

## Australian Magnetite Ore 2023 Factsheet

---

### Steel production and magnetite

Steel is an alloy of iron and carbon, and commonly has minor additions of metallic elements such as manganese, chromium, vanadium, nickel and molybdenum. The addition of further alloying elements can improve the properties of steel by increasing the strength, wear resistance and corrosion resistance of the metal. Primary uses of steel include the automotive, construction and mining industries, machinery, appliances and the oil and gas industry. It is the most commonly used metal in the world.

To produce steel, iron ore is mined and milled, then smelted in a blast furnace. During the smelting process, iron ore is chemically reduced from iron oxide to iron metal with metallurgical coke (which is made from coal) providing fuel and acting as a reductant. This process is carbon intensive, with iron and steel production accounting for approximately 7% of global greenhouse gas emissions per year<sup>1</sup>. With demand for steel expected to increase in coming years, there is a strong case for decarbonising the production chain.

Steelmaking can be decarbonised by using:

- Direct reduced iron
- High-grade ores
- Renewable energy-powered electric-arc furnaces

Magnetite ores are suitable for green steel production, despite typically having lower iron grades than hematite ores. The magnetic property of magnetite allows the efficient separation of iron from impurities such as silica, alumina and phosphorus. This is particularly important in the production of green steel since electric-arc furnaces cannot tolerate these impurities to the degree that blast furnace steel mills do. Further processing of magnetite involves agglomeration and thermal treatment of the concentrate to produce pellets. Direct reduction of the pellets to iron takes place in a shaft furnace in the presence of hydrogen or a mixture of natural gas and hydrogen instead of coal. The iron is then converted to steel in an electric arc furnace.

An alternative green iron pathway uses iron ore fines in a fluidised bed reactor in combination with hydrogen, or with a mix of natural gas and hydrogen. The advantage of this process is that it can use either crushed hematite or magnetite ores without additional thermal processing of the magnetite ore.

### Australian iron ore

Australia has 58,286 million tonnes of Economic Demonstrated Resources (EDR) of iron ore (Table 1), ranking first in the world with 31% of world economic resources<sup>2</sup>. Australia is also the world's leading producer of iron ore, accounting for 35% of supply in 2022<sup>3</sup>. Hematite and magnetite are the two main iron ore minerals in Australia, with hematite being Australia's main iron ore export. Hematite ore is typically higher-grade than magnetite ore, with approximately 60% contained iron whereas magnetite ore has grades in the order of 30% contained iron. However, magnetite can be converted to a higher-grade (approximately 60–70%; Table 2) and lower-impurity product that is preferred for electric arc furnaces.

---

<sup>1</sup> Hasanbeigi, A., 2022. Steel Climate Impact – An International Benchmarking of Energy and CO2 Intensities. Global Efficiency Intelligence. Florida, United States.

<sup>2</sup> Geoscience Australia, 2023. Australia's Identified Mineral Resources 2023.

<sup>3</sup> See footnote 2.

## Australian magnetite resources

Of Australia's total Economic Demonstrated Resources (58,286 Mt) of iron ore 24,251 Mt (41%) are magnetite ore (Table 1). The projected demand for high-grade iron ore products has provided momentum for the recent development of magnetite deposits such as:

- Iron Road Ltd's **Central Eyre** project in South Australia
- Elmore Ltd's **Peko** (tailings) project in the Northern Territory, which commenced production in 2022
- Fortescue Metals Group Ltd's **Iron Bridge** project in Western Australia which commenced production in 2023.

As noted previously, magnetite ores can be upgraded by magnetic separation, which means companies with operating and developing magnetite mines located in Australia report product grades of 65% to 69.5% iron content (Table 2). Pre-beneficiated resource grades range from 16% to 50% iron. Regarding gangue, silica is reportedly as low as 1.34% and as high as 5.35%, whilst aluminium ranges from 0.11% to 1.90%, phosphorous from 0.001% to 0.01% and sulphur from 0.007% to 0.54% (Table 2).

**Table 1. Australian iron ore resources as at 31 December 2022.**

Ore type	EDR (Mt)	Subeconomic Resources (Mt)	Inferred Resources (Mt)	Total Resources (Mt)	Percentage of Australian total
Hematite ore	35,075	1,288	55,056	91,419	58%
Magnetite ore	24,251	4,552	35,917	64,720	41%
Other iron ore	-	909	1,162	1,030	1%
<b>Australian total</b>	<b>58,286</b>	<b>6,749</b>	<b>92,135</b>	<b>157,169</b>	

Notes: EDR=Economic Demonstrated Resources; Mt=million tonnes.

Total Resources = Economic Demonstrated Resources +Subeconomic Resources +Inferred Resources.

A small number of data discrepancies result in some variance (<2%) in the split between magnetite and hematite resources, hence the totals do not add up exactly for EDR.

**Table 2. Grade and gangue attributes of operating magnetite mines and selected magnetite developments and deposits.**

State	Deposit	Status	Average Fe grade (%)	Product attributes				
				Grade (%)	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	P (%)	S (%)
SA	Central Eyre	Developing	16.0	66.7	3.36	1.90	0.009	n.a.
	Middleback Ranges	Producing	34.8	65.5	4.8	0.17	0.02	0.06
NT	Peko (tailings)	Producing	50.0	65-68	n.a.	n.a.	n.a.	n.a.
	Warrego	Developing	35.2	67.1	n.a.	n.a.	n.a.	n.a.
TAS	Kara	Producing	38.4	68.0	2.22	0.71	0.001	0.007
	Savage River	Producing	36.9	68.1	n.a.	n.a.	0.007	0.08
	Rogetta	Developing	38.4	n.a.	n.a.	n.a.	n.a.	0.02
WA	Sino Iron	Producing	32.0	n.a.	n.a.	n.a.	n.a.	n.a.
	Iron Bridge	Producing	29.6	67.3	5.35	0.27	n.a.	n.a.
	Karara	Producing	36.3	68.3	4.73	0.11	0.01	n.a.
	Southdown	Deposit	35.6	69.5	1.34	1.26	0.003	0.54
	Balla Balla	Deposit	45.0	n.a.	n.a.	n.a.	n.a.	n.a.

Average grade is prior to beneficiation and estimated by dividing total contained iron by total iron ore tonnage.

Abbreviations: Fe=iron; SiO<sub>2</sub>=silica; Al<sub>2</sub>O<sub>3</sub>=aluminium oxide, P=phosphorous; S=sulphur, n.a.=not available;

SA = South Australia; NT = Northern Territory; TAS = Tasmania; WA = Western Australia.

Iron ore attributes are sourced from company reports.



**Table 3. Australia’s identified magnetite resources by Australian jurisdiction as at 31 Dec 2022.**

State	Units	Projects	EDR	Subeconomic	Inferred	Total Resource	Average grade
NSW	Mt	1	1,990	0	1,963	2,503	12%
NT	Mt	1	1	0	4.3	3.9	confidential
QLD	Mt	5	0	154	421	575	32%
SA	Mt	23	5,584	1,208	10,081	16,873	25%
TAS	Mt	4	388	1.7	158	543	52%
VIC	Mt	1	0	0	0.55	0.55	48%
WA	Mt	40	16,288	3,188	23,289	42,983	31%
<b>Total</b>	<b>Mt</b>	<b>75</b>	<b>24,251</b>	<b>4,552</b>	<b>35,917</b>	<b>64,720</b>	<b>33%</b>

Mt=million tonnes, EDR=Economic Demonstrated Resources, Total Resource=EDR + Subeconomic Resources +Inferred Resources.  
 NSW = New South Wales; NT = Northern Territory; QLD = Queensland; SA = South Australia; TAS = Tasmania; VIC = Victoria;  
 WA = Western Australia.

## Further information

Australian states and territories are responsible for the administration and management of the exploitation of mineral and energy resources within their jurisdictions. Australia has geological surveys located within each state, and the Northern Territory. Geoscience Australia is the national geoscience organisation (Table 4).

Australia Minerals is a collaboration of these eight geological surveys, led by Geoscience Australia, working together to support mineral explorers and investors in Australia. General enquiries can be sent via the Australia Minerals website or Geoscience Australia can facilitate contact with individual representatives from state and territories upon request.

**Web:** [australiaminerals.gov.au](http://australiaminerals.gov.au)

**Email:** [mineral.promotions@ga.gov.au](mailto:mineral.promotions@ga.gov.au)

**Table 4. Australian geological surveys and parent entities.**

Geological survey	Governing entity
<b>Geoscience Australia</b>	Department of Industry, Science and Resources
<b>Geological Survey of New South Wales</b>	Department of Regional New South Wales
<b>Geological Survey of Queensland</b>	Department of Resources
<b>Geological Survey of South Australia</b>	Department for Energy and Mining
<b>Geological Survey of Victoria</b>	Department of Energy, Environment and Climate Action
<b>Geological Survey of Western Australia</b>	Department of Energy, Mines, Industry Regulation and Safety
<b>Mineral Resources Tasmania</b>	Department of State Growth
<b>Northern Territory Geological Survey</b>	Department of Industry, Tourism and Trade

© Commonwealth of Australia (Geoscience Australia), March 2024.

This product is provided under Creative Commons Attribution 4.0 International Licence and subject to the Disclaimer of Warranties and Limitation of Liability in section 5 of the Creative Commons Attribution 4.0 International Licence. Therefore, you should not solely rely on this information for any purpose.

Geoscience Australia acknowledges the Traditional Owners and Custodians of Country throughout Australia and recognises their continuing connection to land, waters and community. We pay our respects to the people, the cultures and the Elders past and present.