>
</table>
189 projects on foot
- 147 in Bowen Basin (78%)
- 66 companies active

Bowen Basin projects
- 32 underground
- 115 open-cut and/or underground
- Increasing interest in Fort Cooper Coals as possible new met coal resource
Queensland: More information

Trade & Investment Queensland

Tokyo:
  **Tak Adachi**  
  Queensland Trade and Investment Commissioner – Japan  
  Tak.Adachi@tiq.qld.gov.au

Brisbane
  **Ross Buchanan**  
  Global Investment Commissioner  
  Ross.Buchanan@tiq.qld.gov.au

Geological Survey of Queensland

**Tony Knight**  
Chief Government Geologist  
Tony.Knight@dnrme.qld.gov.au

**Dr Helen Degeling**  
Director – Minerals Geoscience  
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Resources sector overview and investment opportunities in Australia’s Northern Territory

Dorothy Close, Director Regional Geoscience, Northern Territory Government

Japan-Australia Mineral Investment Seminar 2019
The Territory’s resources industry

- Six major operating mines
- Record levels of mineral production: $4.49B in 2017/18
- Major exporter of LNG
- Darwin LNG (Conoco Phillips) and Ichthys LNG (Inpex) – combined production 12.6 Mtpa contributing to > 10% Japan’s LNG imports
The Territory's pipeline of mining projects

- Final approvals/finance
  - Mount Bundey Au
  - Nolans REE-P
  - Mount Todd Au
  - TNG TIVAN plant
  - Molyhil W-Mo
  - Spring Hill Au
  - Bigrlyi U
  - Central Tanami Au
  - Oberon Au
  - BP33 Li
  - Karinga potash

- Notice of intent/feasibility
  - Wonarah P
  - Roper Valley Fe
  - Woolwonga Au
  - Teena Zn
  - Angularli U
  - Other Finniss Li
  - Maud Creek Au

- JORC resources
  - Jervois Cu-Ag
  - Mount Peake V-Ti-Fe
  - Tellus salt
  - Mount Porter Au
  - Bigrlyi U
  - Central Tanami Au
  - Oberon Au
  - BP33 Li
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Sustained growth in mineral exploration expenditure

NT mineral exploration expenditure since 2000

Annual exploration calculated quarterly

2011 - $228.4M
2018/19 - $131.9M
2016/17 - $78.4M
2003 - $41.5M

Gold
Mineral exploration activity - commodities

- Key commodities are copper, zinc, gold, lithium and uranium
- Other main commodities for exploration and developing projects: potash, phosphate, vanadium, rare earths, salt, tungsten, magnesium
- Many projects seeking partners for joint ventures, equity investment, project finance, construction and/or offtake
Investment opportunities

The NT Government has compiled information on minerals and energy projects seeking investment, including 10 advanced projects, and numerous early stage exploration projects.

- uranium
- rare earths
- copper
- gold
- phosphate
- zinc-lead
- magnesium
- potash
- vanadium
- titanium
- tungsten
- lithium
Commodity highlights: Copper-zinc-lead-silver

KGL Resources – *Jervois Cu-Ag*

Increased resource definition

- 26.6 Mt @ 1.47% Cu, 24.7 g/t Ag containing 390 600 t copper & 21.1 Moz silver
- In final phase of environmental approvals
- Orebodies remain open along strike and at depth
- Seeking off-take agreement or sale of minority interest
Commodity highlights: Copper-zinc-lead-silver

Todd River Resources – Mount Hardy

Project advancing from discovery to resource definition

- New zinc-rich discovery at Hendrix: Maiden Resource (July 2019): 2.6 Mt @ 6.7% Zn, 0.9% Cu, 1.5% Pb, 35 g/t Ag (10.5% ZnEq)
- Ongoing exploration to increase resources

- Adjacent to road infrastructure & newly commissioned Tanami gas pipeline
Battery commodity highlights: Lithium

Core Exploration – **Finniss project**

Grants and BP33: JORC Resource **9.63 Mt @ 1.3% Li₂O**

- 500% increase in resource base (since 2018)
- Definitive Feasibility Study released in April 2019
- Located close to grid power, gas, rail & Darwin export port
- In advanced stages of mining approvals
- Ongoing exploration to increase resources

- Binding agreements in place for 50% of Li concentrate
- Seeking further offtake agreements or sale of minority interest
Battery commodity highlights: Vanadium-titanium

TNG Ltd – Mount Peake

- 160 Mt resource grading 0.28% $V_2O_5$, 5.3% $TiO_2$, 23% Fe
- Processing plant in Darwin to produce premium (> 96%) battery grade vanadium pentoxide, titanium pigment & high purity iron oxide pellets
- All approvals granted for mine site, awaiting environmental approval for processing site
- Seeking major partner for equity and/or offtake agreements
Battery commodity highlights: REEs

Arafura Resources Ltd - Nolans

- Apatite vein-hosted deposit 56 Mt @ 2.6% REO, 11% P₂O₅, rich in high-value Nd and Pr
- Definitive feasibility study completed

- Proposed annual production of 13 343t TREO plus 135 800tpa of merchant-grade P₂O₅
- Approvals for extraction facility in place
- Approvals for extraction facility in place
- Seeking minority equity investment, JV or offtake agreement
Battery commodity highlights: Cobalt

Northern Cobalt Ltd: *Wollogorang project*

**Stanton deposit** - JORC resource
942,000t @ 0.13% Co, 0.06% Ni, 0.12% Cu

- Significant drilling results:
  - 20m at 0.31% Co
  - 37m at 0.28% Co, 0.12% Cu, 0.16% Ni
  - 18m at 0.33% Co, including 1m at 2.13% Co

- Numerous cobalt exploration targets being drilled & deeper mineralisation identified

- Seeking equity investors, farm-in or JV partners
NT Government support for exploration

- **Resourcing the Territory** - 4 year (2018-2022), $26 million NT Government initiative to grow the exploration sector
- Geoscience Australia committing A$100 million to new geoscience for exploration in northern Australia from 2016-2020
- Significant Territory and Federal government investment in new geoscience
- Co-funding of selected industry greenfields drilling and geophysical programs
- World-class geoscience data and advice
Information for investors

- Promote NT minerals and energy projects to potential investors in Japan
- Take industry delegations to meet investors overseas
- Hosting inbound delegations from Japan with customised visit programs
- Facilitation assistance with regulatory processes

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Thank you
Western Australia
The Source of Japan's Critical Minerals

Gaomai Trench
Manager Resource Investment Information
Department of Mines, Industry Regulation and Safety
<table>
<thead>
<tr>
<th>WA</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 million square kilometres</td>
<td>0.378 million square kilometres</td>
</tr>
<tr>
<td>2.6 million people</td>
<td>126.3 million people</td>
</tr>
<tr>
<td>About 6.6 times of Japan land area</td>
<td>(Tokyo – 13.8 million)</td>
</tr>
<tr>
<td>About 2% of Japan population</td>
<td></td>
</tr>
</tbody>
</table>
Western Australian Merchandise Exports 2018
Total: $144.85 billion

- Mineral and petroleum exports: 91%
- Other WA Exports: 9%

Western Australian Mineral and petroleum exports 2018
Total: $131.4 billion

- Iron ore: 47%
- Gold: 13%
- Petroleum: 26%
- Mineral sands: 1%
- Nickel: 2%
- Base metals: 7%
- Alumina: 2%
- Other *: 2%
Japan is the 2nd export destination in 2018.

Western Australian merchandise exports by country 2018

<table>
<thead>
<tr>
<th>Country/Area</th>
<th>Export Value (A$ million)</th>
<th>Share Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 China</td>
<td>$68,417</td>
<td>47.2%</td>
</tr>
<tr>
<td>2 Japan</td>
<td>$23,139</td>
<td>16.0%</td>
</tr>
<tr>
<td>3 Korea</td>
<td>$8,613</td>
<td>5.9%</td>
</tr>
<tr>
<td>4 Hong Kong</td>
<td>$6,977</td>
<td>4.8%</td>
</tr>
<tr>
<td>5 Singapore</td>
<td>$6,225</td>
<td>4.3%</td>
</tr>
<tr>
<td>6 India</td>
<td>$3,412</td>
<td>2.4%</td>
</tr>
<tr>
<td>7 Thailand</td>
<td>$2,886</td>
<td>2.0%</td>
</tr>
<tr>
<td>8 Taiwan</td>
<td>$2,874</td>
<td>2.0%</td>
</tr>
<tr>
<td>9 UAE</td>
<td>$2,456</td>
<td>1.7%</td>
</tr>
<tr>
<td>10 Indonesia</td>
<td>$2,260</td>
<td>1.6%</td>
</tr>
<tr>
<td>11 Other</td>
<td>$17,613</td>
<td>12.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$144,850</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Western Australia exports to Japan 2017-18

2008 – 2018 WA exports to Japan trend
WA Policy Environment Improves

- Commonwealth Mineral Resources Rent Tax and Carbon Tax removed
- Commonwealth Exploration Development Initiative introduced
- Continuation of the State Exploration Incentive Scheme
- Financial Assistance provided for struggling iron ore producers
- Environmental bonds replaced by small annual contribution to the Mine Rehabilitation Fund
- State Government policy of not changing resources policy without extensive consultation
Improving investment climate
## WA share of Global Production 2018

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina</td>
<td>10.3%</td>
</tr>
<tr>
<td>Cobalt</td>
<td>3.5%</td>
</tr>
<tr>
<td>Diamonds</td>
<td>10.7%</td>
</tr>
<tr>
<td>Gold</td>
<td>6.3%</td>
</tr>
<tr>
<td>Ilmenite</td>
<td>10.2%</td>
</tr>
<tr>
<td>Iron ore</td>
<td>32.5%</td>
</tr>
<tr>
<td>LNG</td>
<td>13.9%</td>
</tr>
<tr>
<td>Nickel</td>
<td>6.5%</td>
</tr>
<tr>
<td>Rare Earth Oxides</td>
<td>17.6%</td>
</tr>
<tr>
<td>Rutile</td>
<td>1.6%</td>
</tr>
<tr>
<td>Salt</td>
<td>4.3%</td>
</tr>
<tr>
<td>Zircon</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

Sources: DMIRS, USGS, Office of the Chief Economist, Energy Quest, International Aluminium Institute, GIIGNL Annual Report
Japan Critical Minerals
and Western Australia as a Source
WA Has Majority of Japan’s Strategic Minerals

30 minerals were designated “strategic minerals” by Japanese government in 2012 which include minor metals such as indium, platinum, rare-earth elements (REEs), and common metals such as iron, copper, and lead.

In March 2018, the Japanese Ministry of Economy, Trade and Industry released a report that identified the following 31 minerals as key: Li, Co, Ni, Cu, REE, PGM, W, Mg, Be, Re, Ti, Cr, Mo, Mn, Nb, P, Zn, Sn, Pb, Sb, Ta, In, Ga, C, Ge, Zr, Sr, V, F, Au and Ag.
Major Commodities and Investment Opportunities
WA is Australia’s only Nickel miner

- Current resources: 34.0 Mt contained Ni
- Production in 2018: 149,642 t
- New discoveries being made
- New mine opening: Nova–Bollinger
- Laterite & sulphide deposits
- Komatiitic and ultramafic intrusive style sulphide deposits as well as lateritic style

WA Ni exports 2018: $AUD 2.615 billion
Western Australian Nickel Exports 2018

<table>
<thead>
<tr>
<th>Nation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>50.14%</td>
</tr>
<tr>
<td>Japan</td>
<td>18.10%</td>
</tr>
<tr>
<td>Taiwan, Province Of China</td>
<td>12.90%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5.70%</td>
</tr>
<tr>
<td>Korea, Republic Of</td>
<td>3.80%</td>
</tr>
<tr>
<td>Spain</td>
<td>1.80%</td>
</tr>
<tr>
<td>United States</td>
<td>1.70%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.20%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.20%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.00%</td>
</tr>
<tr>
<td>Other</td>
<td>2.50%</td>
</tr>
</tbody>
</table>
Cobalt

- Known Co mostly in nickel deposits
- Resources: **2.74 Bt @ 0.05% Co** (46 deposits)
- World’s 2nd largest Co reserves (after DRC)
- Produced 4878 t of Co in 2018
- Production ranked 5th globally in 2018
- Production entirely as by-product from nickel mines
- Now a focus on defining standalone cobalt resources
- Also potential in sediment-hosted Cu-Co deposits (several projects in WA)
- One known scandium resource (Kalgoorlie Nickel Project) – **23.9 million tonnes @ 40.3 gpt Sc**
Graphite

- Flake and ‘amorphous’ graphite
- Majority are Archean to Mesoproterozoic graphitic schists or gneisses (metamorphosed carbonaceous sedimentary rocks)
- Defined resources at:
  - Donnelly River
  - McIntosh
  - Munglinup River – Halberts
  - Yalbra

Relatively small deposits, but high quality
Manganese

- WA has a +50-year history of producing metallurgical-grade manganese ore
- Current resources are 55.4 Mt (4th largest globally)
- Mostly ‘supergene’ or ‘residual’ on carbonates or iron formation
- One producing Mn project — Woodie Woodie (Consolidated Minerals Ltd)
- Montezuma Mining assessing the Butcherbird–Yanneri Ridge Mn project for battery-grade Mn-dioxide
  - Part of resource at JORC Indicated status and scoping study being conducted
Rare Earth Elements

Resources mostly carbonatite- or hydrothermal vein-hosted

Current production from:

- **Mt Weld** (carbonatite-hosted)
  - Significant high-grade **dysprosium** (Dy) resource at Duncan
  - Reserves of 1.7 million tonnes TREO, including 6660 tonnes Dy$_2$O$_3$.
- **Browns Range** (hydrothermal vein-hosted)
  - Hydrometallurgical pilot plant to process 150,000 tonnes of ore. Producing mixed rare earth carbonate
- Other significant resources:
  - **Yangibana** - 21.7 million tonnes @ 1.17% TREO
    - Monazite in heavy mineral sand deposits (but problematic)
Lithium(-Cesium)

- World's largest Li supplier (18,700 tonnes, 43% in 2017, USGS)
- 3rd largest reserves globally (USGS 2017):
  1,007.46 million tonnes @ 1.44% Li$_2$O
- All deposits are 'hard rock' (pegmatite-hosted)
- World's largest single such deposit (Greenbushes)
- 7 operating mines:
  - Greenbushes, Mt Marion, Mt Cattlin, Wodgina, Altura, Pilgangoora, Bald Hill
- Another advanced project at Earl Grey (Mount Holland)
- All Li currently exported as concentrate or DSO
- Downstream processing imminent in WA
- Also WA's first cesium (pollucite) mine at Sinclair (Pioneer Dome)
  7,000t @ 16.4% Cs (1,167t Cs)
Australia is Top Lithium Producer (2018)

<table>
<thead>
<tr>
<th>Country</th>
<th>Mine production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australia</td>
<td>51,000 MT</td>
</tr>
<tr>
<td>2. Chile</td>
<td>16,000 MT</td>
</tr>
<tr>
<td>3. China</td>
<td>8,000 MT</td>
</tr>
<tr>
<td>4. Argentina</td>
<td>6,200 MT</td>
</tr>
<tr>
<td>5. Zimbabwe</td>
<td>1,600 MT</td>
</tr>
<tr>
<td>6. Portugal</td>
<td>800 MT</td>
</tr>
<tr>
<td>7. Brazil</td>
<td>600 MT</td>
</tr>
<tr>
<td>8. Namibia</td>
<td>500 MT</td>
</tr>
<tr>
<td>9. United States</td>
<td>unknown</td>
</tr>
</tbody>
</table>

- The latest data from the US Geological Survey shows that the world’s top lithium producers are doing their best to meet rising demand from energy storage and electric vehicles.
- Worldwide lithium supply rose roughly 23 percent from 2017 to 2018.
- Overview of the nine countries that produced the most lithium in 2018. Australia produced more than 50% known world production.
- If the electric vehicle market continues to grow, and if lithium-ion batteries continue their reign as the top batteries for electric vehicles, it’s likely the lithium demand will continue rising in years to come.
WA Licence Map shows Opportunities

- Many licence holders looking for project JV partners and for company equity funding
- Opportunities at all development stages, including off-take agreements
- Some licences granted in record short periods

Tenement Activity 2017 - 18

Mineral tenements
- Granted
- Applications

Government of Western Australia  |  Department of Mines, Industry Regulation and Safety  |  www.dmirswa.gov.au
A Strategic Time to Invest

Diagram developed by Lion Selection Group

S&P/ASX 300 Energy Index (left axis)
S&P/ASX 300 Metals & Mining Index
Freely available information

Online and free of charge to view and download at
www.dmp.wa.gov.au

• All geological reports, maps (including GIS & Google Earth files)
• All company exploration reports and data files over 5 years old
• Mineral deposit database including resource/reserves
• Map of exploration and mining leases
• All details of licences and leases (ownership, expiry, conditions, expenditure etc)
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Rohan Cobcroft - Director
Geological Survey of South Australia
South Australia’s Mineral Emblem

BORNITE

Bornite, known as peacock ore, is an ore mineral of copper.

Copper was central to the early economic development of South Australia and continues to be a major contributor to the economy.

$\text{Cu}_5\text{FeS}_4$

This rare specimen of bornite, from the Olympic Dam mine, is on display at the South Australian Museum.
South Australia’s Minerals – transforming our future

- community engagement
- safe work practices
- environmental responsibility

Keeping us connected
Taking us where we want to go
Powering our communities
South Australia – Resources & Production
South Australia
Mineral Industry
Project Pipeline

- **MINERAL PROCESSING**
  - 3 Major Mineral Processors
    - Nypro, BHP & GO-Alliance

- **MINES & DEVELOPING PROJECTS**
  - $4.6 Billion Production
  - $150.7 Million Royalties
    - MRC: Production reserves 2018
    - MRC: Royalties 2017-18

- **MINERAL PROJECTS**
  - $955 Million Capital Expenditure
    - Company releases 2017-18

- **MINERAL EXPLORATION**
  - $76.1 Million Exploration Expenditure
    - AUS Cat: B1412B
    - 2018

180 companies with 700+ mineral exploration licences
Exploration, Mineral Projects and Mines
Our Growth State – Opportunity

Growth State – what government is doing, informed by industry needs

**MINERAL INITIATIVES**

#Copper to the World   #Magnetite Strategy    #Discover Gold
#Accelerated Discovery Initiative

**CLEAN ENERGY TRANSITION**

#Hydrogen Action Plan    #Virtual Power Plant
#Oil and Gas Roundtable
South Australia – Mineral Exploration

MINERAL EXPLORATION

• Highest annual expenditure for 4 years
• SA’s prospectivity + relatively under-explored = high potential for new discoveries
Our Growth State – Your Opportunity

$10 million over 3 years

Encourage exploration and foster collaboration through information sharing and testing of new technologies

South Australia – Big science, big data

MINERAL INITIATIVE – Big Data

- World’s single largest contiguous airborne magnetic survey
- Next generation airborne magnetic and radiometric coverage for South Australia
- Over highly prospective region - multi commodity potential
- All data made open file
Big Data – Big solutions: Crowdsource

Explorer Challenge
Journey to discovery with data

Register: https://unearthed.link/Explorer

Pioneers! Make your mark. Can you discover Australia’s next big mineral deposit?

Reward

$1 million prize pool

Experience your winning model tested in real life – the top targets will be drilled in 2019.

A $1 million prize pool

esri Australia, South Australia Department of Energy and Mining, AWS
South Australia Copper to the World

Accelerate exploration, discovery and information

Develop innovative infrastructure, services and research

Engage to build industry and community capacity
COPPER in South Australia

EXPLORATION
(positive drilling intercepts, assays or anomalies)

$39.2 million copper exploration in 2018
130 companies with 400+ exploration licences for copper

ADVANCED PROJECTS
(JORC resource, feasibility studies underway)

$2 billion potential capital expenditure - 8 projects

MAJOR MINES
producing and exporting copper cathode & copper in concentrate

270,524 t $2.2 billion in 2018**

Olympic Dam Prominent Hill Kanmantoo Carrapateena

There is one metal that stands out: Copper

Copper connects and delivers clean energy to the world.
South Australia Magnetite Strategy

Working to guide and support development

- SA as leading supplier of magnetite products
- Stakeholder engagement
- Partnerships to build bulk commodity infrastructure
- Support strong and sustainable Australian steel industry.
IRON ORE in South Australia

Courtesy: GFG
Discover Gold in South Australia

New program

- Increase exploration discovery rates
- Leading to increasing exports and future industries
- Responsible sourcing for a sustainable future
GOLD in South Australia

8t Production
worth $506m

N/A spent on Exploration activities

439t Reserves
2,796t Resources

Contained Gold

Courtesy: WPG
URANIUM in South Australia

4,517t Production worth $333m

$2m spent on Exploration activities

N/A Reserves

2Mt Resources
Strategic Minerals for low-carbon future

South Australia has large graphite resources and hosts one of the world’s largest deposits

Other strategic minerals

**Cobalt:**
- 6 known resources, >30,000t contained Co, 5 ASX listed and 1 private company
- Multi commodity resources (Au, Cu, Ag), none in production.

**Magnesium (Magnesite), Manganese, REE*:**
- Multiple projects, various stages of development, ASX listed.

* Concentrations of the light REE (LREE) and heavy REE plus yttrium (HREE + Y) within the Olympic Dam.

New technology – new research

**NEW RESEARCH CONSORTIUM BOOST TO MINING SECTOR**
- $14.6M research consortium – with University of Adelaide
- Boost Copper production – focus on new lean processing – orebody variabilit

**SHAPING THE FUTURE OF AUSTRALIA’S MINING OPERATIONS**
- $12.5M national research mining and training centre
- Increase value in mining and processing of complex resources

**CRITICAL MINERALS RESEARCH**
- Leading and developing research in critical minerals exploration; particularly those elements that are crucial to transformation to a renewable energy future
Our Growth State – Your Opportunity

South Australia has the sun and wind, land, infrastructure and skills to be a world-class hydrogen supplier.
South Australia ......more to explore
• More competitive and sustainable energy
• Responsibly unlocking our mineral resources
• Discovery, investment and exports
• Capturing new opportunities from clean energy transition*

DISCLAIMER

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www.energymining.sa.gov.au
Minerals Investment opportunities in Tasmania

Dr. Andrew McNeill
Mineral Resources Tasmania
17 October 2019
Why Tasmania?

Geology

Current production of, and projects for, a diverse range of commodities:

- **Zn, Pb, Ag**
- **Cu**
- **Au**
- **Sn, W**
- **Ni, Co**
- **Fe (magnetite, hematite)**
- **Mg**
- **Al (bauxite)**
- **Si (silica flour)**
- **Heavy mineral sands**
- **Coal, oil, geothermal**
- **Limestone, dolomite**
- **Dimension stone**
Why Tasmania?

Well Developed infrastructure: port, rail and renewable power – ranked 5\textsuperscript{th} of 83 jurisdictions in the 2018 Fraser Institute survey for infrastructure

Ranked 1\textsuperscript{st} in the 2018 Fraser Institute survey for availability and skill level of workforce

Established METS and research sectors

Mineral processing sector- three smelters

Minerals industry is Tasmania’s largest exporter (>50%)
Why Tasmania?
Facilitation and support - approvals

**Exploration**
- Single point - all processes, including environmental approvals, managed by Mineral Resources Tasmania (www.mrt.tas.gov.au)

**Mining**
- Mining title – process managed by MRT
- Mining permit – issued by local government with input from State and (possibly) Commonwealth environmental agencies (www.epa.tas.gov.au)

**Investment**
- Single point for advice and information at Office of the Coordinator General (www.cg.tas.gov.au)
Why Tasmania?

Government support

Legislation & policy – streamlining administration
• Mineral Resources Development Regulations – updated 2016
• Mineral Resources Development Act – updated 2017
• Changes usually with industry consultation
• *Mining (Strategic Prospective Zones) Act 1993* – protection from change of land status

Direct Government Assistance
• There are opportunities for infrastructure development and tax relief
• Applications made to independent Tasmanian Development Board (TDB) via Department of State Growth

Initiatives
• $1.0M Mining Sector Innovation Initiative – environment and geoscience (2017-2021)
• $2.0M co-funded greenfield drilling – EDGI (2018-2022)
• $1.4M Geoscience Initiative – pre-competitive geoscience data (2016-2020)
Why Tasmania?
Low sovereign risk – security of title

Exploration
- Exploration licences initially granted for 5 years – give sole rights to explore and has the *exclusive right* to apply for a mining lease over part or all of the licence.
- Licences are issued subject to normal conditions.
- A licensee can apply for extensions of term and these should be granted if the applicant has made a discovery or has complied with licence conditions.
- Extensions are for 1 or more years and there is no limit to their number
- A licence can be revoked if the licensee fails to comply with conditions
- Strategic Prospectivity Zone legislation provides a high level of protection against changes in Crown Land status. Much of the area covered SPZ is Crown Land.
Why Tasmania?
Pre-competitive data

Seamless geology; 55% of state covered at 1:250 000, entire state covered at 1:250 000

Statewide geophysical datasets: airborne magnetics, radiometrics, gravity, MT, physical properties

Geophysically corroborated 3D modelling of prospective regions

Curated data:
>17,000 published maps, tenement charts & mine plans (from 1880)
>14,000 government and company technical reports (from 1823)

Mineral occurrence, drill hole, sample datasets

Ongoing back capture and QA/QC programs

Ranked No.1 for geological databases in 2018 Fraser Institute survey
Why Tasmania?
Data Delivery

- Free on-line delivery of data
- Can layer relevant datasets to create tailored maps or searches on-line

- TIGER system: MRTs linked databases
  www.mrt.tas.gov.au

- TheLIST: viewer for Tasmanian Government spatial data sets
  www.thelist.tas.gov.au

- AusGIN: Australia-wide data viewer
  www.geoscience.gov.au
Critical and new technology Minerals in Tasmania

Metals most impacted by new technology

- Tin
- Lithium
- Cobalt
- Silver
- Nickel
- Gold
- Tungsten
- Vanadium
- Graphite
- Niobium
- Zinc
- PGM (Pt, Pd)
- Salt

**Electrical contact materials**
Tin, Silver, Gold

**Battery materials**
Lithium, Cobalt, Nickel
(Tin, Silver, Vanadium, Graphite, Zinc)

Source: MIT / Rio Tinto
Tungsten

Production since 1880:
• 35,557 t WO₃
• >80% from King Island

Defined resources:
• 183,100 t contained WO₃
• 52% in King Island deposits

>20% of Australia’s economically demonstrated resources (EDR) are in Tasmania

Opportunities in:
Exploration
Advanced projects
Increased production (Kara)
Tin - The forgotten battery metal

Production since 1880:
• 422,000 t tin
• 50% from Renison mine

Defined resources:
• 528,000 t contained tin
• 33% at Renison mine

> 80% of Australia’s economically demonstrated resources (EDR) are in Tasmania

Opportunities:
Exploration
Advanced Projects
Tailings re-treatment
Silica

• Most prospective are high-purity silica flour deposits

• Three of these deposits have been successfully developed

• Tasmania produces approximately 10% of the world supply of high-purity silica

• Used in the manufacture of LCD and OLED screens

• Under-explored

• One advanced project – Maydena Sands
Base metals

- Several styles:
  - Polymetallic VHMS (Cu, Pb, Zn, Ag, Au)
  - VHMS Copper (Cu, Au)
  - Carbonate-hosted (Pb, Zn, Ag)
  - Hydrothermal Ni, Co
  - Granite-related veins (Pb, Ag, Zn)

- Opportunities in:
  - Exploration
  - Existing small projects
  - Remnant mining
  - Tailings & slag re-treatment
Iron Ore

- Production in 2017-18 was 2.75 mt of magnetite pellets and concentrate (1.79 mt of contained Fe)

- Used or steel production and coal washing

- Savage River (Grange Resources) Mine has a total endowment (mined + resources) of 724 mt @ 47% DTR. Ore body is still not closed off

- Other current and potential production from Low-Sulfur magnetite skarns

- Hematite production from weathered magnetite skarns and ultramafics
Summary

• Diverse mineralisation with long-life (>100 years) mining operations
• Mineral processing sector – zinc, aluminium and ferro-manganese smelters
• >90% of electricity generated by renewables (target is 100%)
• Products of mining and mineral processing constitute >55 per cent of mercantile exports
• Highly supportive Government with legislation to reduce Sovereign risk
• High quality, freely available geoscience data sets to de-risk exploration
• Battery and new technology minerals including tin, tungsten and silica flour
• Low interest rates, a favourable $AU/$US exchange rate, and low inflation make an attractive investment environment
• There are many ways in which Japanese groups can become involved; as examples through direct and indirect equity interests and off-take agreements
Thank you
For more information: