

Fieldnotes



Government of Western Australia
Department of Mines, Industry Regulation
and Safety

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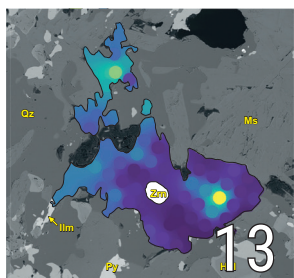
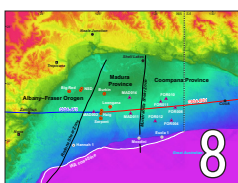
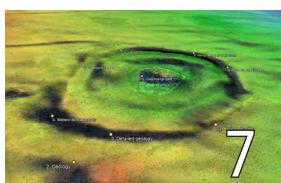


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Fieldnotes

Fieldnotes is a free digital-only quarterly newsletter published by the Geological Survey of Western Australia (GSWA). The newsletter provides regular updates to the State's exploration industry and other geoscientists about GSWA's latest work, programs, products and services.

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Cover image: Evening light surrounds DDH1 Drilling's ER01 rig during the drilling of Waukarlycarly 1



Round 21 EIS co-funded drilling announced

The Western Australian State Government continues to support the search for new resource discoveries across Western Australia. On 21 May, the Minister for Mines and Petroleum, Bill Johnston, announced that 49 successful projects will benefit from the State Government's highly competitive co-funded drilling program.

In the unprecedented times of COVID-19, the Exploration Incentive Scheme (EIS) program has continued with the round attracting 61 applications requesting over \$6.59 million. The successful 49 applicants (Fig. 1), including seven prospectors, were offered a total of \$5.23 million for drilling of projects in the 2020–21 financial year.

Round 21 successful projects are widely distributed throughout Western Australia (Fig. 2) and include a diverse range of commodities from vanadium, rare earth elements, tantalum, nickel, cobalt, gold, copper, base metals, potash, and platinum group elements.

Recent projects drilled with the support of the program have shown significant results both economically and scientifically. Recent co-funded drilling projects have continued to build on the EIS drilling success to progress projects. Capricorn Metals Karlawinda gold project has exceeded 2 Moz in reserves and Bellevue Gold's Bellevue gold project has an inferred resource of 2.2 Moz at 11.3 g/t Au.

Diamond core, from EIS co-funded drilling projects in the Paterson Orogen (eastern Pilbara region) stored in the Perth Core Library, is currently the focus of several research projects. Core from projects by Antipa Minerals, Encounter Resources and Sipa Resources has been sampled by EIS-sponsored MRIWA project 521 conducted by the Centre for Exploration Targeting (The University of Western Australia)–CSIRO to understand the tectonic setting and basin evolution of the orogen. While a second project on the timing and genesis of mineralization is the focus of a Geological Survey of Western Australia (GSWA) project. Researchers from both projects are collaborating to share data and deliver results to the exploration community.

A recent review of co-funded drilling Rounds 1 to 17 indicated that 677 (293 972 m) diamond holes were submitted to either the Perth Core Library or the Joe Lord Core Library in Kalgoorlie. Sixty-eight holes are in excess of 1000 m in length, and an additional 154 holes are between 500 and 1000 m deep. Many of these holes, 43%, have been sampled by either exploration companies or researchers. Sampling was predominantly for geochemistry, petrography, geochronology or isotope analysis.

The next round (Round 22) will open for applications on 21 August 2020. Successful applicants will be refunded up to 50% of their direct drilling costs – with caps of \$150 000 for a multi-hole project, \$200 000 for a single deep hole, and \$30 000 for a prospector's project.

For more information, contact [Charlotte Hall](#).



Drilling of Waukarlycarly 1 with surface casing in the foreground

Exploration Incentive Scheme

Map ID	Application type	Applicant Name	Drilling project title	Target commodities
1	General	Anglogold Ashanti Australia Ltd	Angel Eyes	Au
2	General	Antipa Minerals	North Telfer Project	Au, Ag, Cu, Co, Zn, Pb, W
3	General	Ausgold Exploration Pty Ltd	Deep Extensions To Jinkas Gold Deposit	Au
4	General	Auteco Minerals	Limestone Well	V
5	General	Bellevue Gold	Bellevue	Au
6	General	Black Raven Mining	Jillewarra Woods Anomaly	Pb, Ag, Zn, Au
7	General	Black Raven Mining	Erayinia King South Down Plunge	Au, Cu, Zn, Ag
8	General	Cloonmore Group Pty Ltd	Nimy Exploration Project	Ni, Cu, Co, Au
9	General	Constellation Resources	Transline - Fraser Range	Nickel Sulphide
10	General	Cygnus Gold Ltd	Hammerhead Gold Project	Au
11	General	David Ross	Cowalinya	HREE
12	General	Discovex Resources Limited	Hornet West Drilling	Au
13	General	Dreadnought (kimberley) Pty Ltd	Chianti-Rufina	Cu, Au, Zn, Pb, Ag
14	General	Emetals Limited	Nardoo Well Rare Metals	W, REE, Li, Y, Nb, Ta
15	General	Encounter Resources	Windsor-Vines Targets	Cu, Co
16	General	Geostats Pty Ltd	Quartz Circle Deep Drilling	Au, Cu
17	General	Gold Road Resources Limited	Pebble Beach Komatiite	Ni, Cu, PGE, Au
18	General	Gold Road Resources Limited	Akhal Teke Greenstone Belt	Au
19	General	Gold Road Resources Limited	Beefwood Project	Au, Cu, Ni
20	General	Golden State Mining Limited	Yule Project	Au, Sn, Ta
21	General	Great Boulder Resources	Mt Jewell	Ni
22	General	Gruyere Mining Company	Ziggy West	Au
23	General	Hammer Metals Limited	Bronzewing South Drilling Proposal	Au
24	General	IGO Limited	Quick Shears and Fireant Multi-hole	Ni, Cu, Co, PGEs
25	General	Kairos Minerals Ltd	Croydon Sediment Gold Drilling Project	Au
26	General	Kingston Resources Ltd	Stanley Blind Target	Au
27	General	Manda Resources Pty Ltd	Lake Burnside Project	Potassium and sulphate enriched brine
28	General	Musgrave Minerals Ltd	Starlight Link-lode Deeps	Au
29	General	Peako Limited	Eastman North & East	Cu, Pb, Zn, Ag, Au
30	General	Prodigy Gold	Western Aileron Remote Area Drilling	Au, Cu, Zn, Ag, Pb
31	General	Regis Resources Ltd	Collurabie	Au
32	General	Resource Potentials	Dalgaranga	Au, Ag, Cu, Pb, Zn
33	General	Rio Tinto Exploration	Budjiddowns	Cu, Au
34	General	Salt Lake Mining	Beta Hunt Southern Offset Extension	Ni, Au
35	General	Sipa Exploration NL	Wolfe	Zn, Pb, Ag
36	General	St George Mining Ltd	Cathedrals Deeps Concept	Ni, Cu, PGE
37	General	St Ives Gold Mine	Eastern Lake Lefroy Stratigraphy	Au
38	General	Surveyor Resources Pty Ltd	Aries Litho-structural Target	Au
39	General	Tali Resources Pty Ltd	Alakol IOCG Exploration	Cu, Au
40	General	Traka Resources	Mt Cattlin North	Au
41	General	Yilgarn Exploration Ventures Pty Ltd	Tea Well Ai Target Testing	Au
42	General	Yilgarn Exploration Ventures Pty Ltd	Desdemona North Ai Target Testing	Au
43	Prospector	Baracus Pty Ltd	Old Mac	Au
44	Prospector	Baracus Pty Ltd	Bernts And Honey Eater	Zn, Ag, Pb
45	Prospector	Blue Bull Gold Pty Ltd	Hood Province - Ida Valley	Au, Ag
46	Prospector	Fenton & Martin Mining Developments Pty Ltd	Pride of Jourdis	Au
47	Prospector	Fortified Mining Pty Ltd	Majestic North	Au
48	Prospector	Merchant Holdings Pty Ltd	Southern Cross West Gold Project	Au
49	Prospector	Russell G McKnight	Mask of Harry	Au, Ag, Cu, Zn, Pb

Figure 1. List of successful applicants for Round 21

Exploration Incentive Scheme

GENERAL

- 1 Anglogold Ashanti Australia Ltd
- 2 Antipa Minerals
- 3 Ausgold Exploration Pty Ltd
- 4 Auteco Minerals
- 5 Bellevue Gold
- 6 Black Raven Mining
- 7 Black Raven Mining
- 8 Cloonmore Group Pty Ltd
- 9 Constellation Resources
- 10 Cygnus Gold Ltd
- 11 David Ross
- 12 Discovex Resources Limited
- 13 Dreadnought (kimberley) Pty Ltd
- 14 Emetals Limited
- 15 Encounter Resources
- 16 Geostats Pty Ltd
- 17 Gold Road Resources Limited
- 18 Gold Road Resources Limited
- 19 Gold Road Resources Limited
- 20 Golden State Mining Limited
- 21 Great Boulder Resources
- 22 Gruyere Mining Company
- 23 Hammer Metals Limited
- 24 IGO Limited
- 25 Kairos Minerals Ltd
- 26 Kingston Resources Ltd
- 27 Manda Resources Pty Ltd
- 28 Musgrave Minerals Ltd
- 29 Peako Limited
- 30 Prodigy Gold
- 31 Regis Resources Ltd
- 32 Resource Potentials
- 33 Rio Tinto Exploration
- 34 Salt Lake Mining
- 35 Sipa Exploration NL
- 36 St George Mining Ltd
- 37 St Ives Gold Mine
- 38 Surveyor Resources Pty Ltd
- 39 Tali Resources Pty Ltd
- 40 Traka Resources
- 41 Yilgarn Exploration Ventures Pty Ltd
- 42 Yilgarn Exploration Ventures Pty Ltd

PROSPECTOR

- 43 Baracus Pty Ltd
- 44 Baracus Pty Ltd
- 45 Blue Bull Gold Pty Ltd
- 46 Fenton & Martin Mining Developments Pty Ltd
- 47 Fortified Mining Pty Ltd
- 48 Merchant Holdings Pty Ltd
- 49 Russell G McKnight

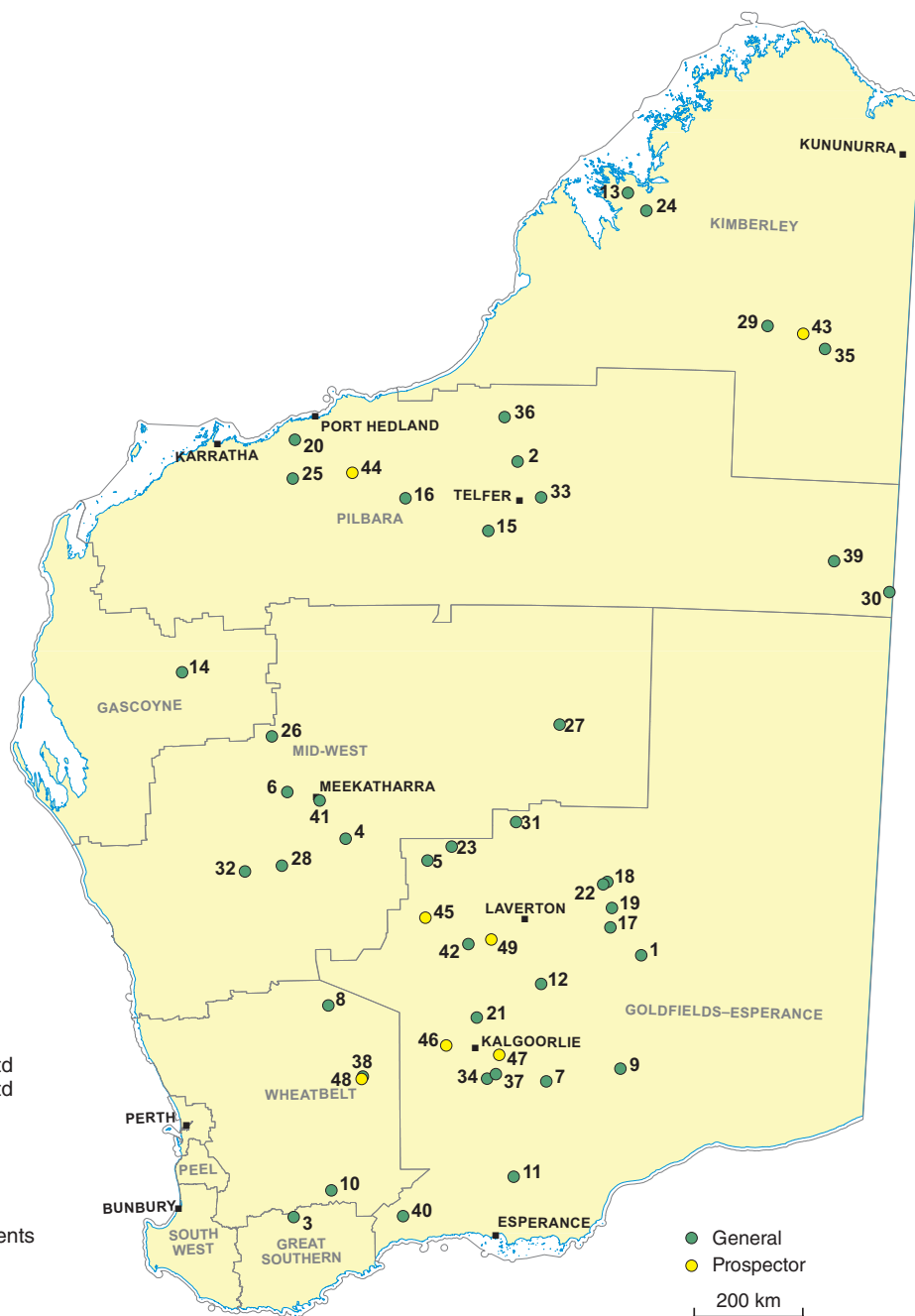


Figure 2. Locations of successful applicants for Round 21

Geocentric Datum of Australia 2020

Spatial datasets available in new GDA2020 datum

The majority of spatial datasets available from the Department of Mines, Industry Regulation and Safety's (DMIRS) Data and Software Centre (DASC) will be available in the new Geocentric Datum of Australia 2020 (GDA2020) from 1 July.

DMIRS is transitioning to GDA2020 as part of the national implementation program necessary to account for Australia's tectonic movement of about seven centimetres northeast each year.

The DASC upgrade meets the adoption date set by ANZLIC – the Spatial Information Council – for its member agencies to deliver and receive national scale foundation spatial data in GDA2020.

The Geocentric Datum of Australia 1994 (GDA94) will be supported for spatial datasets on DASC until 1 January 2021.

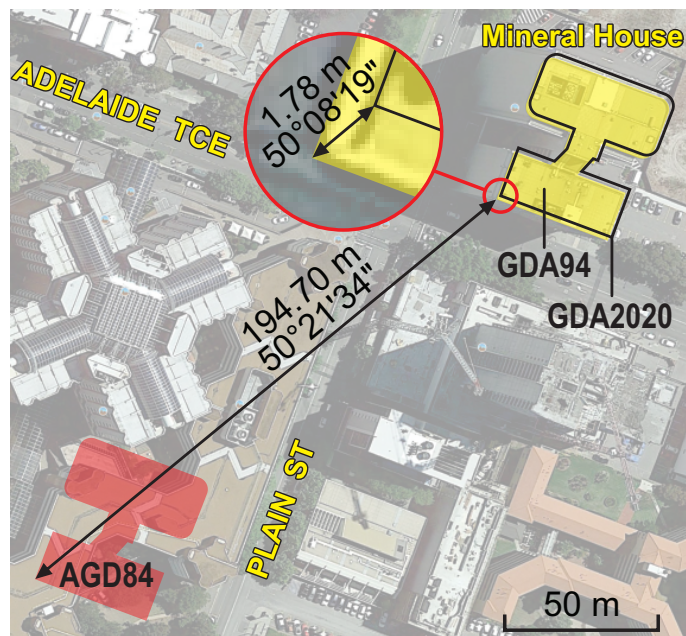
The Intergovernmental Committee on Surveying and Mapping (ICSM) is responsible for coordinating the GDA2020 datum shift nationally. GDA2020 will supersede the current GDA94 datum, and older coordinate systems such as the Australian Geodetic Datum 1966 and 1984.

'While we have focused on supplying GDA2020 via our new DASC at this time, we are also continuing to work to provide access for all currently available products, plus additional GDA2020 products and services, over the coming year,' said Resource Tenure Executive Director Rick Rogerson.

'DMIRS is updating regulations and policies that specify a defined datum to reflect the adoption of GDA2020 and changing systems.'

Information about GDA2020 is available on the DMIRS website at www.dmirs.wa.gov.au/GDA2020 or you can email gda2020@dmirs.wa.gov.au if you require further details.

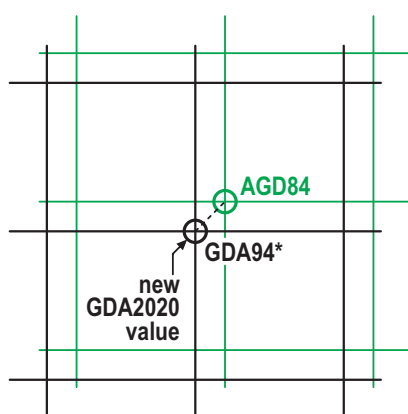
Additional details about the national update are available at www.icsm.gov.au.



This map shows the location of Mineral House described using three different datums: AGD84, GDA94 and GDA2020.

Australian Geodetic Datum 1984 (AGD84) was changed to Geodetic Datum of Australia (GDA94) in 2000 and resulted in an approximate 200 m shift. The shift to Geocentric Datum of Australia 2020 (GDA2020) is approximately 1.8 m.

The buildings always stay in the same place relative to all other buildings and streets etc. The Datum changes represent the movement of the entire continent, requiring updates to the way the building location is described.



GDA2020 tenement

AGD84 grid

GDA94 grid

AGD Australian Geodetic Datum 1984

GDA Geodetic Datum of Australia 1994 and 2020

GDA94 grid to be retained

New GDA2020 values applied to GDA94 grid through coordinate transformation

* The new GDA2020 latitude and longitude value for the same point (circled) on the retained GDA94 grid will differ from the previous GDA94 latitude and longitude values

Meteorite impact structures virtual tour has a new update

This virtual tour is an interactive, Google Earth armchair tour of meteorite impact craters, and old eroded or buried impact sites. The 2020 update provides information on 11 of the most significant impact sites in Western Australia, and includes new entries on the Late Paleozoic to Early Mesozoic Woodleigh impact structure, and the Goat Paddock crater in the Kimberley. It also incorporates information on new isotopic dating for the Yarrabubba impact structure that confirms it as the oldest known meteorite impact structure on Earth at c. 2229 Ma.

The tour has a wealth of up-to-date information on the geology, history and cultural aspects of each impact site. The information is presented at an introductory level suitable for students, teachers and amateur geologists, with a list of references for further reading for those seeking additional, more detailed information. Points of interest at each impact site are illustrated with photos and diagrams, and technical terms are explained through an extensive glossary accessed interactively using tool-tips. Many of the figures are interactive and can be enlarged for better viewing or opened in an external viewer. Maps and geophysical images are also provided as overlays that can be turned on or off as desired.

The online product, **Meteorite impact structures of Western Australia, virtual tour 2020** by SC Goss, provides information on the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop where you can find out how to access the virtual tour itself.

For more information, contact **Terry Farrell**.

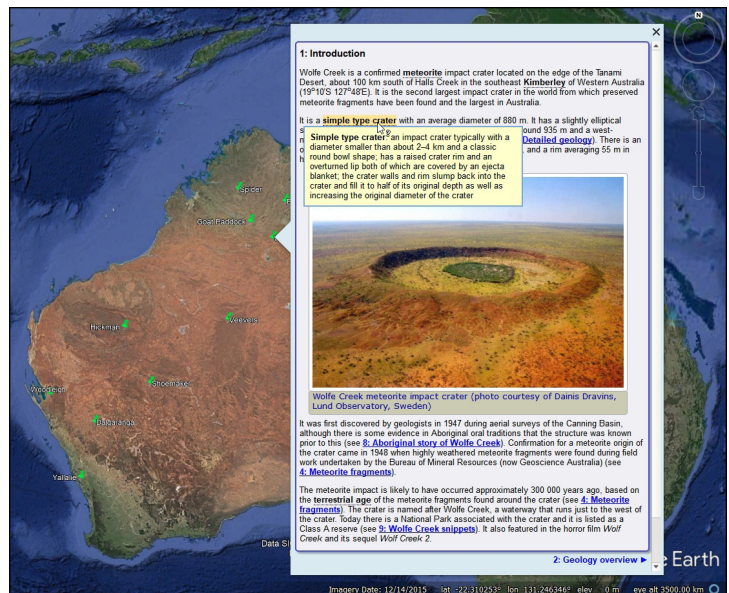


Figure 1. Screen capture showing the introduction and display of glossary definitions for the Wolfe Creek meteorite impact crater

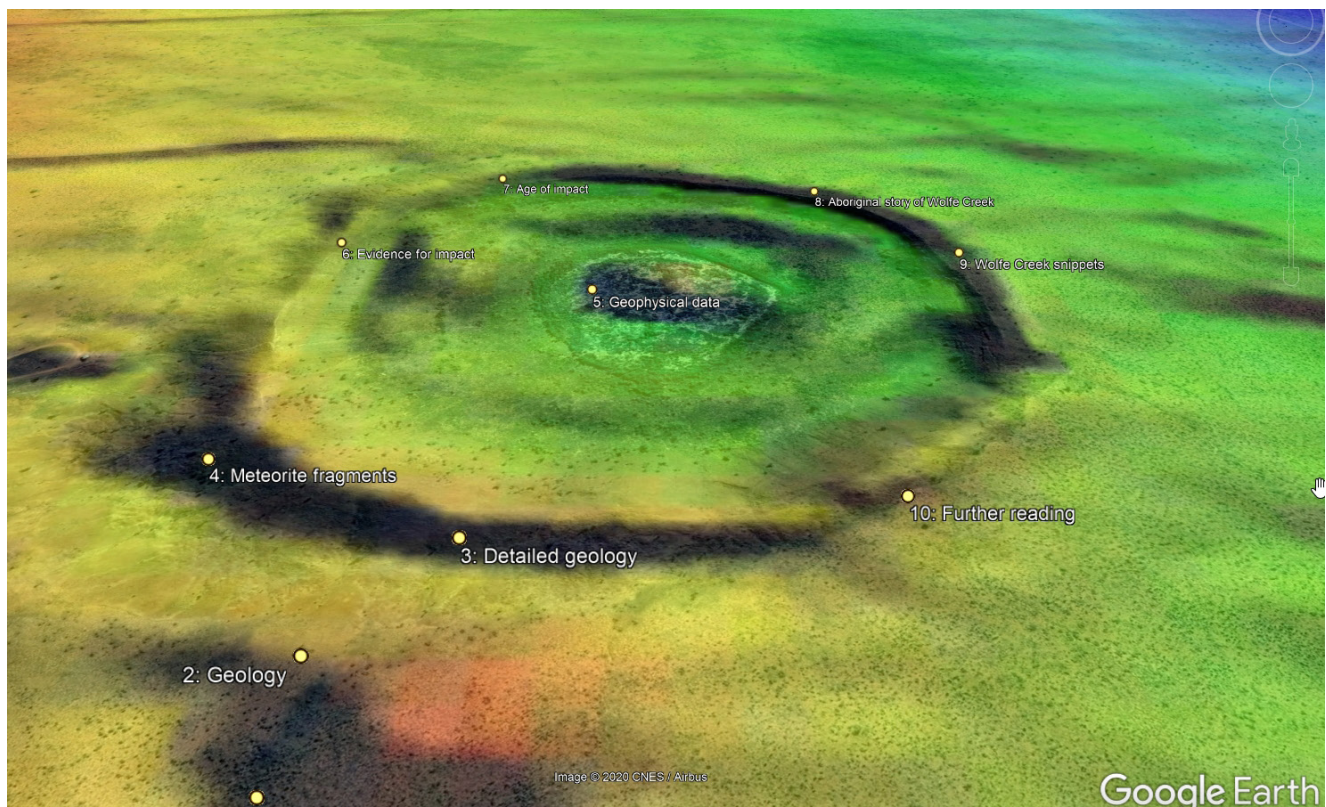


Figure 2. View of the Wolfe Creek crater with the total magnetic intensity overlay turned on. It highlights the magnetic peak in the centre of the crater, the inner magnetic anomaly ring and the outer anomaly ring coincident with the crater rim

Revealing the Proterozoic geology beneath the Nullarbor Plain

The Geological Survey of Western Australia (GSWA) has just released Report 204 which was designed to provide an 'everything we know about this region' guide and data repository of the hidden basement rocks beneath the Cretaceous and Cenozoic, Bight and Eucla Basins. Informally known as the Eucla basement, the region encompasses the far northeast of the Albany–Fraser Orogen and the adjoining Madura and Coompana Provinces (Fig. 1). Due to the cover and a lack of data and geological knowledge, the Eucla basement has remained one of the least-explored regions of Western Australia. However, since 2009 GSWA has invested considerable Exploration Incentive Scheme (EIS) funds into the region through geophysical data acquisition, stratigraphic and co-funded drilling, and data analysis and interpretation. This has recently led to significant tenement uptake, including BHP's Seahorse project and Red Metal Limited's Nullarbor project. Report 204 demonstrates the value of combining interpretations of regional geophysical data with detailed information from diamond drillcores to map the crustal architecture and establish a stratigraphic and crustal evolution framework for basement geology hidden beneath younger basin cover. A variety of Proterozoic metabasalts, felsic metavolcanic rocks and related schists, metagabbros, and dominantly metamorphosed granitic rocks including shoshonite, adakite, and granites with syenogranitic to dioritic compositions have been described.

Distinct differences in crustal evolution are evident between the Madura and Coompana Provinces, highlighting the significant displacement along the Mundrabilla Shear Zone that separates them. The Madura Province formed through hyperextension of the Archean–Paleoproterozoic continental margin of the Yilgarn Craton and Albany–Fraser Orogen to produce the Arid Basin, which subsequently closed via subduction related to

the formation of a c. 1400 Ma oceanic arc. The suture zone is marked by the Rodona Shear Zone, highlighted by a distinct break in conductivity in magnetotelluric data (Fig. 2). In contrast, the Coompana Province underwent early and probably multiphase subduction recycling, potentially starting by 1720 Ma and extending to at least c. 1604 Ma, synchronous with juvenile magmatism along the southwestern Gawler Craton. This led to the development of a thick, enriched and hydrated lithosphere, followed by extension and crustal thinning recorded by the 1499–1479 Ma Undawidgi Supersuite.

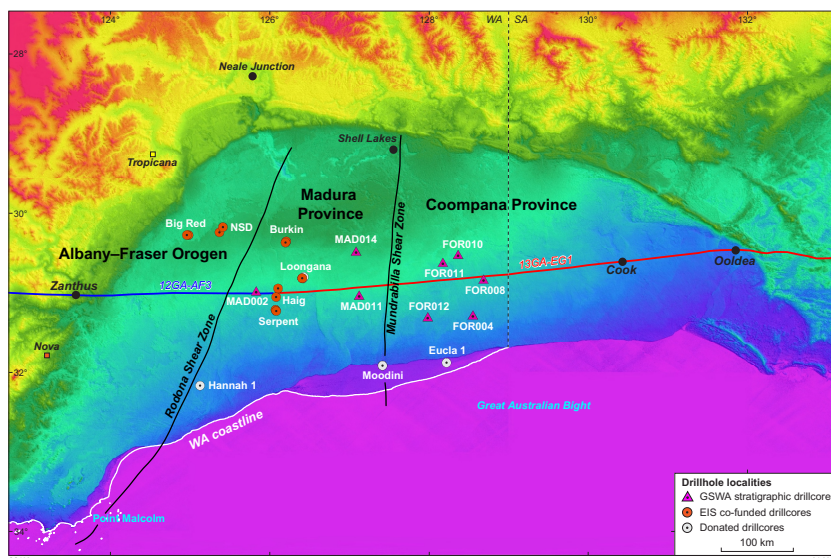


Figure 1. False-colour Shuttle Radar Topography Mission image showing drainage patterns and the extent of the Eucla Basin. The locations of drillholes, deep crustal seismic lines, mines and localities, and approximate position of tectonic boundaries are also shown

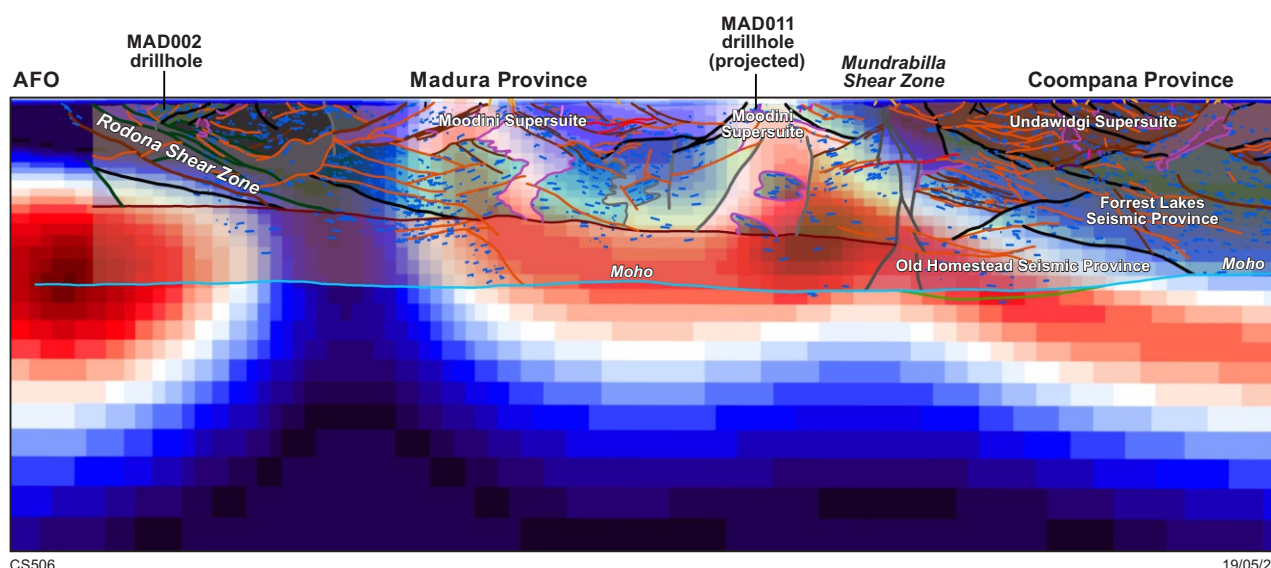


Figure 2. Section of modelled magnetotelluric data overlain with interpreted linework from merged seismic lines 12GA-AF3 and 13GA-EG1 (from the collaborative project work shown in Spaggiari et al., 2017, Geological interpretation of the Madura and Coompana Provinces along the Eucla–Gawler seismic and magnetotelluric line 13GA-EG1: GSWA, non-series map). Warm colours represent conductive features in the magnetotelluric data. Abbreviation: AFO, Albany–Fraser Orogen

Eucla basement

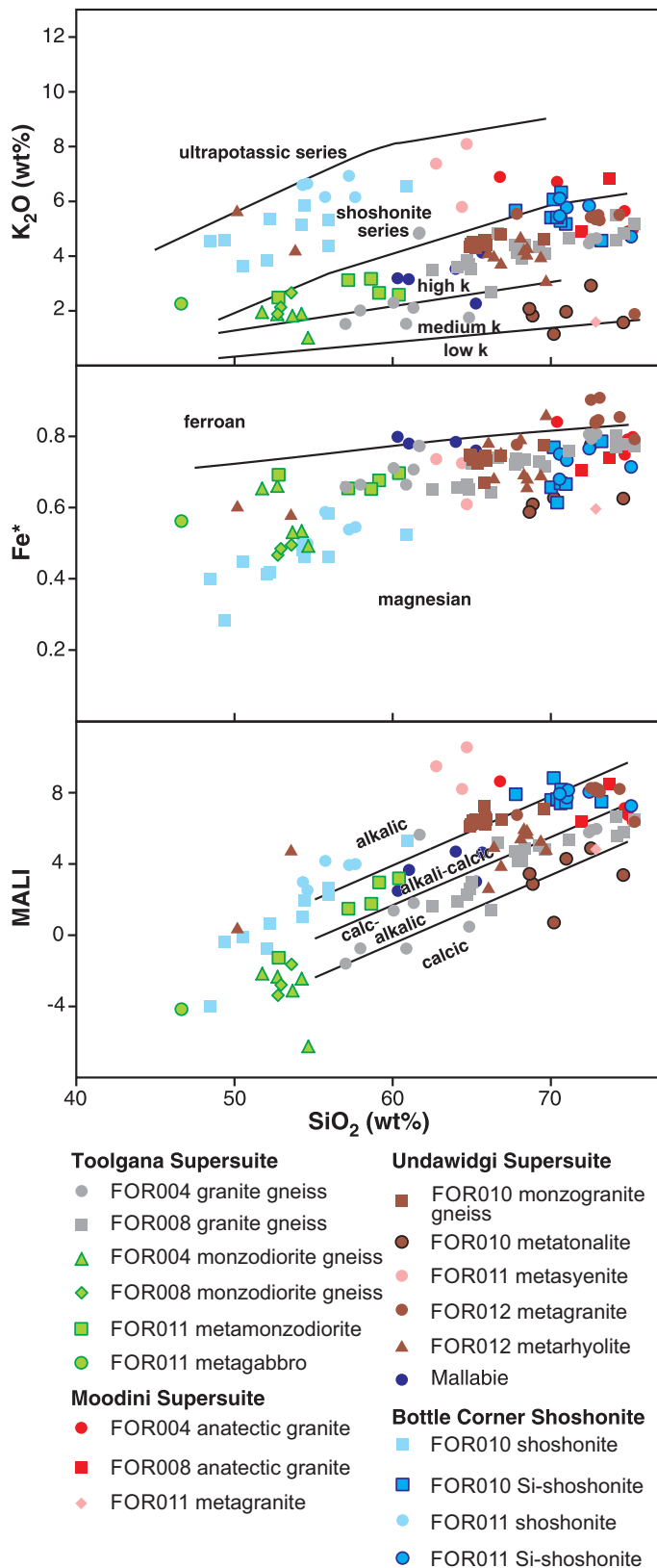


Figure 3. Variation in K_2O , Fe number (Fe^*) and modified alkali-lime index (MALI) with SiO_2 for felsic to intermediate rocks of the Coompana Province. Fe^* and MALI after Frost et al. (2001)

The Madura and Coompana Provinces share a common history from c. 1225 Ma when high-KFe Moodini Supersuite magmatism engulfed the region. Of note is that high-KMg mafic and felsic shoshonites are found in the Coompana Province (Fig. 3), but are rare in the Madura Province. This is consistent with the interpretation that thick lithospheric mantle was significantly thinned, or removed in the Coompana Province and the high-KMg magmatism likely represents deep melting of this older subduction-metasomatized lithospheric mantle.

Most drillcores obtained from the Eucla basement demonstrate the presence of alteration zones and sulfide minerals with anomalous values of Cu, Au, Ag and PGE from various locations. Coupled with interpretations of the geodynamic events, these occurrences indicate the potential for a variety of mineral systems. Deposit types include, but are not limited to, volcanogenic massive sulfide-style or exhalative deposit mineralization; subduction-related deposits such as porphyry Cu-Au or intrusion-hosted Ni and PGE deposits; non-subduction intrusion-related Cu-Au mineralization during emplacement of the Moodini Supersuite and in particular, the shoshonitic rocks; IOCG-type mineralization; and orogenic Au related to the large crustal-scale shear zones. The task now is to move from the regional to the camp scale. Using the information provided in Report 204, new drilling and analytical methods could potentially be applied to refine the exploration space in this vast greenfields region.

GSWA Report 204 Stratigraphic and co-funded drilling of the Eucla basement – the Proterozoic geology beneath the Nullarbor Plain by CV Spaggiari, RH Smithies, CL Kirkland, MTD Wingate, RN England and Y Lu is available as a free downloadable PDF from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact [Catherine Spaggiari](#).

John de Laeter Centre

THE UNIVERSITY OF QUEENSLAND

GEMOC CCFS

Plateforme
Ge O He Li S
Géochimie Élémentaire et Isotopique

Collaborative organizations for the project

Waukarlycarly 1 drilling project

Results published in basic data well completion report

Waukarlycarly 1 was drilled as a stratigraphic well at the southern end of the Waukarlycarly Embayment, a structural division along the southwest margin of the Canning Basin. The drilling was a follow-up project to the Kidson seismic survey (18GA-KB1) to provide stratigraphic data for a previously undrilled and very poorly understood tectonic component of the southern Canning Basin. The wellsite was about 214 km east of Marble Bar and 51 km west-northwest of the Telfer gold mine in the Pilbara region of Western Australia. The project was funded by Geoscience Australia's (GA) Exploring for the Future Initiative with the Geological Survey and Resource Strategy Division (GSRSD) of the Department of Mines, Industry Regulation and Safety (DMIRS) participating as project operator.

The well was spudded on 1 September 2019, rotary drilled from the surface to 580.00 mRT (metres rotary table) and then continuously cored to a total depth (TD) of 2680.53 mRT. After TD was reached on 30 November 2019 the well was plugged and decommissioned, with rig release on 12 December 2019.

The recently published Waukarlycarly 1 basic data well completion report provides the fundamental details of the entire drilling operation. This Report provides details of the well summary, formation evaluation, and drilling and completions data. The following appendices augment the Report:

- A. Daily drilling reports
- B. Daily geological reports
- C. Mud log
- D. Composite mud log
- E. Core run summary
- F. Core tray summary
- G. Core photos
- H. HyLogger-3 ditch cuttings summary
- I. HyLogger-3 core summary
- J. HyLogger-3 photos
- K. Cement bond log 7" casing
- L. Cement bond log 5.5" casing
- M. Wireline logs #1: 155.6 mm (6 1/8") SQ hole
- N. Wireline logs #2: 120.7 mm (4 3/4") PQ hole
- O. Wireline logs #3: 95.3 mm (3 3/4") HQ hole
- P. Vertical seismic profile
- Q. Rig specifications

A second Report bringing together the various post well analysis and subsequent geological interpretations will follow as the 'interpretative' well completion report scheduled for release in June 2021.

GSWA Report 206 Waukarlycarly 1 basic data well completion report by LS Normore and M Rapaic is free to download as a PDF from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop. The report and all appendices are available to download from **WAPIMS**. Add 'Waukarlycarly 1' in the well name to retrieve the report and other data.

For more information, contact **Leon Normore**.

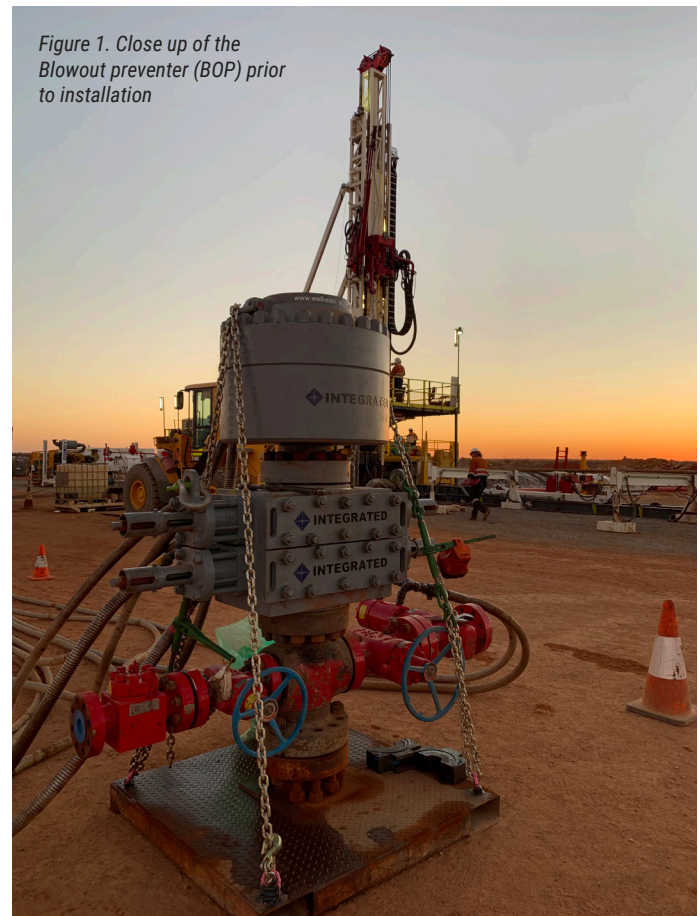


Figure 1. Close up of the Blowout preventer (BOP) prior to installation



Figure 2. Pallet of SQ core trays, DDH1 ER01 drill rig in the background

Economic recovery program 2020–21

The Geological Survey of Western Australia (GSWA) intends to reprioritize its 2020–21 work program in direct response to the impact on the resources industry by the COVID-19 pandemic. The work program has been specifically designed to aid economic recovery and stimulate the exploration industry by utilizing GSWA's extensive, pre-competitive geoscience datasets and archived rock collection. GSWA will deliver new interpretive datasets across all areas of geoscience, in key regions of the State where work is currently underway. This will accelerate understanding of the region's geology and mineral prospectivity.

At the same time, GSWA will continue to provide its key statutory and regulatory business functions and other core projects critical for economic recovery. It is anticipated that no additional funding will be required to facilitate the modified work program. Most resources can be found within GSWA, although some staff may need to move to new areas temporarily. GSWA will provide all staff with an opportunity for upskilling within the division.

Modified work program

The modified GSWA work program for 2020–21 will be structured around two main streams. These streams will create and add value to the resources industry through data-driven exploration. The two streams are:

1. **Accelerated Geoscience program** — a program of accelerated geoscience data synthesis and delivery, in areas of new or emerging mineral potential including those with critical mineral prospectivity.
2. **Business Improvement program** — a series of short-term, big-win, data synthesis projects that will increase mineral prospectivity across the State. Pre-existing geoscience datasets will be integrated for delivery in ways which can be used by exploration companies to generate new exploration targets.

Accelerated Geoscience program

The Accelerated Geoscience program will see dedicated geoscientists from across GSWA concentrate their efforts on four main projects:

- Publication of existing data into GIS layers
- Data integration and analyses — the Yilgarn Craton
- Statewide critical minerals prospectivity study
- Energy systems including petroleum, geothermal, and carbon capture and storage.

The results will be published online as GIS layers available in current GSWA systems, and within three, standalone Geological Exploration Packages (GEP). These will be a Southwest Yilgarn GEP, an East Yilgarn GEP and the Critical Minerals GEP. These standalone packages will facilitate use for all levels of technical competency and software, from prospectors to Tier 1 companies.

Publication of existing data into GIS layers

This project will deliver previously non-digital datasets as new, spatial datasets. The outcome will improve understanding of the prospectivity of the State which will feed into other projects in the Accelerated Geoscience program (Fig. 1).

Data integration and analyses — the Yilgarn Craton

The Yilgarn Craton is one of Western Australia's most prospective regions and contains significant deposits of gold, nickel, lithium, copper–zinc, iron ore, tantalum, aluminium and uranium. Recent high-grade gold and nickel discoveries in the craton's far eastern (Gruyere, Tropicana, Neale) and southwestern margins (Julimar), have shown that these two poorly exposed and geologically not well-understood regions are likely to be as prospective as the craton's interior (i.e. Eastern Goldfields). Despite both regions being covered by a thick blanket of regolith, GSWA holds a vast amount of geoscientific data relating to the bedrock and regolith geology with the potential for uncovering significant, new mineral deposits.

The minerals industry is increasingly aware that the new era of Tier 1 deposits is likely to be under deep cover. Working to the UNCOVER plan, the Accelerated Geoscience program will deliver new integrated geoscience datasets for the southwestern and far eastern Yilgarn Craton margins. The program will incorporate results of ongoing work in the Eastern Goldfields, and perform new analyses on archived samples, which will accelerate understanding of these regions and will define new areas of high mineral prospectivity.

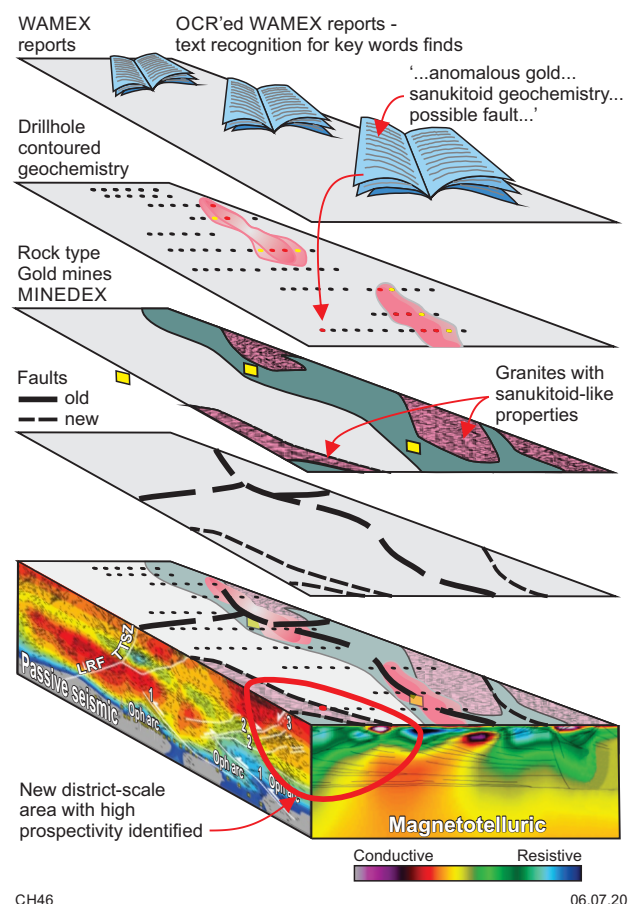


Figure 1. Schematic representation of integrated datasets

Accelerated Geoscience program

Statewide critical minerals prospectivity study

Both the State and Federal Governments have outlined a list of minerals that are deemed critical for emerging high-tech applications and which are considered essential for economic and industrial development over the next decade. Western Australia is well placed to capitalize on increasing demand for critical minerals as we transition globally to low-carbon technologies. Knowledge of the geological addresses where these deposits are likely to be located not only reveals emerging exploration plays but allows the government the foresight to manage land for strategic industrial purposes such as downstream processing.

The aim of this project is to catalogue the known critical mineral resources of the State to better understand the mineral systems in which they occur and the associated alteration systems. These genetic associations can then be explored in existing GSWA datasets to provide a series of prospectivity maps for individual critical minerals. The results aim to stimulate and increase investment in the critical minerals sector by defining new exploration targets and opening up new parts of the State to exploration.

Energy systems

This project will investigate the prospectivity of the State's potential energy resources and will include low-carbon technology and geothermal projects.

The petroleum industry has been one of the most affected by COVID-19 having a simultaneous supply and demand shock caused by an oil price war that coincided with the start of the pandemic. This project aims to produce a graphic summary of the State's well data in addition to other GIS layers that will directly benefit petroleum industry exploration. Other initiatives relate to decarbonization such as CO₂ geosequestration.

Business Improvement program

This program aims to streamline our digital business by synthesizing and publishing key, spatial digital datasets to enhance the mineral prospectivity of the State.

For more information, contact [Michele Spencer](#).



In light of the uncertain global times and a heavy conference load in 2021, the 6IAS and Target 2022 organising committees regret to advise that their respective conferences are now postponed until 2022.

We trust that the new conference date for mid-2022 will maximize the opportunity for participation for our international Archean geoscience community. New dates and information on registration, field trips and abstract submission will be released on the website, www.6ias.org

Stay safe and stay tuned for updates

The 6IAS and Target 2022 Committees



Novel approaches to understanding mineral systems on the margins of cratons

The project ‘Mineral systems on the margins of cratons: Albany–Fraser Orogen / Eucla basement case study’ was Minerals Research Institute of Western Australia (MRIWA) project M0470, supported by MRIWA, Curtin University, the Geological Survey of Western Australia (GSWA) and Ponton Minerals (Creasy Group). The recently released GSWA Record 2020/5 provides an executive summary of the key findings, along with an electronic appendix of the data generated during the project, from both field and drillcore samples. The objectives of Project M0470 were to address the fundamental components of mineral systems across the Albany–Fraser Orogen and Eucla basement. The project utilized a mineral systems concept to place known mineralization within the region in a geological context where ore deposits were viewed as small-scale expressions of Earth processes that took place at different temporal and spatial scales. Ten key findings of this work, documented in GSWA Record 2020/5, can be considered as relating to either, or both, the understanding of isotopic tools or understanding the context of the mineral systems within this region. A selection of these are summarized below.

Project M0470 was divided into three modules, each with an associated PhD student. Their theses are, or will be, available on the Curtin University Library website, and several journal articles are available (reference list provided in Record 2020/5).

Module A: Isotopic monitors of crustal evolution (architecture); through cutting-edge split-stream LA-ICPMS instrumentation. This module enhanced the existing Hf-in-zircon database by integrating O isotopic signatures, which addresses limitations associated with Hf model ages that reflect mixtures between crustal and mantle source components. A significant outcome was that the spatial variation in the hafnium isotopic compositions of granitic rocks from the Albany–Fraser Orogen does not correlate with the present-day structure of the belt, but more closely resembles that of the Yilgarn Craton (Fig. 1).

Module B: Petrochronology (geodynamic driver); complemented GSWA's existing zircon geochronology program by coupling U–Pb geochronology (on a wide range of different mineral phases) to the grain-scale mineral chemistry as a proxy for the conditions of the crust during specific periods in time. A significant outcome was the identification of gold mobilization along the linked Harris Lake and Fraser Shear Zone during Stage II of the Albany–Fraser Orogeny, through detailed mineral analysis (Fig. 2). No gold event of this age has previously been recorded in the region.

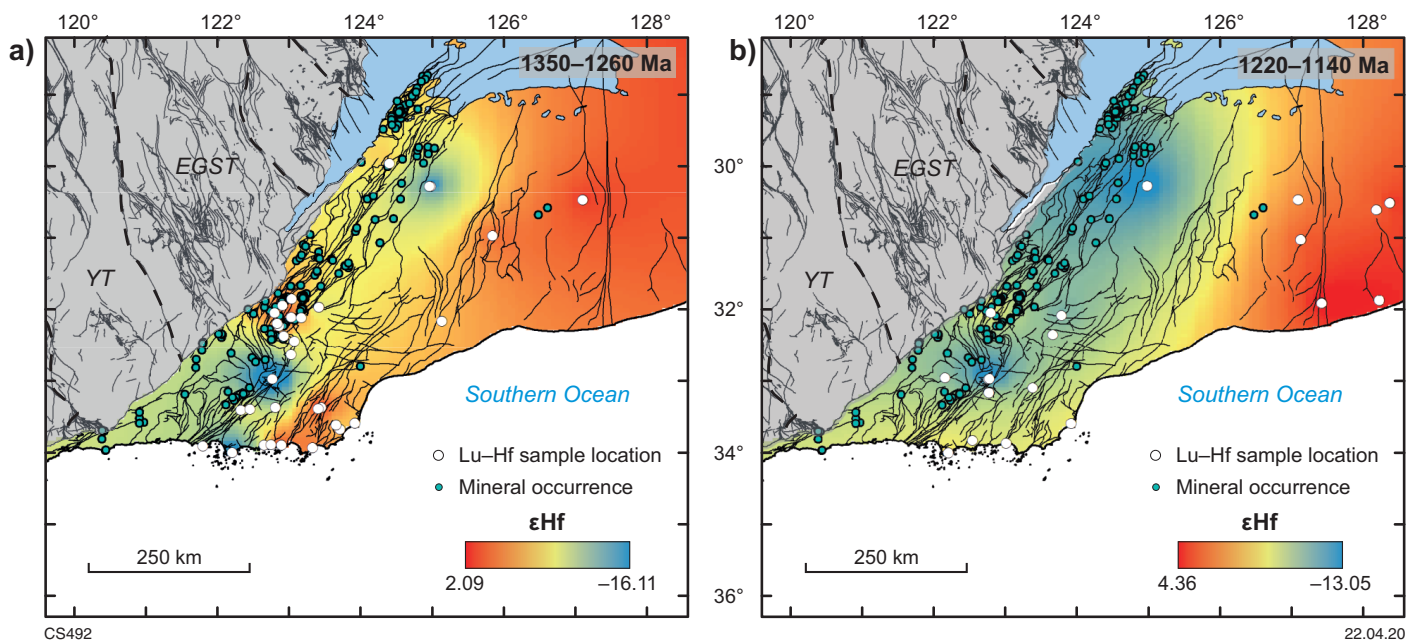


Figure 1. Time-sliced zircon Hf isotope maps for the Albany–Fraser Orogen and Eucla basement: a) Stage I magmatism (1350–1260 Ma); b) Stage II magmatism (1220–1140 Ma). Mineral occurrences extracted from the [MINEDEX database](#). Abbreviations: EGST, Eastern Goldfields Superterrane; YT, Yuanmi Terrane

Albany–Fraser Orogen

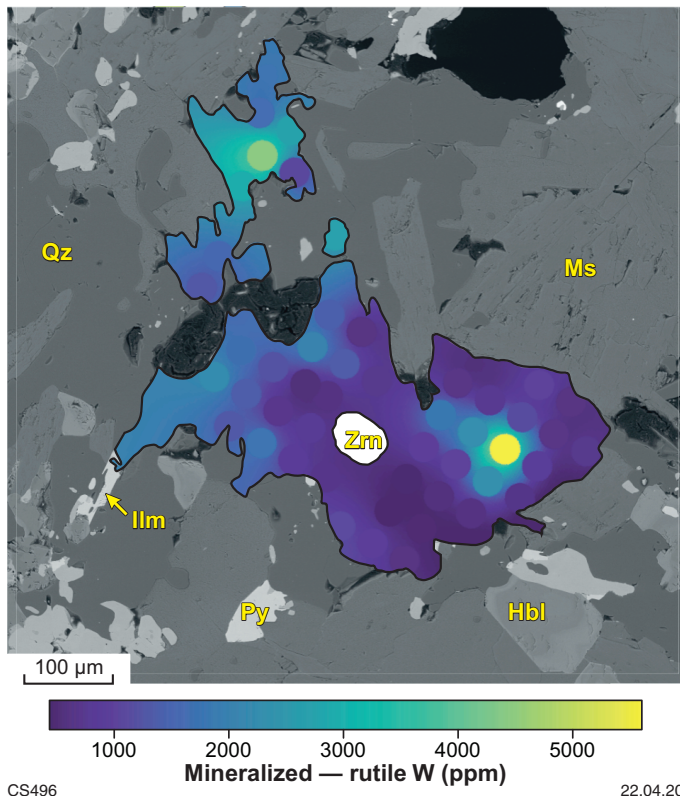


Figure 2. Contour map of tungsten concentration (ppm) within an irregularly shaped rutile grain from a mineralized metasedimentary rock. The background is a backscatter electron image showing the in situ relationship between metamorphic zircon (Zrn), hydrothermal muscovite (Ms), quartz (Qz), pyrite (Py) and rutile; other abbreviations: Hbl, hornblende; Ilm, ilmenite

Module C: Sulfide sources and budgets (fertility); through the use of multiple sulfur isotopes, combined with trace element ratios, a robust fingerprint of sulfur mobility and metal reservoirs in the region has been developed for key case study localities. A significant outcome is the absence of an Archean sulfur signature in major Ni–Cu deposits of the Fraser Zone (e.g. Nova), which suggests that sulfur, but not Archean zircon, was recycled through surface, rather than magmatic, processes and this must have occurred prior to incorporation of detritus into magmatic rocks of the Fraser Zone. In contrast, the Andromeda deposit records the presence of crustal sulfur, most likely seawater derived, in the ore body. Preliminary results indicate that an Archean sulfur signature might be preserved in these rocks and suggests interaction with Archean-influenced fluid along the Fraser Shear Zone (Fig. 3).

GSWA Record 2020/5 MRIWA M0470 final report – Mineral systems on the margins of cratons: Albany–Fraser Orogen / Eucla basement case study, an executive summary by CL Kirkland, KA Evans, MIH Hartnady, AT Walker, J Chard, C Clark, CV Spaggiari, R Quentin de Gromard, S Reddy, RH Smithies, OC Kiddie and M Barham is available as a free downloadable PDF from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact [Catherine Spaggiari](#) or [Chris Kirkland](#).

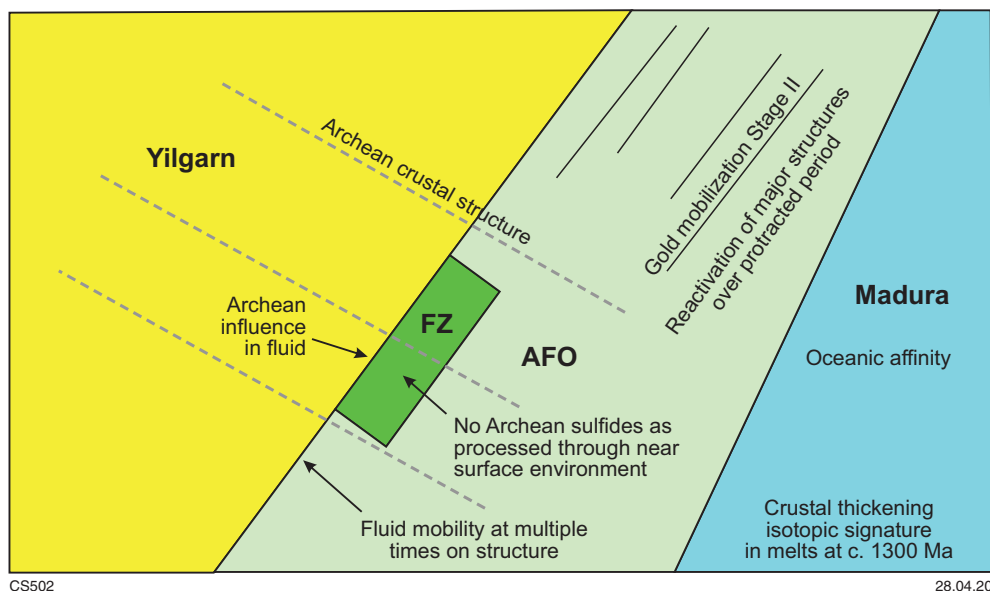


Figure 3. Conceptual block diagram indicating some key points, with implications for mineral systems within the region. Abbreviations: AFO, Albany–Fraser Orogen; FZ, Fraser Zone

Product releases

• TEXT PUBLICATIONS •

Bulletin 147 Handbook for the study and description of microbialites

by Grey, K and Awramik, S

Report 204 Stratigraphic and co-funded drilling of the Eucla basement – the Proterozoic geology beneath the Nullarbor Plain

by Spaggiari, CV, Smithies, RH, Kirkland, CL, Wingate, MTD, England, RN and Lu, Y

Report 206 GSWA Waukarlycarly 1 Basic Data Well Completion Report

by Normore, LS and Rapaic, M

Record 2020/5 MRIWA M0470 final report – Mineral systems on the margins of cratons: Albany–Fraser Orogen / Eucla basement case study, an executive summary

by Kirkland, CL, Evans, KA, Hartnady, MIH, Walker, A, Chard, J, Clark, C, Spaggiari, CV, Quentin de Gromard, R, Reddy, S, Smithies, RH, Kiddie, O and Barham, M

Record 2020/7 Rare-element pegmatites: a mineral systems analysis

by Duuring, P

Record 2020/9 Layered intrusion-hosted vanadium: a mineral system analysis

by Guiliamse, JN

Lower Devonian thelodont *Turinia australiensis* Gross 1971 from petroleum well Wilson Cliffs 1 (Core 5, 1353-1355m, Tandalgoo Formation)

by Allen, HJ, Trinajstić, K and Haines, PW



• DATA PACKAGES •

Compilation of WAROX data, 2020

• ONLINE •

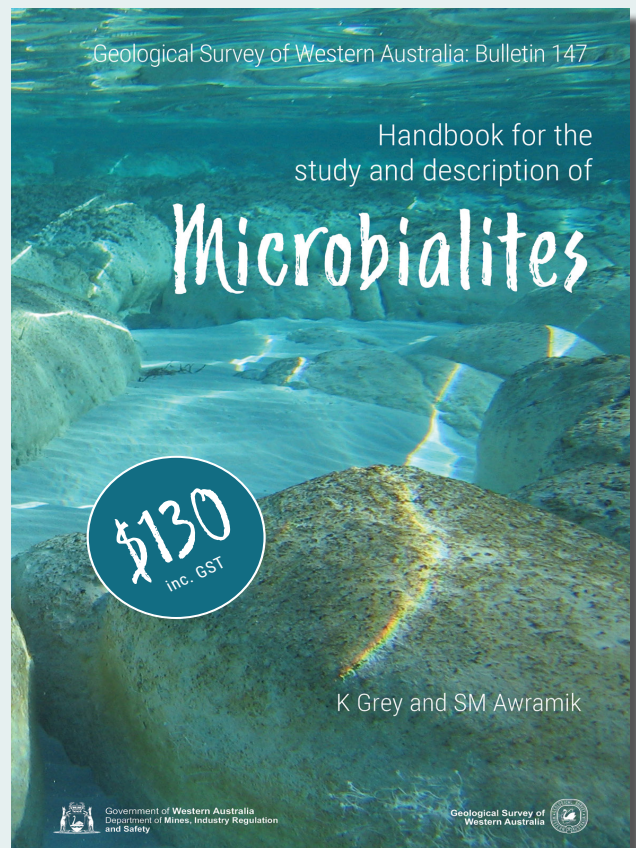
1:500 000 State interpreted bedrock geology of Western Australia

Compilation of HyLogger records, 2020 (includes 20 individual records and data)

East Yilgarn 1:500 000 interpreted bedrock geology, 2020

Meteorite impact structures of Western Australia, virtual tour 2020

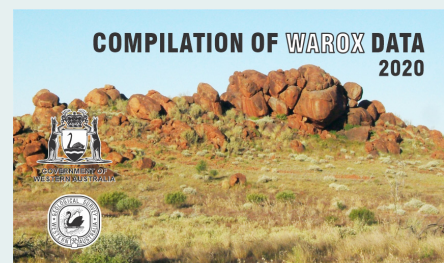
by Goss, SC



This handbook presents state-of-the-art terminology and descriptive methodology for the study of microbialites.

Available NOW

Order your copy at the [eBookshop](#) now!



Update on status of DMIRS online systems and database information sessions for the remainder of 2020

We will recommence our sessions in September/November with limited class sizes in order to abide by social distancing requirements due to COVID-19. Please find all information on dates and session content on our [website](#).