SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

GEOLOGICAL SURVEY OF South Australia

Mineral prospectivity mapping in the central-western Gawler Craton, South Australia

Next Generation Explorers Award Association Dataset for Participants in the NGEA™

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South Australian Resources Information Gateway (SARIG)
SARIG provides up-to-date views of mineral, petroleum and geothermal tenements and other geoscientific data. You can search, view and download information relating to minerals and mining in South Australia including tenement details, mines and mineral deposits, geological and geophysical data, publications and reports (including company reports).
map.sarig.sa.gov.au

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Acknowledgement of Country
As guests here on Kaurna land, we acknowledge everything this department does impacts on Aboriginal country, the sea, the sky, its people and their spiritual and cultural connection which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.

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Provided by the Geological Survey of South Australia

Introduction

The Gawler Craton in South Australia hosts the world's most richly endowed iron oxide copper-gold (IOCG) ore province, the Olympic IOCG Province, containing the supergiant Olympic Dam copper-gold-uranium-silver deposit, and the major Prominent Hill, Carrapateena and Oak Dam IOCG deposits. However, the Gawler Craton is also highly prospective for many other commodities and critical metals such as nickel, graphite, lead-zinc, and uranium, and has significant opportunities for greater mineral exploration and discoveries especially in its underexplored central-western part.

In 2020 the Geological Survey of South Australia (GSSA) ran ExploreSA: The Gawler Challenge, a cutting-edge, crowd-sourced competition where participants delved into the GSSA's open-source treasure trove of geoscience data. The aim was to dissect, analyse, and unveil hidden mineral prospectivity and targets using a mix of traditional techniques, artificial intelligence and machine learning. This competition shed light on the power and untapped potential of our data, but we also realised we needed to enrich our data landscape.

Based on the outcomes and recommendations of this challenge, GSSA implemented a new project, the Gawler Phase 2 (GP2): Next Generation Mineral Systems Mapping Project (2021-2023). GP2 focused on new precompetitive geoscience data acquisition across the central-western Gawler Craton margin in the prospective areas identified by entrants in the Gawler Challenge. This new data complements existing legacy data and aims to assist opening and defining new search spaces and to generate new mineral system knowledge, particularly in the more underexplored parts of the central-western Gawler Craton (Fig. 1).

New precompetitive datasets collected for GP2 include:

- geophysical surveys (gravity, magnetotellurics, and airborne electromagnetics);
- geochemistry;
- geochronology;
- lithology logging from 34 holes from the region held at South Australia's Drillcore Library;
- petrophysical logs and xrf data from an additional 50 drillholes from the region;
- biostratigraphic data; and
- landscape and lineament mapping data.

These datasets can be accessed through the SARIG Catalogue, which can be accessed directly from the SARIG homepage. Using a search term such as ‘GP2’, or ‘Gawler Phase 2’ will return ‘Western Gawler: Gawler Phase 2 data packages’ as one of the results. Clicking on this result will open a page with all of the data packages, reports and videos available for download. Launch SARIG https://map.sarig.sa.gov.au

A report book of extended abstracts(external site)(PDF) based on the Western Gawler and Gawler Phase 2 Geoscience Insights Workshop (2023) presentations is available for download. These abstracts present new data and insights on a wide range of topics including background to the project, new geophysical data, surficial processes, and basement processes.

All of the workshop presentations are available for viewing via the Energy and Mining SA YouTube channel

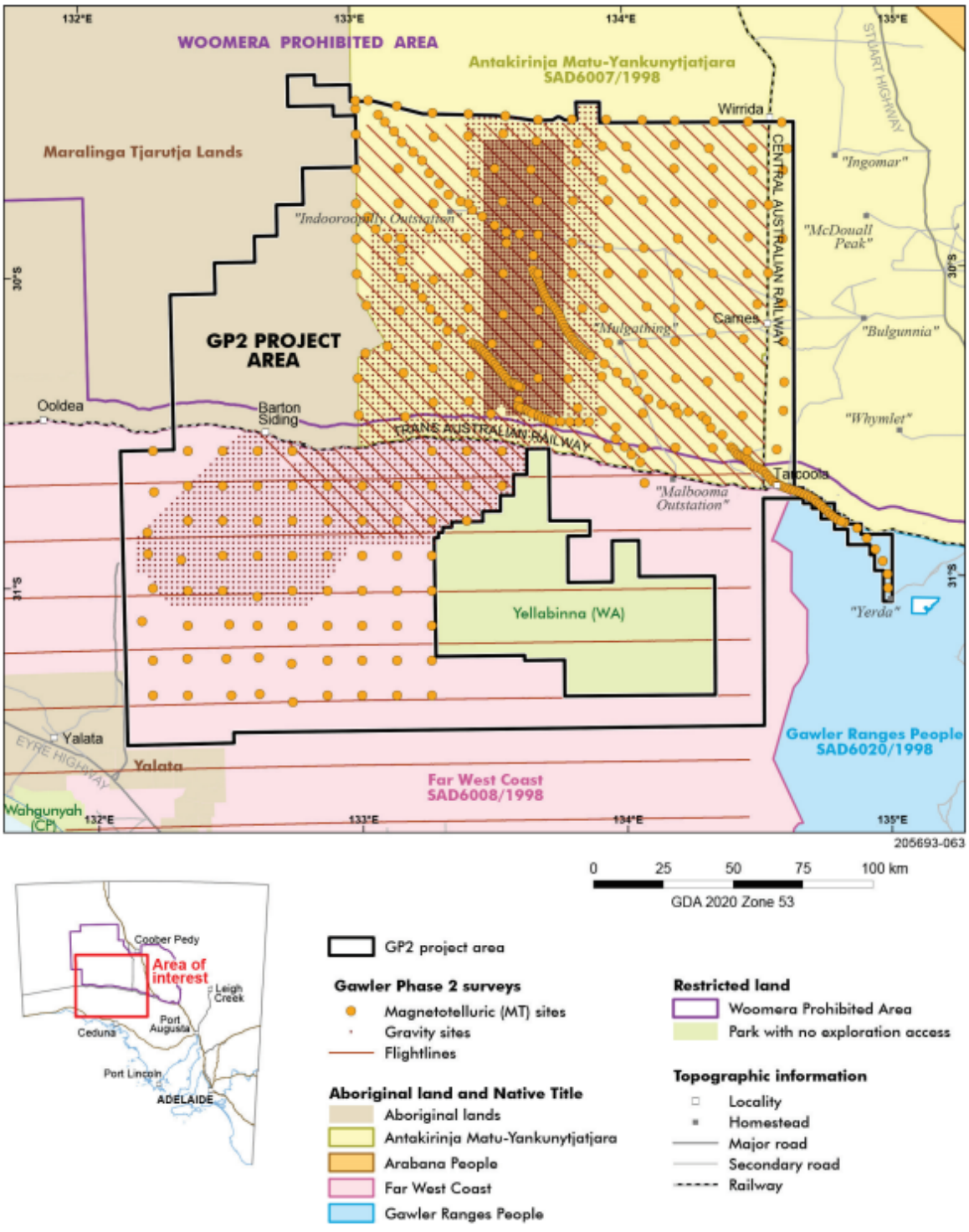

Figure 1. Map of gravity and magnetotelluric (MT) stations plus airborne electromagnetic (AEM) survey lines in the GP2 study region, with Aboriginal land and Native Title boundaries.

Exploration Challenge

The aim is to minimise uncertainty for mineral explorers and develop mineral prospectivity models across the central-western Gawler Craton by utilising the newly collected pre-competitive geophysical, geochronological, geochemical and petrophysical data acquired during GSSA's GP2 project. The central-western Gawler Craton is endowed with Archean Proterozoic gold deposits and has nickel-copper potential. Historically, exploration for gold in the western Gawler Craton has been conducted using broad-scale geophysical datasets, and surface geochemical methods (calcrete geochemistry, biogeochemistry and soil sampling).

As part of this challenge, we encourage the students to interrogate precompetitive data in relation to these deposit types but also to widen the prospectivity mapping to other mineral systems especially for critical minerals and energy exploration targets like titanium and hydrogen.

Geological Summary

The central-western Gawler Craton represents a long-lived, geologically complex area with potential for numerous mineral commodities. The area is remote and poorly understood, with the current geological understanding coming from the scattered outcrop, variably spaced drill core, and remote sensed data.

A geological overview of this region is summarised by Wade & Reid 2023, pp. 9-18 in:
Pawley M, Wade C, Petts A, Thiel S and Krapf C 2024. Western Gawler and Gawler Phase 2 Geoscience Insights Workshop extended abstracts, Report Book 2024/00020. Department for Energy and Mining, South Australia, Adelaide.
https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB202400020.pdf

Data Sources

South Australian Resources Information Gateway

SARIG map: Access to a wider array of state-wide datasets including geology (surface, regolith, solid, paleodrainage), geophysics, drillholes and wells, mines and mineral deposits, depth to cover, groundwater, remote sensing, seismology, tenements, land use, infrastructure. https://map.sarig.sa.gov.au/

SARIG catalogue: Provides searching across a broad range of records including departmental publications, mineral company reports and geoscience publications, maps, models and data products. All metadata is based on the ISO 19115:2014 standard. https://catalog.sarig.sa.gov.au/

GP2 data packages – new data acquisition

- 2022A01 - Gawler Phase 2 gravity data
  https://catalog.sarig.sa.gov.au/dataset/mesac67/resource/63ad43aa-4182-4ef9-95b4-f8c1325b776a

- 2022SA002 - AusAEM western SA component
  https://catalog.sarig.sa.gov.au/dataset/mesac766/resource/da8c6a54-277e-4a00-bb16-57ed755216ba

- Gawler Phase 2 MT resistivity models
  https://catalog.sarig.sa.gov.au/dataset/mesac30539/resource/34a5d2b5-9acb-4c7d-b1a5-19992b760b2c

- Western Gawler: Gawler Phase 2 drillhole geochemistry and lithology data package
  https://catalog.sarig.sa.gov.au/dataset/mesac487/resource/b5e9ea97-2141-41e1-b967-0d7884d08221

GSSA publications

- Zircon LA–ICP–MS geochronological and geochemical results from the central-western Gawler Craton. Brown D, Pawley MJ, Williams M, Reid AJ and Jagodzinski EA 2022. Report Book 2022/00008. Department for Energy and Mining, South Australia. https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB202200008.pdf

- Multi-isotopic apatite and zircon SHRIMP U–Pb geochronological results from the central-western Gawler Craton. Brown D, Reid AJ, Jagodzinski EA, Williams M, Pawley MJ, Kirkland CL, Simpson A, Glorie S and Ribeiro B 2023. Report Book 2022/00010. Department for Energy and Mining, South Australia.

  https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB202200010.pdf
- Eucla Basin and peripheral paleovalleys. Hou B, Keeling JL, Reid AJ, Petts AE and Stoian LM 2022. Report Book 2022/00011. Department for Energy and Mining, South Australia.

  https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB202200011.pdf
- Connecting the cover to the basement in the central-western Gawler Craton: Manual- and automated-derived surface and subsurface lineaments for the Gawler Phase 2 area of South Australia. Krapf CBE, Irvine JA, Pawley MJ, McMaster M and González-Álvarez I 2023. Report Book and data package 2023/00036. Department for Energy and Mining, South Australia. https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/wci/Record?r=0&m=1&w=catno=2043932

- Landscape pattern recognition map for the central-western Gawler Craton, South Australia. Albrecht T, González-Álvarez I, Krapf C and Ibrahimi T 2023. Report Book 2023/00037. Department for Energy and Mining, South Australia. https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB202300037.pdf

- Connecting the cover and the fabric of the basement in the central Gawler Craton, South Australia. González-Álvarez I, Krapf CBE, Albrecht T, Kelka U, Martínez C, Pawley MJ, Ibrahimi T, Irvine J, Petts A, Gum JC and Klump J 2022. *MESA Journal* 96:4–21. Department for Energy and Mining, South Australia. https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/MESAJ096004-021.pdf

Journal publications

- Testing in-situ apatite Lu–Hf dating in polymetamorphic mafic rocks: a case study from Palaeoproterozoic southern Australia. Brown DA, Reid A, Jagodzinski EA, Williams M, Simpson A, Pawley MJ, Kirkland CL, Wade C, De Vries Van Leeuwen AT and Glorie S 2024. *Contributions to Mineralogy and Petrology* 179:46. https://doi.org/10.1007/s00410-024-02117-0

Gawler Phase 2: new data acquisition - videos

- Acquiring data: why is it important?
- Acquiring geochemistry
- Acquiring gravity data
- Acquiring magnetotellurics
- Acquiring data: landscape mapping
- Acquiring data: landscape mapping, paleochannels
- Acquiring petrophysics
- Acquiring geochronology
- Why was the Gawler Phase 2 project important?

Western Gawler and GP2 geoscience insights workshop - videos

- Importance of the western Gawler Craton – *Bronwyn Camac*
- Next Generation Mineral Systems Mapping – Gawler Phase 2 – *Zia-uddin Durrani*
- Regional geology and prospectivity in the Mulgathing Complex – *Claire Wade*
- The geophysical landscape of the western Gawler – *Philip Heath*
- Disentangling the braids; improving paleovalley mapping using AEM in the GP2 area – *Yusen Lee-Cooper, Geoscience Australia*
- Paleovalley-landform expression of central-western Gawler Craton – *Baohong Hou*
- Connecting the cover to the basement in the central-western Gawler Craton – *Mark Pawley*
- Mobile petrophysical lab – *Tim Keeping*
- Isotopic and geochemical results from the central-western Gawler Craton – *Dillon Brown*
- Metamorphism and Au mineralisation in the western Gawler Craton – *Alex Van Leeuwen*
- Crustal and mantle architecture underpinning the area – fluid and magma pathways and fertility – *Stephan Thiel, CSIRO*
- Looking at GP2 gravity and MT data: how the new solid geology compilation helps interpretation – *Mark Pawley*
- Group summary – new learnings for mineral potential in the western Gawler – *Stephan Thiel, CSIRO*

Australia wide data portals

- Geoscience Australia Portal
- AuScope Discovery Portal
- AuScope National Virtual Core Library
- AGSON Australian Geological Survey Organisation Network

Data source acknowledgments

The data has been provided by the Government of South Australia, Geological Survey of South Australia, Department for Energy and Mining.

Further information

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