AUSTRALIAN EARTH SCIENCE EDUCATION

Geological Resources

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Economic Importance

- Australia's biggest export earner
- Major employer
- World class resource production
  - Largest exporter of iron ore, coal, unwrought lead
  - Second largest exporter of aluminium ores

Rank	Commodity	Value ($ million)
1	Iron	61,357
2	Coal	60,356
4	Natural gas	30,907
6	Gold	19,293
7	Aluminium	9,448
9	Crude petroleum	6,507
10	Copper	5,720

2017-18 export figures from Department of Foreign Affairs and Trade based on World Trade Organisation data.

Mining royalties (2017-2018 figures)

- $30.6 billion in company tax and royalties – equivalent to all Federal spending on schools, universities and vocational training
- $12 billion in royalties goes to State Governments
  - Coal royalties = 92% of mining royalties paid to NSW government

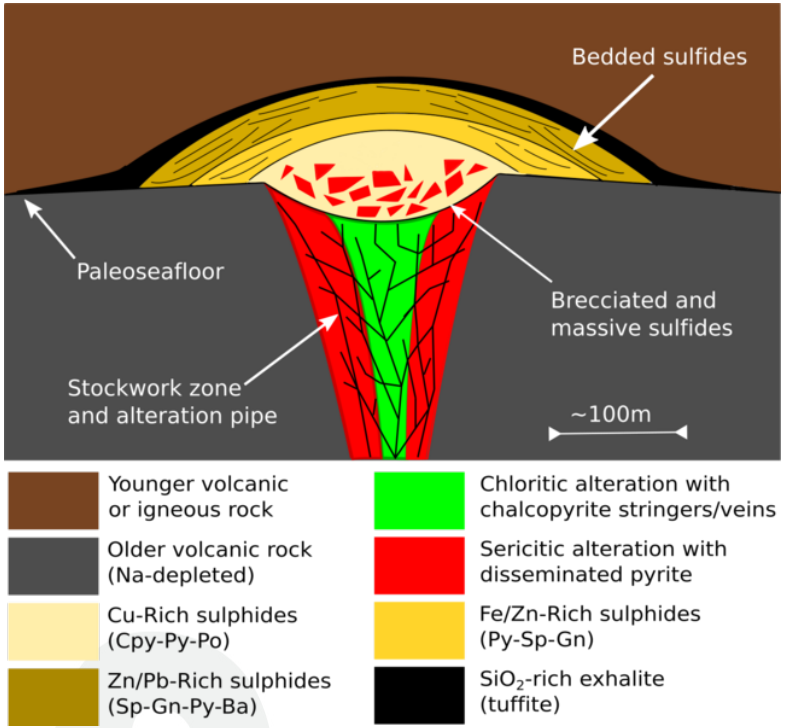
Terminology

- Ore mineral
- Gangue minerals
- Ore
- Ore grade
- Deposit
- Resource

Gossan of nickel-sulphide ore Otter Shoot, Kambalda, WA by R Hill. CSIRO Science Image

Ore Formation

- Igneous
  - Intrusive
  - Exhalative
- Hydrothermal
- Weathering = leaching
- Complex combinations



Cross-section of a typical volcanogenic massive sulphide ore deposit. (RockingGeo 2019 Wikimedia Creative Commons)

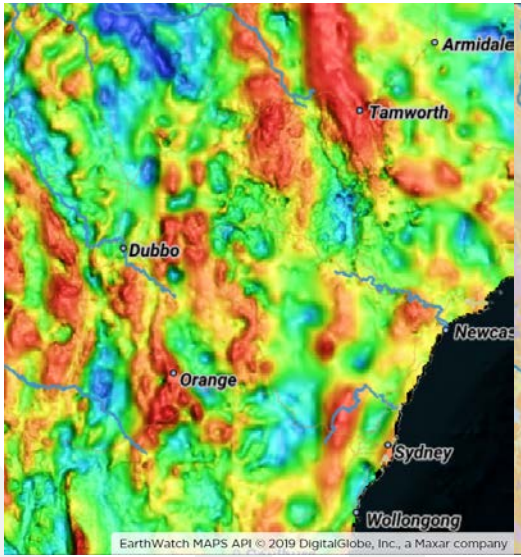
Exploration Techniques

- Gathering information

Exploration Techniques

- Gathering information
- Geophysical surveys
  - Magnetic
  - Gravity
  - Radiometric

Gravity Map



Geological Map

From MinView https://minview.geoscience.nsw.gov.au/#/ accessed 19 March 2020

Exploration Techniques

- Gathering information
- Geophysical surveys
  - Magnetic
  - Gravity
  - Radiometric
- Field work
  - Chip samples
  - Stream sediment sampling
  - Soil sampling
  - Drilling (reverse circulation, diamond)

A core sample for the Woodlawn mine near Goulburn, NSW (CSIRO Science Image)

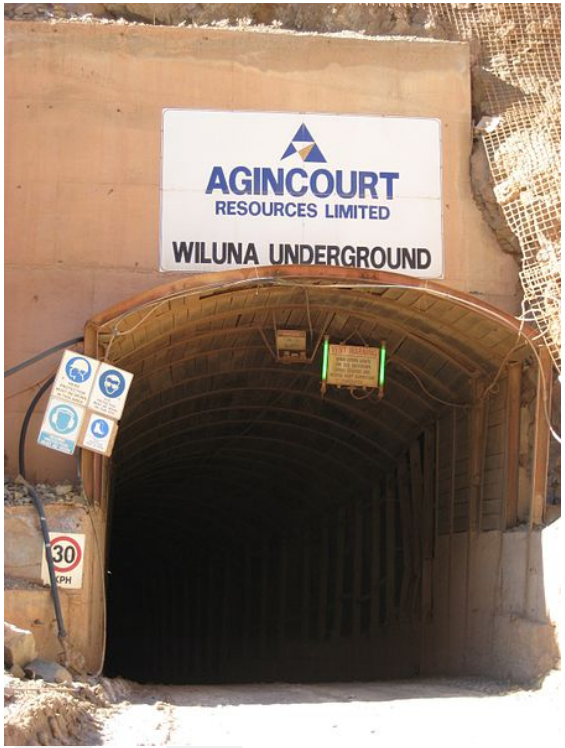
Mining

- Open cut
  - Ore deposit relatively close to surface
  - Dug downwards in intervals (= benches)

Open cut mining at Paddington Gold Mine near Kalgoorlie (1998, CSIRO Science Image)

Mining

- Open cut
  - Ore deposit relatively close to surface
  - Dug downwards in intervals (= benches)
- Underground
  - Ore deep underground (often in pockets)
  - Accessed through tunnels and shafts



Entry to Wiluna Underground Gold Mine, Wiluna WA (2009, Wikimedia Creative Commons)

Major resources

- Iron
- Coal
- Gold
- Mixed metals

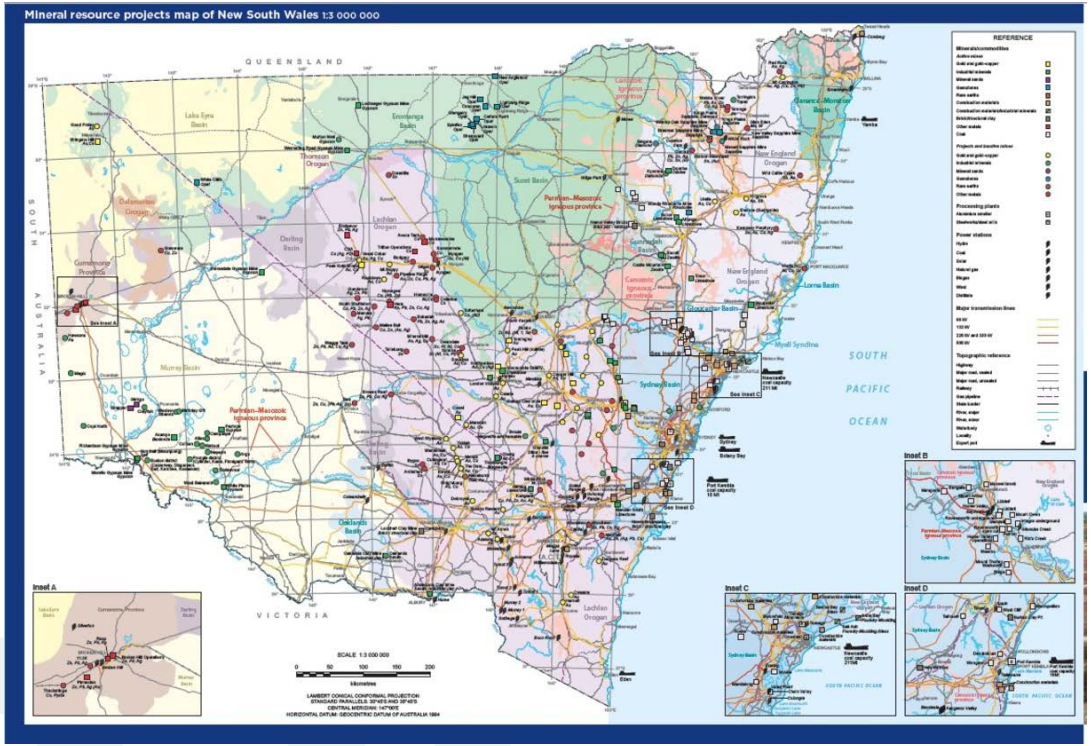
Banded iron formation from South Australia (J St John 2014, Wikimedia Creative Commons)

8 kg gold nugget from Victoria (CSIRO Science Image)

Hunter Valley black coal (S Filan 2020)

Mining in NSW

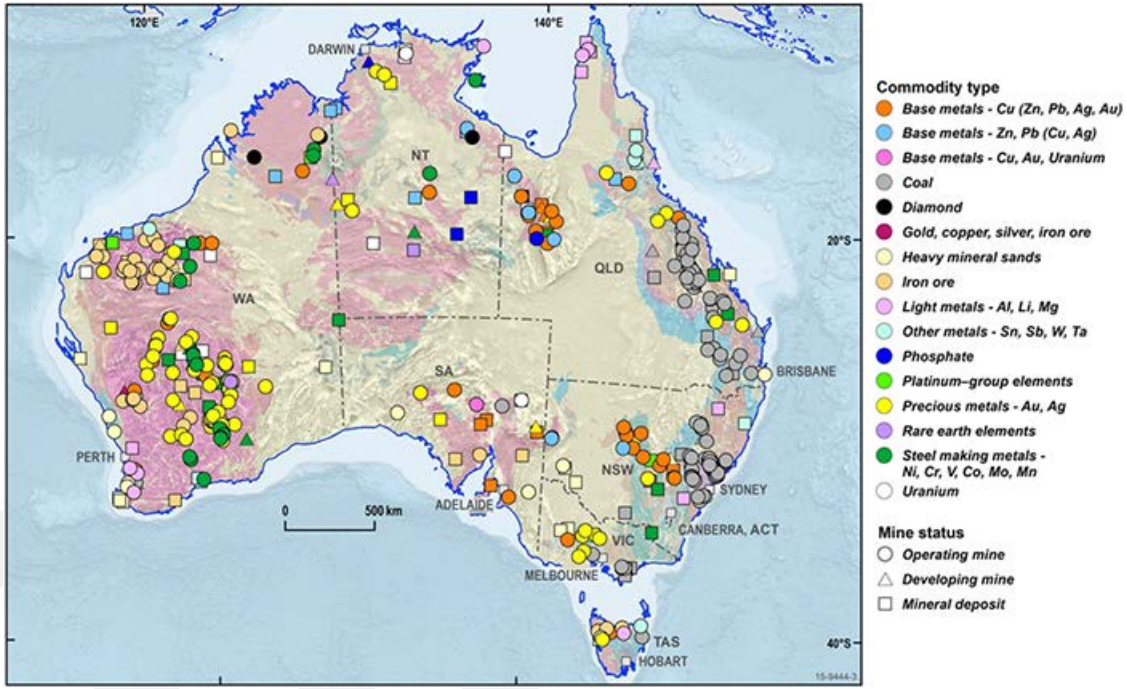
- Hunter Valley coal mines
- Lachlan and New England Orogen mineral mines
- Murray Basin mineral sands
- Sydney sandstone quarries



Forster DB, Montgomery KL, Talbot L (2020). Mineral resource projects of New South Wales, 1:3 000 000 map. Geological Survey of New South Wales, Maitland, Australia

Mining in Australia

- Western Australia iron, gold and other metals
- NSW, Victoria and Queensland coal
- Queensland, NSW and South Australia base metals



Major mining and mineral deposits in Australia, 2016 (Geoscience Australia)

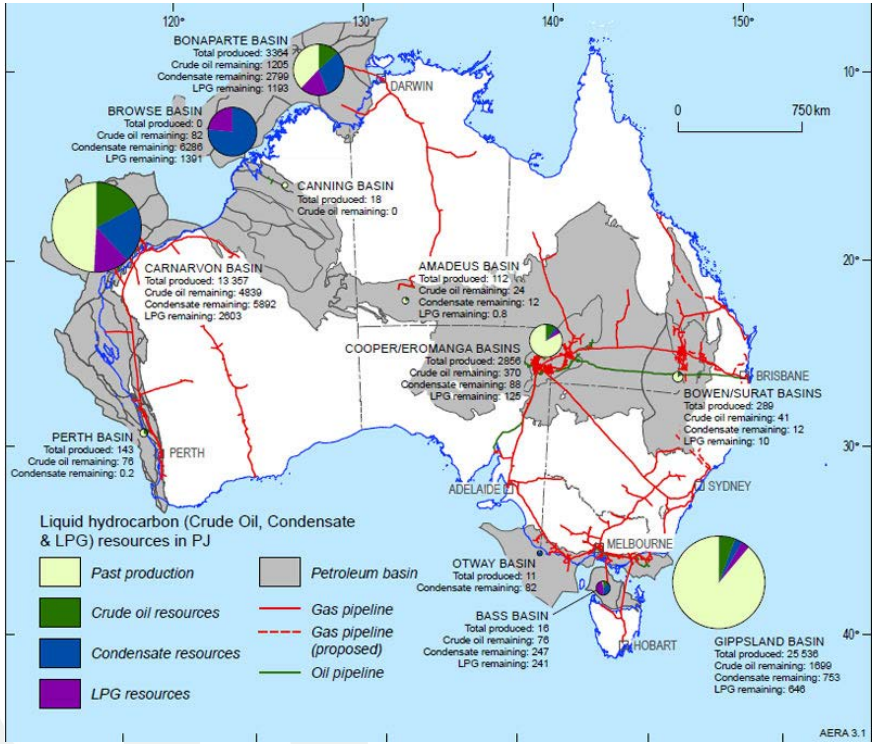
Drilling

- Features
  - Onshore – petroleum or coal seam gas (fracking)
  - Offshore – fixed platorms or ships
- Resources
  - Natural gas
  - Crude petroleum

Oil and gas drilling platform (CSIRO Science Image)

Oil drilling in Australia

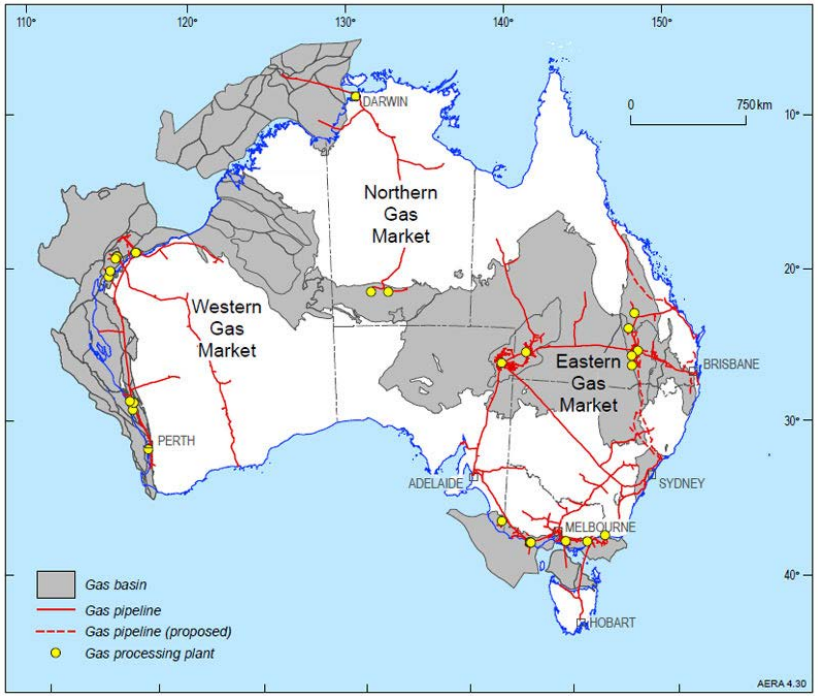
- Major reserves
  - Carnaron Basin
  - Browse Basin
  - Bonaparte Basin
  - ?Great Australian Bight?



Australian crude oil, condensate and naturally-occurring LPG resources, infrastructure, past production and remaining resources (© Geoscience Australia)

Gas drilling in Australia

- Oil basins
  - 14 different basins
  - Bonaparte, Browse & Carnarvon have most gas
- Coal seam gas basins
  - Queensland: Bowen & Surat
  - NSW: Sydney, Gunnedah, Clarence-Moreton, Gloucester



Australia's gas facilities (© Geoscience Australia)

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