IOCG Exploration in the Gawler Craton

PDAC 2026

Tom Wise, Acting Director

Geological Survey of South Australia

acknowledging big contributions from the team at the Geological Survey of South Australia

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Government of South Australia
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GEOLOGICAL SURVEY SOUTH AUSTRALIA

AUSTRALIA MINERALS
REALISE THE OPPORTUNITY

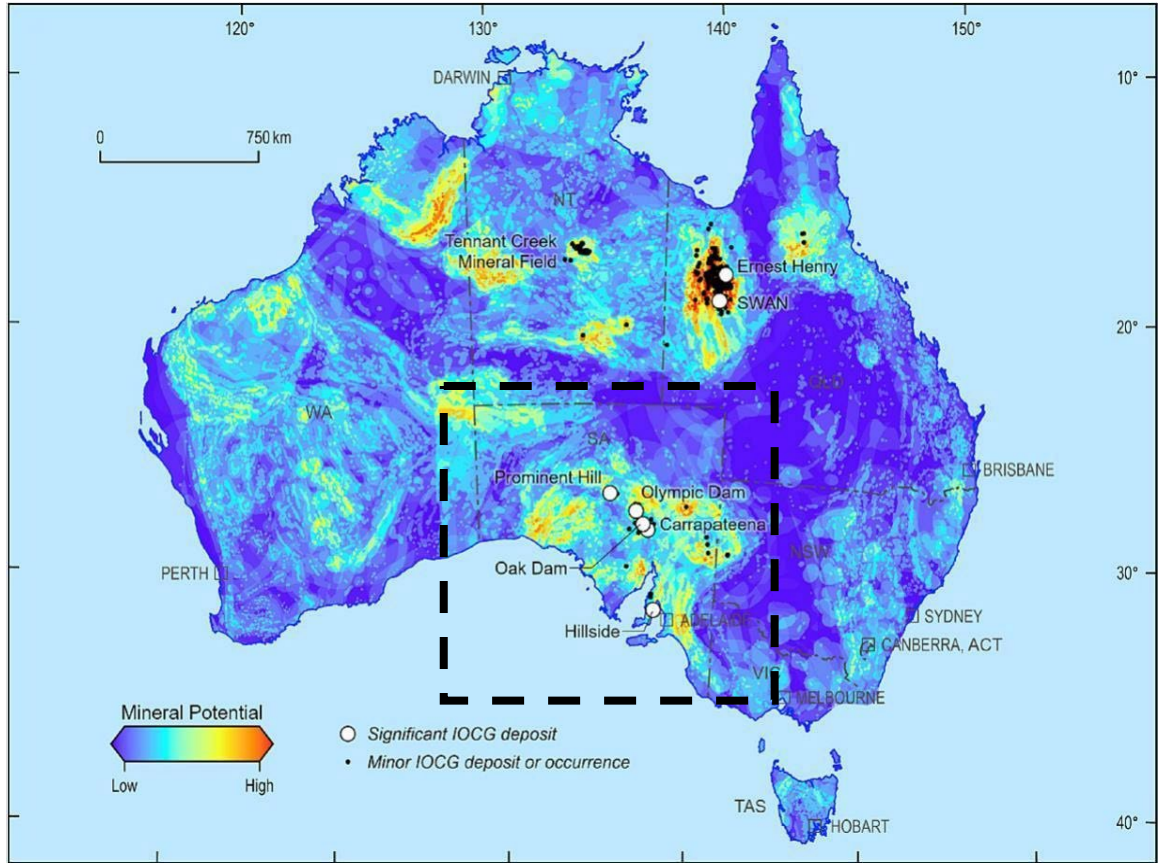
South Australia

A copper investment capital

Hosts **68%** of Australia's known copper resources

Produced **320,000 tonnes** of copper in 2024

SA's **#1 export** commodity



Cloutier et al., 2025

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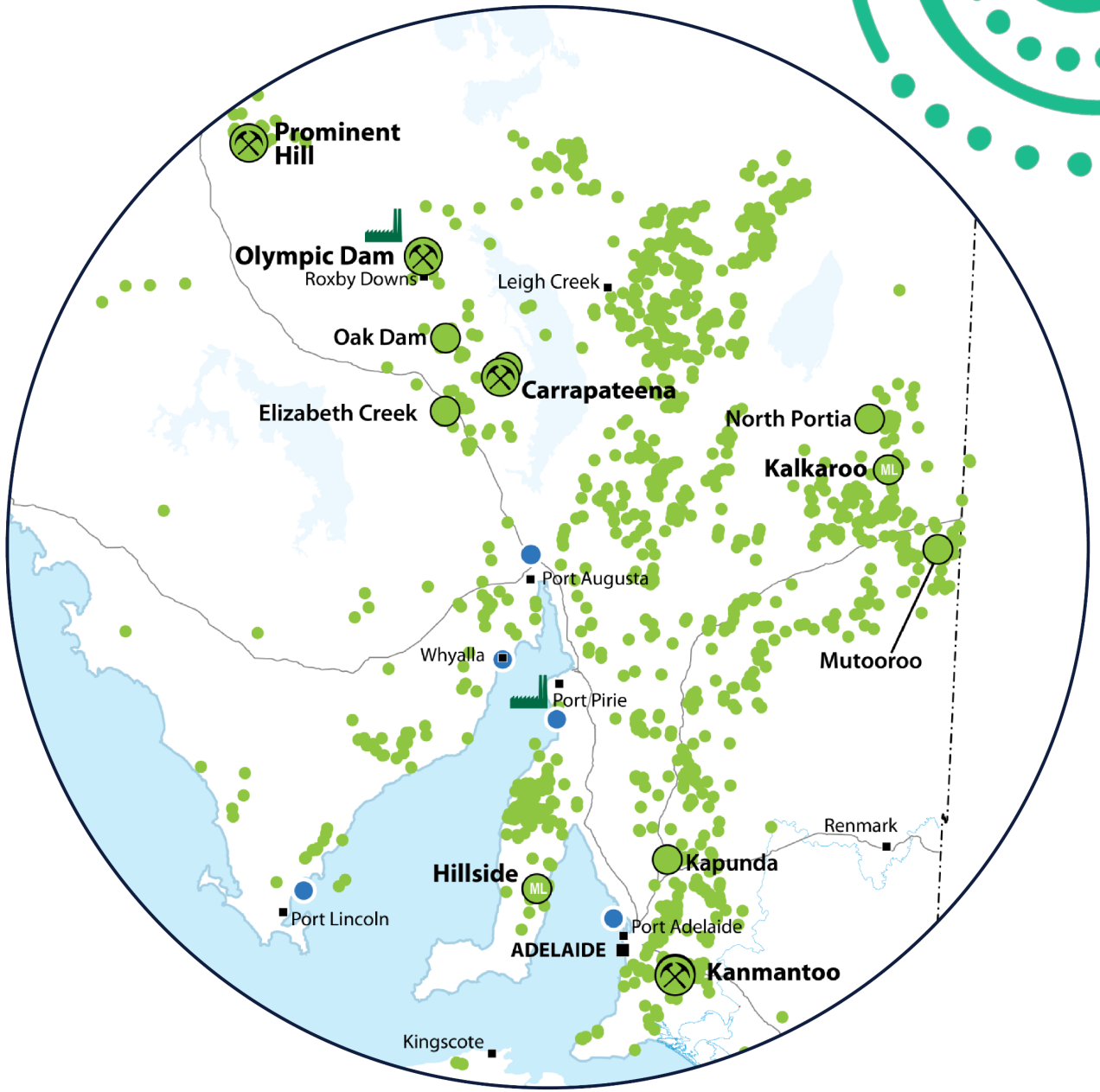
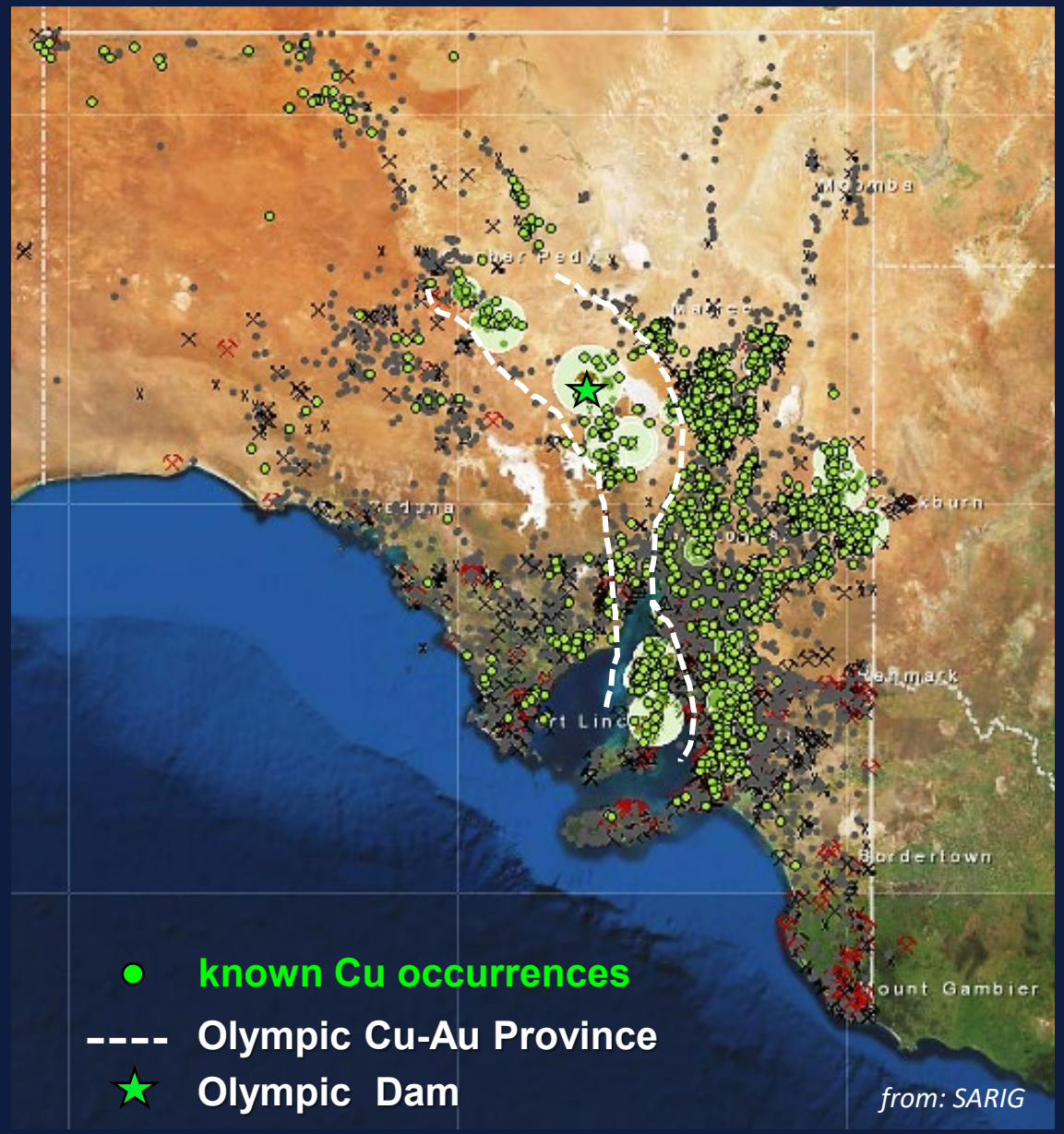
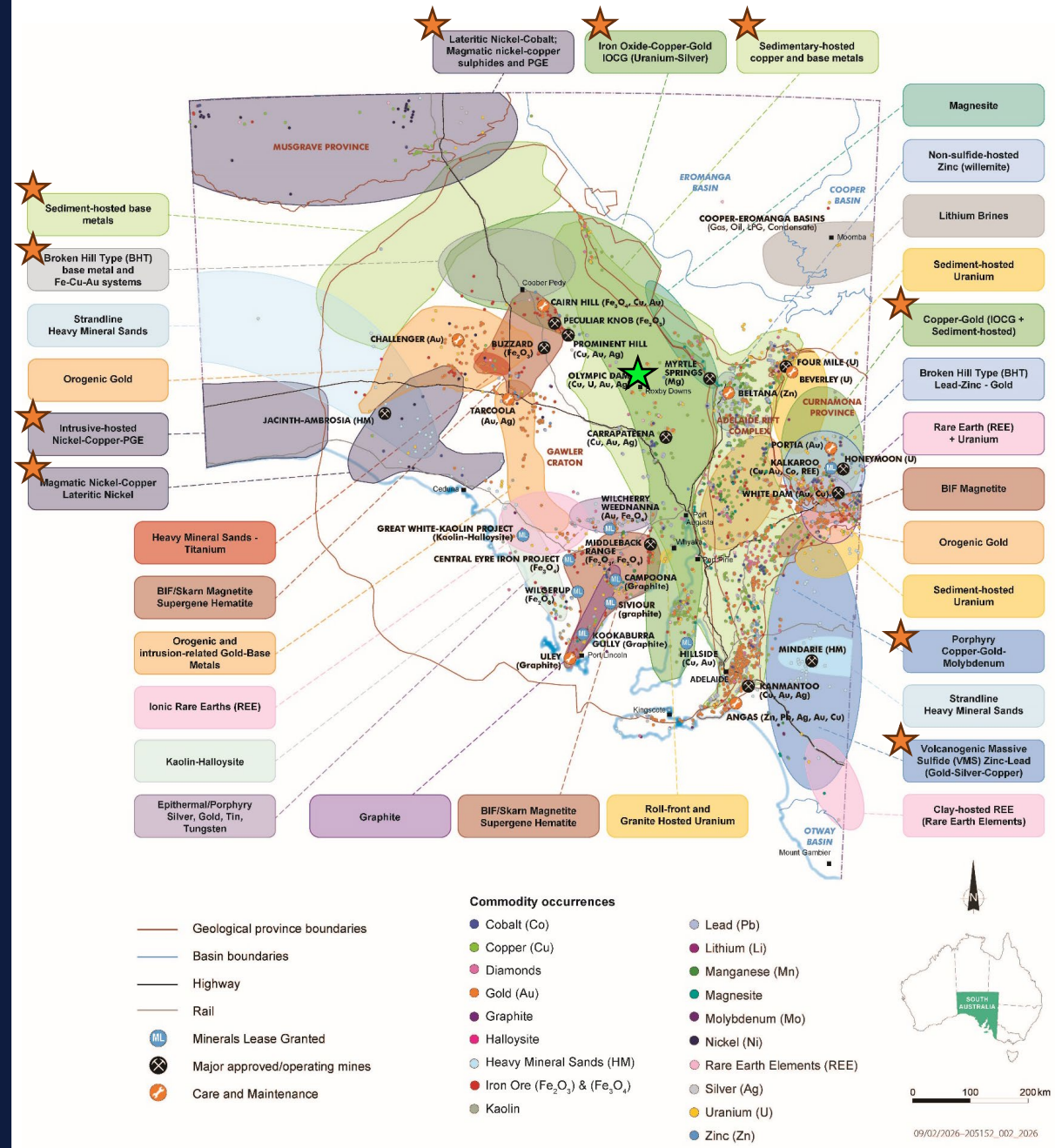


Copper in South Australia





Olympic Dam

- Current resource: 11,370 Mt @ 0.72% Cu, 0.3 g/t Au, 1.29 g/t Ag, 0.24 kg/t U_3O_8
- World's 4th largest Cu and largest U deposit
- Production commenced in 1988
- >100 year mine life
- Big deposit with a huge footprint

Ehrig 2014, SAEMC

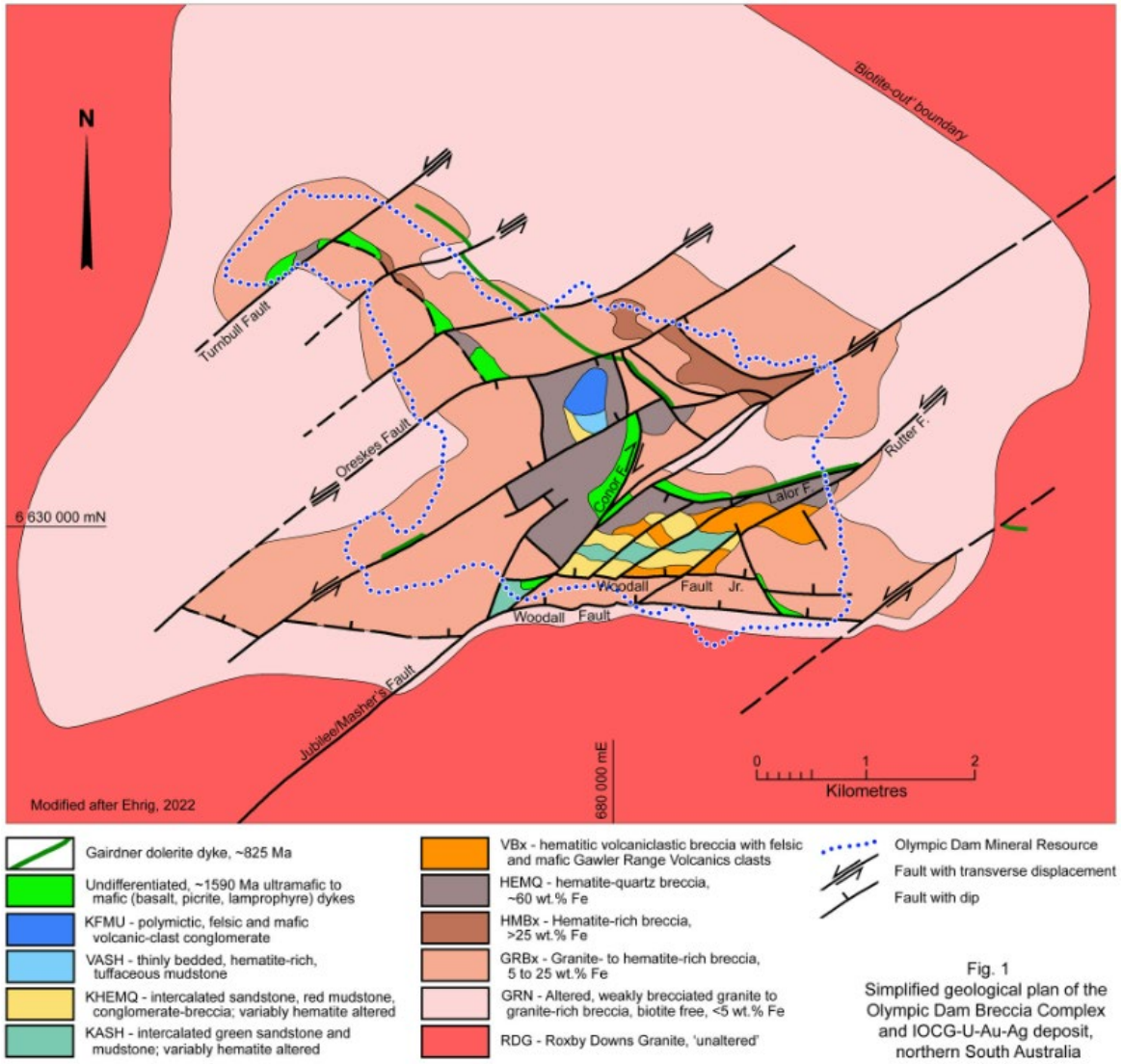


Fig. 1
Simplified geological plan of the Olympic Dam Breccia Complex and IOCG-U-Au-Ag deposit, northern South Australia

Porter Geo, 2024

Iron Oxide Copper Gold deposits (IOCG)

Reference drillholes from IOCG and associated deposits in South Australia

Adrian Fabris and Bernd Michaelsen

Two main types: Magnetite-dominant and hematite-dominant

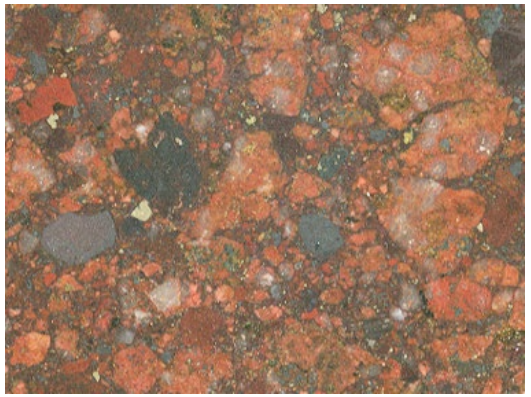
South Australia renowned for hematite-dominant IOCG deposits, typically larger than magnetite-dominant deposits

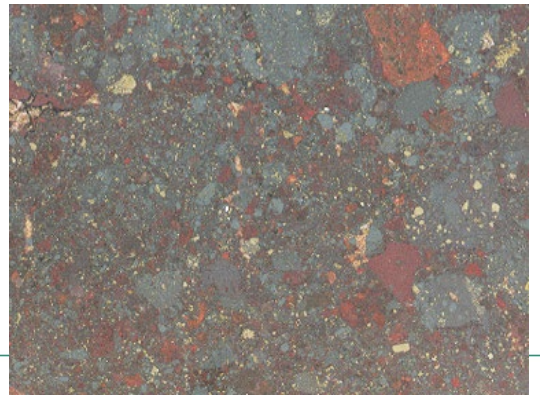
Associated commodities: Cu, U, Au, Ag ± Mo, Co, LREE. Fe is enriched but uneconomic to produce due to impurities

South Australian

IOCG deposits:

- Olympic Dam
- Carrapateena
- Prominent Hill
- Oak Dam

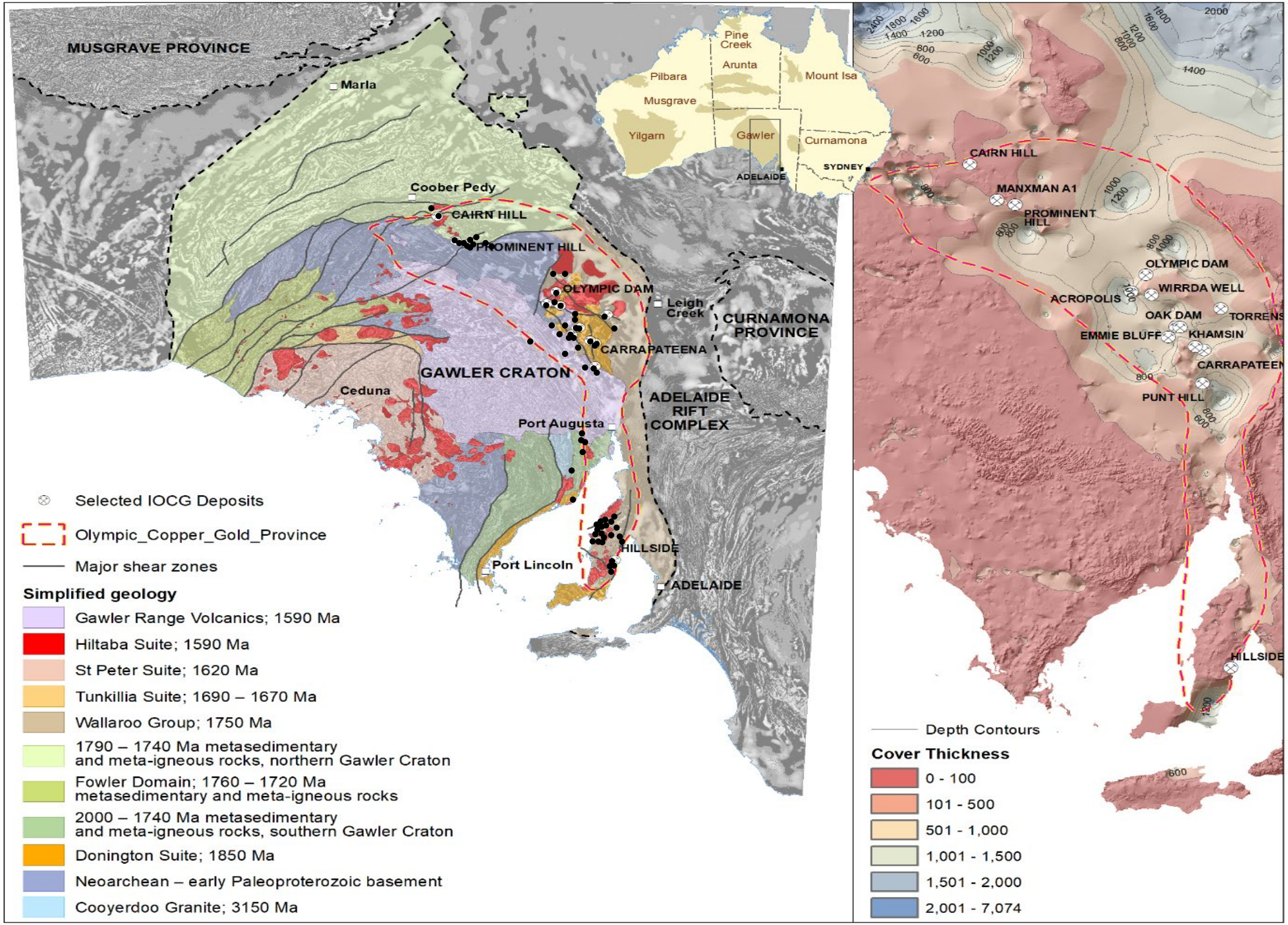




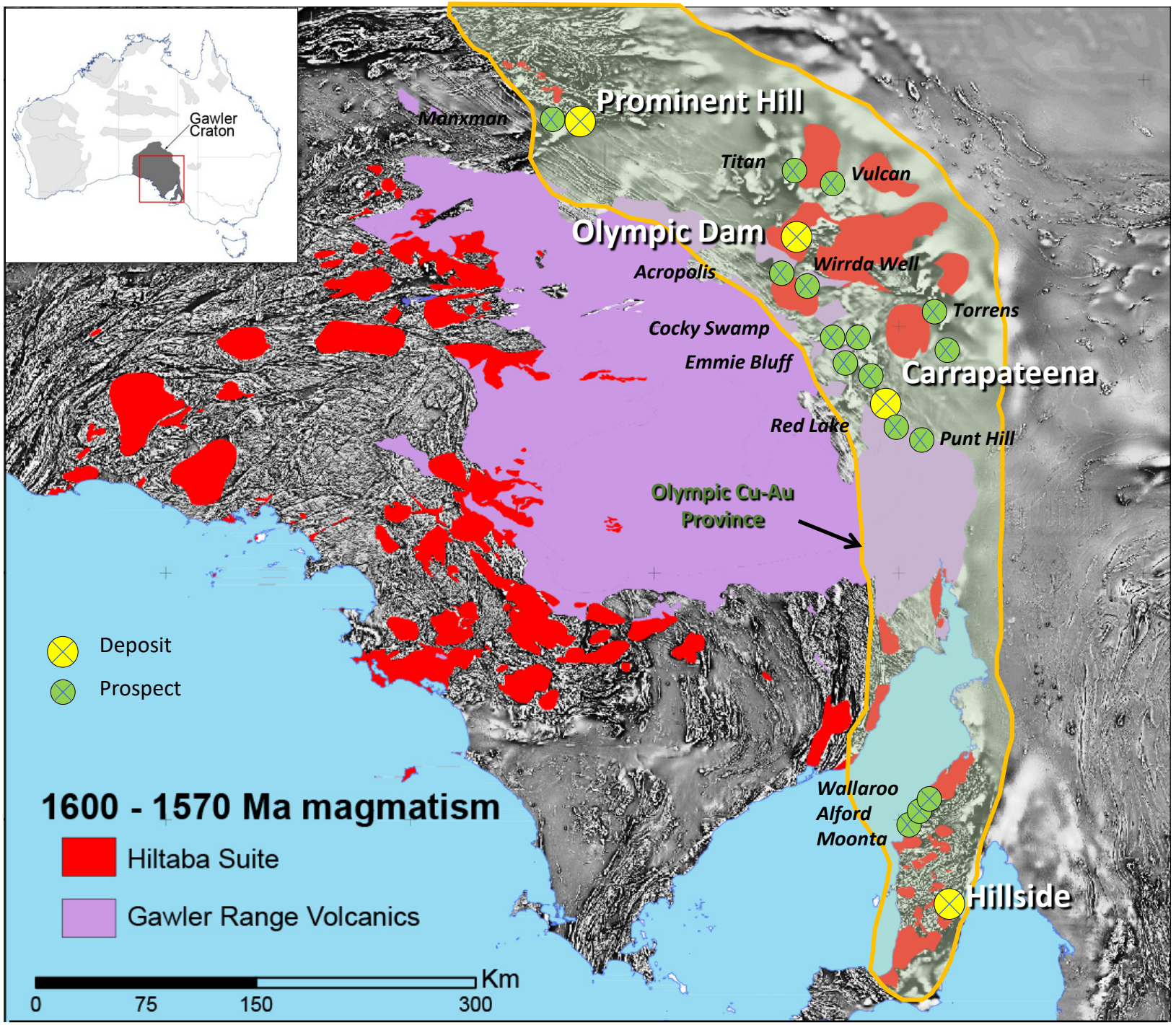
Olympic Dam

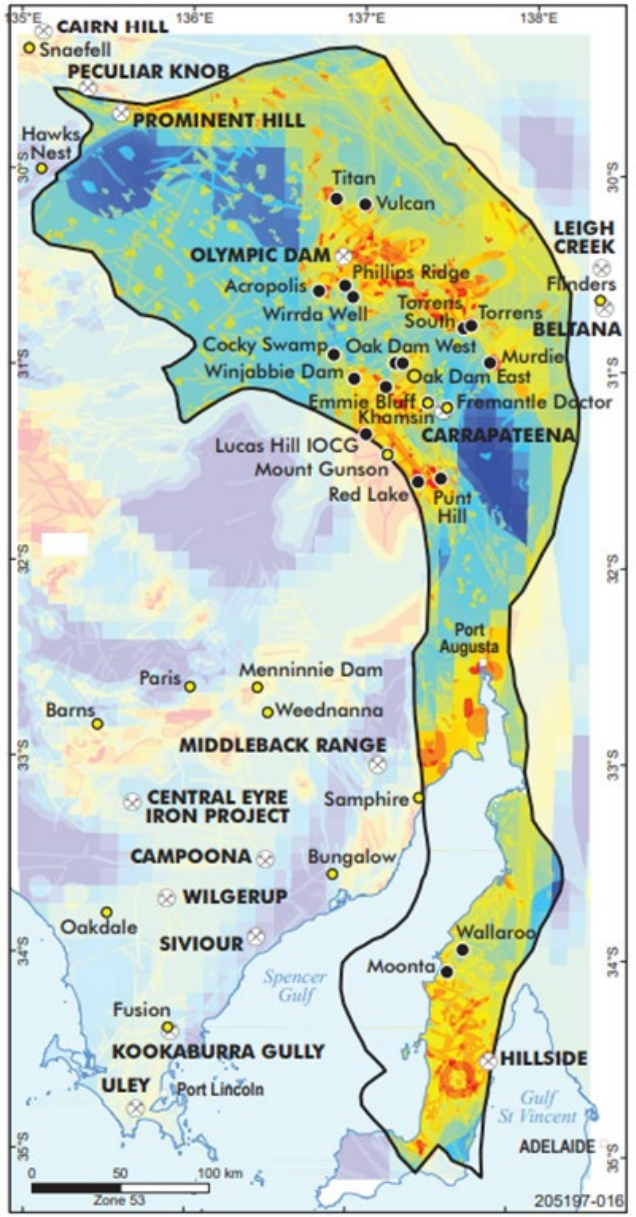
Carrapateena

Prominent Hill



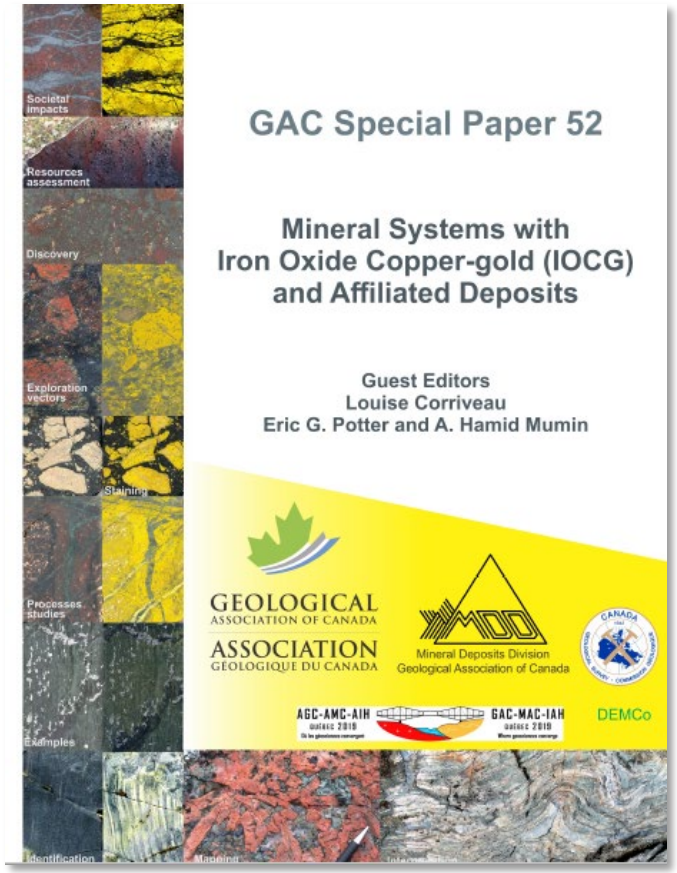
1. **Iron-oxide copper–gold (IOCG) mineral systems** that are anomalously enriched in **copper, gold, uranium, silver and rare earth elements**, and formed during a **short-lived but intense mineralising episode at ~1.60–1.57 Ga**, broadly coincident with a major magmatic event.
2. Deposits are associated with a range of **repeatable mineral assemblages and geochemistry.**
3. **Linking crustal scale architecture**


Gawler Craton
Prominent Hill
Manxman
Titan
Vulcan
Olympic Dam
Acropolis
Wirrda Well
Torrens
Cocky Swamp
Emmie Bluff
Carrapateena
Red Lake
Punt Hill
Olympic Cu-Au Province
Wallaroo
Alford
Moonta
Hillside
Deposit
Prospect
1600 - 1570 Ma magmatism
Hiltaba Suite
Gawler Range Volcanics
Km
0
75
150
300


CAIRN HILL
Snaefell
PECULIAR KNOB
PROMINENT HILL
Hawks Nest
Titan
Vulcan
LEIGH CREEK
OLYMPIC DAM
Phillips Ridge
Acropolis
Flinders
Wirrda Well
Torrens South
Torrens
BELTANA
Cocky Swamp
Oak Dam West
Murdie
Winjabbie Dam
Oak Dam East
Emmie Bluff
Fremantle Doctor
Khamsin
CARRAPATEENA
Lucas Hill IOCG
Mount Gunson
Red Lake
Punt Hill
Port Augusta
Paris
Menninnie Dam
Barns
Weednanna
MIDDLEBACK RANGE
CENTRAL EYRE IRON PROJECT
Samphire
CAMPOONA
Bungalow
WILGERUP
Oakdale
SIVIOUR
Wallaroo
Moonta
Spencer Gulf
Fusion
KOOKABURRA GULLY
HILLSIDE
ULEY
Port Lincoln
Gulf St Vincent
ADELAIDE
0
50
100 km
Zone 53
205197-016
Relative potential
Higher
Lower

Wise, 2019

Predictable paragenetic patterns



Recommended citation: Corriveau, L., Montreuil, J.-F., Potter, E.G., Ehrig, K., Clark, J.M., Mumin, A.H., and Williams, P.J., 2022, Mineral systems with IOCG and affiliated deposits: part 1 – metasomatic footprints of alteration facies, in Corriveau, L., Potter, E.G. and Mumin, A.H., eds., Mineral systems with iron oxide copper-gold (IOCG) and affiliated deposits: Geological Association of Canada, Special Paper 52, p. 113-158.

Alteration facies

Silicification
(<250°C)

Low T K-Fe-H-CO2
Hem-Kfs/Musc-Carb-Chl-sulfides
(<350°C)

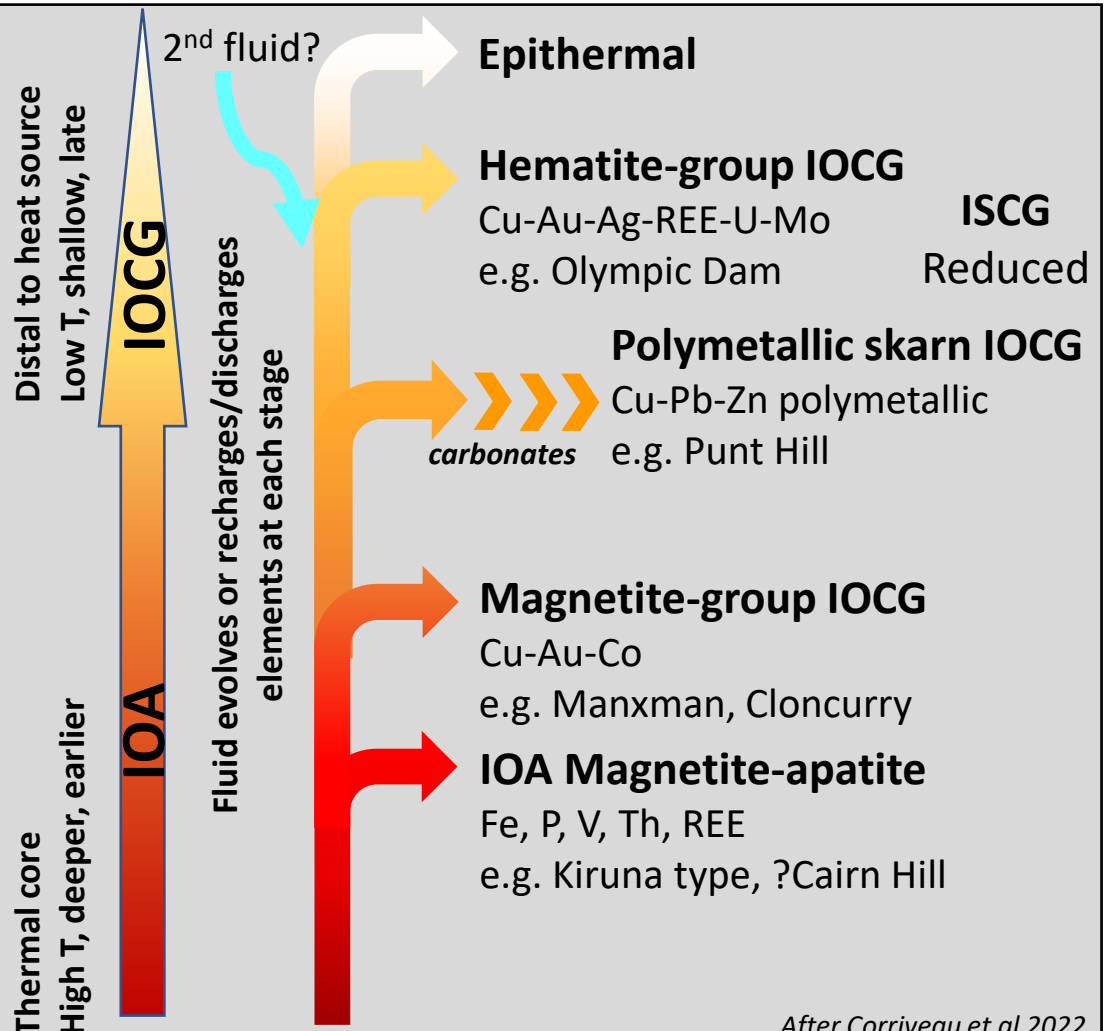
Mag to Hem transition
Kfs/Cpx-Grt-Kfs-sulfides

High T K-Fe
Mag-Bt/Kfs-sulfides

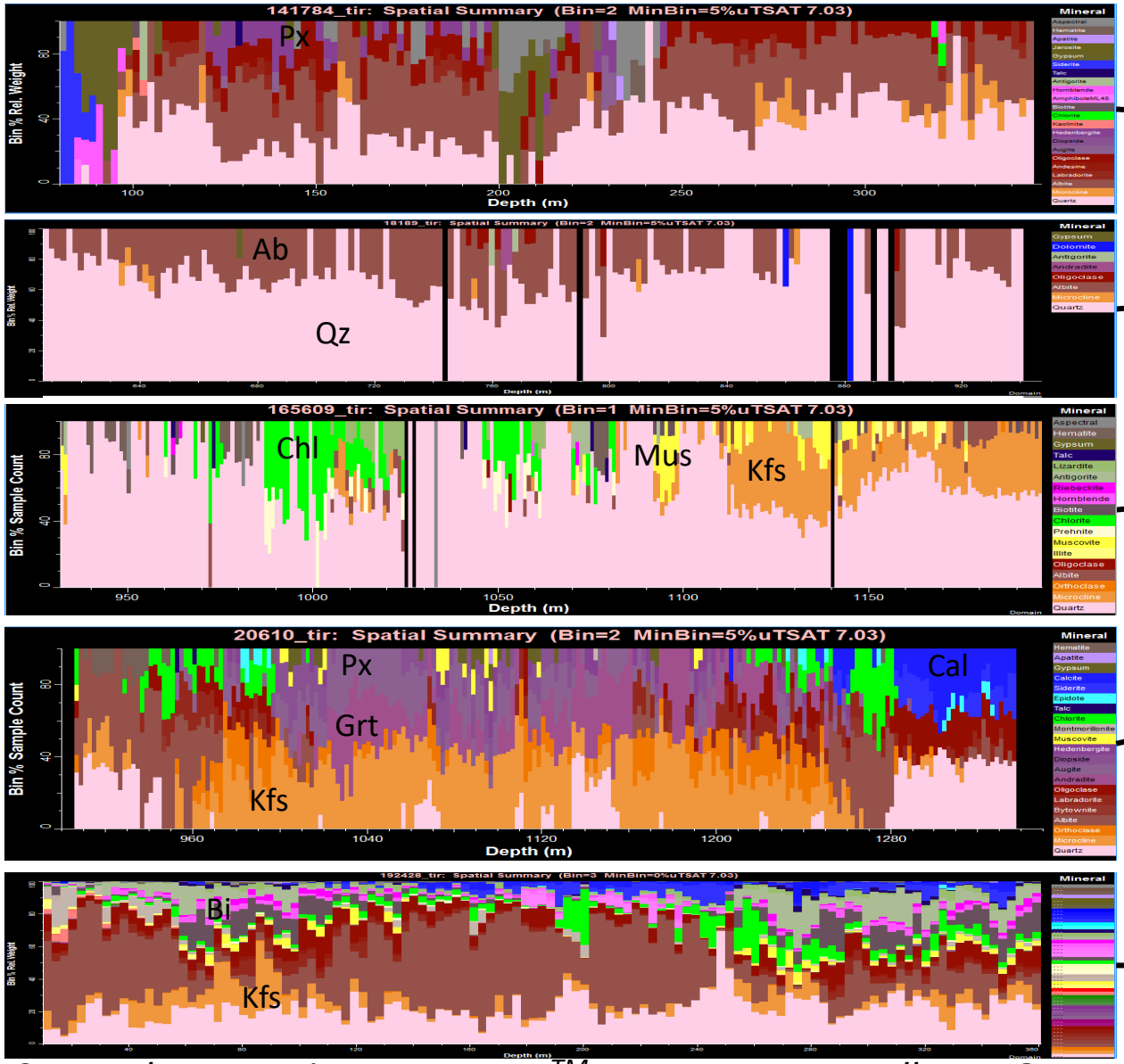
High T Ca-Fe ± Mg (+skarn)
Amp-Mag ± Cpx-Ap-Ttn
(largely barren of sulfides)
(<800°C)

Na ± Ca (albities)
Ab-Scp-Qz-Zrn-Rt (<600°C)

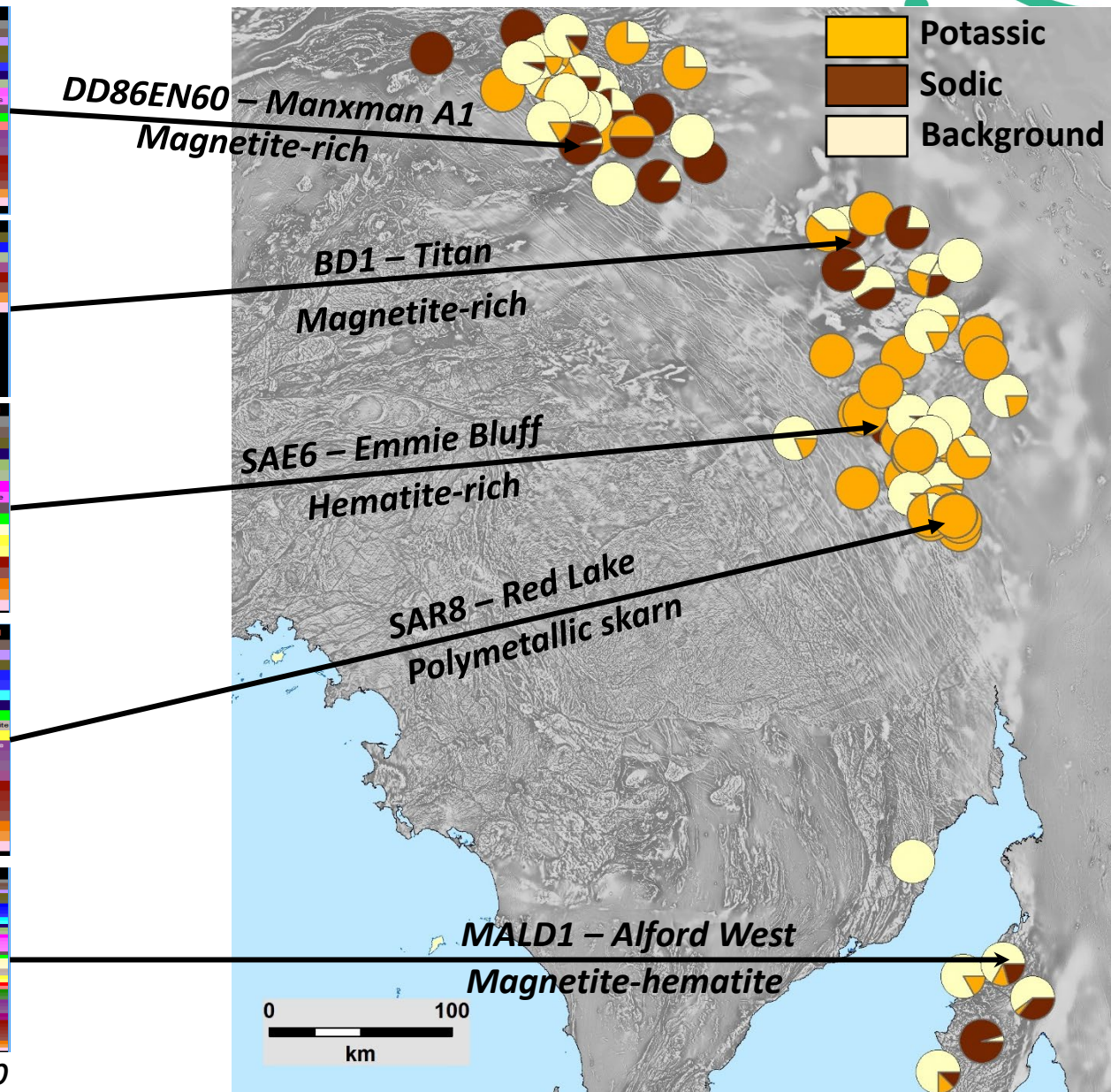
Deposit styles



Mapping regional alteration trends



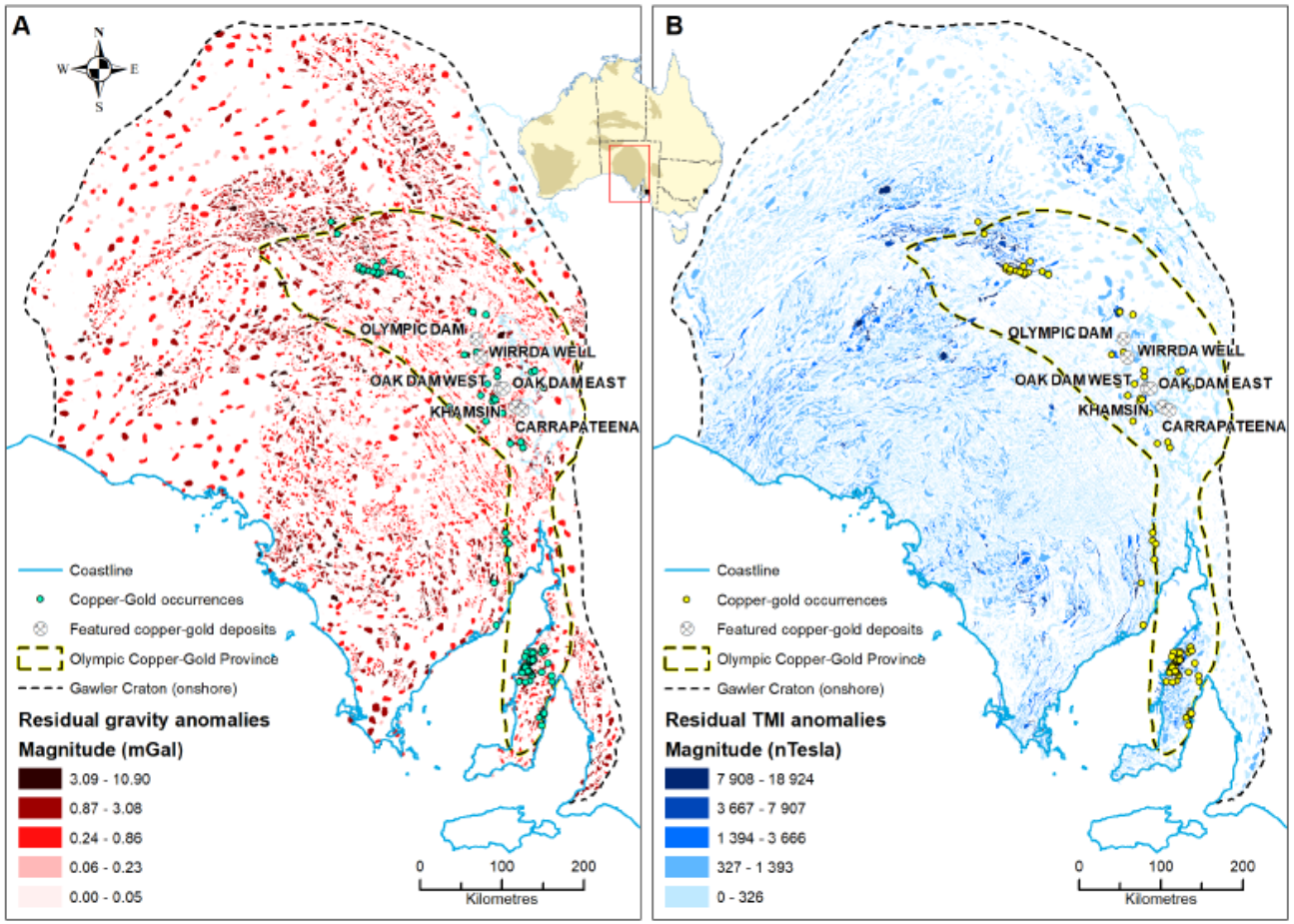
Spectral summaries - HyLogger™

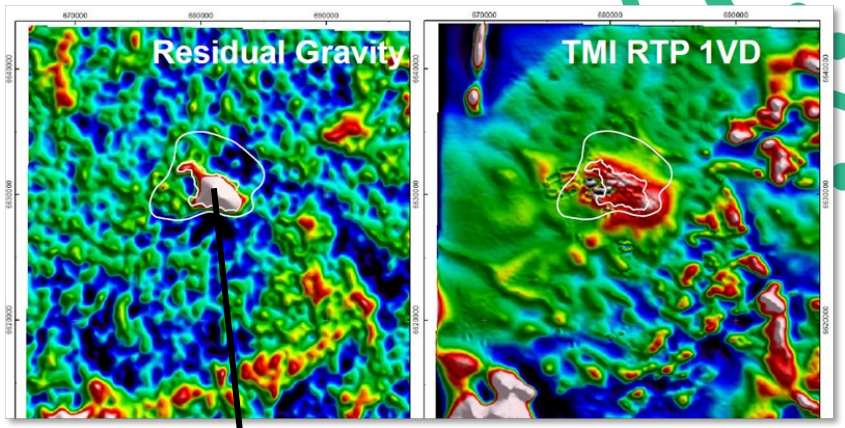


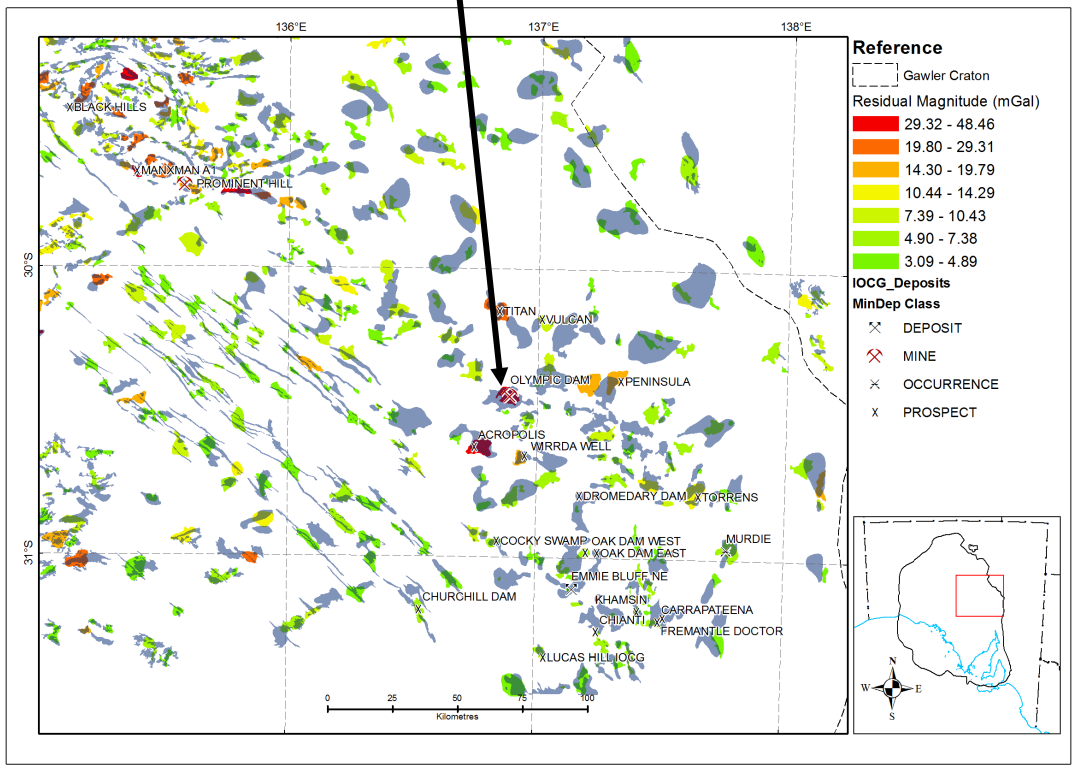
Wallaroo Group

Geophysical signatures

- 96.2% of known IOCG occurrences in SA are within 1km of a positive TMI anomaly with a spatially coincident gravity anomaly.
- Many anomalies have limited testing.





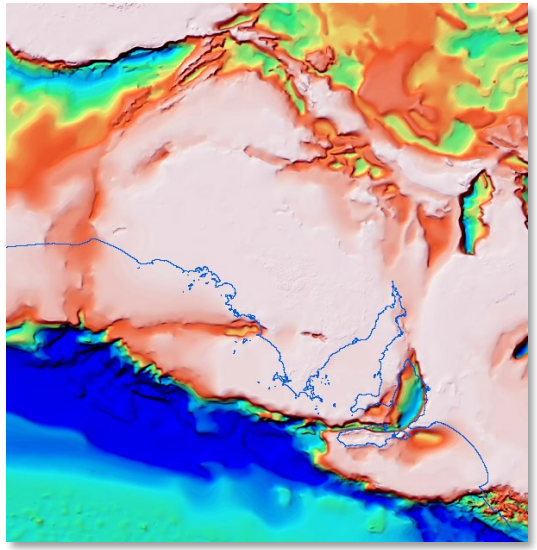


Katona et al 2018

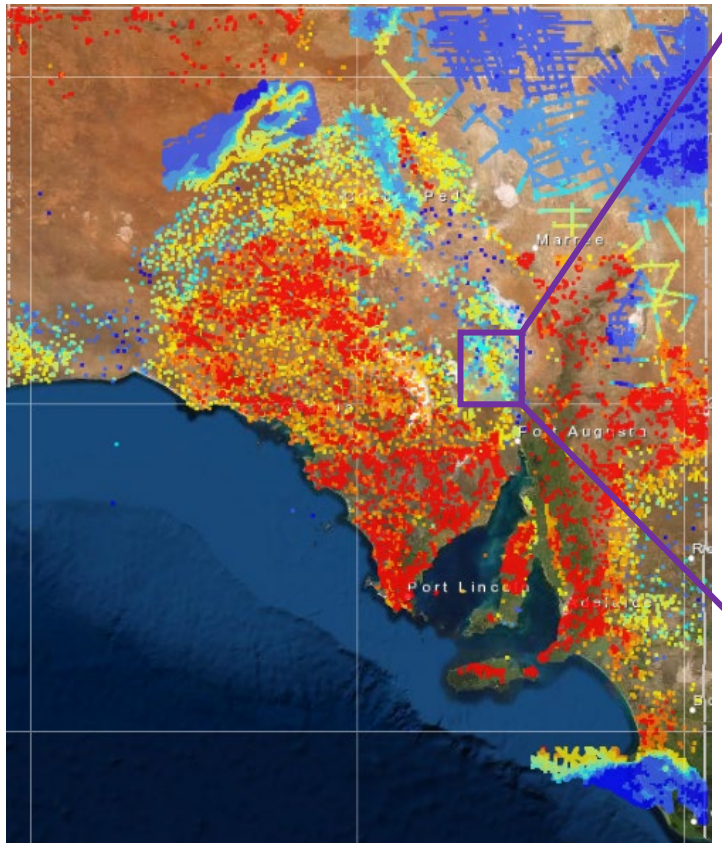
Katona & Fabris 2022

Depth to basement

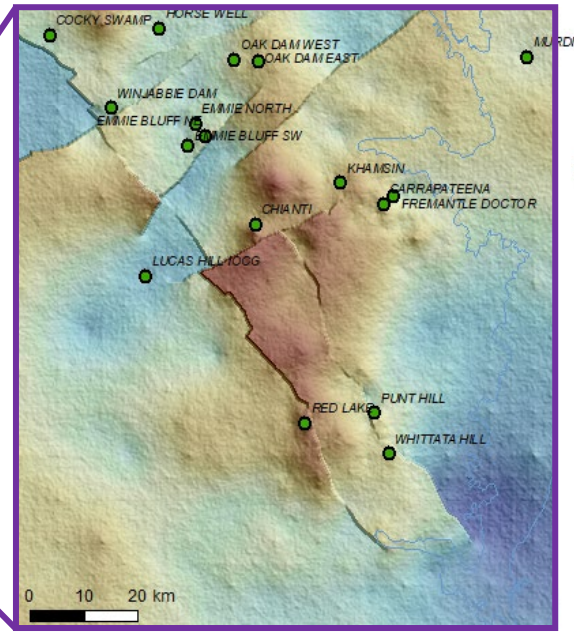
- Several major IOCG deposits are recognised on paleo-highs
- Improved methods for determining Depth to Basement are critical



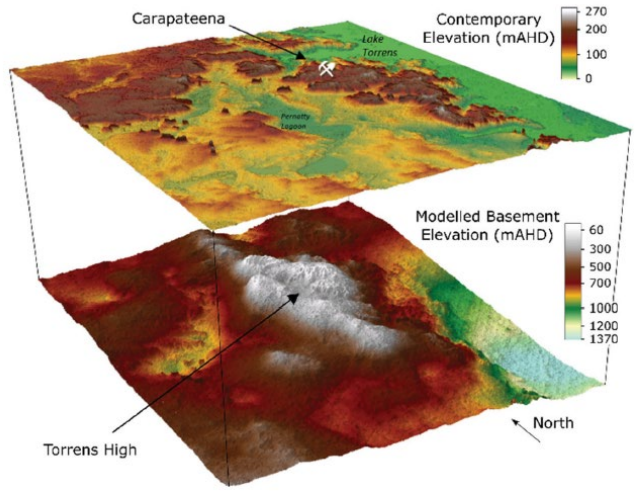
Geognostics, 2021. OZ SEEBASE® 2021



Depth to basement (drillholes, seismic, magnetic source estimates) - SARIG



Depth to basement (MT, drillholes, faults) Seille et al., 2023



Depth to basement calculated from MT probabilistic models and drill holes (Seille et al., 2023)

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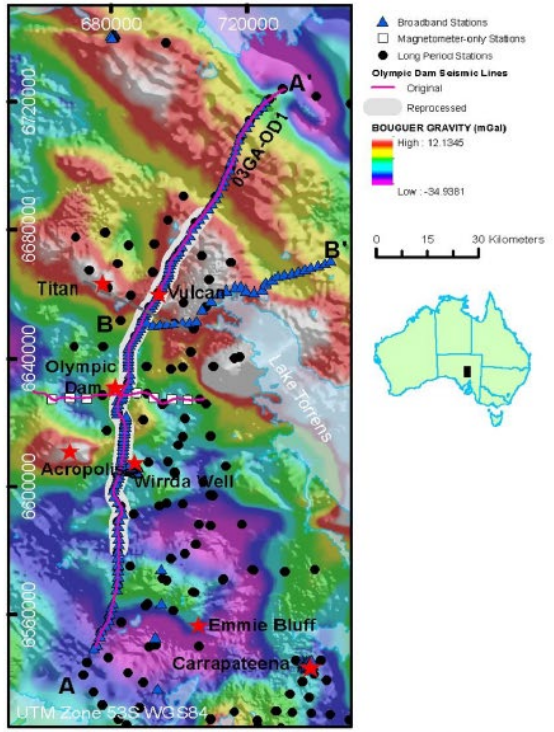
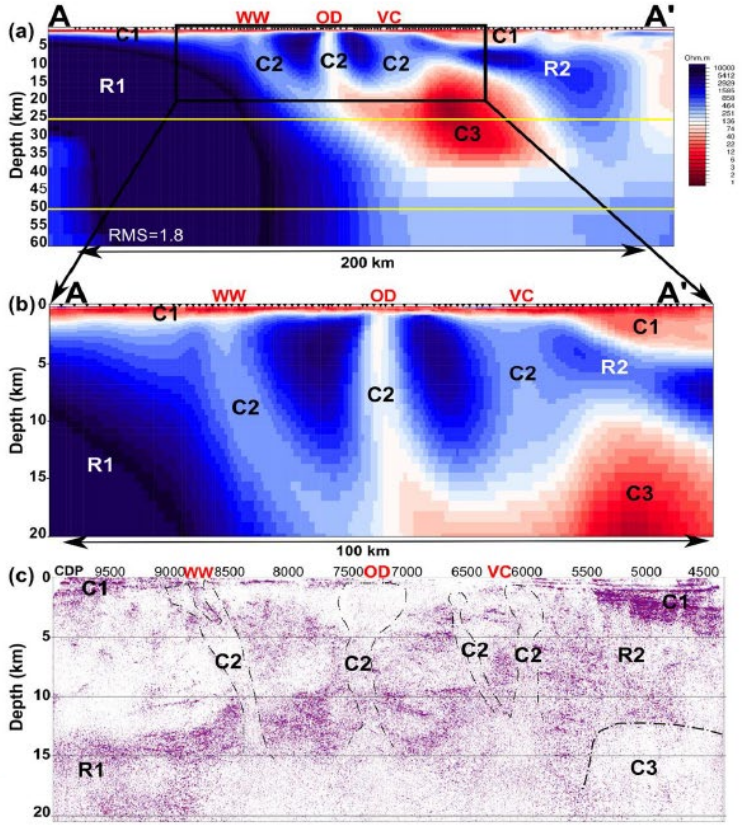
Depth extent of the mineral system: Olympic Dam

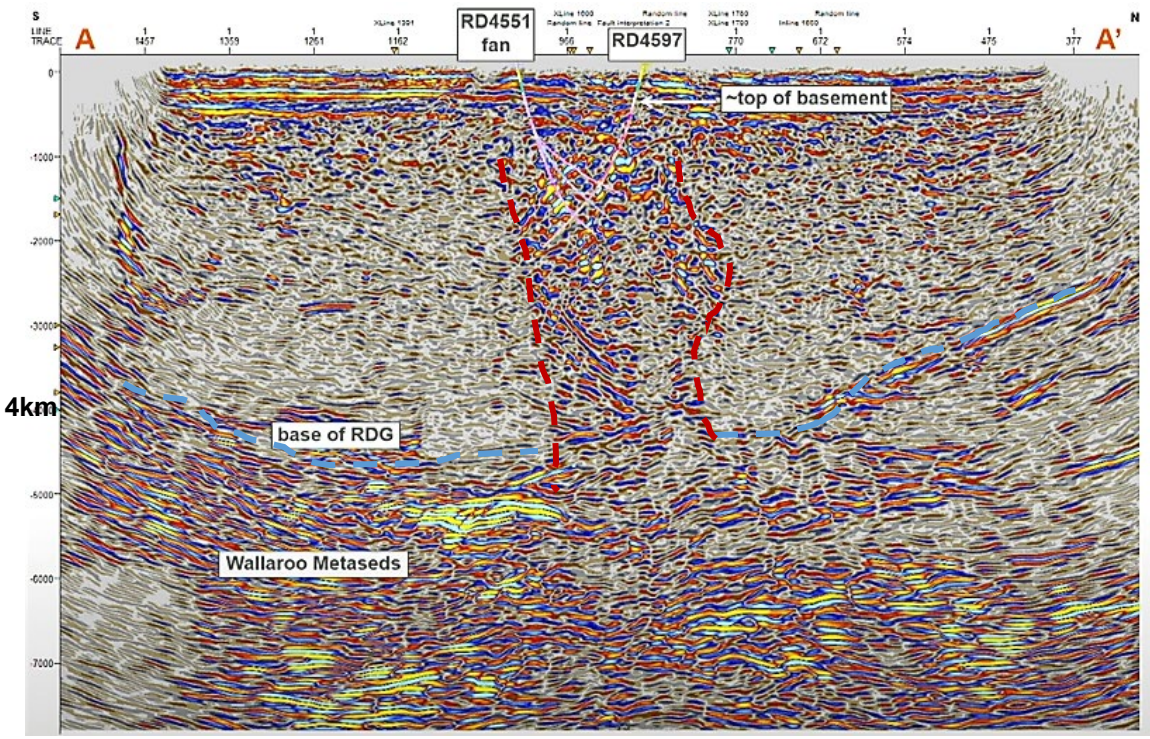
- Large and intense alteration systems
  - ➢ Implication: <u>trans-crustal (lithospheric) scale structures</u>



Heinson et al. 2018

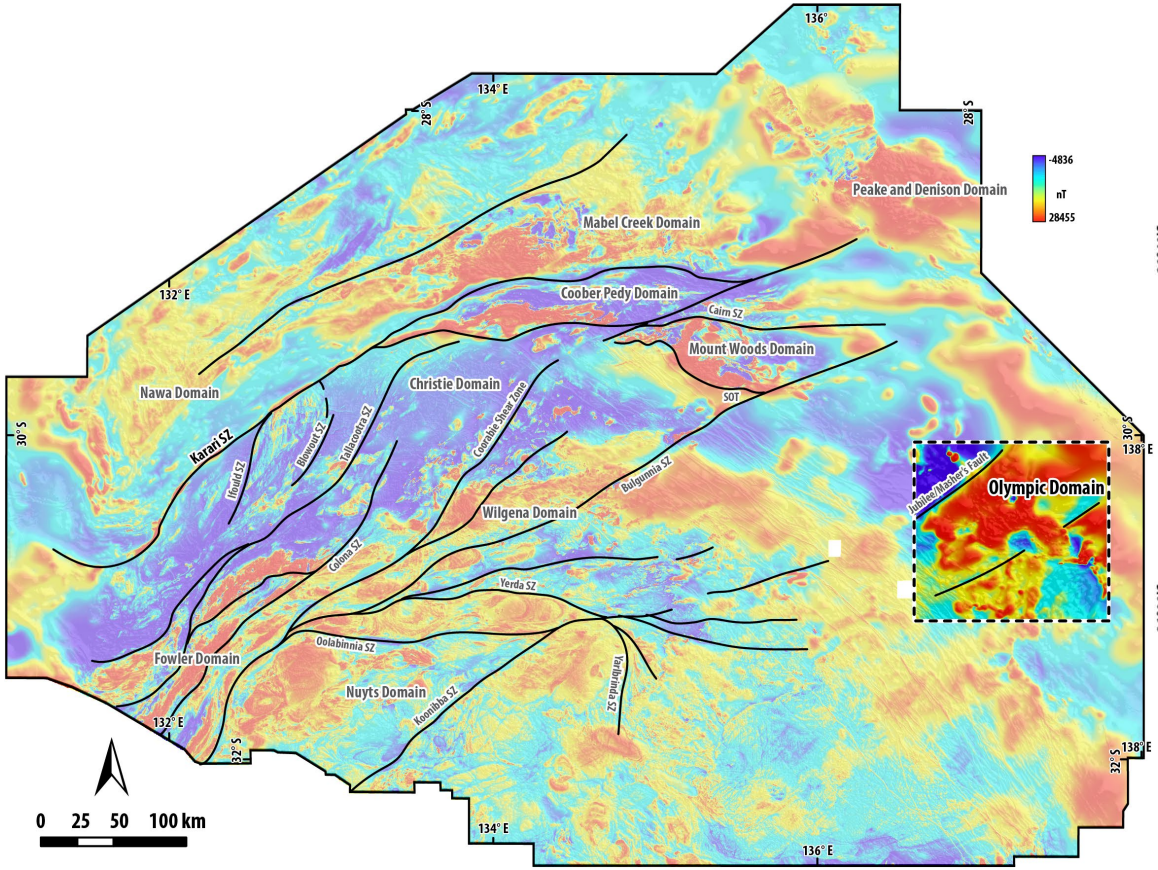


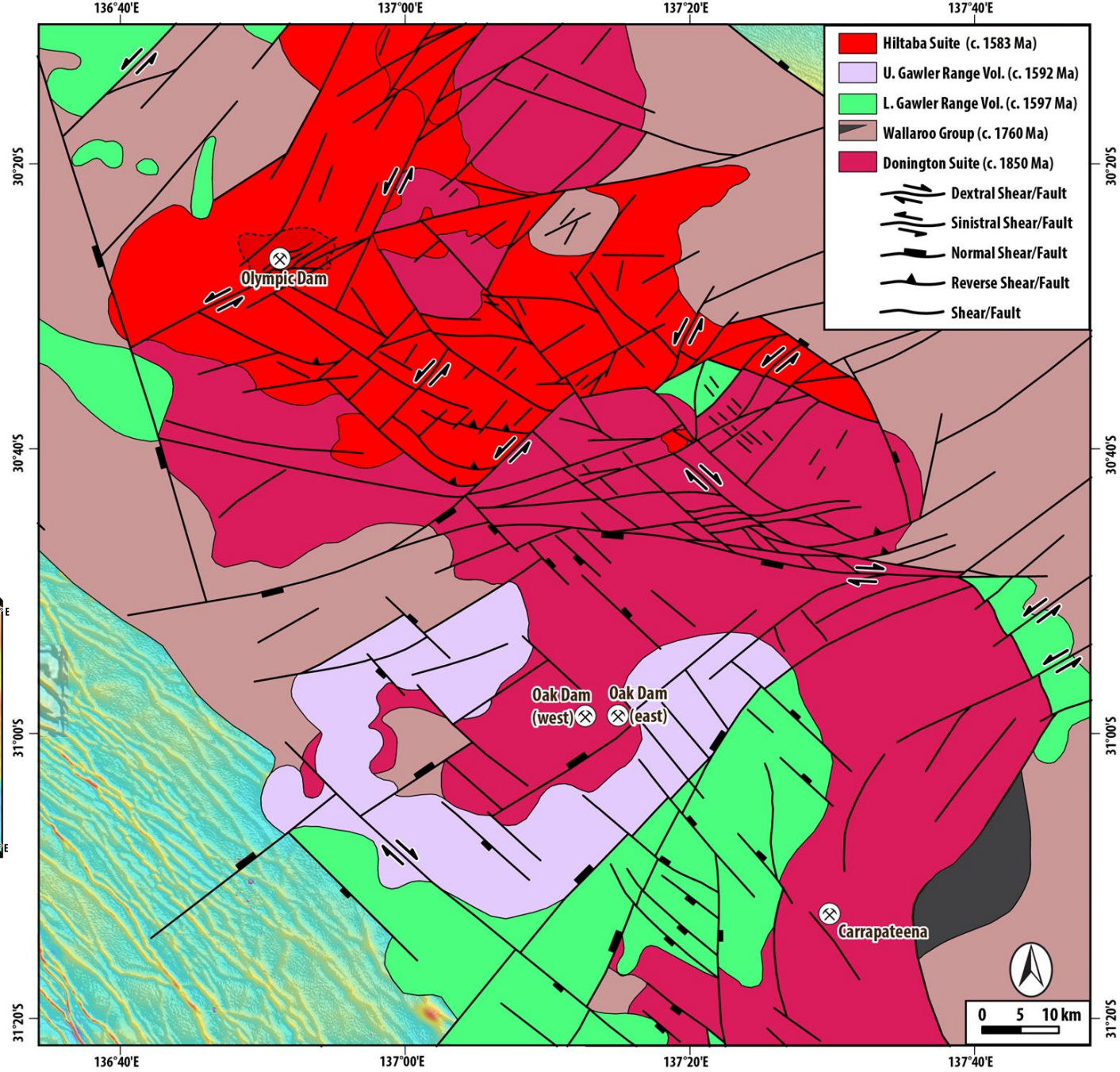
Olympic Dam



Ehrig 2024

Structural Interpretation: Updating geological datasets





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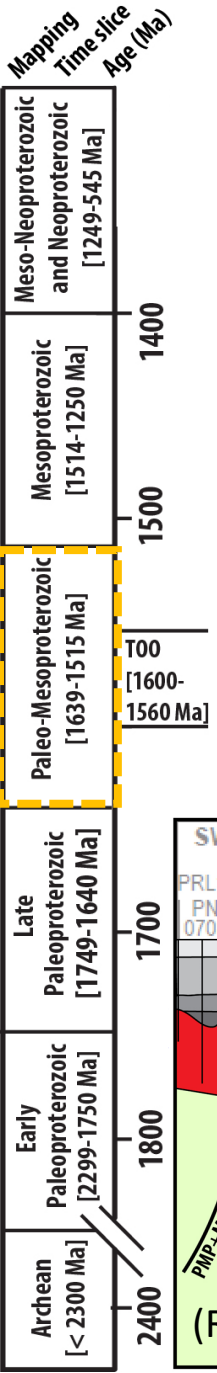
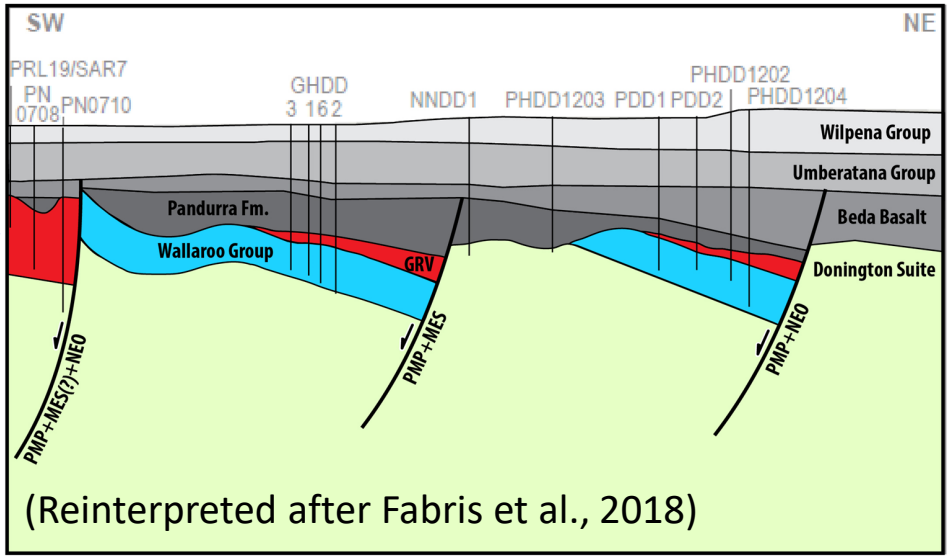
New Solid Geology Map (Ongoing) of the Olympic Domain

Sedimentation | Magmatism/ Volcanism | Tectonic event

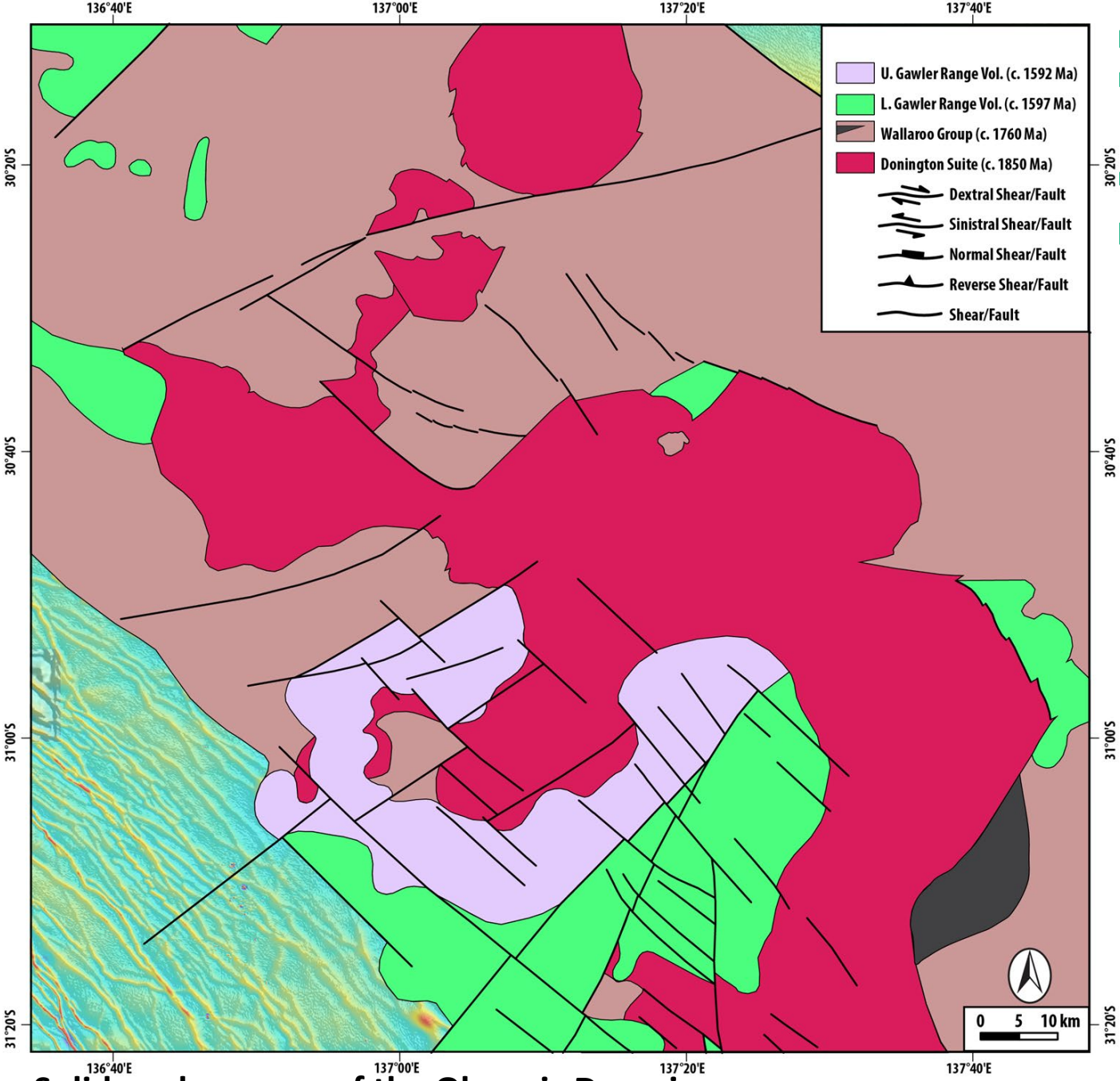


- Widespread volcanism (i.e, Gawler Range volcanics; c. 1595-1580 Ma) was synchronous with extension-related deformation
- Evidence for such extensional structures are observed at major deposits.
- Similar-aged extensional structures are targets where magmatic-hydrothermal fluids meet wet basinal sediments.

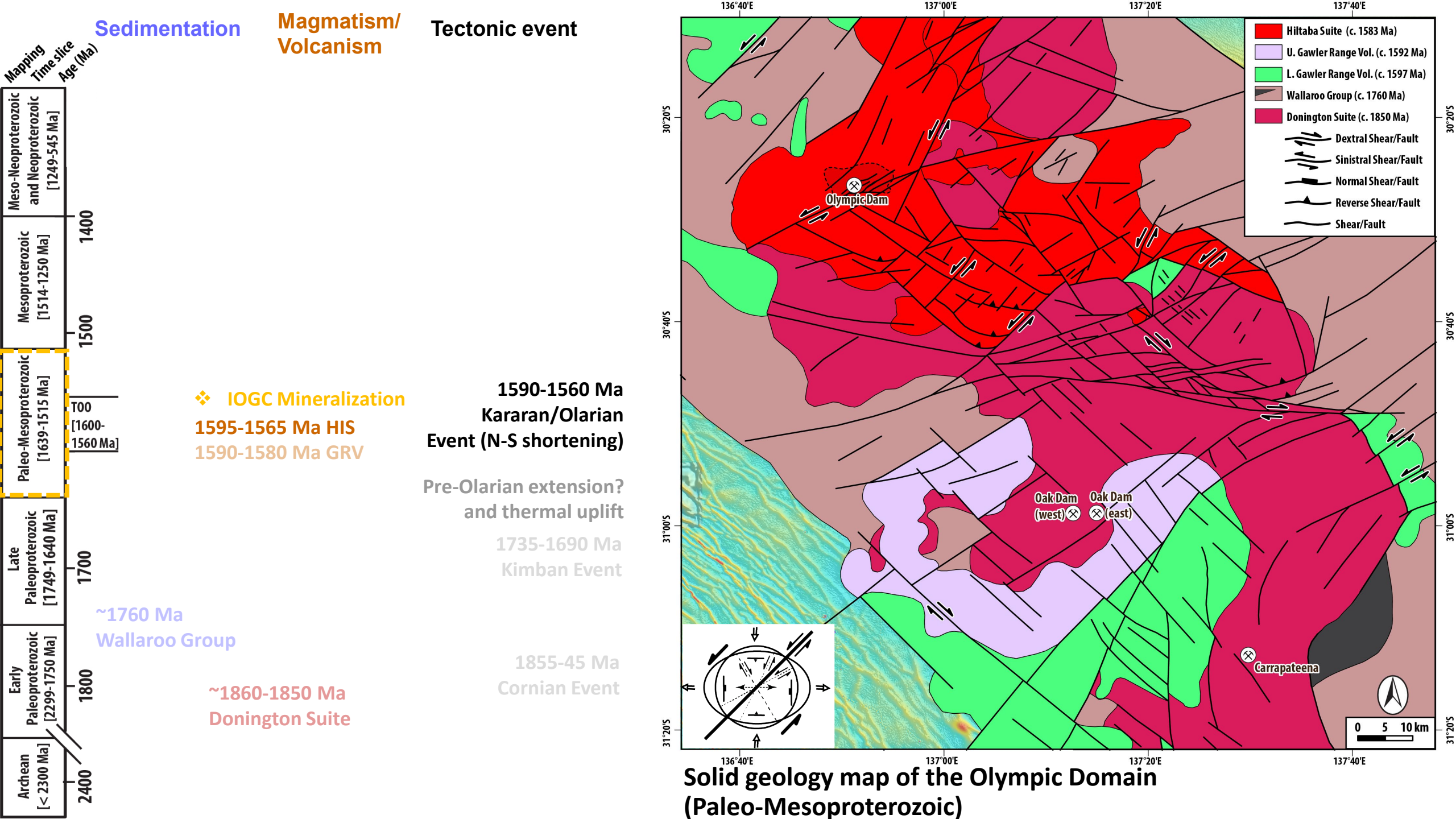
1590-1580 Ma GRV



(Reinterpreted after Fabris et al., 2018)



Solid geology map of the Olympic Domain (Paleo-Mesoproterozoic)



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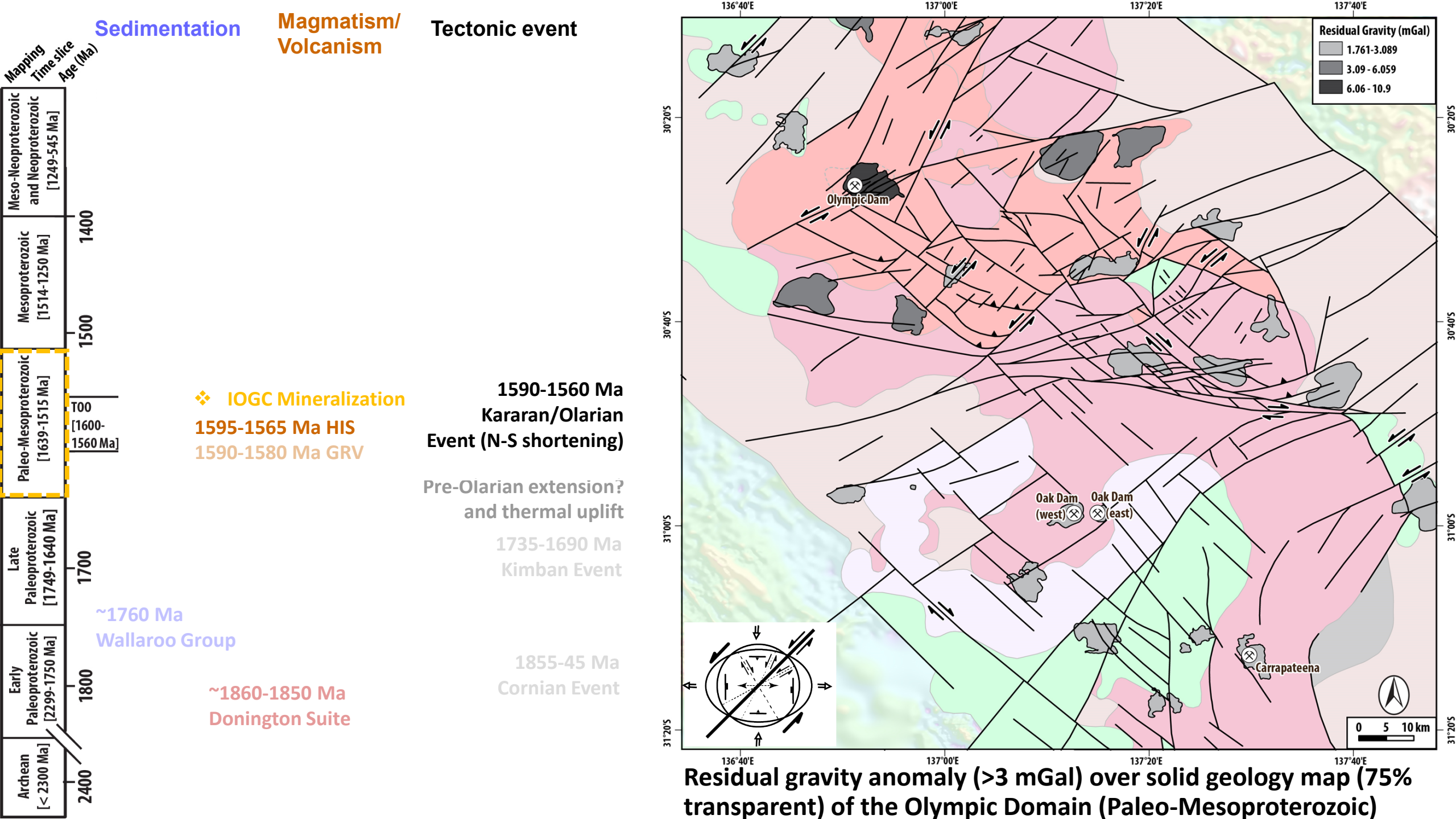


Residual gravity anomaly (>3 mGal) over solid geology map (75% transparent) of the Olympic Domain (Paleo-Mesoproterozoic)

Sedimentation

Magmatism/ Volcanism

Tectonic event

Mapping Time slice Age (Ma)

Meso-Neoproterozoic and Neoproterozoic [1249-545 Ma]

Mesoproterozoic [1514-1250 Ma]

Paleo-Mesoproterozoic [1639-1515 Ma]

Late Paleoproterozoic [1749-1640 Ma]

Early Paleoproterozoic [2299-1750 Ma]

Archean [< 2300 Ma]

1400

1500

1700

1800

2400

T00 [1600-1560 Ma]

<1450 Ma
Pandurra Fm

❖ IOGC Mineralization

1595-1565 Ma HIS
1590-1580 Ma GRV

~1760 Ma
Wallaroo Group

~1860-1850 Ma
Donington Suite

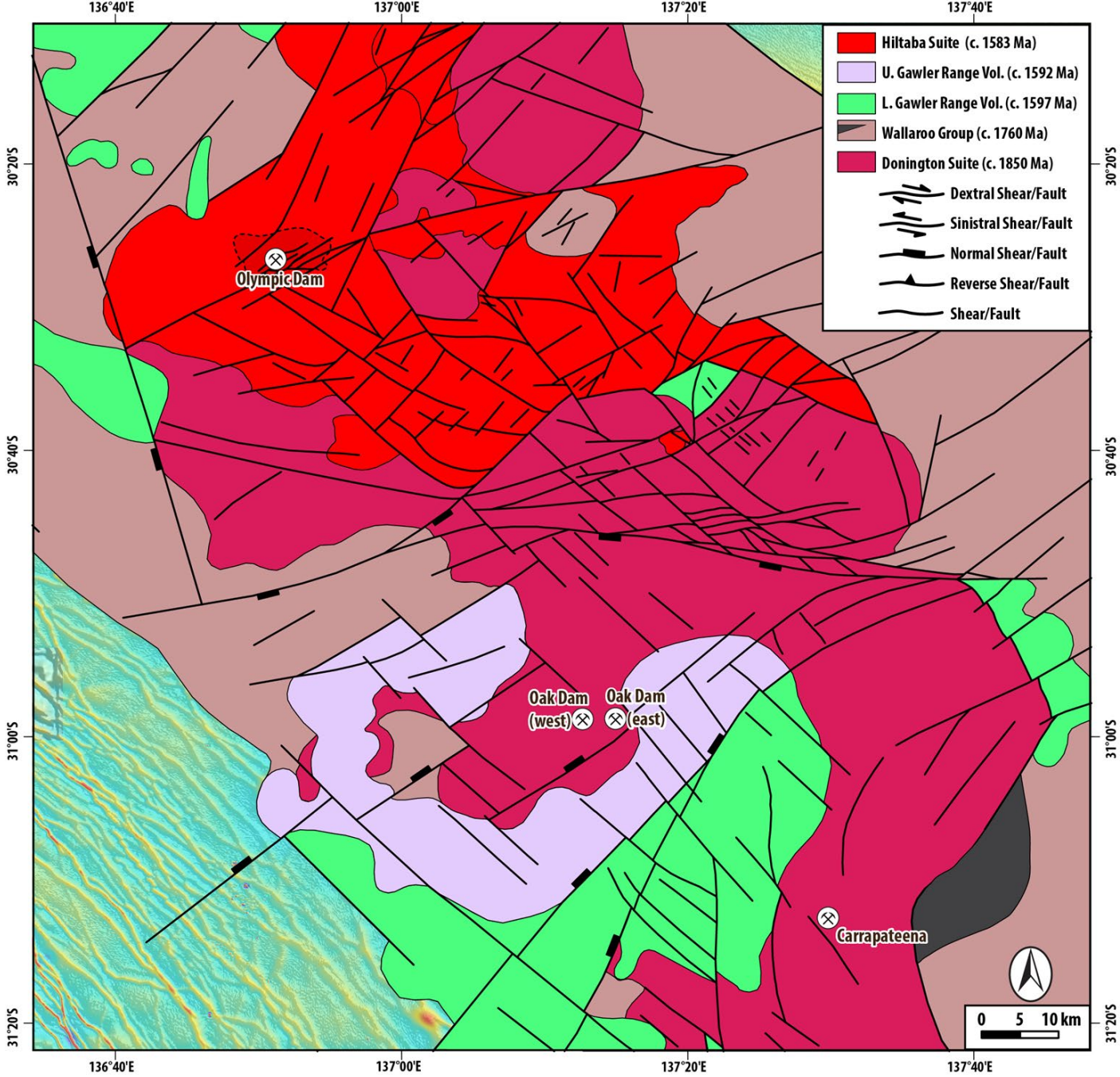
Post-Olarian extension? and thermal subsidence (Cariewerloo Basin)

1590-1560 Ma
Kararan/Olarian Event (N-S shortening)

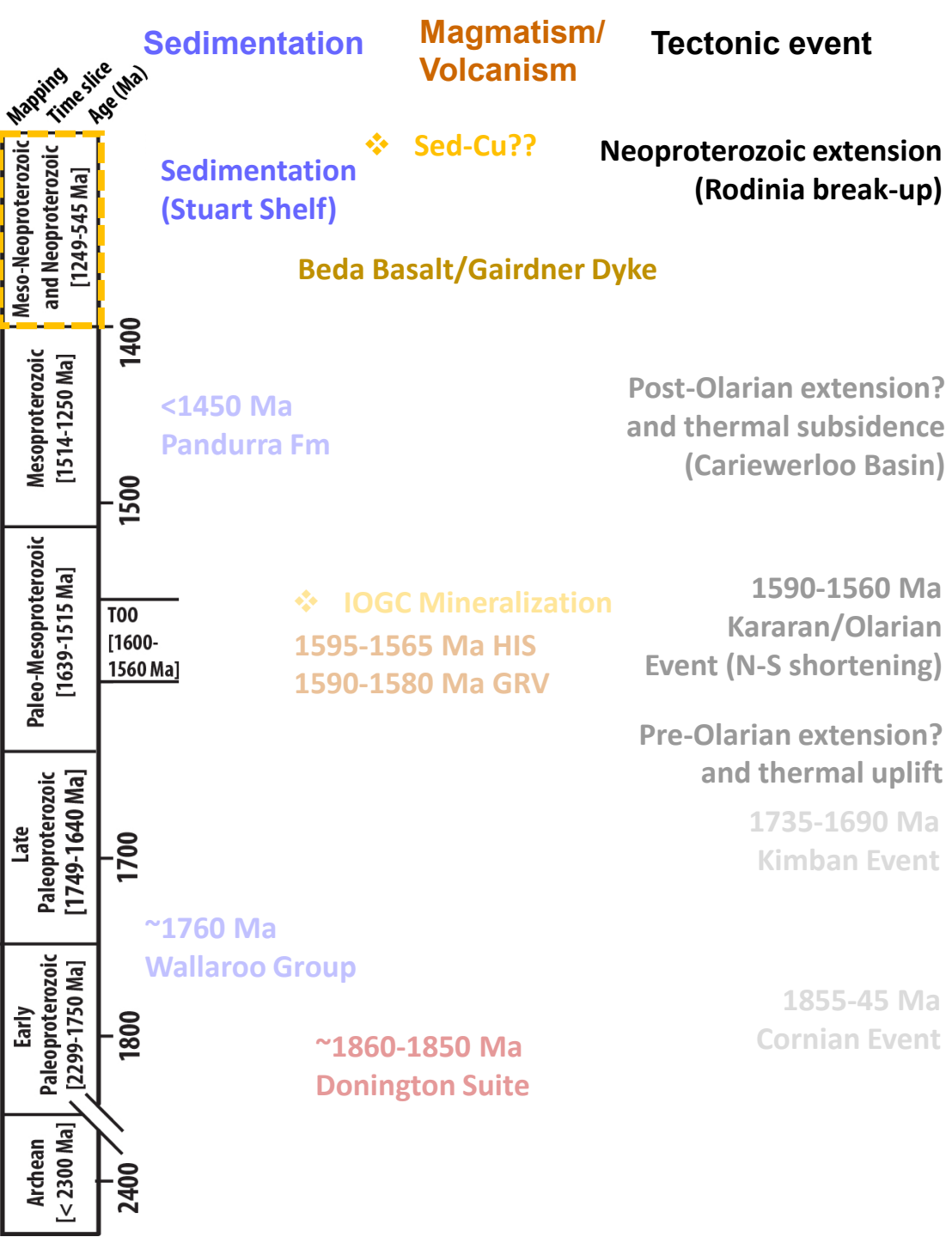
Pre-Olarian extension? and thermal uplift

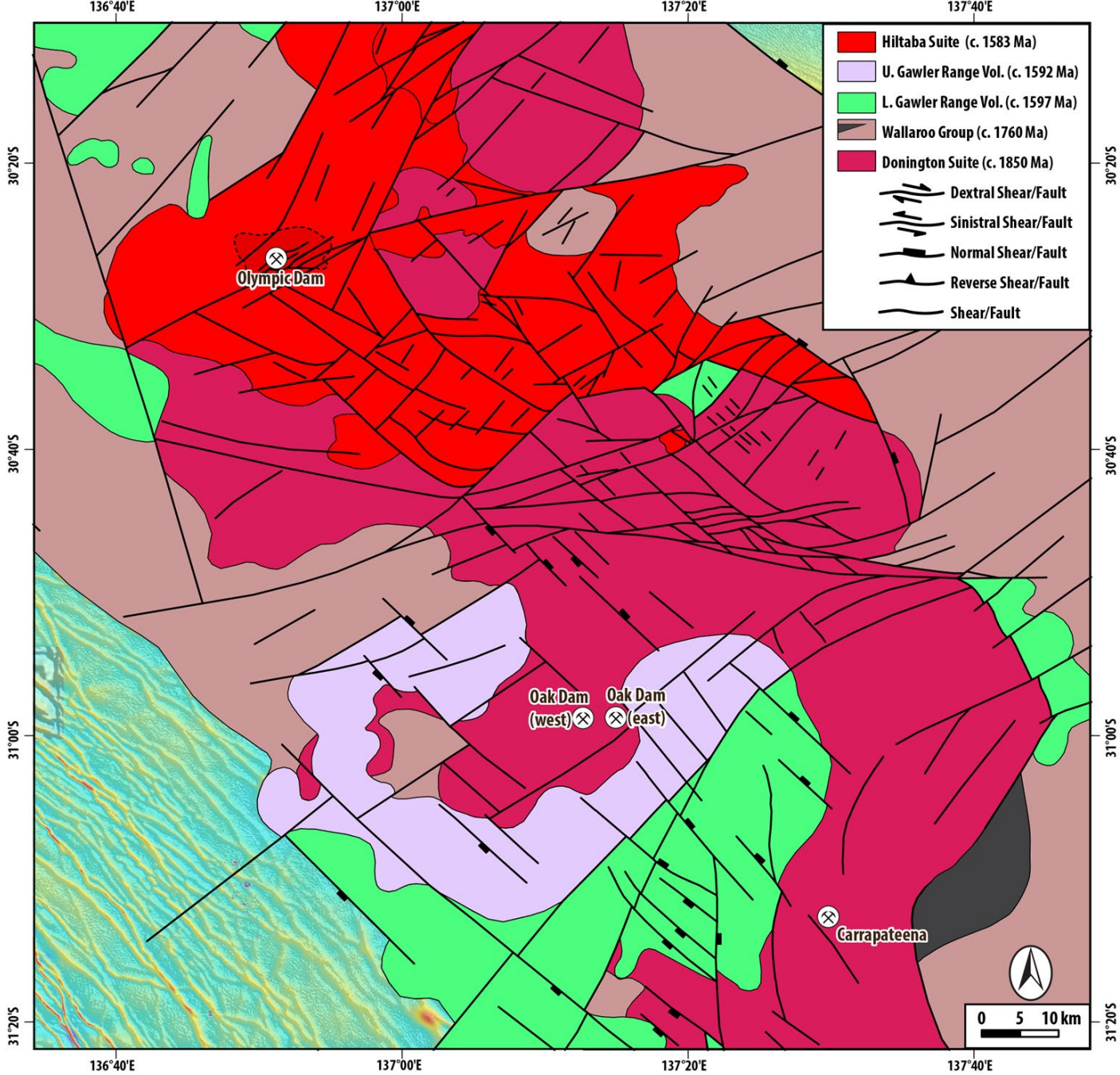
1735-1690 Ma
Kimban Event

1855-45 Ma
Cornian Event



Solid geology map of the Olympic Domain (Mesoproterozoic)





Solid geology map of the Olympic Domain (Neoproterozoic)

Exploring the Gawler Craton — Key Conclusions

1. Olympic Dam–style IOCG systems are lithospheric-scale, time-bound events

2. Crustal architecture is the first-order control on prospectivity

3. Structural inheritance matters but timing matters more

4. Geophysical signatures and predictable alteration and chemical footprints combine to reveal prime targets

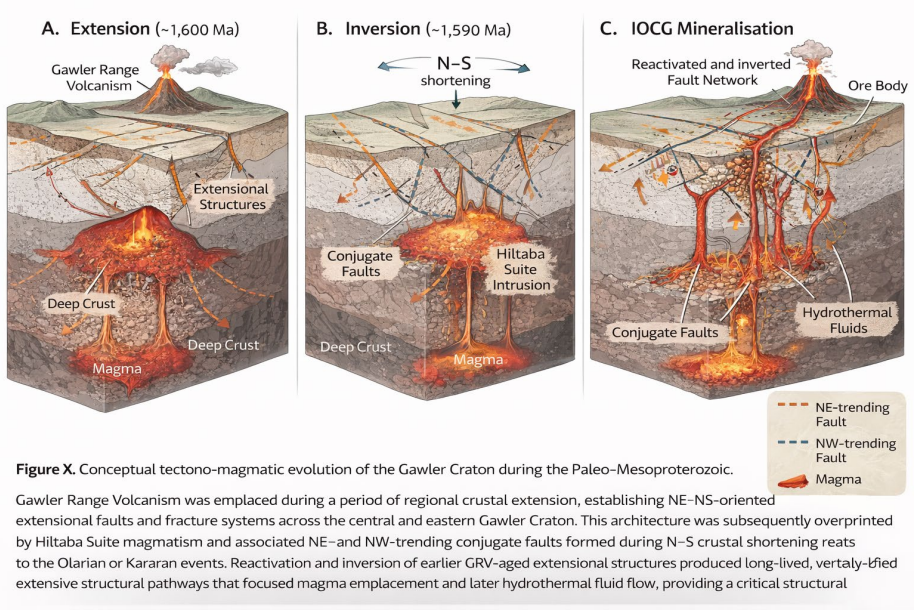


Figure X. Conceptual tectono-magmatic evolution of the Gawler Craton during the Paleo-Mesoproterozoic.

Gawler Range Volcanism was emplaced during a period of regional crustal extension, establishing NE–NS-oriented extensional faults and fracture systems across the central and eastern Gawler Craton. This architecture was subsequently overprinted by Hiltaba Suite magmatism and associated NE– and NW-trending conjugate faults formed during N–S crustal shortening reats to the Olarian or Kararan events. Reactivation and inversion of earlier GRV-aged extensional structures produced long-lived, vertaly-bied extensive structural pathways that focused magma emplacement and later hydrothermal fluid flow, providing a critical structural

Courtesy Paul Heithersay & AI

Exploring the Gawler Craton — Key Conclusions

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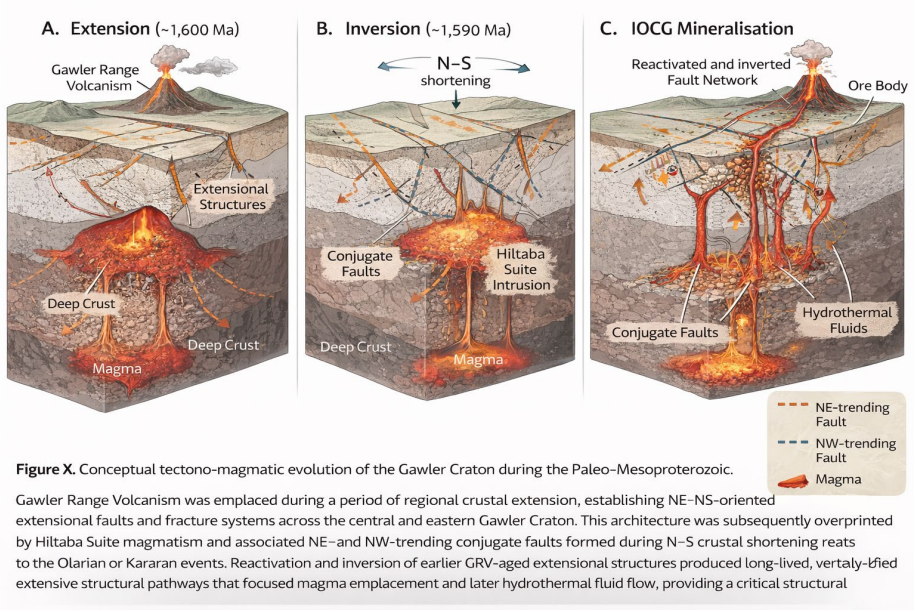

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Courtesy Paul Heithersay & AI

Within a “brownfields” context, discovery in the Gawler Craton requires **integrated system-scale targeting**, combining:

- lithospheric architecture (MT, seismic),
- basement geometry (depth-to-basement models, mapped structure),
- alteration footprints (HyLogger, geochemistry), and
- ranked coincident geophysical anomalies tested properly.

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Web service API includes:

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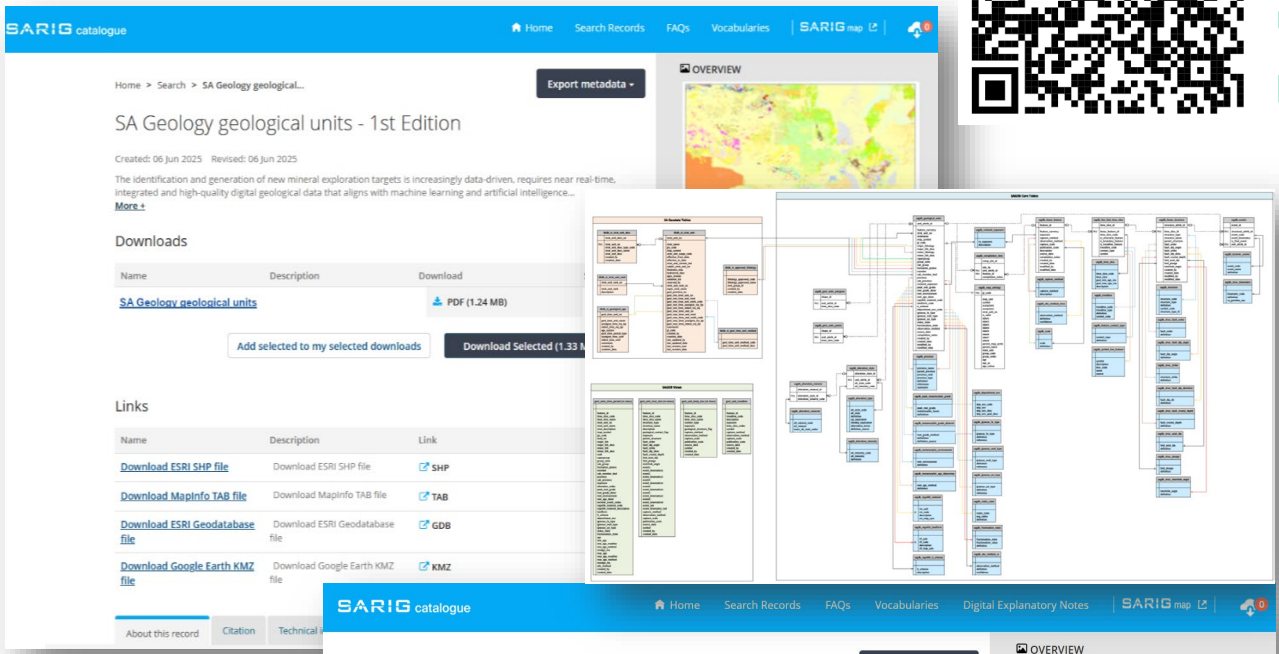
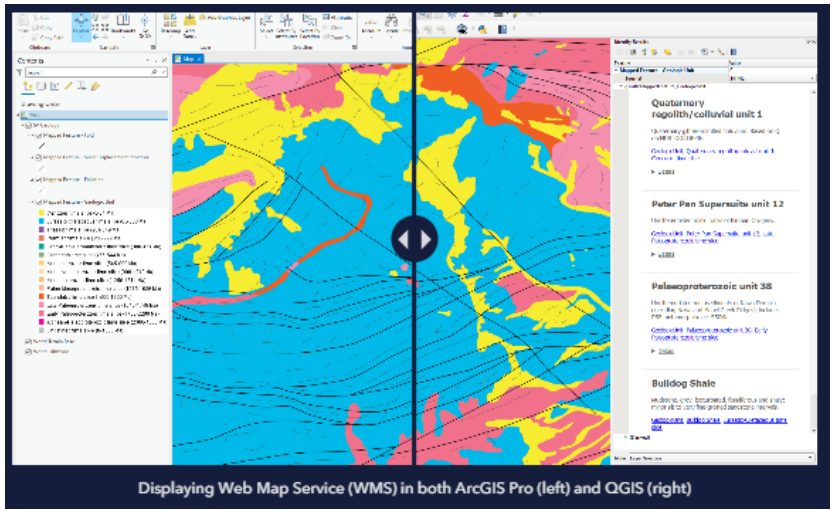
- Machine readable





Web service
National Mineral Tenements
International Drillholes
International Mineral Occurrences

Now including

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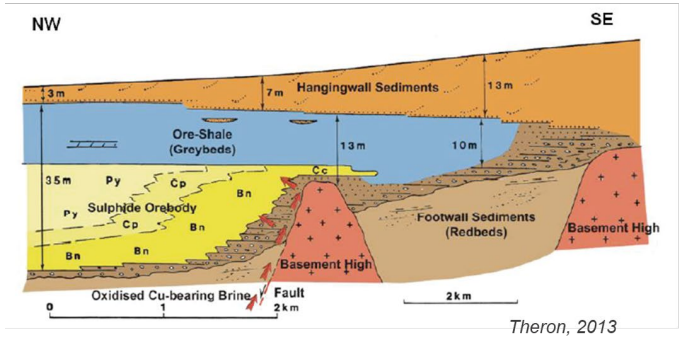
Contacts, folds, foliation, shear displacement structures and geological units and geomorphologic features

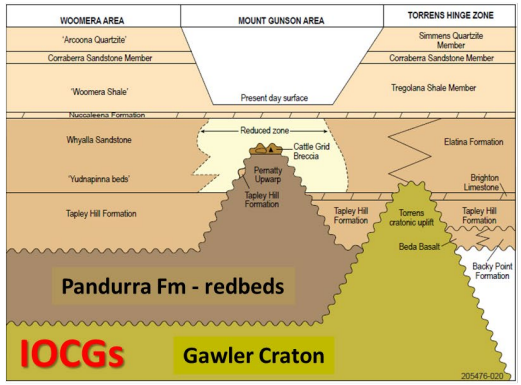
IOCG-adjacent opportunities in SA

Basement-proximal Zambian Copperbelt



Theron, 2013

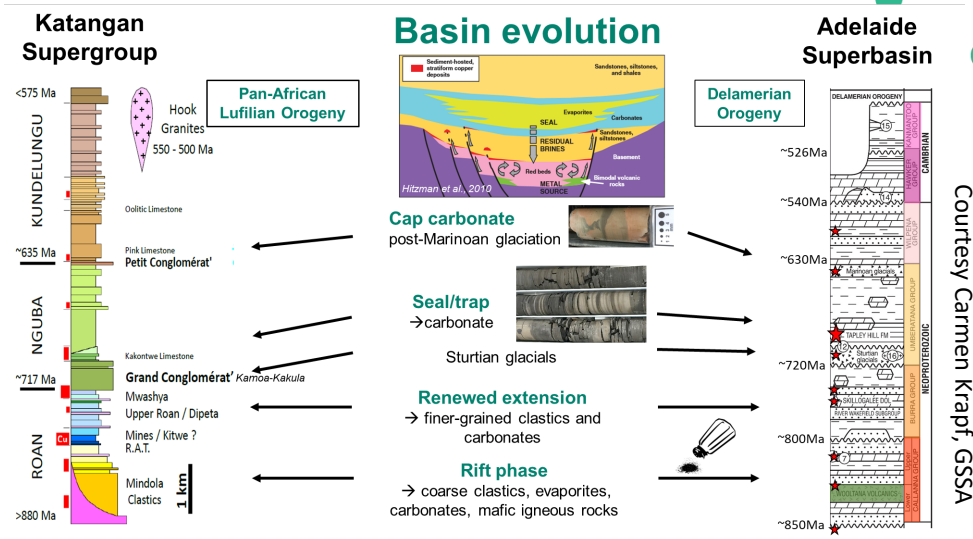
Stuart Shelf



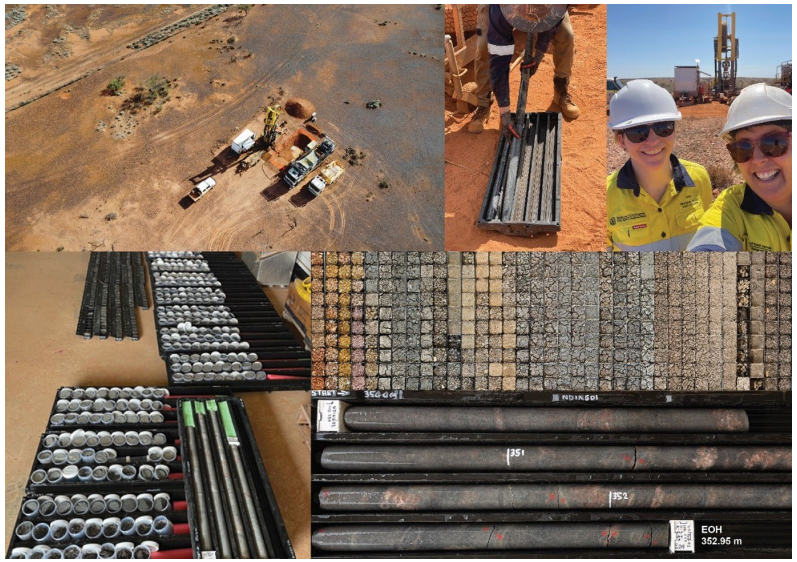
Tonkin and Wallace, 2021

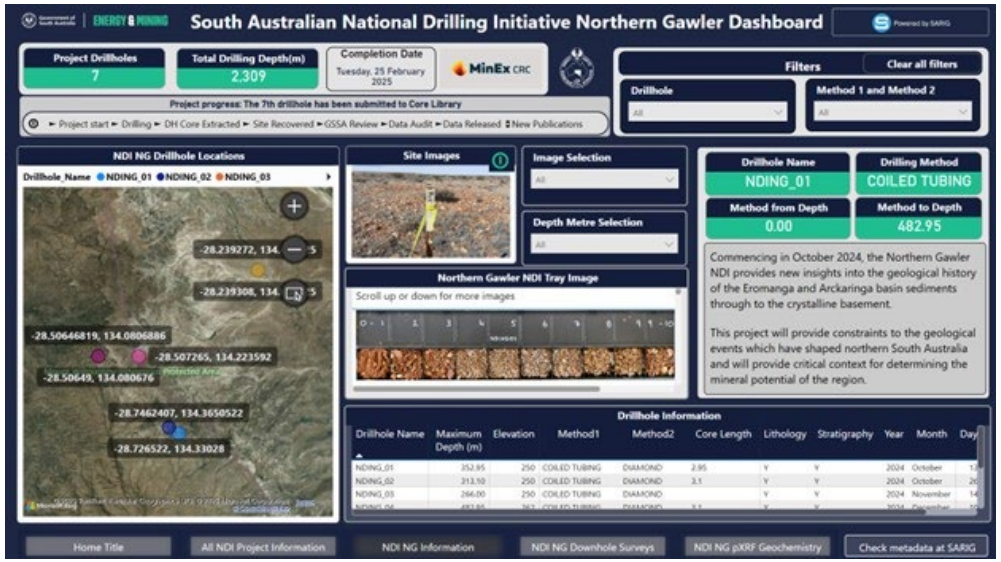
Investigating Cu recycling into overlying basins

Basin evolution



Courtesy Carmen Krapf, GSSA

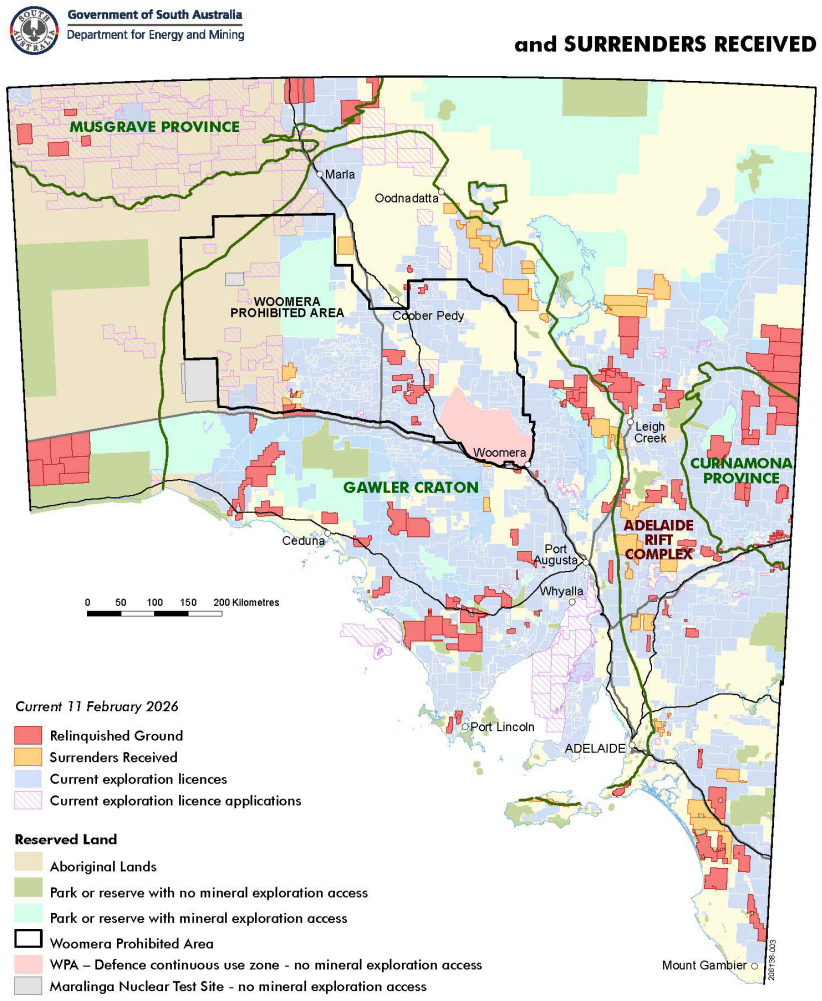




Testing the greenfield northern extent of SA's copper-gold province.

Drilling > live public data > mapping > competitive acreage release

Significant exploration acreage to be released over the next 6 months



Access our data and find out more!

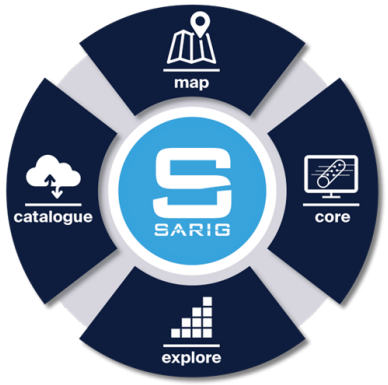
140 years of geoscience information

People
Easy access to accurate, up-to-date geoscience data for exploration drilling decisioning making.

Process
Cloud-based integration improving digital service efficiency, flexibility and scalability.

Technology
Establish open API endpoints making geoscience data findable, accessible, interoperable and reusable (FAIR data principles).

Digital Delivery
Expanded digital footprint of South Australia geoscience information to unlock mineral resources.



Contacts

Tom Wise

Acting Director, Geological Survey of South Australia

Department for Energy and Mining

11 Waymouth Street,
Adelaide, South Australia 5000
GPO Box 320
Adelaide, South Australia 5001
E: Tom.Wise@sa.gov.au

SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

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Acknowledgement of Country

The Department for Energy and Mining acknowledges Aboriginal people as the First Nations Peoples of South Australia. We recognise and respect the cultural connections as the traditional owners and occupants of the land and waters of South Australia, and that they continue to make a unique and irreplaceable contribution to the state.

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