

# Examining Government Support for Investment in Critical Minerals

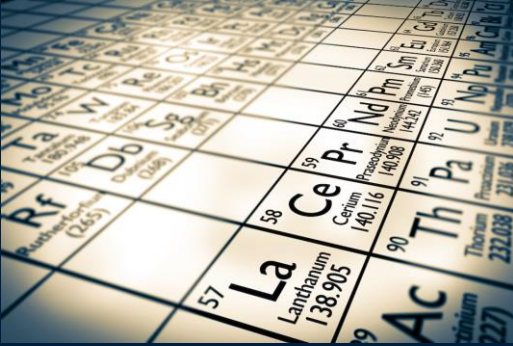
**Geological Survey of South Australia**

Australian Critical Minerals Conference  
31 May 2023

**Bronwyn Camac (A/Director)**

[energymining.sa.gov.au](http://energymining.sa.gov.au)



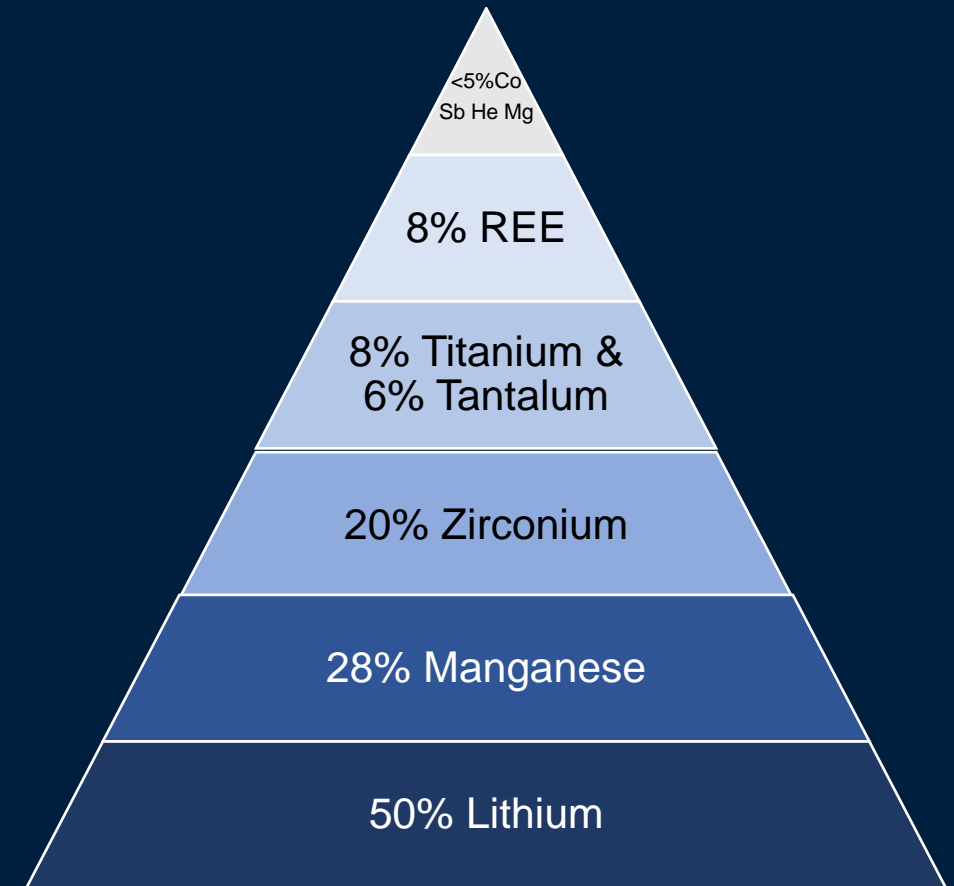


# 26 elements on the Australian critical minerals list

- 2022 saw the addition of high-purity alumina and silicon
- Australia is 4<sup>th</sup> largest producer of REE globally
  - Permanent magnets 70-75% REE value\*
  - China & Japan represents ~90% of market\*
  - Light and Heavy REE are complementary\*
  - Australia to develop downstream capability & R&D\*
  - Need to secure the supply chain ASAP!
- Many opportunities to collaborate with other countries (Fed Govt incentives – US energy policy)

\* Jevon Global 2022

## Australia's global production



# South Australia

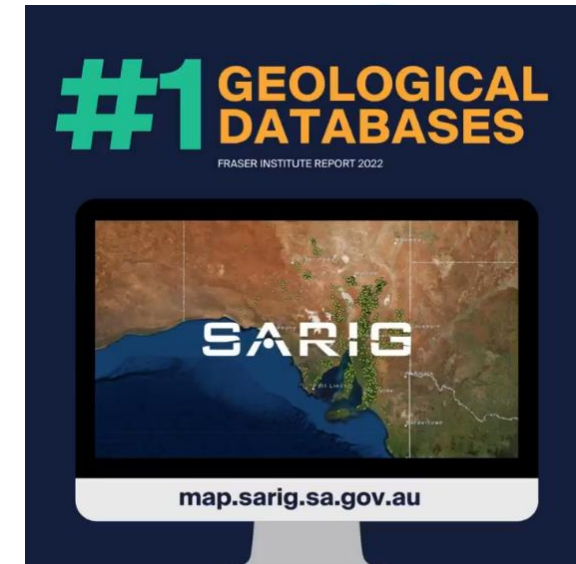
Is positioning itself to be the jurisdiction of choice for solutions to a net-zero emissions future

- understands the intrinsic link between the global demand for critical minerals and a decarbonised world
- invested many \$MMs on precompetitive data acquisition
- makes this information available online through the South Australian Resources Information Gateway SARIG; and physically at the world-class SA Drill Core Reference Library
- SA's geoscience databases are ranked the best in the world by international mining companies (*Fraser Institute 2022*)



Our government is committed to:

- free Trade and Democracy
- decarbonised net-zero energy
- the preservation, understanding and recognition of our aboriginal heritage
- creating a sustainable circular economy



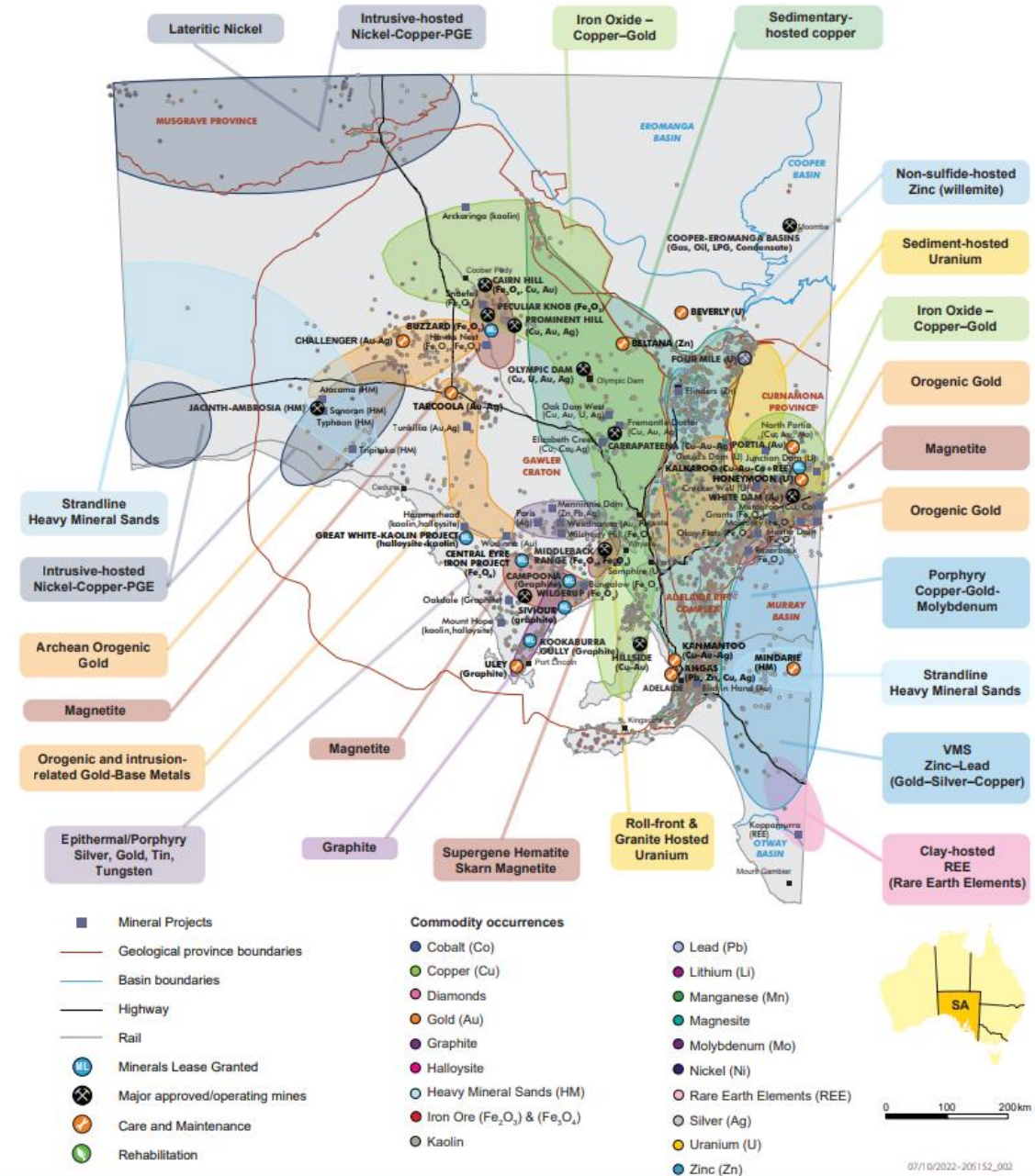
# South Australia is rich in:

- Copper
- Magnetite
- Mineral Sands (Zirconium)
- Graphite
- Rare Earth Elements (REE)
- Halloysite-Kaolin
- Magnesium

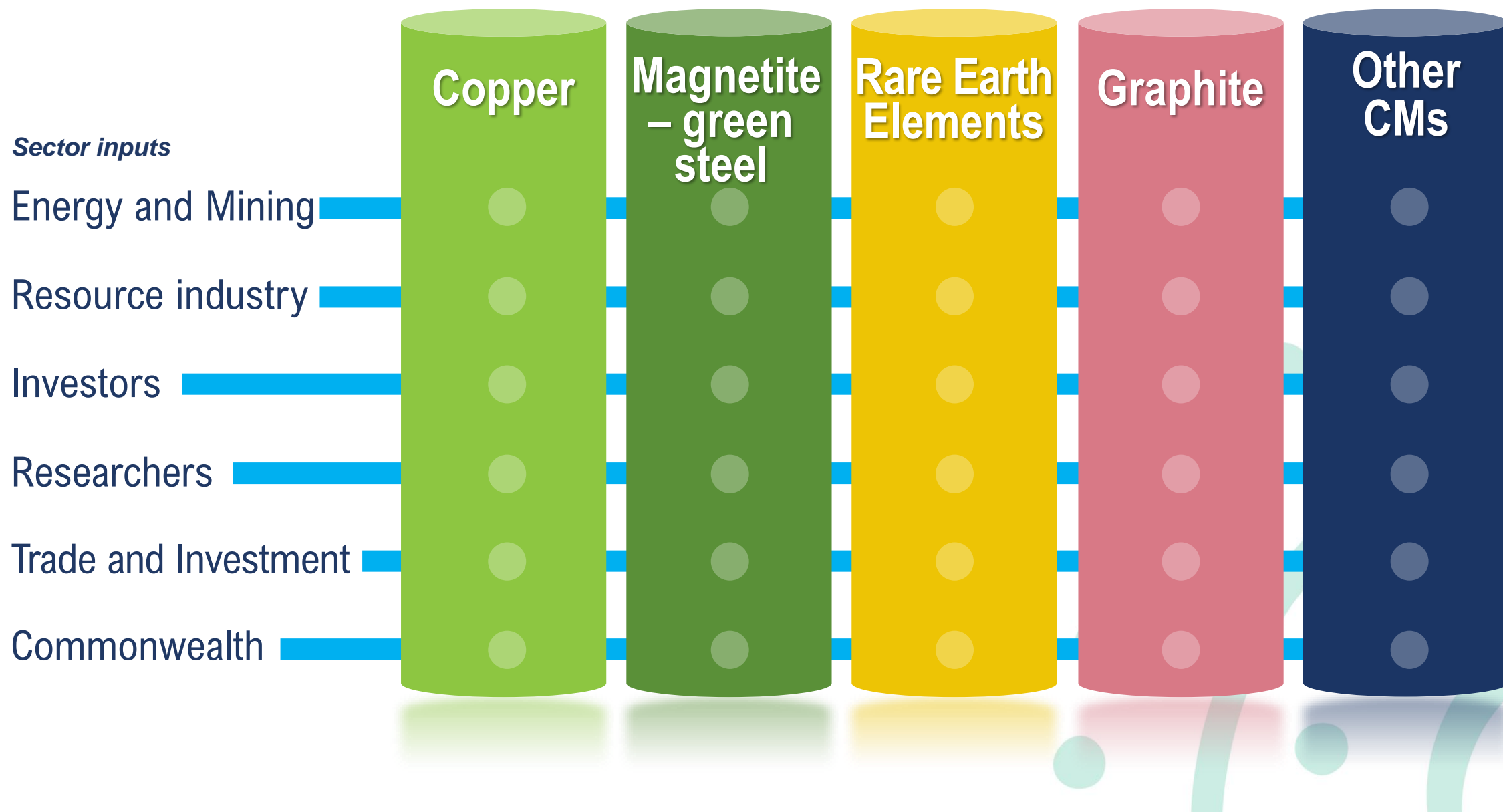


Government  
of South Australia  
Department for  
Energy and Mining

## Major Exploration Models



# Minerals for a net-zero future





# South Australia's Critical Minerals Strategy

SA's Critical Minerals Strategy aligns with the vision and missions set out in the South Australian Economic Statement:

- Contributes to the State's response to the Climate Change emergency.
- Supports the ambitions to be set out in the soon-to-be developed Energy Transition White Paper.
- Leverage value through emerging opportunities for funding in the critical minerals sector and the Commonwealth and State incentives for investment.
- Australia's Free Trade Agreements provide pathways to new markets for critical mineral exports. South Australia aims to leverage these trade partnerships to ensure an international contribution to the sector's accelerated development.

Builds on the work already underway on the Hydrogen Jobs Plan, the South Australian Copper Strategy and the South Australian Magnetite Strategy



*"There is an exciting path ahead. South Australia has the potential to be a global leader in the race for critical minerals." Edgar Basto, Chief Operating Officer, BHP*  
From Edgar Baston speech at Austmine Conference 2023, <https://www.bhp.com/news/media-centre/reports-presentations/2023/05/edgar-basto-speech-at-austmine-conference-2023>

# Government programs and opportunities

>\$20 million invested in SA's precompetitive geoscience and acceleration plans in the critical mineral supply chain

## Supply Chain

- Thinking Critical SA 2022
- South Australian Productivity Commission – Inquiry into SA's Renewable Energy Competitiveness (potential for SA in additional processing of SA's mineral deposits) 2022
- New SA Critical Minerals Strategy and Action Plan 2023

## Geoscience

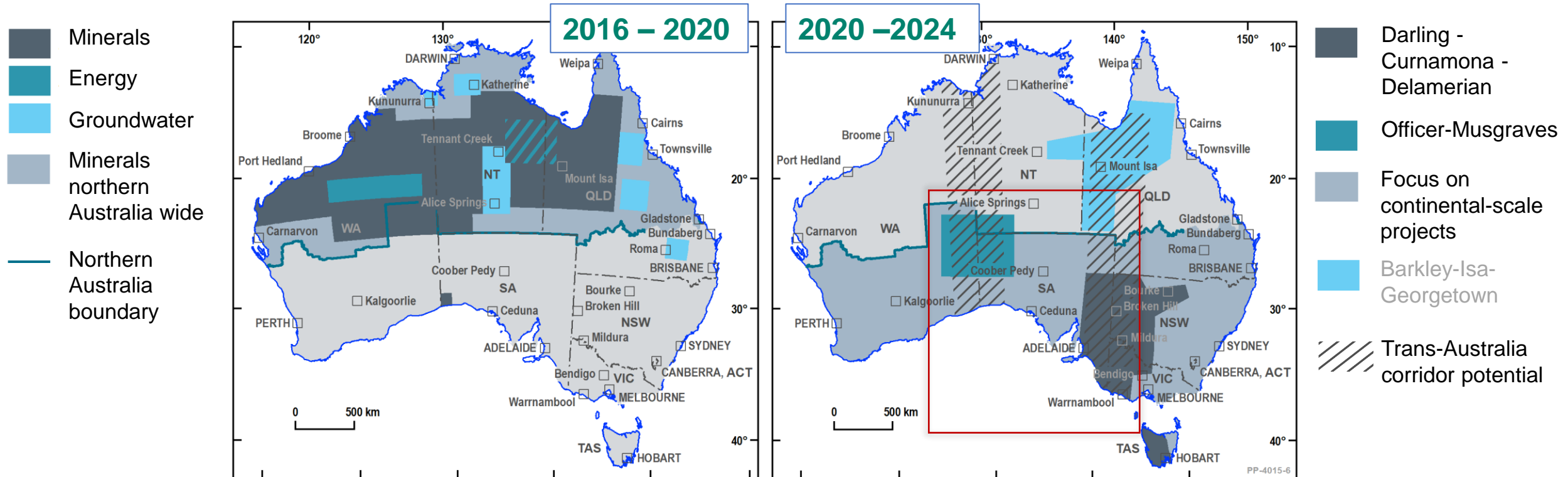
- Critical Minerals – South Australia Project
- Accelerated Discovery Initiative (co-funded exploration)\*
- Exploring for the Future\* (GSSA/GA)
- Sedimentary Copper – (GSSA/CSIRO)
- Mine Waste – Circular Economy (GSSA/GA/SMI UQ)
- Gawler Phase 2: next generation mineral system mapping
- MinEx CRC collaboration: Delamerian NDI



# Geoscience Australia – Australia’s Exploring for the Future (EFTF2) current program – more focus on South Australia

## VISION:

To support a **strong economy, resilient society** and **sustainable environment** for the benefit of Australians via an integrated geoscience understanding of our mineral, energy and groundwater potential

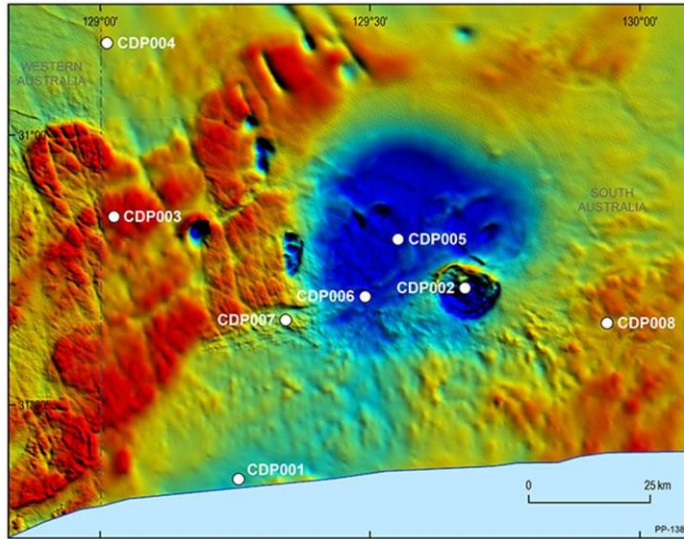


GSSA provides critical state-wide expertise into these national geoscience programs



# Exploring for the Future (EFTF2) in South Australia

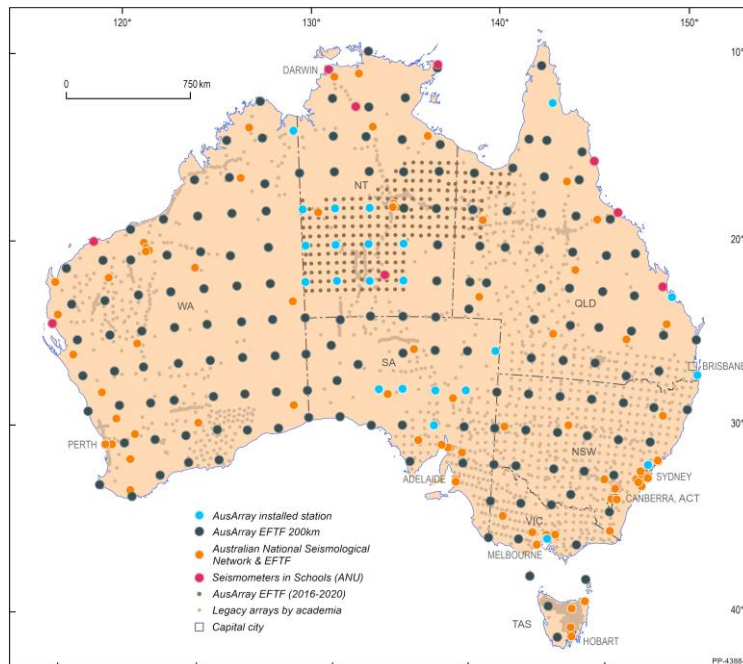
OFFICIAL



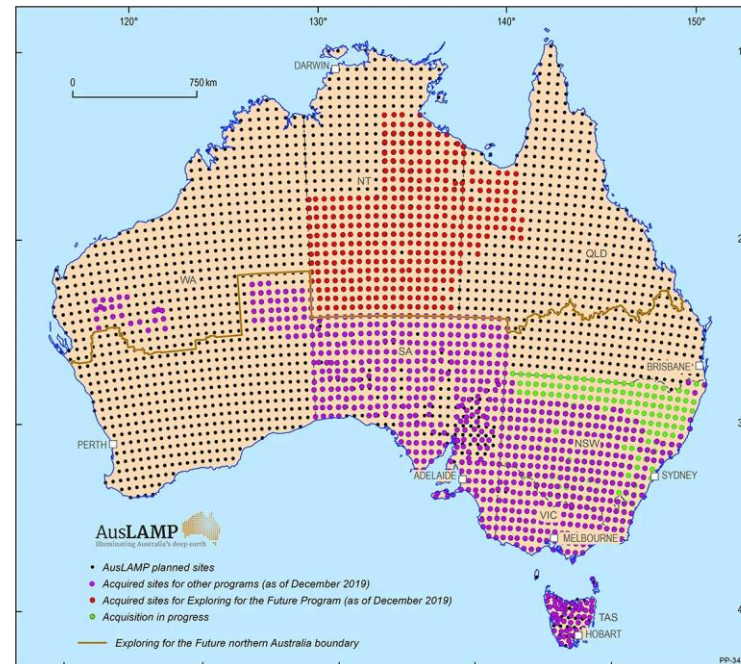
○ Completed borehole

GSSA - GA Collaboration  
Coompana Drilling Program

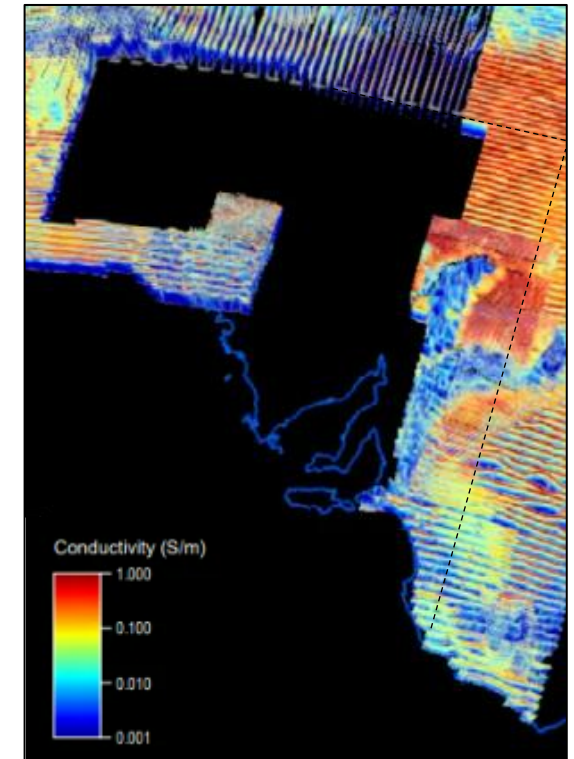
AusArray passive seismic array



AusLamp MT (lithospheric architecture)



East & Western Resources  
Corridor AEM survey (GP2)





# Exploring for the Future (EFTF2): National Mine Waste Assessment

- Accurate location of mine waste
- Model and predict critical mineral content
- Test and refine modelling
- Economic modelling for extraction and modern management of reprocessed mine waste
- Data and decision-making tools
- National Atlas







# South Australia focus: Gawler Craton

## GP2: Next Generation Digital Mapping

### Gawler Craton Airborne Survey GCAS: 2017 – 2021

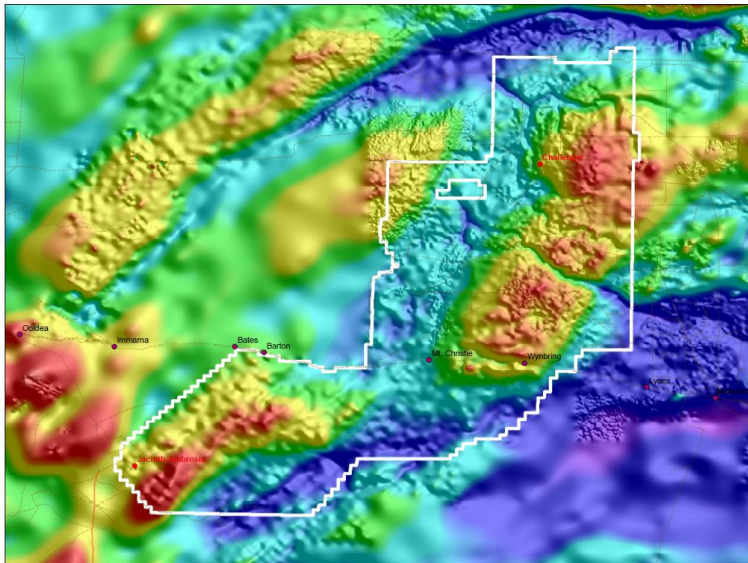
- Survey captured approximately 1,660,000 line kilometres of new magnetic, radiometric and digital elevation data over an area of about 295,000 km<sup>2</sup>
- New data provides a single, internally consistent dataset that will be fundamental in reinterpreting the geological structure of the Gawler Craton

### Gawler Phase 2: GP2: 2021 – 2023

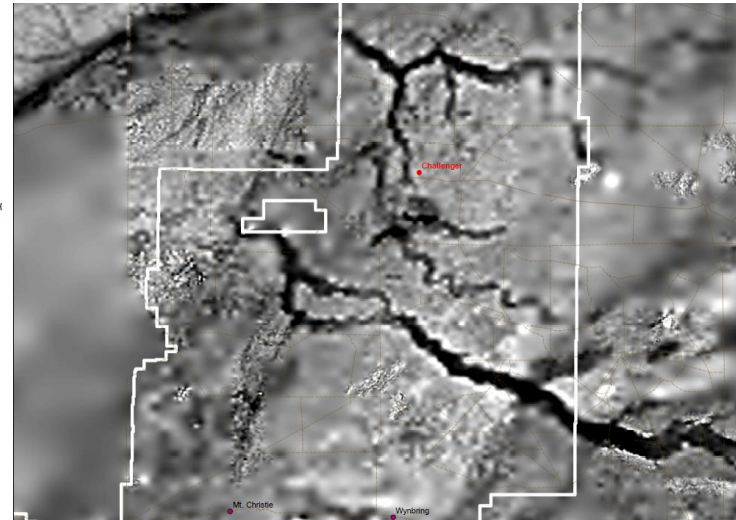
- Project to infill data into the current database
- Develop understanding of mineral systems in under-explored parts of the state, leading to new insights

✓ Gravity ✓ MT ✓ AEM

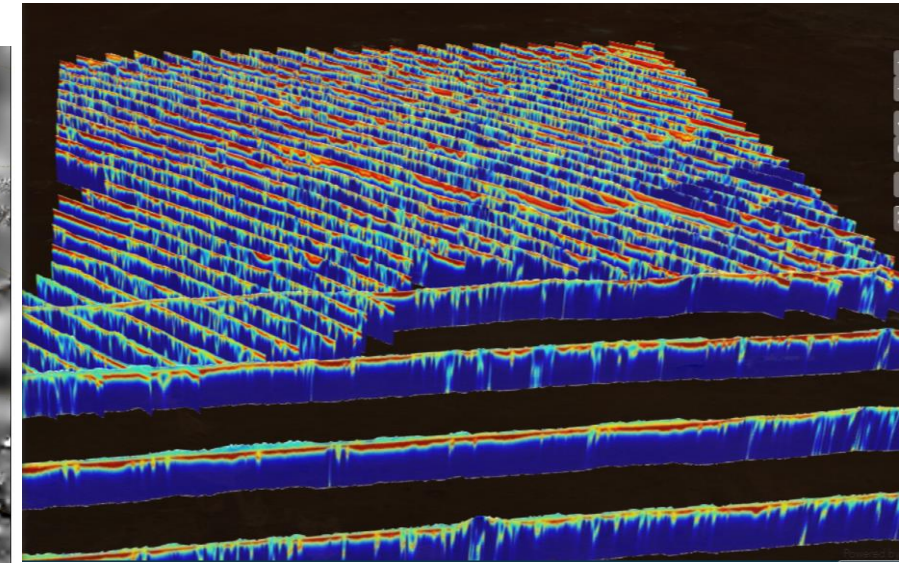
GP2: Gravity



GP2: Gravity 1VD, showing pre-Cenozoic palaeochannels



GP2: Airborne Electro-magnetics

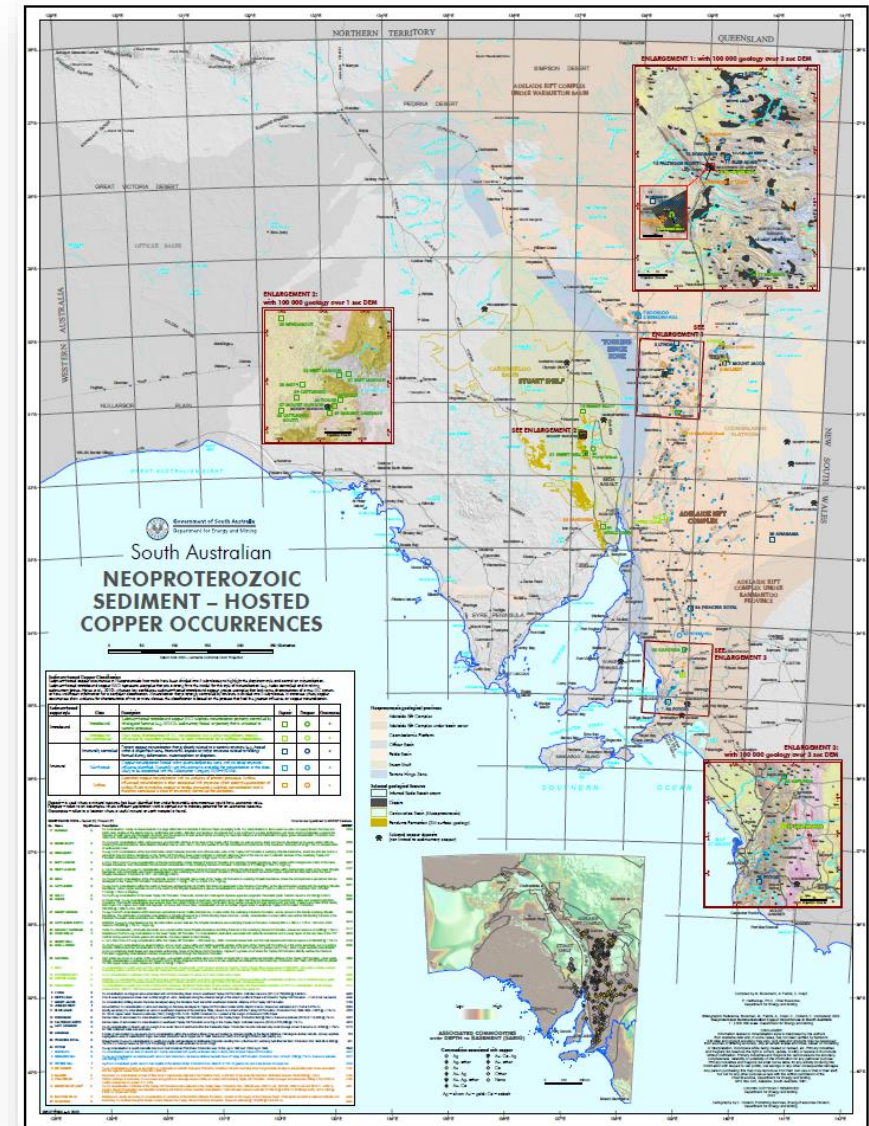


# New Geoscience Initiatives – Sedimentary Copper

- A GSSA-CSIRO joint project to develop a robust model and understanding the basin architecture of the Stuart Shelf
- Sedimentary-hosted copper deposits are the second most important source of copper in the world
- Stuart Shelf has long been considered as having considerable potential for sedimentary-hosted Cu resources due to similarities with the world-class African Copper belt.
- This deposit type is the main source of **cobalt**

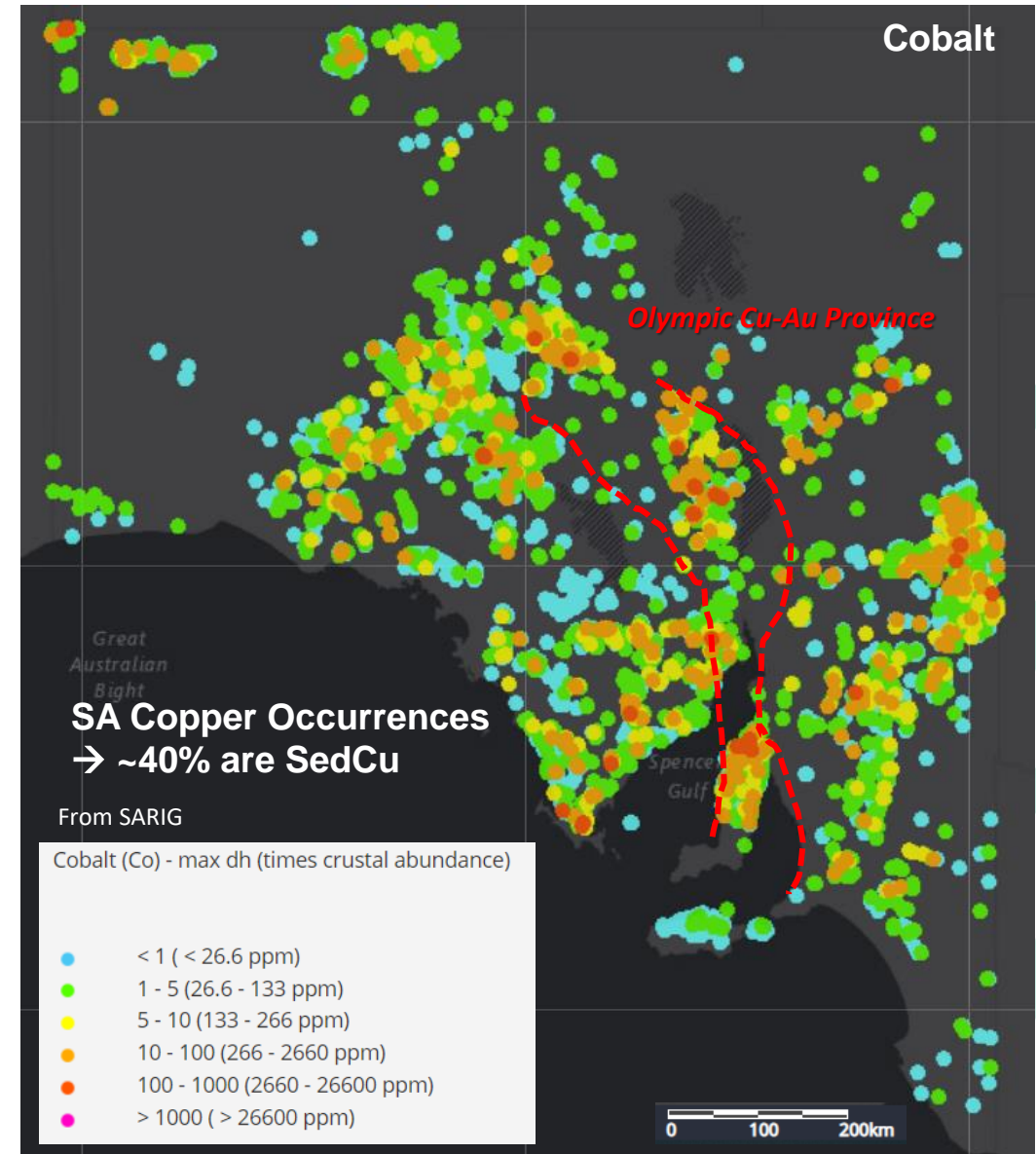
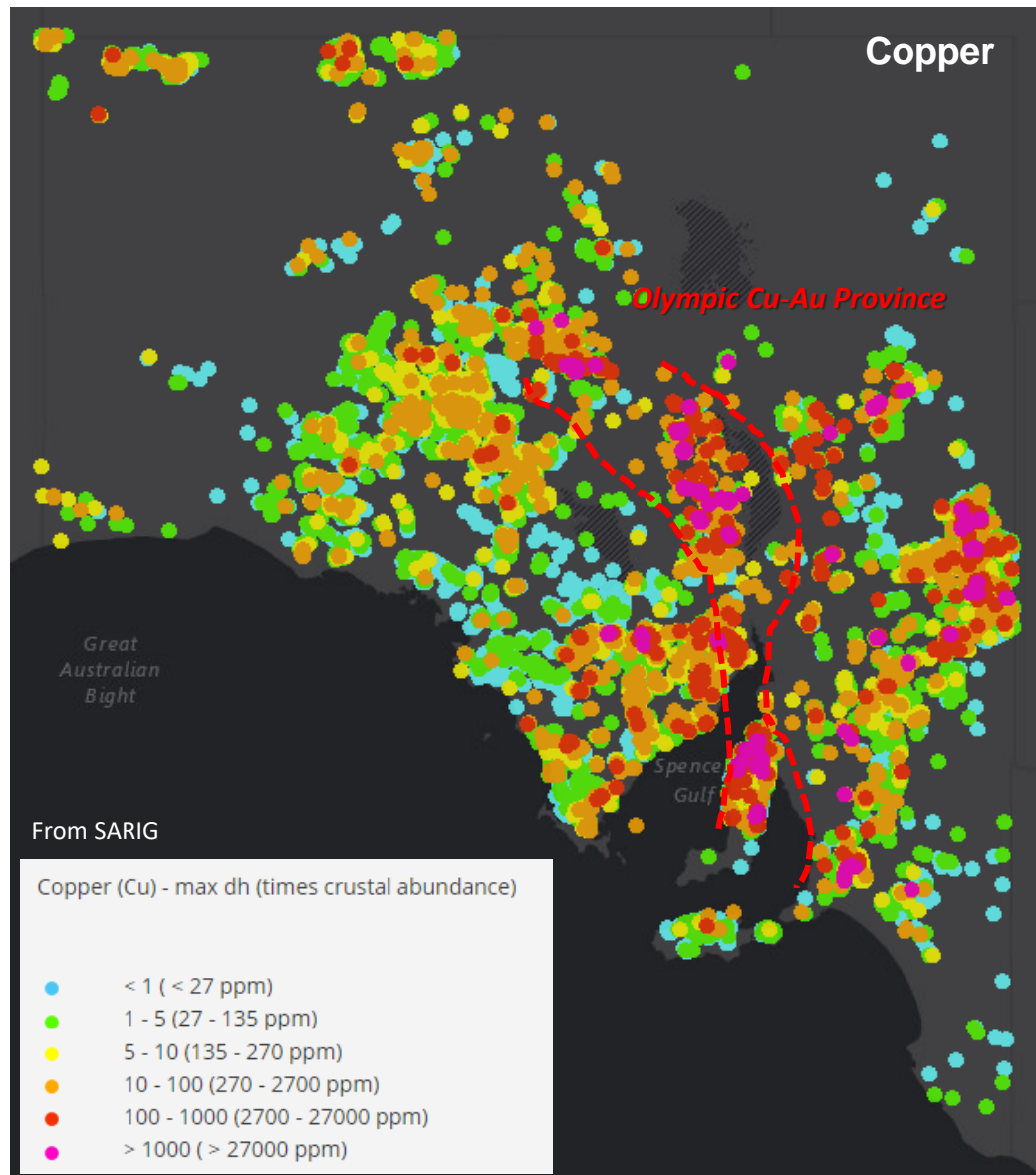


<https://www.energymining.sa.gov.au/industry/geological-survey/gssa-projects/sedcu>





# SA hosts ~70% Australia's Copper | Geochemistry data sets





# South Australia: Increased Interest in Critical Minerals

- Recent announcements confirming the geographic location, recent activity, geological domains and mineral systems
- Increase in demand for legacy data and access to Drill Core Reference Library
- Increase in critical mineral exploration interest

**But how well do we understand critical minerals in South Australia?**

SA's potential for Critical Mineral supply:  
proximity to economic production

Platinum Group  
Elements  
Silicon Vanadium  
Chromium Lithium  
Beryllium Rhenium  
Scandium Gallium  
Helium Tungsten  
Tantalum

Cobalt  
Manganese  
Germanium  
Indium  
Niobium  
High Purity Alumina

Graphite  
Zirconium  
Titanium  
Rare Earth Elements  
Magnesium  
Antimony  
Bismuth  
Hafnium

# New geoscience initiatives – Critical Minerals South Australia Project:



Is a government funded, precompetitive geoscience project which aims to describe SA's potential and drive exploration and development of Critical Minerals. Key deliverables are:


- Take a mineral systems approach to critical minerals to uncover SA potential for critical minerals
- SA focused **Mine-Waste** assessment
- Develop high quality data sets and reports to be progressively released to the public
- Facilitating & providing advice to explorers to come to SA, with data availability and resource advice
- Economic and Market Analysis Report for Critical Minerals in South Australia\*
- Develop a Critical Minerals Strategy / action plan for SA which draws together all parties - government, industry, research



\*Critical Minerals SA Economic Study – commenced with SA Centre for Economic Studies

# Critical Minerals South Australia: Deliverables



Activity	Description	Timeframe
Stocktake of SA's critical mineral potential	Review and compile the nature of mineral systems that produce economic grades of each of the defined critical mineral.	Q2 2023
Geochemical Characterisation	Detailed characterisation and analysis of key drill holes from the state core library collection. New precompetitive datasets highlighting discovery opportunities at a state and regional level	Mid-late 2024
Mine-waste Assessment	<p>An assessment of the potential for critical mineral recovery from Mine-waste / tailings, whilst rehabilitating the environment (two-phase)</p> <ol style="list-style-type: none"> <li>1. Using publicly available information, develop a ranked list of prospective mine-sites</li> <li>2. Conduct a program of sampling and geochemical analysis to describe the full suite of CMs in the mine-waste for selected sites</li> </ol>	 Mid-2024
Critical Minerals economic study – value chain demand and supply	Assessment of barriers, opportunity and drivers at state level and understanding existing and potential market advantages.	Q4 2023
Critical Mineral reporting and SARIG	Critical Mineral specific launch pad and data visualisation tools.	Ongoing throughout

<https://www.energymining.sa.gov.au/industry/geological-survey/gssa-projects/critical-minerals-south-australia>



# Rare-Earth Elements

SA is very fertile for REEs

- › Mineral Sands – hosted
- › IOCG – associated
- › Ionic-clay – hosted
- › Carbonatites?

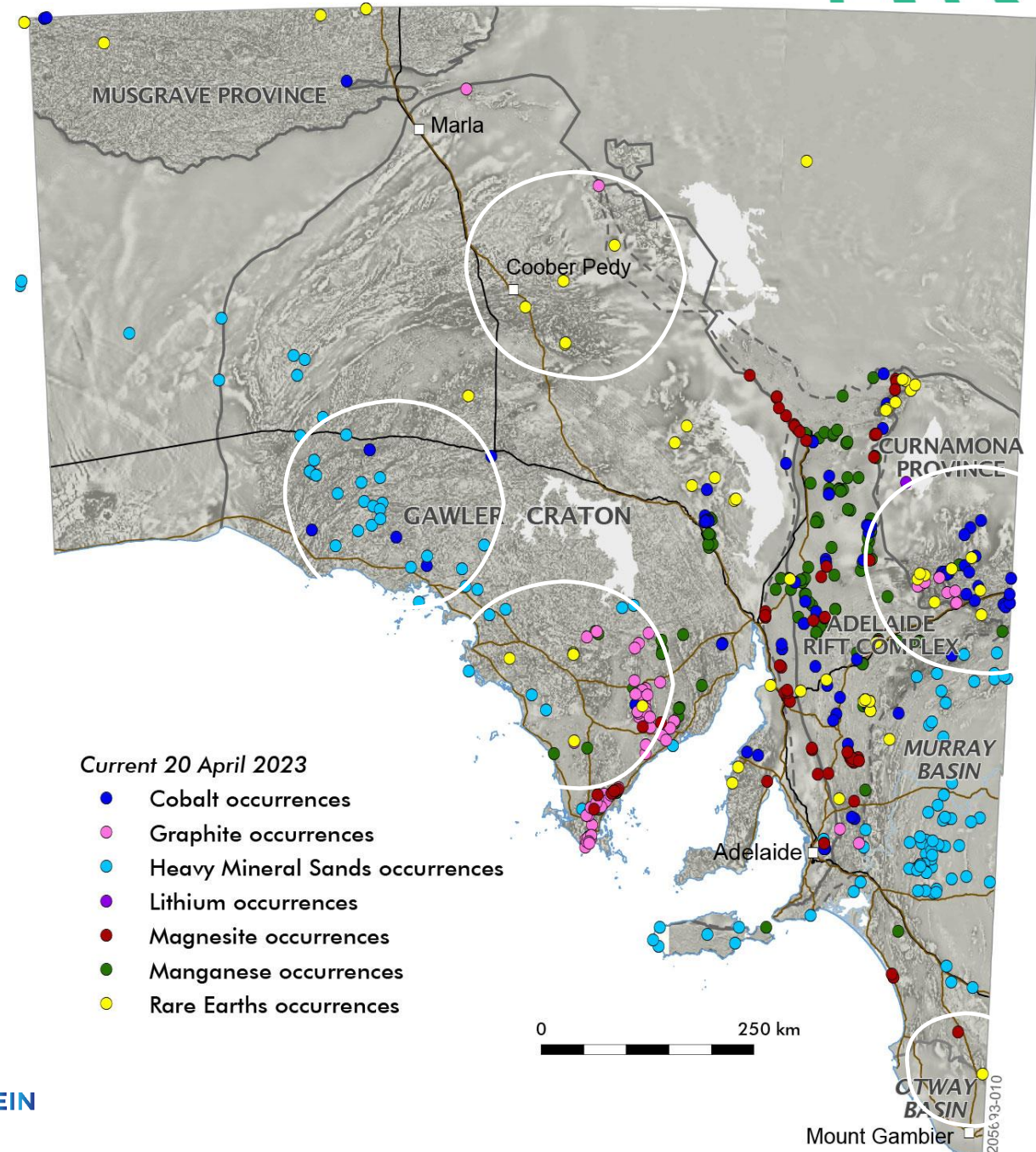
**JURY'S OUT!**



Research programs underway:

- › 12 months study into SA's prospectivity in REEs
- › 4 year Post-Doc on Lithium underway with UoA

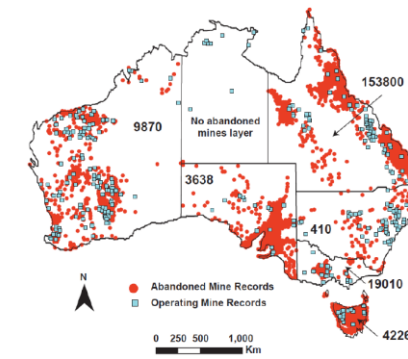
Ionic clay-hosted REE discovered in Naracoorte (AR3), Flinders Ranges, Wudinna, Coober Pedy and Eyre Peninsula



# SA's Mine-waste desktop study: Review of MINDEP via SARIG & open file information

- ~1000 sites ranked using a newly developed system of weighted criteria in consultation with GSSA
- Developed top 30 ranked list of opportunities that could be further high-graded for site sampling and geochemical and mineralogical analysis
- 10 detailed case studies are also provided in the report

[Critical Minerals South Australia | Energy & Mining](https://energymining.sa.gov.au)  
([energymining.sa.gov.au](https://energymining.sa.gov.au))



Rank	Parameter (weighted)	“Better” Assumptions
1	Mine status	C&M, ceased, or abandoned
2	Known commodity	Ni, Co, Zn, Mn, Cu, Co, Au, Ag, Fe
3	Associated commodities	Known to have CM affinity
4	Discovery year	Older
5	Mine waste feature	Larger volume

Other considerations included: Distance to a major city, mine site or port; and environmental contamination

- South Australian mine waste is fertile in metals including Co, Cu, Ni, REEs and Au.
- Middleback Ranges was recognised as a potential host for Mn, with notable enrichment likely in waste materials.
- Potential for bismuth in several sites.



# Mine Waste Study



**Table 10.** Highest ranking sites for potential critical metal prospectivity in mine waste (n=30).

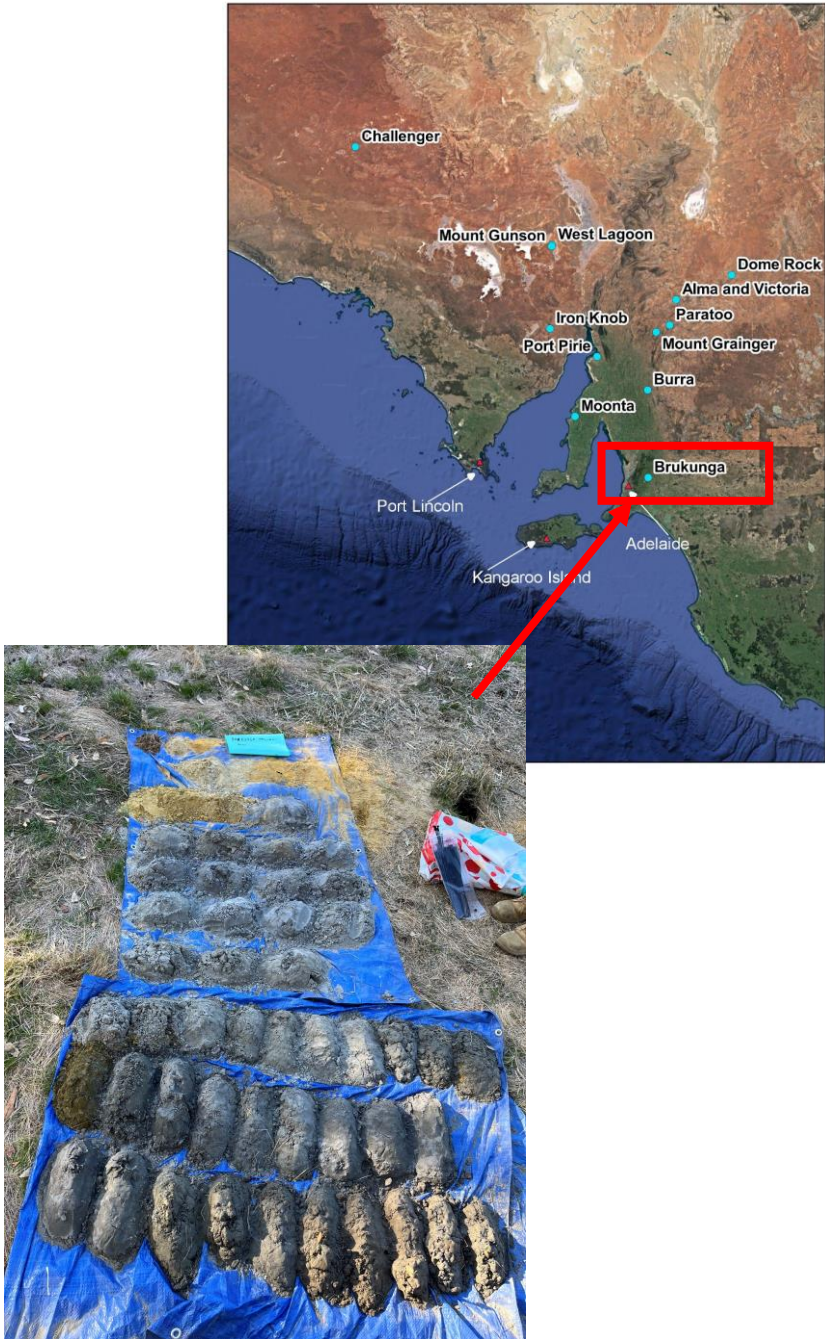
Rank	MINDEP_NO	DEP_NAME	Description	Score (/50)
1	3137	West Lagoon	Mount Gunson area	47
2	8908	Port Pirie (REE)	Radium Hill waste majority	42
3	3807	Burra	Historic/ tourist site	42
4	3088	Mount Gunson	Mount Gunson area	41
5	4856	Kapunda	Existing company activity	41
6	1933	Mount Grainger		41
7	1927	Paratoo		41
8	5104	Moonta Central Lode	Historic/ tourist site	41
9	3046	Challenger	Care and maintenance	40
10	5136	Moonta Eastern Lode	Historic/ tourist site	40
11	5967	Alma and Victoria		40
12	1025	Dome Rock		40
13	6644	Iron Knob	Existing company activity	39
14	7854	Beltana	Zinc in willemite	39
15	3206	Blinman	Historic/ Tourist site	39
16	842	Mutooroo		39
17	7300	Walleroo		38
18	8256	Burra smelting works	Historic/ tourist site	38
19	962	Radium Hill	Radioactive hazard	38
20	1482	Brukunga		37
21	3057	East lagoon	Mount Gunson area	37
22	3002	Iron Monarch	Care and Maintenance	36
23	4401	Leigh Creek Lobe B		36
24	394	Perseverance		36
25	3051	Cattlegird	Mount Gunson area	36
26	5208	Wheal Hughes		36
27	8203	Glenloth Government Battery		36
28	3029	Iron Prince	Existing company activity	35
29	3010	Peculiar Knob		35
30	4207	Rossman		35

# Mine-waste Study and Next Steps:

Sites highly ranked for Phase 2 sampling and analysis

Sites	Mined Commodity	Potential Critical Minerals
Mt Gunson	Cu, Ag, Co	Cu, Co, Ag, Bi, Au, Zn
Port Pirie	REE, RT	REE
Iron Monarch-Knob-Prince	Fe	Mn
Brukunga*	S	Cu, As, Ag, Co

\* Brukunga sampling completed





# Research programs

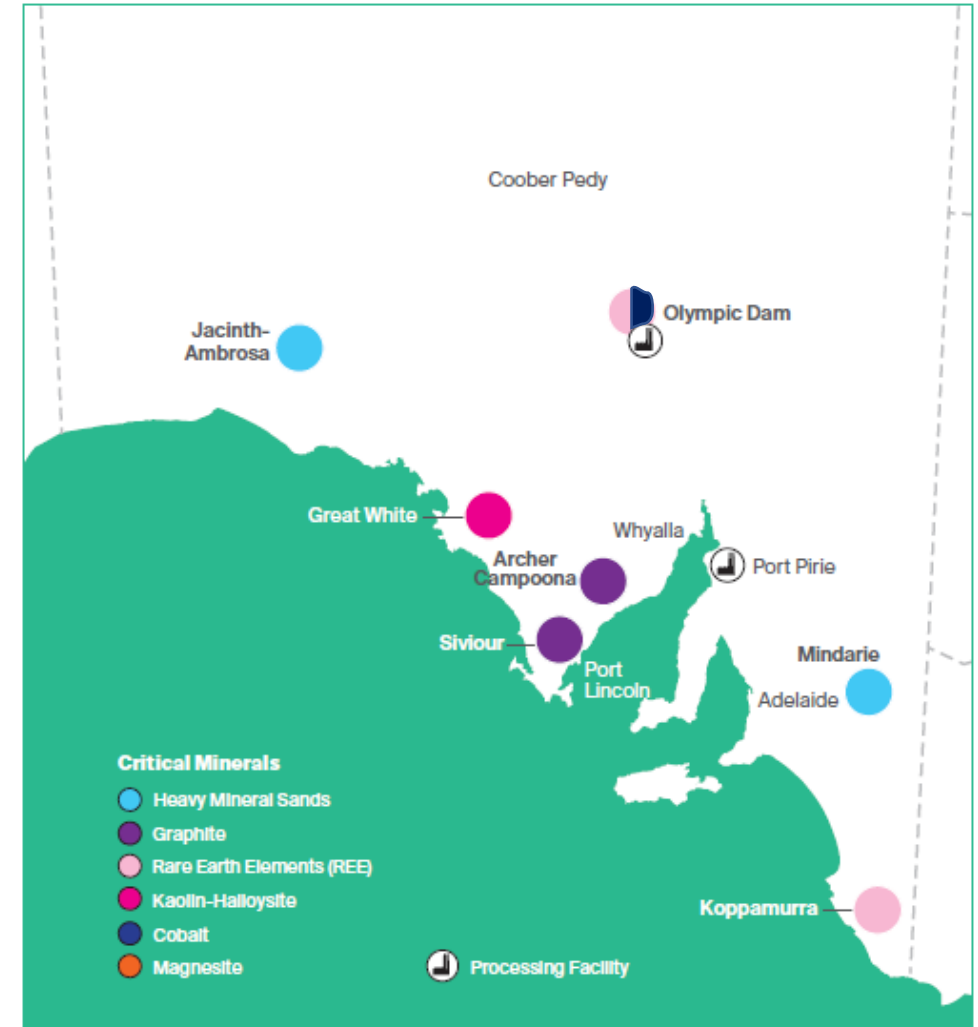


- Origins of REE accumulations in South East
- Nickel + PGE mineralisation in Musgraves and Western Gawler
- Joint postdoc between Uni Adelaide and GSSA Lithium pegmatite mineralogy (Jarred Lloyd)
- UniSA/MinExCRC PhD mineral systems research (Justine Flahaut )
- Uni of Adelaide/MinExCRC PhD metal isotopes in the regolith (Cu, S isotopes) (Zara Woolston)
- ARC Linkage project value-add metals from mine streams and wastes from Olympic Dam (with BHP)
- Critical minerals focussed processing studies
- Mineral Exploration Cooperative Research Centre MinEx CRC including an embedded researcher gold mineralisation in the central Gawler Craton (Alex Van Leeuwen)
- UniSA assessment underway on critical minerals and net zero mining as a major research focus



# Critical Mineral Strategy & Action Plan for SA: focus on doing what we do best: working together!

- Consolidated approach which draws together all sectors; addressing:
  - Supply chain diversity providing strategic advantages
  - Which minerals will see sustained demand – play to SA's strengths
  - Facilitate and support producers to meet demand
  - Have a clear understanding of our inventory – key characteristics? What new data is required to shift discovery to development?
  - Water and power – major barrier to delivery, how can we help
- Centralised processing hubs
- Geoscience, Metallurgy, Processing Upskilling Hub – R&D / education powerhouse



# Contacts

## Bronwyn Camac

A/Director Geological Survey of South Australia (GSSA)

---

**Department for Energy and Mining**

***Geological Survey of South Australia***

11 Waymouth Street,  
Kaurna Country, Adelaide, South Australia 5001

T: +61 8 8429 0597

E: [Bronwyn.Camac@sa.gov.au](mailto:Bronwyn.Camac@sa.gov.au)





# Disclaimer

---

The information contained in this presentation has been compiled by the Department for Energy and Mining (DEM) and originates from a variety of sources. Although all reasonable care has been taken in the preparation and compilation of the information, it has been provided in good faith for general information only and does not purport to be professional advice. No warranty, express or implied, is given as to the completeness, correctness, accuracy, reliability or currency of the materials.

DEM and the Crown in the right of the State of South Australia does not accept responsibility for and will not be held liable to any recipient of the information for any loss or damage however caused (including negligence) which may be directly or indirectly suffered as a consequence of use of these materials. DEM reserves the right to update, amend or supplement the information from time to time at its discretion.

