

# Fieldnotes



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

[www.dmirs.wa.gov.au/GSWA](http://www.dmirs.wa.gov.au/GSWA)

## Accelerating exploration investment in the resources sector

page 3

## Important changes to the EIS Co-funded Drilling program

page 4

## Geochronology samples available for research

page 5



## FEATURES

- 3 Exploration and investment in Western Australia
- 4 Exploration Incentive Scheme
- 5 Geochronology research
- 6-9 New work in 3D modelling
- 10 Geotourism strategy
- 11 GSWA webinar series
- 11 Flashback discount – Australia goes it alone

## REGULARS

- 12 Product releases



## EDITORIAL TEAM

### Editor

Robin Bower, Manager Editing and Publishing

### Design and layout

Bec Hitchings, Desktop Publisher

### Graphics

Michael Prause, Graphics Manager

### Contributors to this issue

Lucy Brisbout  
Charlotte Hall  
Jeff Haworth  
Jenna Meehan  
Ruth Murdie  
Charmaine Thomas  
Michael Wingate  
Alex Zhan

### Disclaimer

Products use information from various sources. The Department of Mines, Industry Regulation and Safety (DMIRS) and the State cannot guarantee the accuracy, currency or completeness of the information. DMIRS and the State accept no responsibility and disclaim all liability for any loss, damage or costs incurred as a result of any use of or reliance, whether wholly or in part, upon the information provided in this publication or incorporated into it by reference.

## Access publications

### All publications

Download maps, reports and digital information free from our [website](#).

### Hard copies

Maps, USB data packages and various premium publications are available to purchase as hard copies from the eBookshop or the First Floor counter at Mineral House, 100 Plain Street, East Perth WA 6004. An online cart and payment system is in place. Records, Reports, Bulletins and other non-series books cannot be purchased in hard copy but are all available as PDFs to view and download free of charge.

### 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.

Access Fieldnotes by:

- subscribing to the **GSWA eNewsletter** – there will be a Fieldnotes page with a link to the latest issue
- browsing previous issues from the **eBookshop**.

### GSWA eNewsletter

The GSWA eNewsletter is an online newsletter delivered roughly once a month that contains information on workshops, field trips, training, events and the latest releases of maps, books and digital data packages. If you would like to stay informed about new products, services and other news, please **subscribe**.

GSWA publishes a vast amount of pre-competitive geoscience information on the State, contributing to billions of dollars' worth of resources for exploration and development. To find more information about publications and maps we publish, go to our [website](#).



**Cover image:** After announcing funding for the EIS, Australia's first CAMECA-1300 ion microprobe, and the core library extension, it's only up from here for Premier Mark McGowan and Minister Johnston at the Joe Lord Core Library with Debbie Caple, Core Librarian



## Accelerating exploration investment in the resources sector

Premier Mark McGowan and Mines and Petroleum Minister Bill Johnston have announced a total of \$15.2 million to ensure that the resources sector is well positioned to bounce back when the global economy recovers. The investment, which forms part of the WA Recovery Plan, will boost exploration opportunities and provide next generation geoscience information for Western Australia's resources sector. The funding will support:

- a \$7 million expansion to the Joe Lord Core Library in Kalgoorlie
- an additional \$5 million for the Exploration Incentive Scheme (EIS) in 2020–21
- the provision of \$3.2 million for a new ion microprobe for Curtin University.

### Joe Lord Core Library expansion

The world-class facility in Kalgoorlie stores diamond core that contains valuable geoscientific information for exploration companies and others seeking new petroleum and mineral discoveries. However, the continued interest in the State Government's EIS has resulted in the Kalgoorlie facility being close to capacity, with all of the current storage areas in use. The \$7 million extension will provide more space and improved facilities to view and analyse the drillcores. The acquired geoscientific data will help industry to reduce exploration risk and attract investment in order to find the next big discovery, ensuring that resource exploration continues to prosper in Western Australia. It is expected that ground works at the core library will commence in early 2021, creating jobs for the local Kalgoorlie–Boulder community.



Figure 2. Pallets storing drillcore in the core library



Figure 1. Celebrating the SHRIMP (L to R): Chris Moran (Deputy Vice-Chancellor, Research); Jeremy Kilburn (Pro Vice-Chancellor, Science and Engineering); Hon Bill Johnston MLA (Minister for Mines and Petroleum); Prof Brent McInnes (Director, John de Laeter Centre). Image courtesy John de Laeter Centre

### Exploration Incentive Scheme (EIS)

The EIS supports five high-level programs, including the successful Co-funded Drilling program, which offers up to a 50% refund for innovative drilling in underexplored areas in Western Australia. The additional \$5 million will increase funding to \$15 million in 2020–21, with up to an extra \$3 million being available across the next two co-funded drilling rounds (Rounds 22 and 23). Additionally, the funding will accelerate the acquisition of airborne electromagnetic data across the southern half of the State, which is testing for the presence of critical battery minerals (such as nickel) and potential water reservoirs.

### Curtin University ion microprobe

Curtin University has a 27-year-old ion microprobe that previously provided valuable data about the timing of mineralizing events, but it is no longer fully operational. State funding of \$3.2 million will enable Curtin to secure \$5 million in Commonwealth (AuScope, NCRIS) funding to purchase a new, next-generation, CAMECA-1300 Ion Microprobe, which will be an Australian first and one of only five in the world. This will provide the State with a unique technological advantage to discover the next generation of resources. It will revolutionize our understanding of how and when Western Australia's key mineral deposits formed and how those deposits might be detected under thick regolith cover. In addition to its geoscience applications, the instrument will be used to support the Australian Space Agency's interest in increasing Australian participation in international deep space sample return missions.

For more information, contact [Jeff Haworth](#).

# Exploration Incentive Scheme

## Important changes to the EIS Co-funded Drilling program

Important administrative changes to the Exploration Incentive Scheme (EIS) Co-funded Drilling program will be introduced in 2021. The changes are designed to provide industry with a regular scheduling for opening of applications, and avoidance of the 12-month drilling period ending at the end of either a financial year or in the Christmas period. The new changes are as follows:

### OPENING TIMES FOR APPLICATIONS

The submission of applications for co-funded drilling will now always open on:

- First Monday of February
- First Monday of August
- Will only be open for four weeks.

### CLOSING TIMES FOR APPLICATIONS

- Will close at 4 pm (1600 hours) WST, *not* 5 pm
- Will close 25 days after a round opens, which will be a Friday.

### 12-MONTH DRILLING PERIOD SHIFTS BY ONE MONTH

Completion of drilling at the end of a financial year (i.e. 30 June), or at the end of a calendar year (i.e. 31 December) has made it difficult to estimate any potential underspend in the co-funding before the financial year closes, or provide assistance over the holiday period. In consultation with the Geological Survey of Western Australia industry liaison committee, it has been agreed to move the 12-month drilling period forward by one month. This means the drilling period will start and end on either:

- 1 June to 31 May (e.g. Round 23 and subsequent odd-numbered rounds), or
- 1 December to 30 November (e.g. Round 24 and subsequent even-numbered rounds).

Round 23 will be the first round for which this change occurs and is shown graphically in Figure 1.

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

**EIS Co-funded Drilling – Round 23**

2021	JAN	1	FEB	26	MAR
	APR		MAY	1	JUN
	JUL		AUG		SEP
	OCT		NOV		DEC
2022	JAN		FEB		MAR
	APR		MAY	31	JUN

- 1** FEB 2021 Application period opens (first Monday of February)
- 26** FEB 2021 Application period closes (4 pm Friday, 25 days after applications open)
- 1** APR 2021 Successful applicants notified (mid-late April)
- 1** JUN 2021 **START** of drilling period (first day of June, three months after applications close)
- 31** MAY 2022 **END** of drilling period (last day of May, one year after drilling starts)

**EIS Co-funded Drilling – Round 24**

2021	JUL	2	AUG	27	SEP
	OCT		NOV	1	DEC
2022	JAN		FEB		MAR
	APR		MAY		JUN
	JUL		AUG		SEP
	OCT		NOV	30	DEC

- 2** AUG 2021 Application period opens (first Monday of August)
- 27** AUG 2021 Application period closes (4 pm Friday, 25 days after applications open)
- 1** OCT 2021 Successful applicants notified (mid-late October)
- 1** DEC 2021 **START** of drilling period (first day of December, three months after applications close)
- 30** NOV 2022 **END** of drilling period (last day of November, one year after drilling starts)

CH47

15.10.20

Figure 1. Changes to submission timings for EIS Co-funded Drilling program

## McNaughton Legacy SHRIMP Mount Collection

The McNaughton Legacy SHRIMP Mount Collection data layer represents a 25-year collection of university geochronology samples and associated digital information donated to the Geological Survey of Western Australia (GSWA) by Professor Neal McNaughton of the John de Laeter Centre (JdLC) at Curtin University. This material was provided as part of the Curtin University Preservation of Legacy Collections Project, funded jointly by AuScope, GSWA and Curtin University.

Neal McNaughton served in the role of sensitive high resolution ion microprobe (SHRIMP) geochronologist at the Centre for Global Metallogeny (1994–2005) and the Centre for Exploration Targeting (2005–07), both at The University of Western Australia, and at the JdLC (2007–19).

Western Australian mineral samples in the form of SHRIMP mounts in the McNaughton collection are curated by GSWA. These samples, together with about 1700 GSWA geochronology samples listed in the accompanying GSWA Geochronology layer, are available for access by researchers via email request to GSWA.

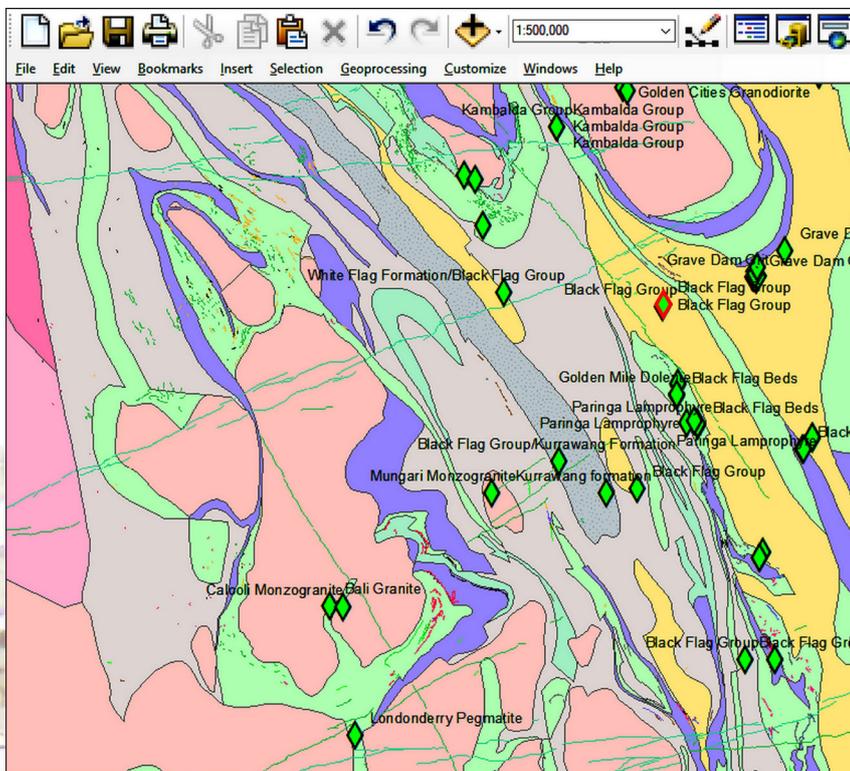


The data layer (Fig. 1) can be accessed using GeoVIEW.WA, GSWA's online interactive mapping system, which allows data to be viewed and searched together with other datasets, including GSWA and Geoscience Australia geochronology data, geological maps and mineral exploration datasets. The McNaughton collection data layer is also available for download from GSWA's Data and Software Centre, as ESRI Shape files and MapInfo Tab files.

For more information, contact [Michael Wingate](mailto:Michael.Wingate@gswa.gov.au).

To request material from the McNaughton Legacy SHRIMP Mount Collection, please email [geochronology@dmirs.wa.gov.au](mailto:geochronology@dmirs.wa.gov.au)

Figure 1. The McNaughton Legacy SHRIMP Mount Collection data layer in ArcGIS



**Identify** □ ×

Identify from: McNaughton Legacy SHRIMP

---

Location: 44,151.167 -3,346,066.816 Meters

Field	Value
OBJECTID	169
YEAR_	1996
Location	WA
MOUNT_ID	96-73
MT_LABEL	A
SAMPLE_ID	EMD-2
GRAIN_TS	grains
MINERAL_1	zircon
AGE_1_MA	2666
UNCERT_1	6
CONF_LVL_1	95%
EVENT1	maximum depositional age
MINERAL_2	<null>
AGE_2_MA	2728
UNCERT_2	9
CONF_LVL_2	95%
EVENT2	age of detrital component
MINERAL_3	<null>
AGE_3_MA	<null>
UNCERT_3	<null>
CONF_LVL_3	<null>
EVENT3	<null>
ROCK_TYPE	sedimentary siliciclastic
LITHOLOGY	sandstone
TECT_UNIT	Kalgoorlie Terrane
UNITNAME	Black Flag Group
LOCDESC	Eight Mile Dam
DLAT_1994	-30.6465
DLONG_1994	121.4615
LOCMETHOD	surveyed from ground control
INSTITUTN	UWA Postdoc

Identified 3 features

## Geophysics enhances the West Musgrave 3D model

The west Musgrave 3D model explores the crustal architecture of an area which has been mapped in detail by various Geological Survey of Western Australia (GSWA) geologists including Evins et al. (2010), Howard et al. (2011), Smithies et al. (2009, 2011), and more recently by de Gromard (2017). The west Musgrave Province is a region of economic potential as evidenced by important discoveries such as the Nebo–Babel Ni–Cu–PGE deposit and other known mineralized locations. The mapping has resulted in a greatly improved knowledge of the stratigraphy and structure of the area. Specifically, the model images the deep-penetrating structures which may be considered conduits for hydrothermal fluids and magmas.

This 3D model is the product of work described in detail in GSWA Report 114 (Aitken et al., 2013). Detailed interpretation of aerial magnetic maps combined with seismic reflection profiling and surface geology were projected into geological profiles.

These profiles had densities assigned to the rock units so that their gravitational response could be compared and adjusted to fit the observed gravity anomaly. Finally the profiles were extrapolated to make solid geological volumes which represent the current configuration of the different phases of intrusions and deformation events of the Giles Event and Petermann Orogeny.

**West Musgrave Province 3D, 2013** is available to access from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact **Ruth Murdie**.

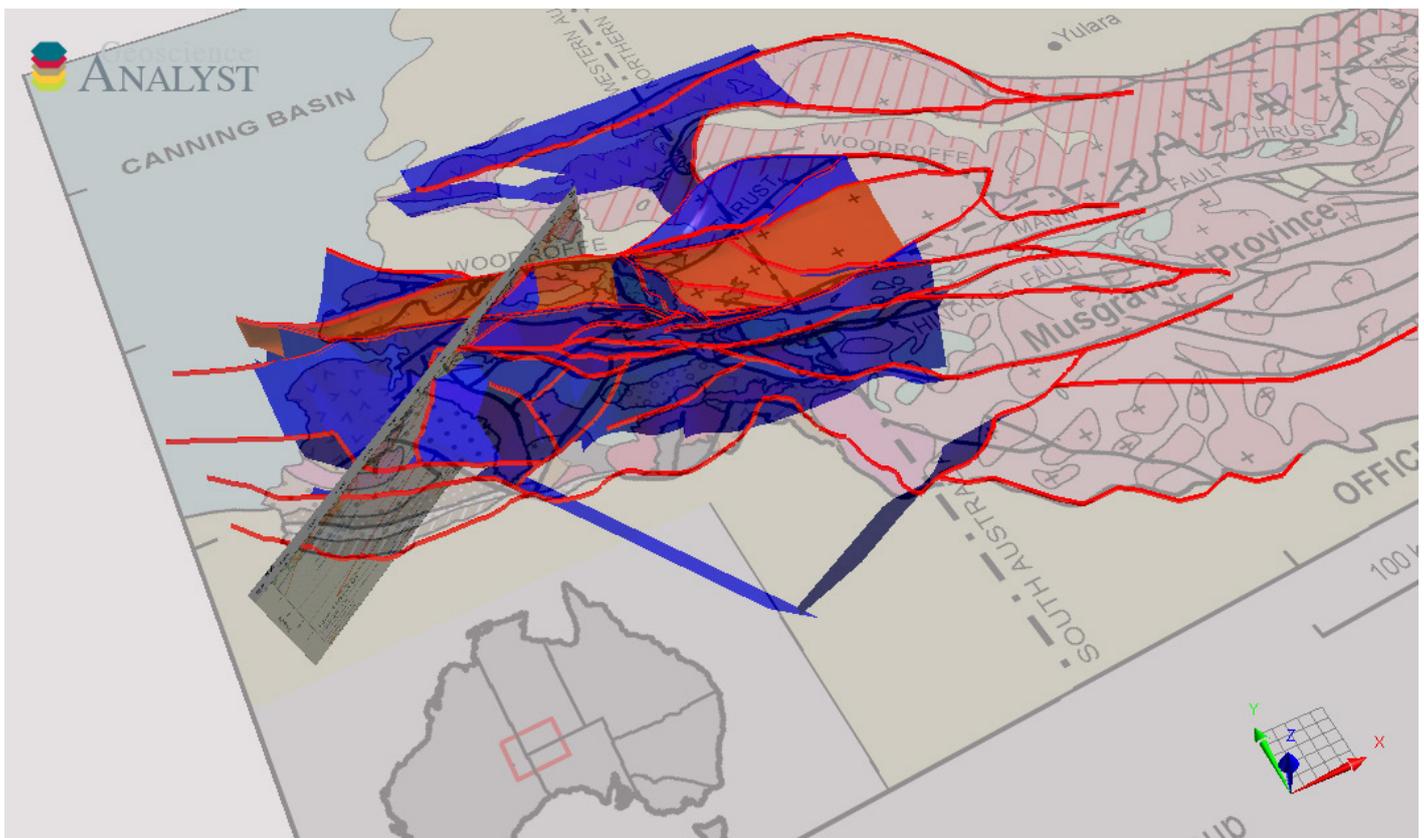


Figure 1. Opening screen shot of the west Musgrave 3D model in the GEOSCIENCE ANALYST Viewer showing the surface fault traces, 3D fault surfaces, interpretation of the 10GA-Y01 seismic line and location map

## Imaging a magmatic underplate along the east Albany–Fraser Orogen and Yilgarn Craton margin

With the advent of 3D modelling, geologists are now able to image a zone, interpreted as a magmatic underplate, along the margin of the Archean Yilgarn Craton and Proterozoic east Albany–Fraser Orogen.

A regional-scale geological model has been constructed from a recent interpreted bedrock geology map, three deep-crustal reflection seismic profiles and a high-resolution Moho model from passive seismic data. 3D gravity forward modelling has demonstrated that dense material is required in a belt of thickened continental crust that extends along the craton margin. The dense material has been modelled in the lower crust (Fig. 1) coincident with a large non-reflective zone in reflection seismic profiles.

The geophysical properties of this zone, including its high density, can be interpreted to indicate the existence of a magmatic underplate. This interpretation is consistent with recent geological mapping, geochemistry, geochronology,

and metamorphic studies which identified a widespread thermal anomaly related to ultra high-temperature reworking, deformation, and magmatism in central Australia (Musgrave Orogeny), in the Madura and Coompana Provinces (Maralinga Event), and in Albany–Fraser Orogen (Stage II), and included numerous circum-Yilgarn mafic dykes (Marnda Moorn LIP). These studies also suggested the existence of a widespread mafic underplate at c. 1210 Ma, particularly around the margins of the Yilgarn Craton. Our new investigations based on 3D geophysical modelling provide independent support for these previous conclusions.

**Record 2020/11 Imaging a magmatic underplate with 3D gravity modelling: east Albany–Fraser Orogen margin** is available to access from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact [Lucy Brisbout](#).

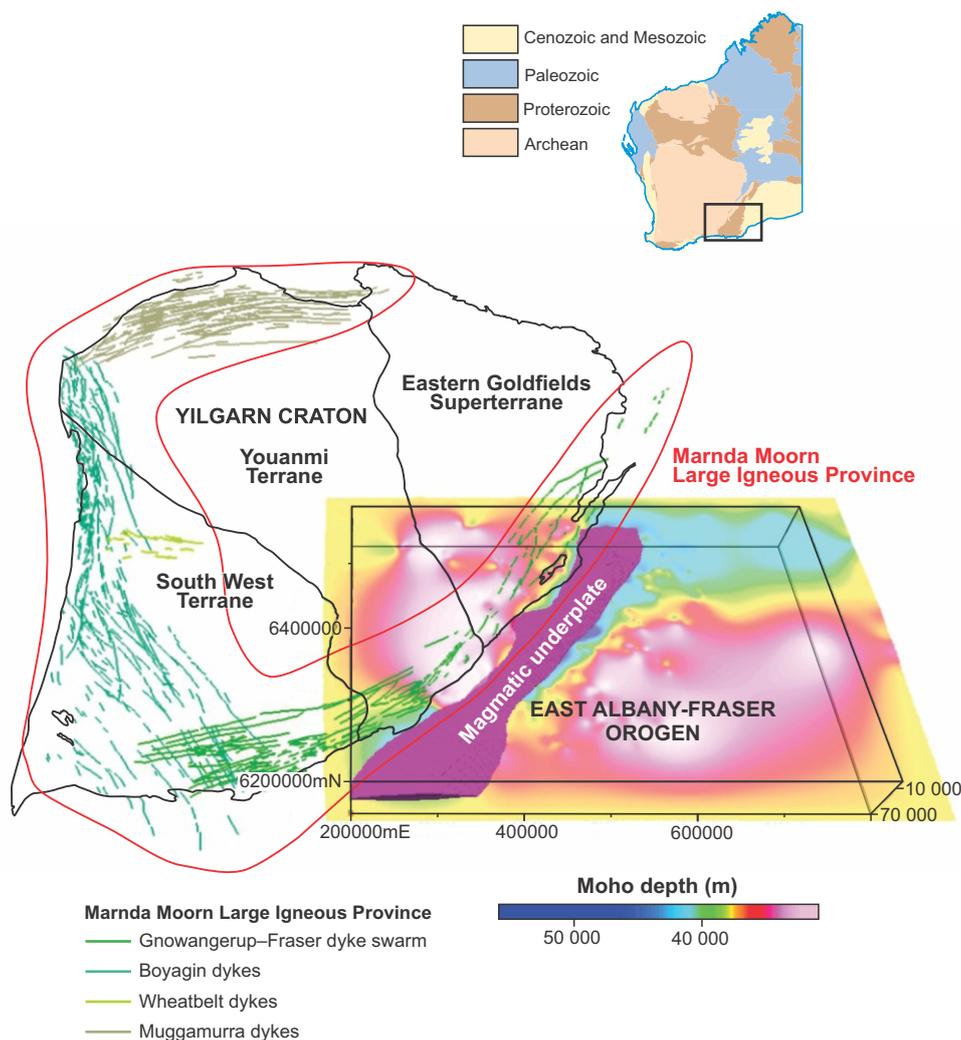


Figure 1. Interpreted magmatic underplate, extending along the margin of the east Albany–Fraser Orogen and Yilgarn Craton

## 3D geomodelling of the southwest Canning Basin – Broome Platform

The subsurface of the southwest Canning Basin and Broome Platform was interpreted by integrating seismic data, well intersections and potential field data to address geological uncertainties and highlight the tectonic development of the basin. The 3D modelling project integrates recent mapping results by the same author (Y Zhan in 2018 and 2019) with preliminary interpretation from the Kidson Sub-basin 2018 seismic survey and Waukarlycarly 1 stratigraphic well.

The modelling focuses on visualization of the structural configuration and lateral extent of the basin infill. This is the 3D visualization of the Paleozoic faults and horizons between the southwest Canning Basin and the Broome Platform area.

The subsurface horizons include top of the basement and horizons within the Ordovician section, tops and bases of salt intervals, and angular unconformities at the bases of the Permo-Carboniferous and Jurassic successions. The 3D model and associated datasets are available as a GOCAD project, or can be viewed using the free viewer Geoscience ANALYST.

**Southwest Canning Basin – Broome Platform 3D, 2020** is available to access from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact **Alex Zhan**.

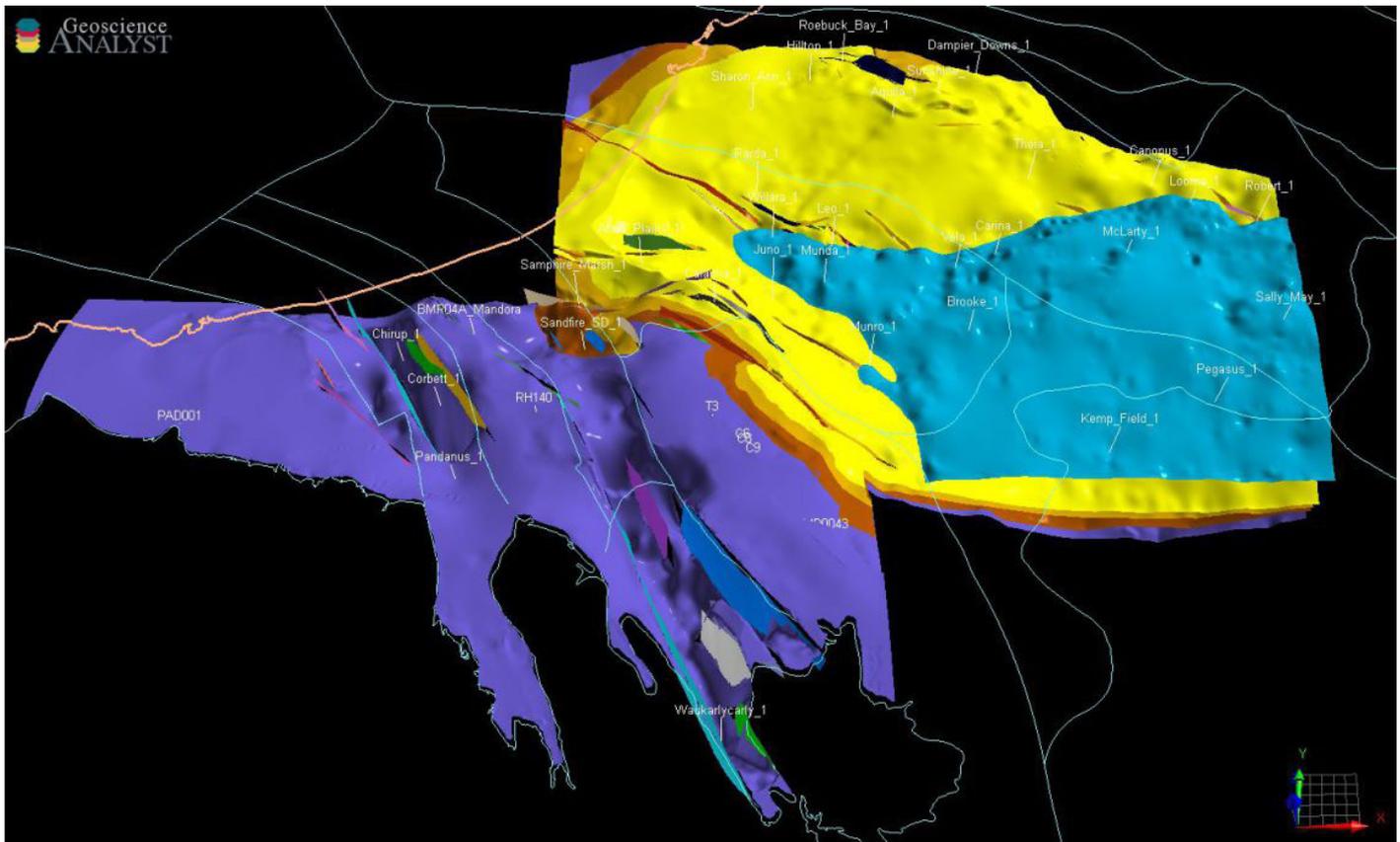


Figure 1. 3D view of selected wells and horizons

## 3D geomodelling of the southern Perth Basin

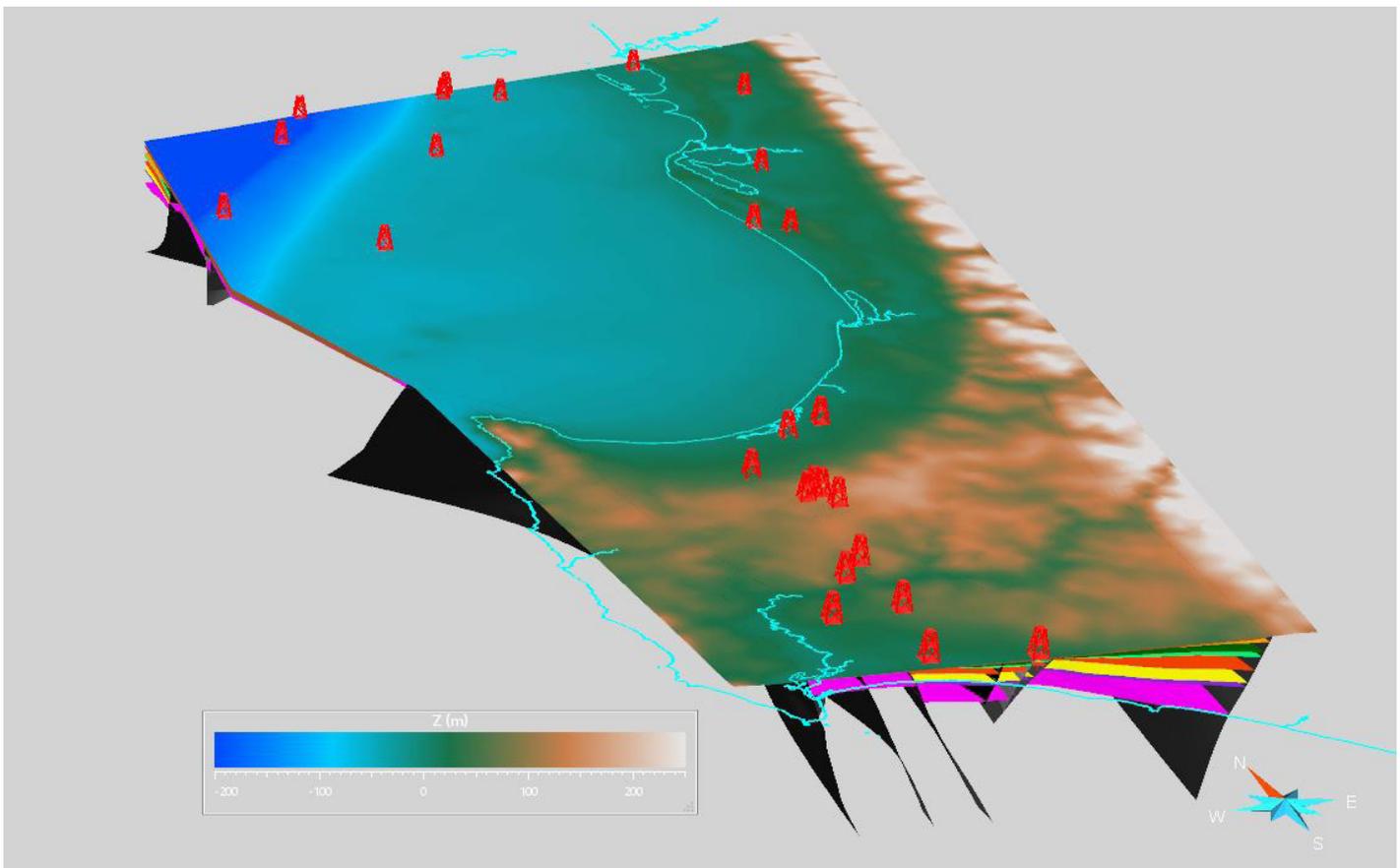
The southern Perth Basin 3D geomodel is an interactive 3D subsurface view of the geology of the basin down to the basement. It covers the geographical area stretching from the Rockingham area in the north, south to Augusta, and extends westwards into the offshore portion of the basin including offshore petroleum wells, and as far east as the Darling Fault. Subsurface stratigraphic horizons and faults were previously interpreted using primarily reflection seismic data tied to deep drillhole data, including petroleum wells, mineral exploration holes and waterbores. Aeromagnetic and gravity survey data were used to constrain the model in areas with sparse seismic and well data. The model comprises horizons to the tops of key formations (or groups), and both major and minor faults including the Darling Fault, Badaminna Fault, Busselton Fault

and Dunsborough Fault. Wells/drillholes, and aeromagnetic and gravity grids/imagery are all included in the model.

The model was constructed using the GOCAD software, and can be used as a basis for future basin analyses or regional groundwater modelling. It can be viewed within the GOCAD package or in Geoscience ANALYST, a free 3D viewer software.

**Southern Perth Basin 3D, 2020** is available to access from the Department of Mines, Industry Regulation and Safety (DMIRS) eBookshop.

For more information, contact **Charmaine Thomas**.



*Figure 1. Perspective view of model looking northeast, showing the various stratigraphic layers, faults and petroleum wells. Topmost layer is the topography (coloured by elevation level)*

# Geotourism strategy

The Geological Survey of Western Australia (GSWA) develops geotourism products that help travellers experience the magnificent geological heritage of Western Australia.

Geotourism focuses on geology and landscapes to provide visitor engagement, learning, and enjoyment for fossickers, prospectors, students, tourists and travellers.

## How can GSWA help?

- ✦ We can offer our geological knowledge to create geotourism products such as brochures, booklets, mobile apps or on-site signage
- ✦ We can provide current geological information
- ✦ We can verify your content
- ✦ We collaborate with and support other government agencies in their work on geotourism
- ✦ We maintain a register of geoheritage sites to consider in the development of geotourism attractions.

For more information:

Visit: [www.dmirs.wa.gov.au/geotourism](http://www.dmirs.wa.gov.au/geotourism)

Email: [geotourism@dmirs.wa.gov.au](mailto:geotourism@dmirs.wa.gov.au) OR [geoheritage@dmirs.wa.gov.au](mailto:geoheritage@dmirs.wa.gov.au)



## New webinar series part of broader engagement strategy

The Geological Survey of Western Australia (GSWA) has responded to the COVID-19 pandemic by reprioritizing its 2020–21 work program, to aid economic recovery and stimulate the exploration industry. Our response includes a program of webinars to help continue to support Western Australia's explorers. In an attempt to better disseminate our information to you, we have put together these webinars as part of a broader stakeholder engagement strategy. Join geoscientific experts from a number of fields and explore a diverse range of topics.

Visit the [GSWA web page](#) for more details of upcoming webinars and to register for the free sessions. Recordings of previous sessions are also available.

For more information, contact [Jenna Meehan](#).

The webinar series commenced in September 2020 with these webinars having already taken place:

### Friday 4 September

**Au–Cu mineralization at Obelisk, northern Paterson Orogen**  
*Dr Paul Duuring, Senior Geologist*

### Friday 25 September

**Seismic monitoring in the Wheatbelt**  
*Dr Ruth Murdie, Senior 3D Geophysicist*

### Friday 2 October

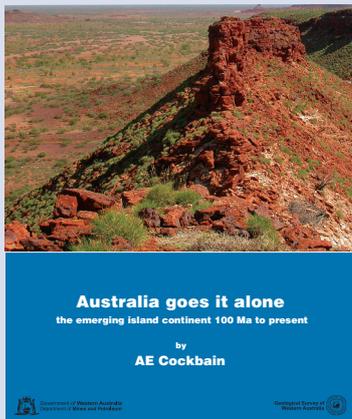
**GSWA's 2020–21 Accelerated Geoscience program**  
*Jeff Haworth, Executive Director*

### Friday 23 October

**A snapshot of the EIS Co-funded Drilling program: Rounds 1–17**  
*Dr Charlotte Hall, EIS Coordinator*



## GSWA Webinar Series



## Flashback publication at a discount

Western Australia covers a third of the continent of Australia with rocks ranging in age from about 3 billion years old to those that are forming along the coastline at present. In this book published in 2014, author Tony Cockbain has drawn together the various strands of geology covering the period from 100 Ma to the present – including:

- Australia's split from Antarctica
- four sedimentary depositional cycles between the Paleocene and the Holocene
- the formation of giant iron ore deposits by regolith processes
- Western Australia's seismic and earthquake history
- the precious water resources of a dry and thirsty State.

Geologists and interested readers will learn about the recent geological events that have shaped and are still shaping Western Australia. It is the second book in the 'Western Australia unearthed' series that chronicles the geological evolution of Western Australia.

**Australia goes it alone – the emerging island continent 100 Ma to present** is available from the DMIRS eBookshop as a free downloadable PDF. The physical copy is also available for \$15 (normally \$33) and can be ordered by contacting [bookshop@dmirs.wa.gov.au](mailto:bookshop@dmirs.wa.gov.au). Order while stocks last.

# Product releases

## • TEXT PUBLICATIONS •

Calendar 2021: Geological Survey of Western Australia

**Paleo Report – WRD-1 (Worrall Range), Canning Basin, palynology of 5 samples**

**Paleo Report 2020/47 – Waukarlycarly 1: palynology of 7 samples**

**Paleo Report 2020/48 – RUD0007: palynology of 9 samples**

by Backhouse, J

**Report 208 A passive seismic experiment in the Perth Basin, Western Australia**

by Yuan, H, Dentith, MC and Lin, X

**Report 209 Syngenetic gold mineralization at Mount Clement – an underexplored mineralization style in the northern Capricorn Orogen**

by Guilliame, JN

**Record 2020/1 Geological Survey work program for 2020–21**

**Record 2020/10 1:500 000 State regolith geology of Western Australia – compilation methodologies**

by Jakica, S, de Souza Kovacs, N, Hogen-Esch, J and Granada, IMT

**Record 2020/11 Imaging a magmatic underplate with 3D gravity modelling: east Albany–Fraser Orogen margin**

by Brisbott, L and Murdie, RE

**Record 2020/12 Proterozoic dolerite dykes in the western Capricorn Orogen, Western Australia**

by Blay, OA, Wingate, MTD, Johnson, SP, Thorne, AM, Kirkland, CL, Tessalina, MR, Verrall, MR and Cutten, HN

**Record 2020/13 Stratigraphy, petrography and structure of Archaean rocks in the Rothsay mining area, western Yilgarn Craton**

by Price, JJ, Blenkinsop, TG, Goodenough, KM and Kerr, AC

## • DATA PACKAGES •

**1:500 000 State linear structures of Western Australia**

**East Albany–Fraser Orogen, 2020**

**McNaughton Legacy SHRIMP Mount Collection**

by Blereau, E, McNaughton, NJ, McInnes, BIA and Wingate, MTD

**Youanmi, 2020**

## • 3D GEOMODELS •

**Southern Perth Basin 3D, 2020**

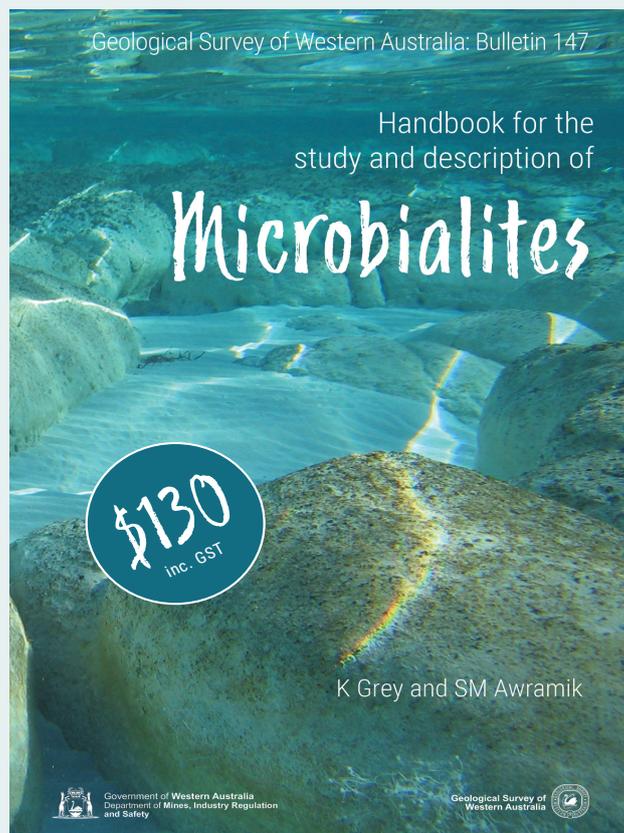
by Thomas, CM

**Southwest Canning Basin – Broome Platform 3D, 2020**

by Zhan, Y

**West Musgrave Province 3D, 2013**

by Aitken, ARA, Joly, A, Dentith, MC and Murdie, RE



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!

Reprinted due to popular demand!

Mineral Resources Bulletin 25

**\$55\***

**GEMSTONES OF WESTERN AUSTRALIA**

**SECOND EDITION**

by J Michael Fetherston, Susan M Stockmayer, and Vernon C Stockmayer



Please purchase your copy from the **eBookshop**

\* includes GST



## 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**.