

Fieldnotes



Department of Energy, Mines,
Industry Regulation and Safety

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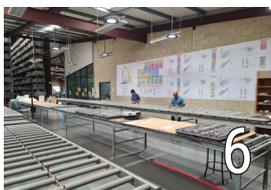


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Maps, USB data packages and various premium publications are available to purchase as hard copies from the eBookshop or the First Floor Counter at Mineral House, 100 Plain Street, East Perth WA 6004. An online cart and payment system is in place. Records, 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.

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- browsing previous issues from the [eBookshop](#).

GSWA eNewsletter

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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: Convoy of Vibroseis trucks on Cascade Road, between Cascade and Lake King, Western Australia, acquiring active-source seismic data along SW1. Photo courtesy HiSeis Pty Ltd

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Acknowledgement of Country

We respectfully acknowledge Aboriginal peoples as the Traditional Custodians of this land on which we deliver our services to the communities throughout Western Australia. We acknowledge their enduring connection to the lands, waterways and communities and pay our respects to Elders past and present.



A geoscientific investigation into the nature and structure of southwest Western Australia

The Geological Survey of Western Australia (GSWA) is undertaking a program of 1200 km of deep-crustal seismic surveys along three lines in the southwestern portion of Western Australia (Fig. 1). The Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) has contracted the specialist seismic company HiSeis Pty Ltd to conduct the surveys. Work began in late 2023 and is expected to be completed in early 2024.

Deep seismic reflection profiling enables geoscientists to make interpretations of geological features and structures as deep as 60 km. Reflection seismic surveying is a geophysical technique that uses specialized 'Vibroseis' trucks to artificially

generate sound wave vibrations to image the rocks below Earth's surface (Figs 2, 3). The waves propagate into the ground and are reflected by velocity change interfaces such as a change in rock type, or structures such as faults and shear zones. The reflected waves return to the surface where they are recorded by geophones. The recorded data are processed to make images of the crustal architecture of the various geological domains beneath the path of the survey lines. These data are then interpreted to characterize the seismic nature and structure of these domains, and to infer the spatial and temporal (relative) relationships between them.

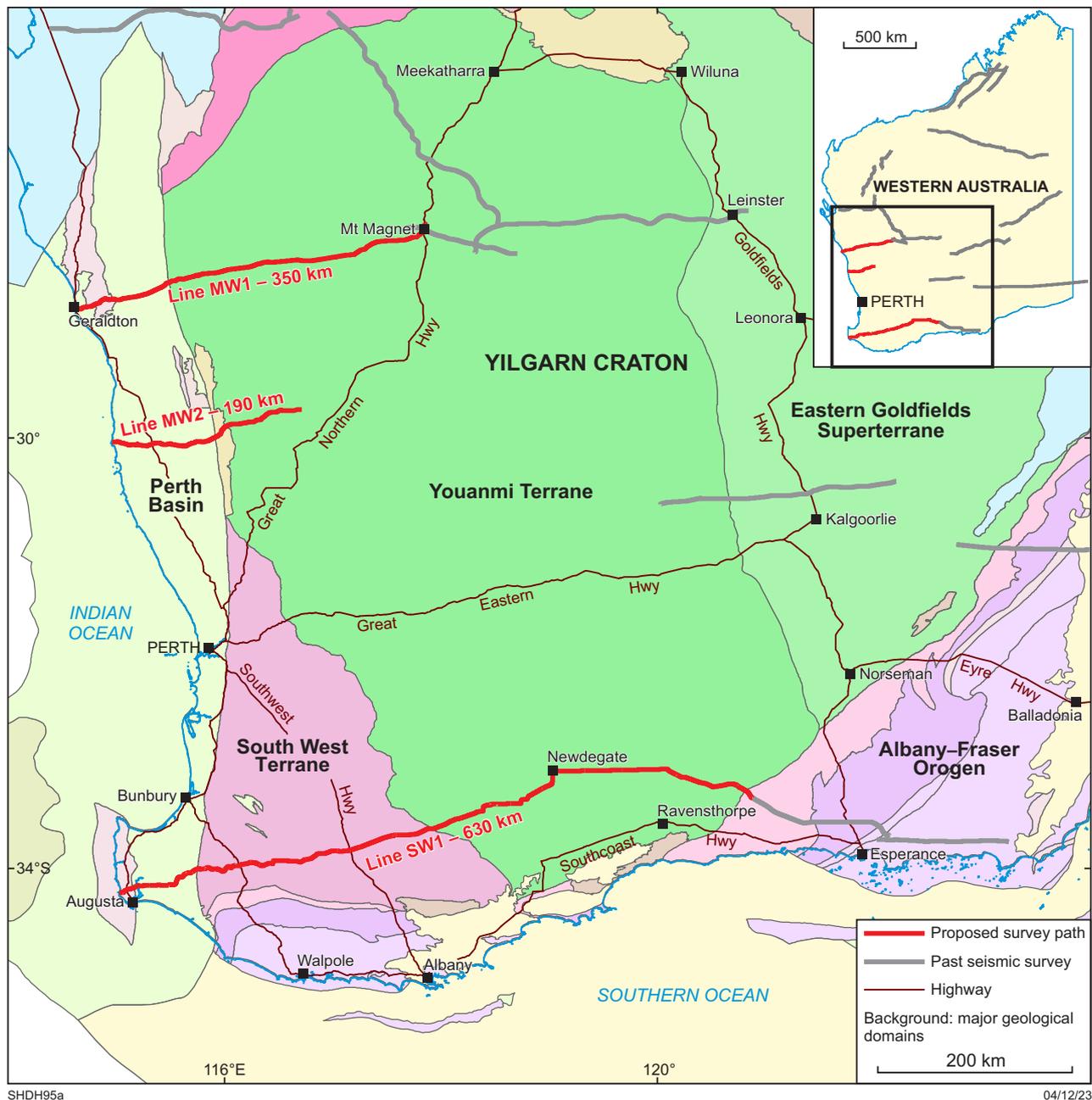


Figure 1. Tectonic map of southwest Western Australia showing the location of the three deep-crustal seismic surveys undertaken by GSWA between late 2023 and early 2024

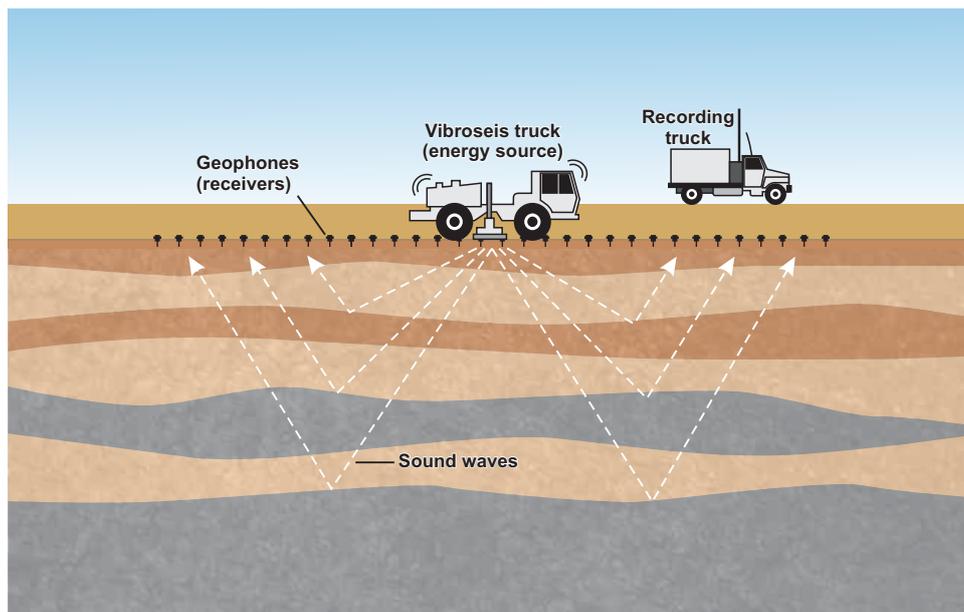


Figure 2. Schematic diagram showing the principle of active source reflection seismic surveying

The three lines are designed to image the nature and deep crustal structure of tectonic units of southwestern Western Australia including the Paleoproterozoic to Cambrian Leeuwin, Mullingarra and Northampton inliers of the Pinjarra Orogen, the Paleo- to Cenozoic Perth Basin and the Archean Youanmi and South West terranes of the Yilgarn Craton (Fig. 1). Additionally, these surveys will image several major crustal boundaries including the Dunsborough Fault, the Darling Fault, the recently redefined boundary between the South West and southern Youanmi terranes, and the Youanmi Shear Zone.

Acquisition of this seismic data represents a further step in our ongoing statewide seismic acquisition program funded by the Exploration Incentive Scheme. The resulting geological interpretations will contribute towards our understanding of the geological evolution and architecture of this part of the Western Australian crust — key components for targeting of critical minerals and new energy systems.

For more information, contact [David Howard](#) or go to this [GSWA web page](#).



Figure 3. Seismic survey; vibrator trucks (left); geophone in position (centre); downloading and recharging geophones (right). Photos courtesy HiSeis Pty Ltd

Cl isotopes from the West Aileron Province

Using apatite to assess mineralization potential in undercover Western Australia

EXPLORATION
INCENTIVE
SCHEME



Apatite, a mineral found across most rock types and mineralized systems, was analysed from drillcore from an understudied region of Western Australia – the West Aileron Province (Fig. 1). Situated at the southwestern margin of the North Australian Craton, the West Aileron Province lies in an area considered to have a high potential for hydrothermal mineralization. Six diamond drillholes, five at Top Up Rise (TUR) and one at Webb, provide a glimpse into the bedrock geology in an area of thick cover and limited outcrop.

Trace elements, halogens, and chlorine (Cl) isotopes were analysed in apatite grains across areas subject to obvious fluid alteration, including grains from within quartz and carbonate veins. Chlorine isotope analyses show that in areas of discrete veining and limited fluid influx, apatite has $\delta^{37}\text{Cl}$ signatures of

-1.0–0.0‰, consistent with most Cl isotopic reservoirs, including sea water. With increased metasomatism and hydrothermal alteration, the $\delta^{37}\text{Cl}$ increases to over +2.0‰ at TUR, and nearly +8‰ at Webb, values rarely reported in terrestrial apatite (Fig. 2). This indicates there is a positive correlation between the degree of hydrothermal alteration an apatite has experienced, and the degree of heavy fractionation in Cl isotopes.

A similar positive correlation is present between increasing $\delta^{37}\text{Cl}$ values and F contents (Fig. 2). This relationship suggests that the F content in apatite can be used as a measure of the degree of fluid interaction, and which may provide information on a region's potential for hydrothermal mineralization.

For more information, contact [Jen Porter](#).

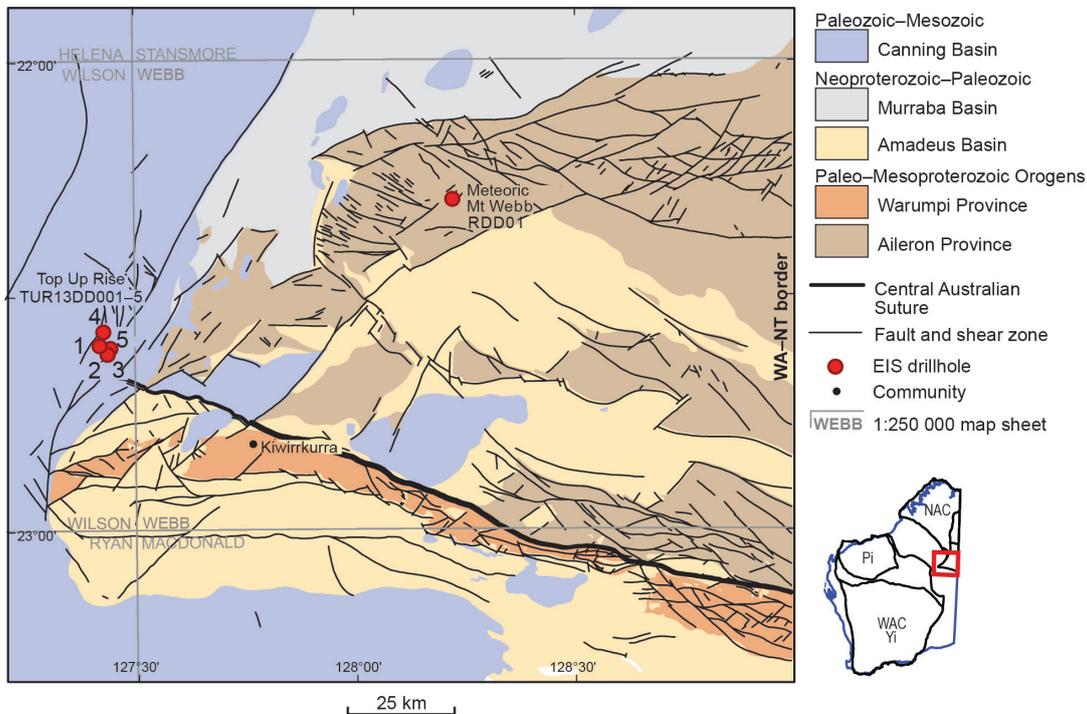


Figure 1. A simplified map of tectonic units in the West Aileron Province showing drillhole locations at Top Up Rise and Webb. NAC – North Australian Craton; WAC – Western Australian Craton; Pi – Pilbara Craton; Yi – Yilgarn Craton

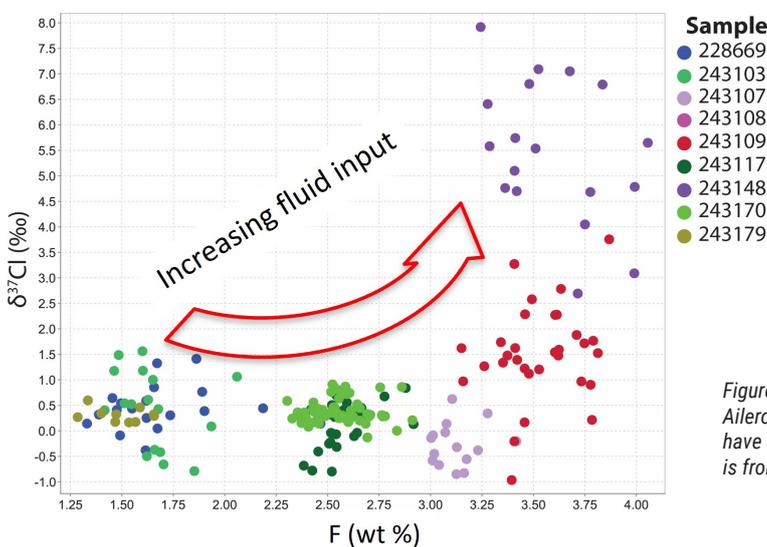


Figure 2. Cl isotopic ratios vs F contents in weight percent from apatite of the West Aileron Province. Samples with the greatest amount of hydrothermal alteration have >3 wt.% F and $\delta^{37}\text{Cl} > +1.5\%$. All samples are from TUR, except 243148 which is from Webb

Goldfields stratigraphy on display

A new comprehensive display of diamond drillcore is now on show at the Geological Survey of Western Australia (GSWA's) Kalgoorlie Regional Office and the Joe Lord Core Library in West Kalgoorlie. The display showcases the entire Archean greenstone stratigraphy typical of the Kambalda–Kalgoorlie region (Figs 1, 2). This permanent exhibit illustrates the primary rock types spanning the Lower Basalt (2720 Ma) of the Kalgoorlie Group, through the felsic volcanic and volcanoclastic deposits of the Black Flag Group, and up into the epiclastic and clastic rocks of the overlying Late Basins (<2650 Ma).

Tailored for geologists across a range of experience levels – from early-career professionals to seasoned experts – the exhibit particularly caters to individuals engaged in the meticulous task of logging RC and AC chips. It serves as a valuable resource for those facing challenges in directly observing specific contact relationships, recognizing and understanding rock textures (Fig. 3) within and between different rock units, and in appraising what part of the stratigraphy is specifically relevant to their project.

A noteworthy aspect of the exhibit is the engaging quest to locate the unconformable contact between the Black Flag Group and the Late Basin conglomerates. The display also highlights the strategic placement of key deposits within the greenstone stratigraphy typical of the Kambalda–Kalgoorlie region.

For a nuanced exploration of the Kambalda–Kalgoorlie stratigraphy and an opportunity to enhance your stratigraphic knowledge and interpretation skills, the Joe Lord Core Library beckons.

For more information, contact [Alicia Verbeeten](#).



Figure 1. GSWA geologists reviewing the Kambalda–Kalgoorlie stratigraphy in front of posters displaying the geochemical classification of the magmatic rocks of the Goldfields region

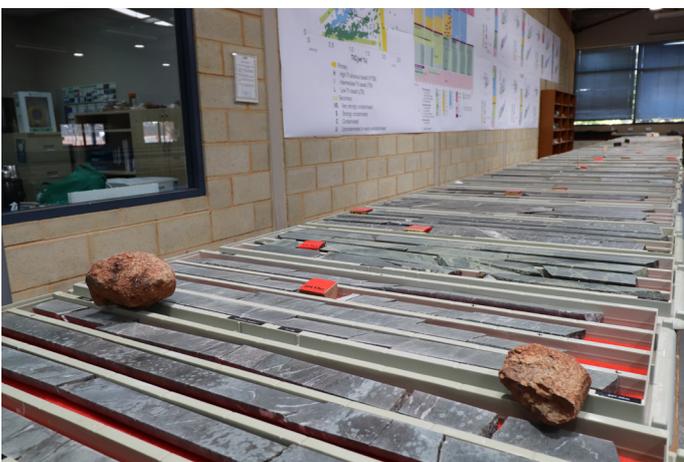


Figure 2. Permanent display of the Kambalda–Kalgoorlie stratigraphy. Variolitic basalt (Upper Basalt) is evident in the foreground



Figure 3. Example of Victorious Basalt showing the characteristic porphyritic texture of subhedral to euhedral plagioclase phenocrysts within a fine-grained groundmass, and an example of sheared Victorious Basalt

GeoMap.WA version 1.9.15 released

GeoMap.WA is a computer-based application that allows users to visualize, interrogate and integrate vector and raster data types and associated attribution. It is an easy-to-use software application that does not require specialized skills or costly computer systems. This innovative desktop application is designed to help exploration geologists, prospectors and the community to create a customized view of geoscientific, resource and other government information on their computers in the office, at home or in the field.

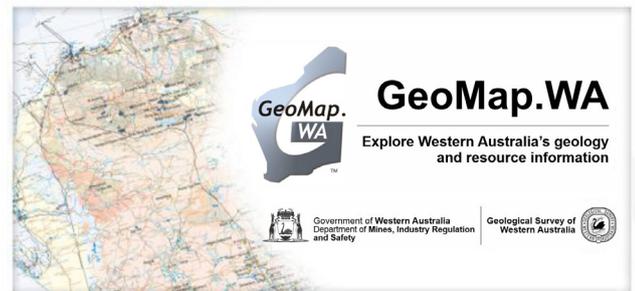
What's new:

- Version change from 1.9.14 to 1.9.15
- GDA2020 support
- GPS tracking bug fix
- Printing bug fix
- 32 bit version of GeoMap.WA no longer supported
- DMIRS name and logo updated to DEMIRS

How to access

GeoMap.WA is available as a **free downloadable application** from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) **Data and Software Centre (DASC)**.

For more information, visit **GIS viewer for Windows (GeoMap.WA)** (dmp.wa.gov.au) or contact gsd.dda@dmirs.wa.gov.au.



Did you know?

Department name change reflects importance of energy transition

The Department of Mines, Industry Regulation and Safety (DMIRS) was renamed the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) on 1 December 2023.

The name change better reflects the importance of Western Australia's energy portfolio and the critical role it will play in the State Government's decarbonization ambitions.

Energy Policy WA continues to lead the State's energy transformation by delivering expert advice and initiatives to support the interests of Western Australia's energy consumers.

The renaming does not affect DEMIRS' other regulatory functions, and it will continue to support a safe, fair and responsible community, industry, energy and resources sector.



New digital layer of GSWA Gold Mineralogy

The initial 11 Gold Mineralogy records, detailing the mineralogy and chemistry of gold grains from the Pilbara Craton, have been released through a newly introduced data layer under 'Geochemistry & Mineralogy' in GeoVIEW.WA (Fig. 1).

The GSWA Gold Mineralogy records systematically document the placer or bedrock-hosted gold samples donated by various mining and exploration companies. The aim is to help gold exploration in Western Australia by understanding various gold-forming processes including sources of gold deposit, mineralizing fluid composition, timing and mechanisms of gold crystallization, and hydrothermal and supergene alteration. Each record encompasses geological context, methodology, morphology, microstructure, trace element composition, and interpretation of gold grain evolution (Fig. 2).

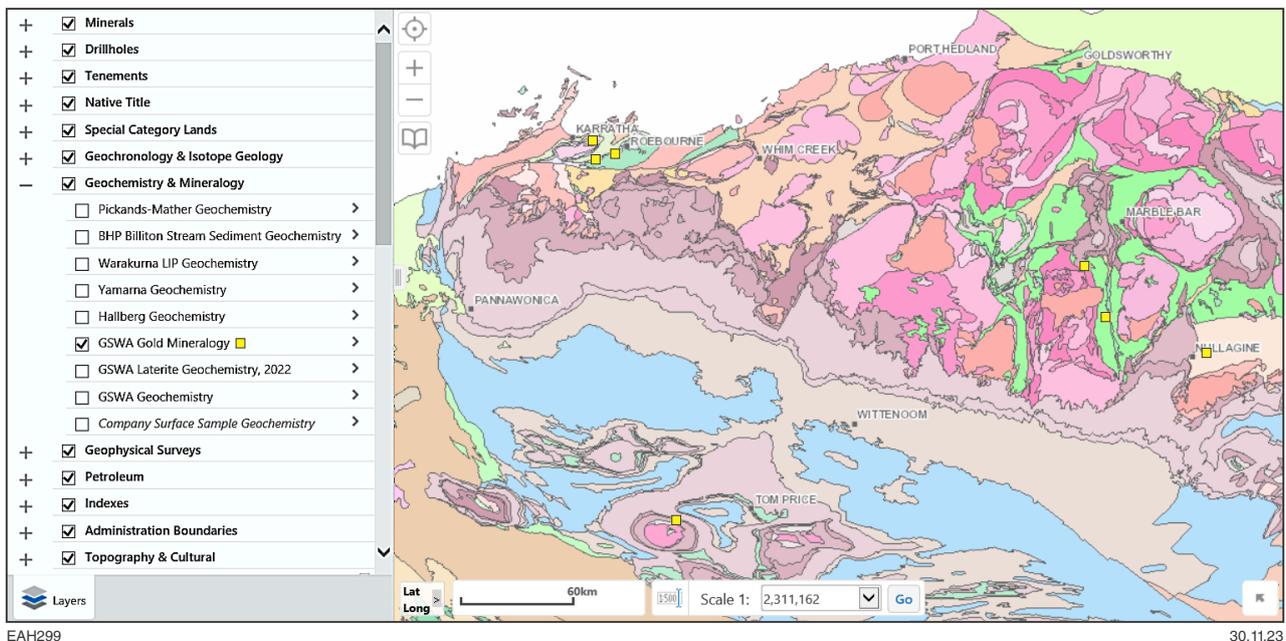
Gold grains with elevated Pb content or galena inclusions can be used for geochronology analysis to determine the timing of gold crystallization.

It is anticipated that over 100 Gold Mineralogy records will be released across Western Australia in the coming years.

How to access

GSWA Gold Mineralogy records are available as a free downloadable PDFs from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) eBookshop. The **GSWA Gold Mineralogy** digital data are best accessed using GeoVIEW.WA or can also be downloaded from the **Data and Software Centre**.

For more information, contact [Lena Hancock](#).



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Figure 1. Extraction from GeoVIEW.WA showing the new GSWA Gold Mineralogy data layer on the 1:500 000 Interpreted Bedrock Geology map of Pilbara Craton



Figure 2. Gold nugget sample 201968 from Beasley Creek prospect in the southern Pilbara Craton

Petrophysical data from stratigraphic diamond core through the Eucla Basin and Basement 2022–23

A new Report and petrophysical data have been released for 10 publicly available diamond drillholes intersecting the Eucla Basin and Basement. Eight of these drillholes, prefixed in Figure 1 as MAD or FOR, were drilled by the Geological Survey of Western Australia (GSWA) in 2013 and 2014 to target distinct geophysical domains interpreted from magnetic and gravity datasets. Two additional drillholes, EIS co-funded company drillcore HDDH002, and company donated drillcore HANNAH 1 were drilled to target magnetic anomaly highs and included for petrophysical analysis.

Report 242, authored by Terra Petrophysics, contains a datasheet on 484 petrophysical samples taken down the length of core, a photo of each sample, a description of the methods for acquiring an array of different physical property values, and data presented in the form of petrophysical cross plots discriminated by lithology.

The petrophysical data are further presented in cross plots discriminated by stratigraphic formation in Figure 2. Report 242 includes the 2020–21 petrophysical data collected on two Eucla drillcores reported on in Report 218.

GSWA has a five-year program to collect petrophysical data from EIS co-funded drillcore, GSWA stratigraphic drillcore or from company-held core on request from GSWA. The current program commenced in 2021. Terra Petrophysics was awarded the tender for the data acquisition, and the project is funded by the Exploration Incentive Scheme. Core selection for petrophysics is primarily chosen where data can assist in:

- modelling of geophysical data in regions with cover
- interpretation of recent or upcoming 2D seismic lines
- classification of regional stratigraphy (often in conjunction with geochemistry).

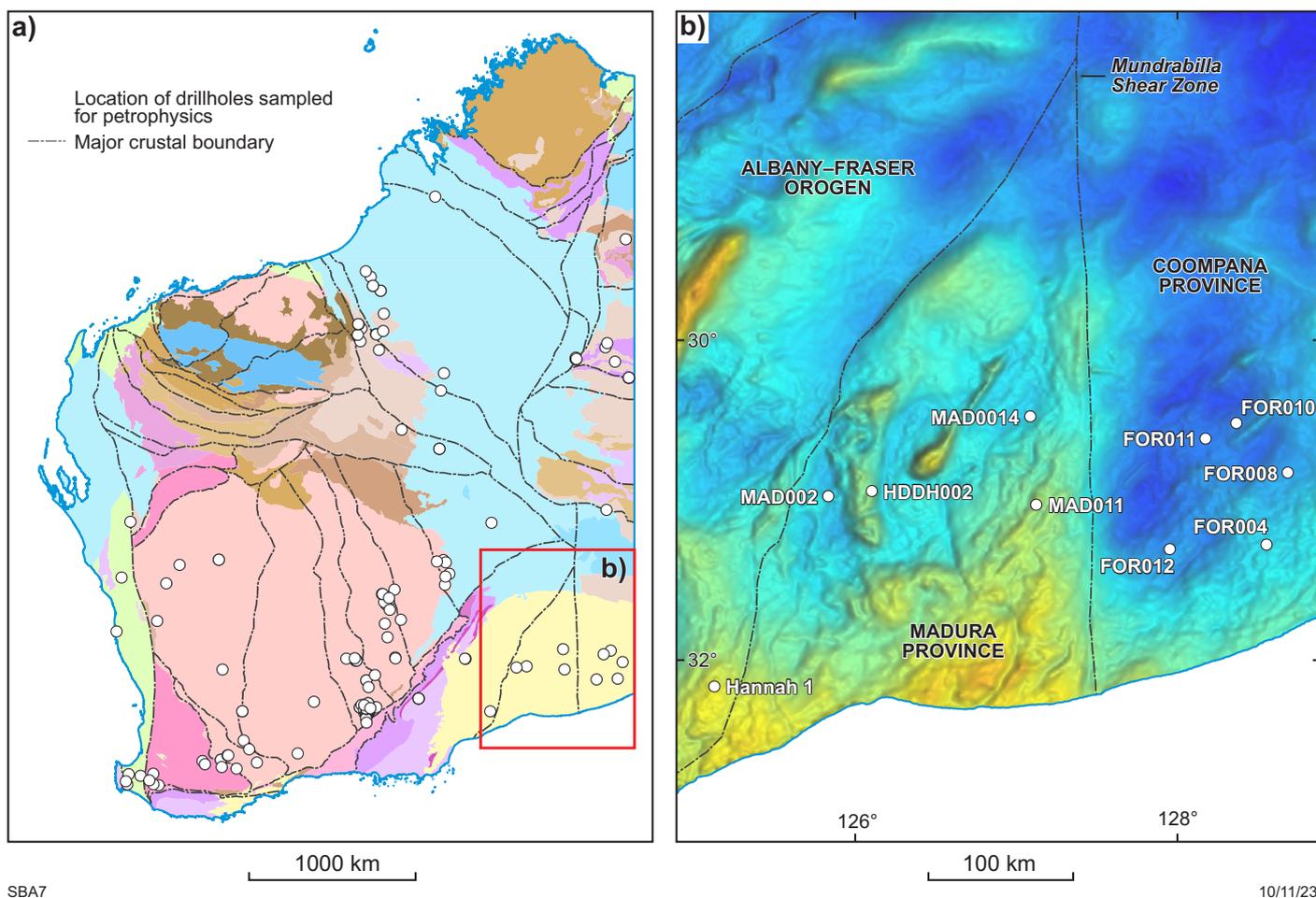


Figure 1. Drillcore locations sampled for petrophysics: a) statewide drillcores sampled since 2021, shown on tectonic units map (2021) with major crustal boundaries; b) location of 10 drillholes sampled for petrophysics (this Report) shown on 400 m gravity data (colour) draped over an 80 m 1VD total magnetic intensity data grid (grey scale)

Regional petrophysics

How to access

Report 242 Regional petrophysics: Eucla Basin and Basement 2022–23 by Mortimore, C, Bourne, B is available as a free downloadable PDF from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) **eBookshop**. All datasets relating to Report 242 are also available in **MAGIX** registration number 72466. All cores sampled for petrophysics have HyLogger data and most have open-file company assay data, available from the **Mineral Exploration reports database (WAMEX)**.

For more information, contact **Sasha Banaszczyk**.

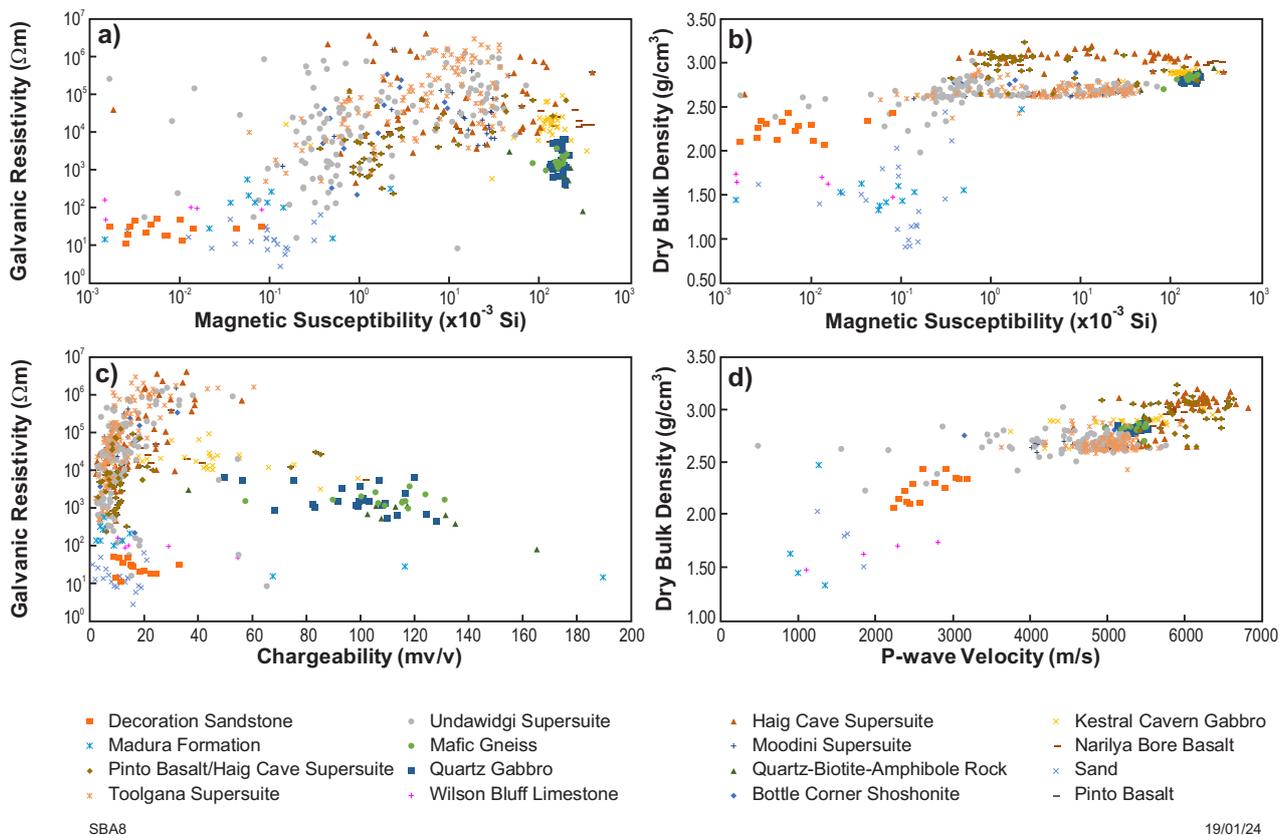


Figure 2. Petrophysical cross plots coloured by stratigraphic formation: a) galvanic resistivity against magnetic susceptibility; b) dry bulk density against magnetic susceptibility; c) galvanic resistivity against chargeability; d) dry bulk density against p-wave velocity for 10 drillholes from the Eucla Basin and Basement

Future-focused geoscience

The Geological Survey of Western Australia (GSWA) Open Day, held on Friday 17 November 2023, marked another milestone in the event's 25-year history. This gathering of geoscientists, energy experts, researchers, professionals and enthusiasts, created a dynamic platform for knowledge exchange and collaboration.

Expert-led presentations showcased the latest research, featuring flagship projects: the **Exploration Incentive Scheme, WA Array**, the **Geoscience Data Transformation Program**, and collaborative drilling programs with **MinEx CRC**. The day also included presentations from research partners CSIRO Mineral Resources and the Department of Jobs, Tourism, Science and Innovation.

Highlights included a preview of the **GSWA Industry Ready Graduate Program, Co-funded Geophysics** launching in 2024, the use of AI in geoscience, and how GSWA data supports the State's green energy ambitions. A panel discussion on our evolving role in the green future, featuring experts from Energy Policy WA, Geoscience Australia, Western Mining Services, and The University of Western Australia, sparked authentic and inspirational conversations.

GSWA Open Day served as a nexus for networking and collaboration, with interactive displays, including MinEx CRC's RoXplorer Digital Twin immersive VR experience. Positive feedback reinforces the event's reputation as a key industry fixture. As we reflect on another successful conference, we look forward to continued growth, collaboration and innovation.

How to access

GSWA Open Day 2023 Conference Program is available as a free downloadable PDF from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) eBookshop.

GSWA Open Day 2023 Conference Program (Interactive Version)

Presentations are available via DEMIRS **YouTube** channel.

For more information, contact **Sabrina Bednarski**.



OPEN DAY 2023

Product releases

• PUBLICATIONS •

Report 239 Barnicarndy 1 Interpretative Well Completion Report

Normore, LS, Haines, PW, Zhan, Y, Wingate, MTD, Edwards, DS, Lu, Y, Martin, SK, Grosjean, E, Boreham, CJ, Wang, L, Dewhurst, D, Bailey, A, Foster, CB, Kelsey, DE, Allen, HJ, Fielding, IOH, Wawryk, M, Hancock, EA, De Souza Kovacs, N, Carr, LK and Henson, P

Report 243 Structural control on copper mineralization at Nifty, northwest Paterson Orogen, Western Australia

Hickman, MM

Report 244 Regional Petrophysics: Paterson Orogen 2022–23

Markoski, M and Bourne, B

Report 245 Regional Petrophysics: Perth Basin 2022–23

Markoski, M and Bourne, B

Report 246 Regional petrophysics: Youanmi and Southwest Yilgarn Terranes 2022–23

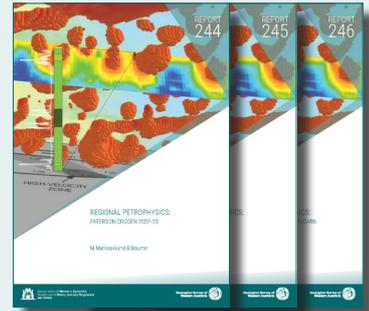
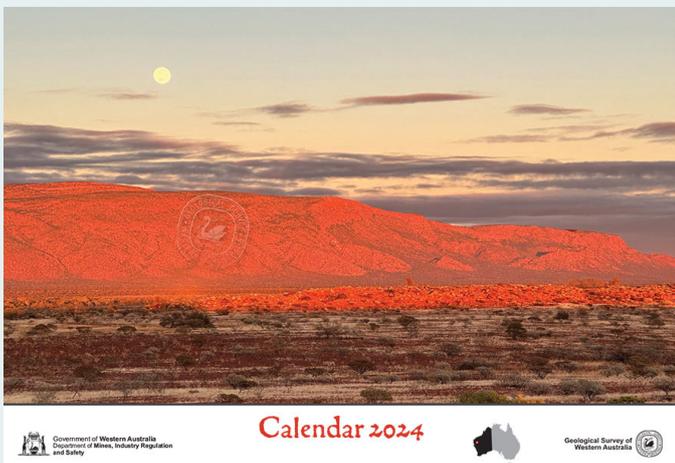
Mortimore, C and Bourne, B

Record 2023/15 GSWA Open Day 2023 – conference program

Record 2023/17 The preservation of legacy collections project: a template for preserving high-value collections for future research

Blereau, ER and Bellenger, A

GSWA calendar 2024



• MAP •

Mineral deposits and major petroleum projects Western Australia – 2023

Pal, T, D'Ercole, C, Murray, SI, Johnston, A and Thomas, CM

• POSTER •

Western Australia – Selected exploration and mining highlights, July 2023

Pal, T, D'Ercole, C, Murray, SI and Johnston, A

