

Fieldnotes

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Department of Energy, Mines,
Industry Regulation and Safety



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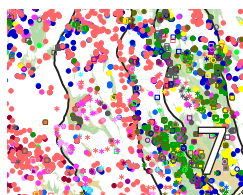
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We respectfully acknowledge Aboriginal peoples as the Traditional Custodians of this land on which we deliver our services to the communities throughout Western Australia. We acknowledge their enduring connection to the lands, waterways and communities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

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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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Upskilling the next generation of geoscientists

The Geological Survey of Western Australia's (GSWA) groundbreaking Industry Ready Graduate Program (IRGP) will supercharge the next generation's geoscience skills and data awareness before they enter the workforce. The ongoing two-year program will create unique opportunities for knowledge-sharing and on-the-job applied geoscience training. Graduates will be industry ready, super-skilled, and data literate. The program also provides an incentive for more students to complete their Honours year.

The IRGP will sponsor up to three geoscience or data science students per year, each for a total of two years and will be open to graduating students from all Western Australian universities. In the first year of the program the students will remain at university and will receive a substantial stipend to complete their fourth year Honours program or complete a Masters with a Honours-equivalent research Degree. GSWA will pay the course fees and associated analytical or equipment costs, including in-kind support for any field-based activities. During the second year, the graduate will take on a full-time, fully paid, one year placement within GSWA.

During the one-year placement, the graduate will rotate through different areas of GSWA and carry out several core applied geoscience functions. Alternatively, if the graduate has a very strong focus on a particular subject area, significantly more time could be spent in that area of expertise. It is anticipated that the core applied geoscience functions would include advanced lithological and structural field mapping, advanced core logging, sampling and analysis, and geoscience data management.

Applications for Round 2 of the IRGP will be open towards the end of May 2024. You can find more Information on the application process [here](#).

For more information, contact [Simon Johnson](#).



GSWA congratulates and welcomes its inaugural graduate students who were inducted into the Program in February 2024. All three students are enrolled at The University of Western Australia. Alan Silvio and Alejandro Varela are both studying to achieve a Master of Energy Geoscience degree and Matthew McAuliff is studying Honours for his Bachelor of Science (Geology) degree. They will all join GSWA for their one-year placement in January 2025.

Critical minerals: Western Australia's gift to tech

Global demand for the ingredients to power technology and renewable energy generation has placed Western Australia in pole position for critical minerals exploration and production. The Geological Survey of Western Australia's new StoryMap **Critical minerals in Western Australia overview** summarizes what critical minerals are, why they've shot to the top of the agenda, and Western Australia's resource potential.

Nearly half of the 92 elements that occur in nature are rated as critical in the 21st century economy. Lithium, nickel, cobalt, graphite and manganese are key components of rechargeable batteries. Small amounts of less well-known elements germanium, gallium and tantalum are essential for smart tech. Indium is the magic ingredient that makes touchscreens come to life.

As well as making possible everyday items in our homes and workplaces, critical minerals, such as rare earth and platinum group elements, graphite and silicon, greatly improve the efficiency of solar photovoltaic cells and the motors in wind turbines.

The accelerating trend towards sustainable renewable energy generation, coupled with the myriad of other applications for critical minerals, requires more exploration and mining. This seems paradoxical, given the growth of the circular economy model and the urgency to manage environmental risks.

This StoryMap briefly discusses the paradigm shift needed to harmonize these societal demands. Among the initiatives underway are reassessment of previous mine waste as a resource for critical mineral exploration, and a transition to renewable energy to power mining operations.

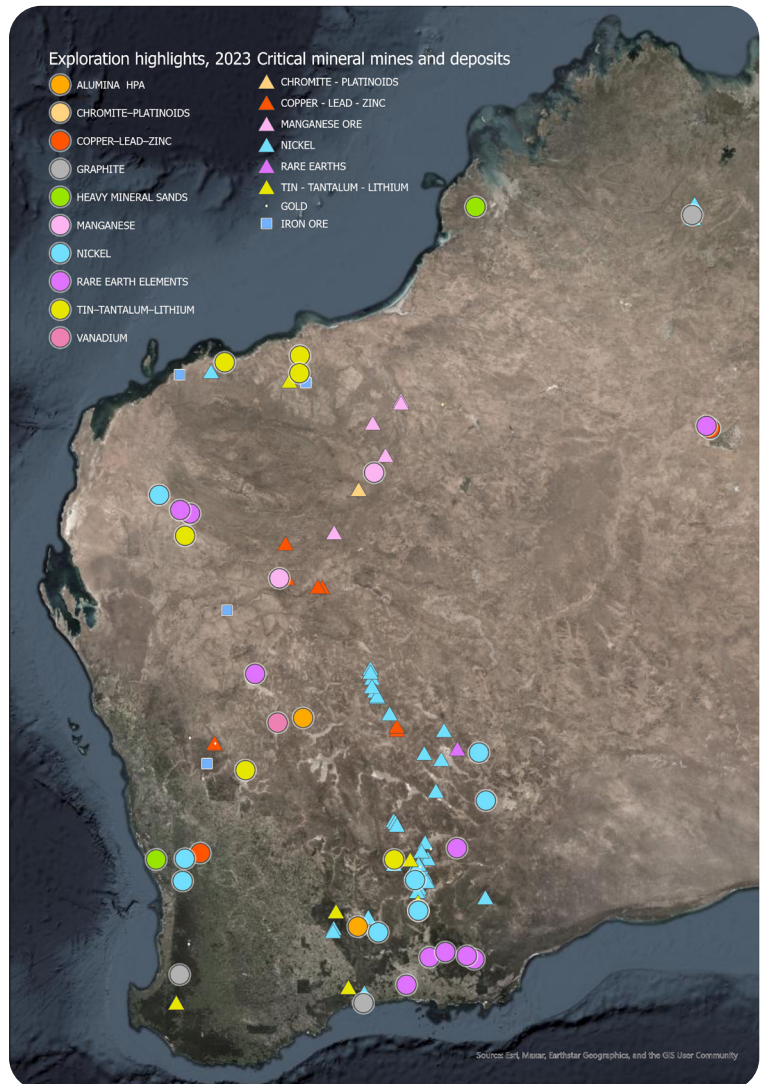
In many ways, the story is only just beginning. Much more work is needed to ensure the high-tech future is sustainable.

Forthcoming chapters of this critical minerals StoryMaps series will chart Western Australia's opportunity to supply many of the critical elements for achieving this.

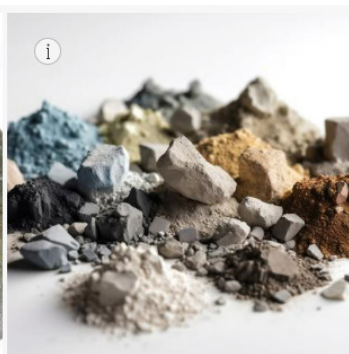
How to access

A link to Critical minerals in Western Australia overview: Resources for a sustainable high-tech future is available at the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) **eBookshop**.

For more information, contact publications@dmirs.wa.gov.au.



Distribution in Western Australia of some of the major critical mineral deposits and exploration activities



Spodumene (lithium ore mineral), nickel briquettes, rare earth oxides and e-scooters – a popular application for these critical elements

Graphite: Western Australia's unsung resource

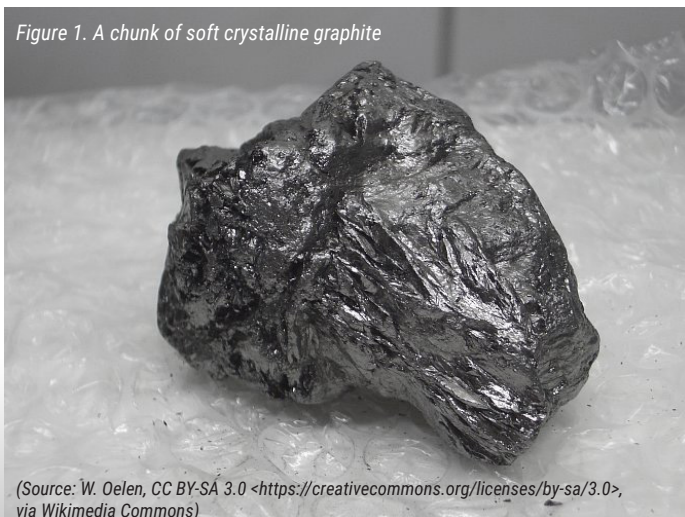
This StoryMap is the newest release in the series published by the Geological Survey of Western Australia (GSWA). The content is based on [GSWA Mineral Resources Bulletin 26 Graphite in Western Australia](#) but includes updated information, graphics, current trends and statistics.

The StoryMap contains the following sections:

- Graphite's versatility
- Natural graphite
- Synthetic graphite
- Deposit types
- Graphite prospectivity in Western Australia
- Applications
- Global distribution and production
- How will demand impact Western Australia?

Although graphite seems like the dowdy sibling of its glamorous polymorph, diamond, its use in the renewable energy sector is seeing it gain considerable value. Graphite crystallizes under a broad range of metamorphic and metasomatic conditions. Despite a variety of mineral habits, from flakes through scales, grains, or disseminated in veins, lenses, and pods, the underlying crystalline structure is the same – hexagonal rings of carbon arranged in thin sheets. This structure results in its properties of black to steel-grey colour, opacity, submetallic lustre, and a soft (Moh-scale hardness of 1–2) and greasy feel (Fig. 1).

Figure 1. A chunk of soft crystalline graphite



(Source: W. Oelen, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons)

Graphite has many uses in addition to pencils
(image AdobeStock)

Graphite's crystal form makes it an excellent conductor of electricity, immune to attack from most acids, and an extremely good refractory material. These features have led to its place on the world's list of critical minerals.

Advances in technology and evolution of industries are likely to increase the global demand for graphite. Many analysts forecast demand for natural graphite to grow to around 6.3 million tonnes per annum, an increase of about a 700% on today's production. They predict that there will be a supply deficit from about 2024–25 up to 2030.

This represents huge potential for Western Australian projects at feasibility and exploration stages (Fig. 2).



Figure 2. Exploring for graphite

How to access

Graphite: Western Australia's unsung resource compiled by RS Bower is available to view on the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) [eBookshop](#).

For more information, contact publications@dmirs.wa.gov.au.

Excursion guide to the northern Perth Basin

Palaeo Down Under 3, the Australasian Palaeontologists' quadrennial conference was held at Boola Bardip in Perth from 10 to 14 July 2023. As a supplementary activity to the conference, the Geological Survey of Western Australia (GSWA) organized a post-conference excursion to the northern Perth Basin. The excursion focused on a variety of fossiliferous outcrops including early arthropod trackways in the Siluro-Ordovician Tumblagooda Sandstone, as well as marine Permian, Mesozoic and Pleistocene outcrops areas around Geraldton and Kalbarri.

The excursion guide is derived mostly from GSWA Record 2005/9 *Geology of the northern Perth Basin, Western Australia* — a field guide, and subsequent guides to the region, and has been updated from recent published research.

The pre-conference excursion guide to modern and Precambrian localities, which included early life sites in the Pilbara, is expected to be released later in 2024.

How to access

Palaeo Down Under 3 post-conference excursion guide, northern Perth Basin, 17–20 July 2023 compiled by AJ Mory and H Ryan is available as a free downloadable PDF from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) eBookshop.



Excursion participants examining the Lower Permian Fossil Cliff Member at Coal Seam National Park with High Cliff in the background



General view of pinnacles in the Pleistocene Tamala Limestone

Geochemical mapping the lithospheric architecture of the Yilgarn Craton

In an article recently published in *Geology*, GSWA and collaborating authors used a large, high-quality, granite geochemical dataset to develop new ideas regarding lithospheric architectural evolution of the Yilgarn Craton. This dataset was considerably expanded and updated under the Exploration Incentive Scheme.

The basement of Meso- to Neoproterozoic greenstone basins in the Yilgarn Craton comprise fragments of evolved crust up to 3.7 Ga old. The new data presented in the *Geology* journal article combined craton-wide geochemical and isotopic data with unparalleled spatial resolution to image a northeasterly to east-northeasterly trending architecture in pre-2.73 Ga crust. These trends cannot be reconciled with plate tectonic models, as they persist across younger north-northwesterly striking structural fabrics, including a proposed suture, previously interpreted to result from exotic terrane accretion.

These results suggest that, despite their substantial strike length, north-northwesterly trending structures have limited horizontal displacement. Once the basis of an east–west terrane accretion paradigm for the Yilgarn Craton, the prominent north-northwesterly structural trends that dominate the Eastern Goldfields Superterrane are instead more likely a late overprint on a continuous basement already characterized by an ancient northeasterly–east-northeasterly trending architecture.

An additional release of the Yilgarn granite geochemical database is planned for later this year which should continue to aid explorers in understanding the architectural evolution of the Yilgarn Craton.

For more information, contact
hugh.smithies@dmirs.wa.gov.au.

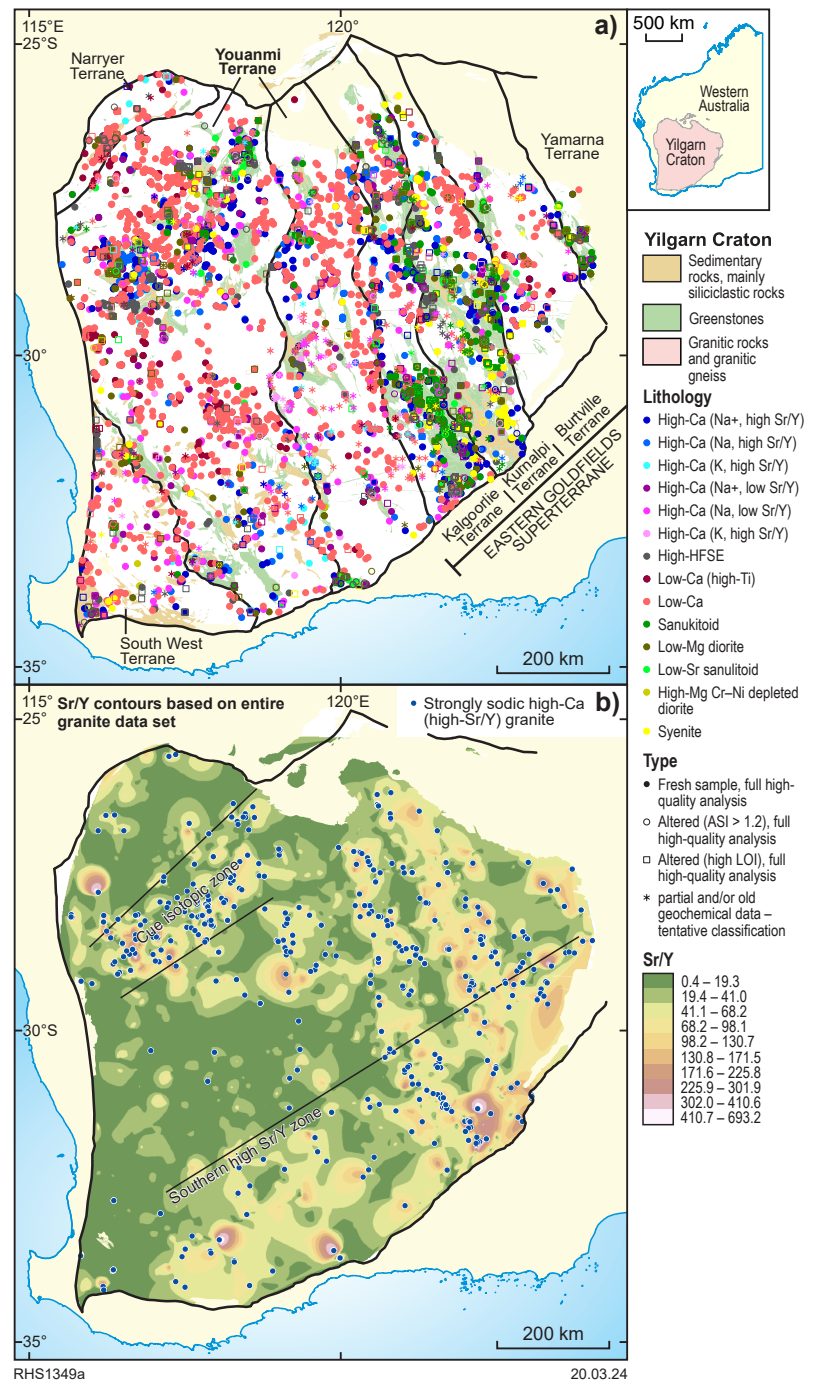


Figure 1. a) Soon-to-be released dataset of c. 7200 data points classified into granite geochemical types; b) Sr/Y proxy for source melting depth highlighting potential compositional change in lower crustal architecture

The west Yilgarn Project provides new views about the geological evolution of the Yilgarn Craton

EXPLORATION
INCENTIVE
SCHEME

The Geoscience Update Forum (GUF) is a new Geological Survey of Western Australia (GSWA) initiative designed to provide an open forum where GSWA geoscientific working groups can present and discuss the results, ideas, and future directions related to current GSWA geoscientific projects. The forums will provide an opportunity for interested industry and academic groups to exchange relevant data, ideas and experiences with each other and with GSWA project staff, potentially influencing ongoing project plans. The first GUF was held in the Theatre of Mineral House on Wednesday, 27 March 2024. It showcased the ongoing work that GSWA's west Yilgarn Project team, and associated university researchers, have been directing towards dramatically increasing our understanding of the geodynamic evolution of the western Yilgarn Craton, and providing and integrating the comprehensive geoscientific datasets that will inform future exploration and land-use activities.

GSWA's west Yilgarn Project incorporates the geological evolution of the region between the Eastern Goldfield Superterrane in the East and the Perth Basin in the West and is bounded to the North and South by the Proterozoic Capricorn and Albany–Fraser Orogens respectively. It comprises the Narryer, Youanmi, and the South West Terranes (Fig. 1a).

Major geoscientific advances emerging from the project so far were shown via a series of oral presentations covering a wide range of topics including lithospheric architecture, structural evolution, new U–Pb zircon ages, particularly focussing on the old components of the west Yilgarn Craton, novel and isotope geochronology, granite geochemistry, and thermal structure (Fig. 2).

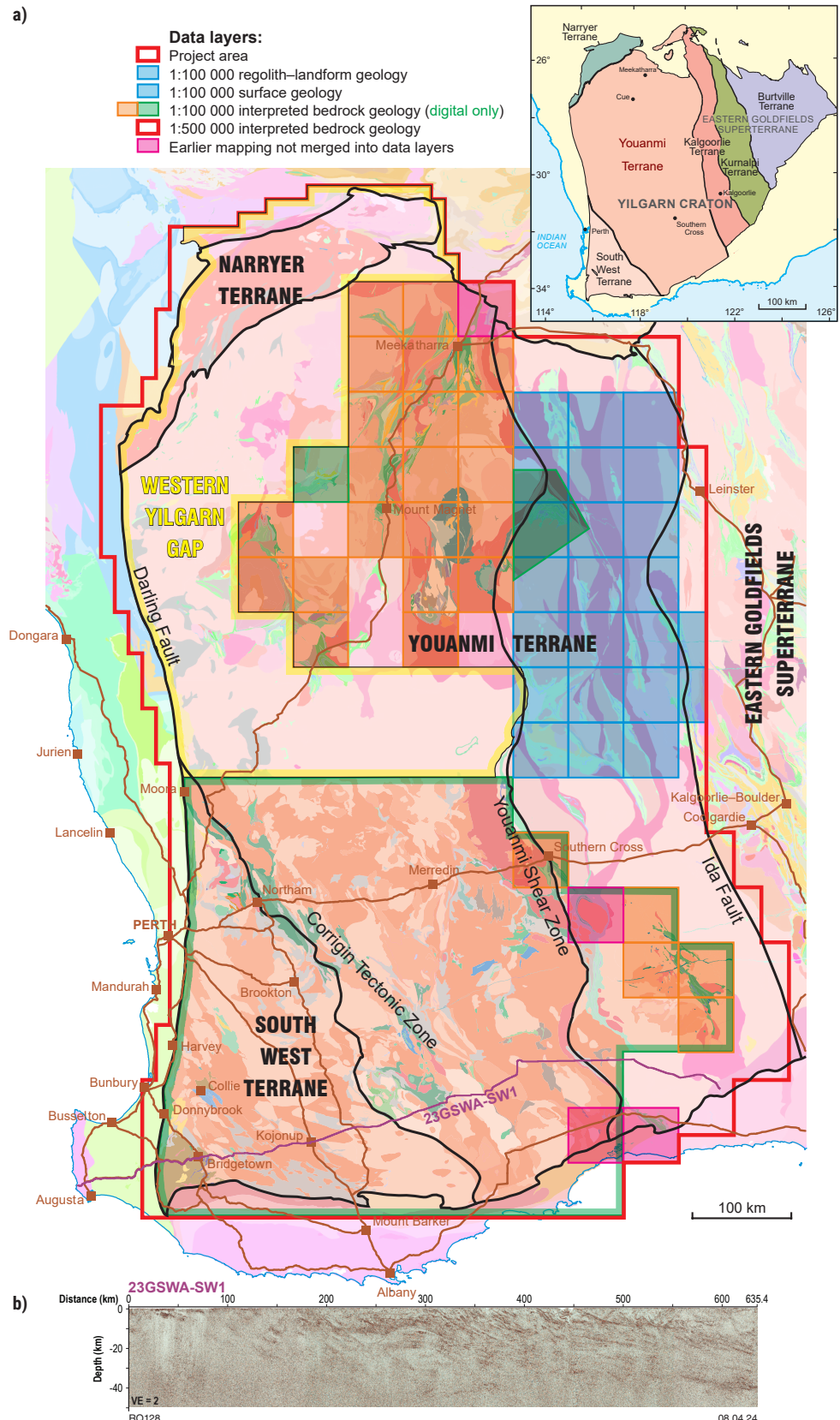


Figure 1. a) Simplified geological map of the west Yilgarn Project area showing the status of mapping and the location of the south-west (23GSWA-SW1) and mid-west (23GSWA-MW1 & 2) active source seismic lines; b) preliminary pre-stack time-migration image (depth section) of the southwest active source deep crustal seismic line 23GSWA-SW1

West Yilgarn Geoscience Update Forum



Figure 2. Professor Tony Kemp (UWA) presenting on the 'Thermal and magmatic evolution of the Narryer Terrane' at the west Yilgarn Geoscience Update Forum

One major dataset that was discussed and presented on a ~4.5 m-long poster, was the recently released preliminary pre-stack time-migration image of the active source deep crustal seismic section 23GSWA-SW1 traversing the southwestern Yilgarn Craton (Fig. 1b).

An open-discussion session completed the day and allowed members of the audience to ask questions and provide comments and feedback on outcomes and future directions of the project.

For more information, contact the manager of the west Yilgarn Project, **Raphael Quentin de Gromard**, or go to this [GSWA web page](#).

Filmed presentations will be made available online on the [DEMIRS YouTube Channel](#).



GEOSCIENCE UPDATE FORUM

West Yilgarn

Product releases

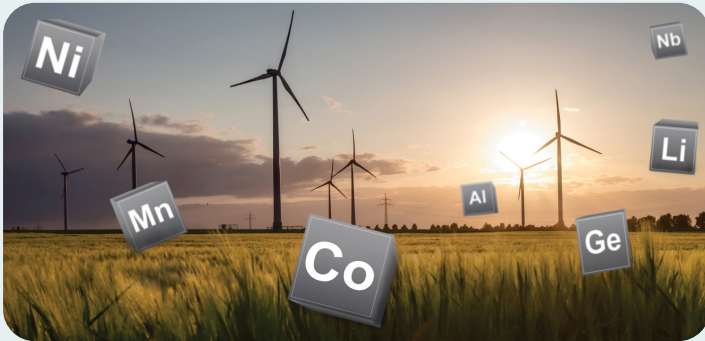
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Record 2023/16 Palaeo Down Under 3 post-conference excursion guide, northern Perth Basin, 17–20 July 2023
Mory, AJ and Ryan, H

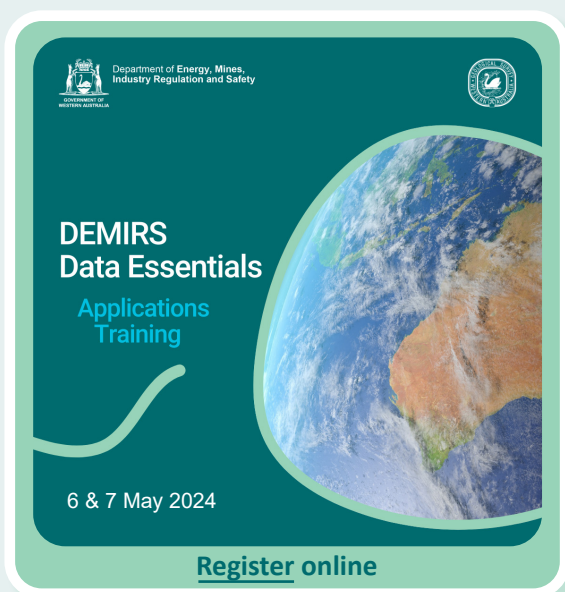
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• STORYMAPS •

Critical minerals in Western Australia overview: resources for a sustainable high-tech future
White, SR



Graphite: Western Australia's unsung resource
Compiled by Bower, RS



• MAP •

Major resource projects, Western Australia – 2024
Pal, T, Murray, SI, D'Ercole, C, Johnston, A and Situmorang, Y

