



Department of Energy, Mines,
Industry Regulation and Safety



Geological Survey of
Western Australia

Fieldnotes

Quarterly news for Western Australia's
exploration industry and geoscience community



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Acknowledgement of Country

The Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) respectfully acknowledges Aboriginal peoples as being the traditional custodians of Western Australia. We acknowledge the enduring connection Aboriginal people continue to share with the land, sea and sky through both their ancestral ties and custodianship to Country. We pay our respect to Elders both past and present, and acknowledge the value brought to our department through the collective contribution of Aboriginal and Torres Strait Islander peoples across Western Australia.

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Cover image

Installing a WA Array field station

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All publications

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

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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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- subscribing to the [GSWA eNewsletter](#) — linked to the latest issue.
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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](#).

Keep up-to-date



Report 256: WA Array Phase 1 – Southwest Western Australia

The WA Array project (see Fieldnotes July 2024) is revolutionising our understanding of Western Australia's lithospheric architecture, providing high-resolution passive seismic data and models to support geoscientific research and resource exploration. With the first site put in the ground in November 2022, this ambitious initiative continues to grow, with each phase contributing to nearly 170 new seismic stations at 40km station spacing. Nine such areas in total will sweep the State of WA by 2033, which would provide a comprehensive dataset that will enhance interpretations of the region's deep crustal and mantle structures.

Here we promote a milestone with the release of the data models and report from Phase 1: Southwest Western Australia. GSWA Report 256 details the processing techniques behind the models and delivers some high-level interpretations which hints at the impact that the final State-wide model will eventually have.

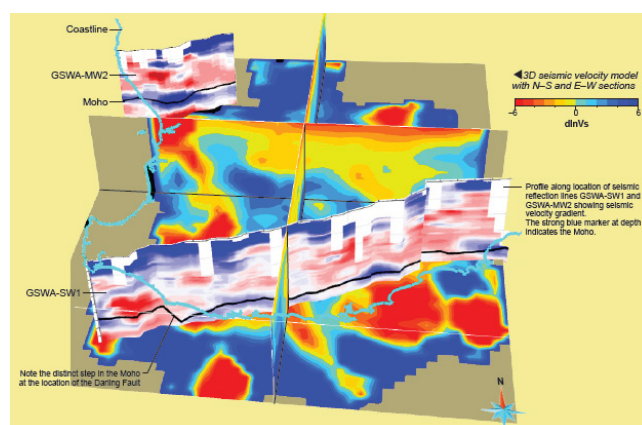


Installing a WA Array field station



During this project, we have used the waveforms generated by local, regional and teleseismic earthquakes to produce detailed models at various depths and features within the Earth from the shallow surface, through the crust and into the mantle.

Shallow models look at the depth to basement, f_0 (the fundamental resonance frequency of the soil layer) and the velocity of the shear waves in the soil layer. There is a detailed map of the local earthquakes which happened over the past three years showing just how seismically active this part of Australia is. This data is useful for seismic hazard mitigation when planning new infrastructure.



3D velocity models of the crust from the SKUA (geological modelling software) data compilation of models from Phase 1 of WA Array

Crustal models show velocity models of the P- and S-waves. Regions of different velocities can indicate different rock types, location of faults or zones of alteration. The thickness of the crust has been calculated from the different delays in arrival times of the P- and S-waves and their reflections and refractions from the Moho (base of the crust). Different thicknesses of crust can indicate different origins of adjoining crustal blocks and lead to tectonic interpretations of the region.

WA Array Phase 1 results

The use of waveforms from teleseismic earthquakes is one of the few methods capable of imaging below the Moho. Here we have derived both P- and S-wave velocity models which show that there is a thick root to parts of the Yilgarn Craton. The steepest gradient of this root seems to coincide with the surface location of mineral deposits in the Yilgarn. This, so far, supports the theory that mineralisation at the surface is a result of processes deep within the mantle and that we need to understand the mantle structure if we are to find the next generation of big ore deposits.

In addition to the report, waveforms, individual models, and a 3D data compilation are all available for download using the following the links.

How to access

Report 256 WA Array Phase 1 – Southwest Western Australia compiled by R Murdie, is available at the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) eBookshop.

Waveform data is available through the **Australian Passive Seismic Server**.

Individual models and a 3D SKUA model compilation are available from MAGIX file number 72202.

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



Warning – monitoring in progress, a solar panel powering a WA Array field station

Pegmatite-hosted lithium prospectivity map

A statewide pegmatite-hosted lithium (Li) prospectivity map has been released on the Mineral Systems Atlas (MSA). A hybrid data-rich, knowledge-driven approach was used to produce a series of predictor maps, showing the spatial distribution of geological data that correlates with Li mineralisation. Each predictor map was calibrated using a dataset of 138,310 exploration drillholes with harmonised lithium grades. The results of this map correlate well with known Li resources in Western Australia, and highlight areas for further exploration, while considerably reducing the search area of the State.

The pegmatite-hosted lithium prospectivity map, intermediate predictor maps, and input datasets are available on the MSA and the Data and Software Centre along with an explanatory note, allowing the end-users to recreate the map or combine this approach with their own datasets. Lithium is a key component in lithium-ion batteries and has been identified as a critical mineral in Western Australia's Battery and Critical Minerals Strategy 2024–2030 and Geoscience Australia's Critical Minerals Strategy 2023–2030.

The MSA seeks to help anyone who wants to find exploration-relevant spatial data and information presented in a logical mineral systems-based framework.

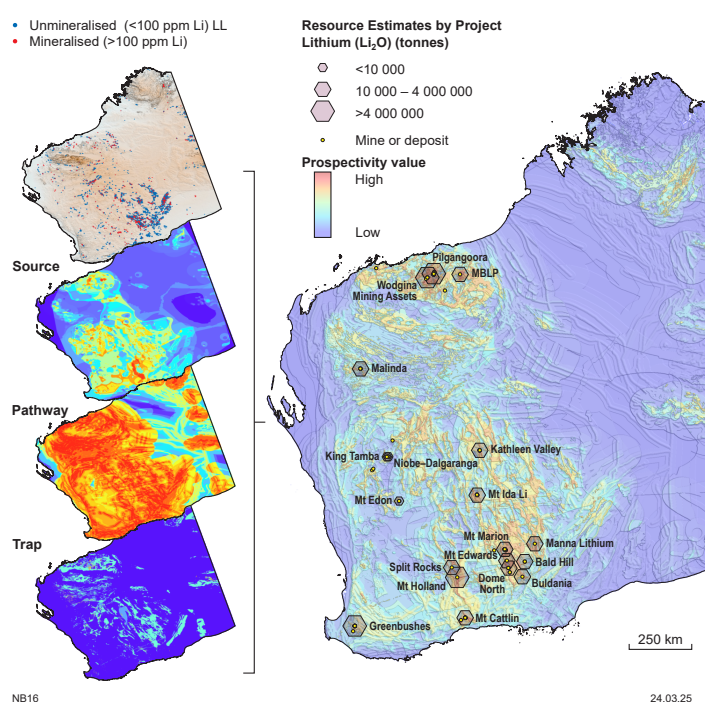
Each system is accompanied by an online MSA Guide and GSWA Record. The online guide presents information on each spatial layer, the primary data from where it was derived, and any filters or query models used. The record provides a succinct overview of the mineral system including critical processes and potential targeting elements and mappable proxies.

How to access

The **pegmatite-hosted lithium prospectivity map** is available on the MSA, a browser-based viewer similar to GeoVIEW.WA. Digital data is also available as a free download from the **Data and Software Centre** via Datasets – statewide spatial datasets – Mineral Systems Atlas, as rasters, a geodatabase, and ESRI shapefiles.

Record 2025/2 Pegmatite-hosted lithium prospectivity: mineral systems atlas explanatory notes by NH Bowman is available as a free downloadable PDF from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) eBookshop.

For more information, contact **Nathan Bowman**.



Harmonised exploration drillhole data was used to calibrate predictor maps. Predictor maps were combined to form a summary map for each major component of the mineral system, and these were then combined to produce the final image. Higher relief and red-orange colours depict higher prospectivity values and lower relief and blue colours depict lower prospectivity values

Graduating top of the crust — What it means to be a GSWA graduate

When you rest your gaze on the scorched red dirt of Western Australia and take your eyes over the multicoloured cliffs that rise in the distance, you know that you're standing on earth both rich in history and resources. Home to some of the oldest rocks and minerals ever found, our diversity in mineral and energy resources underpins our economy and society.

The importance of geoscience is no secret, especially in Western Australia. That's why it's equally important to welcome graduates into GSWA to provide them with a hands-on education of geoscience, data science, and earth science.

The **GSWA Industry Ready Graduate Program** is a two-year fully paid program aimed at university students finishing a Bachelor of Science degree in geoscience or data science and starting their Honours or Masters.

Bhavik Lodhia, former Graduate Program coordinator, said, "We're providing graduates with a broad range of experience within specialised teams to upskill them in core areas of geoscience. This makes them competitive for industry.

"The GSWA Industry Ready Graduate Program is really the first of its kind," he continues. "It's been well received across universities and there's a large demand for students to take part, which is evident with each increase of applications per application round."

Those who apply are diverse in age and experiences. Some applicants are fresh out of university while others might have joined university in a later stage in life and are looking for a career change.

"It's quite inclusive in that sense," said Riley Rohrer, acting Graduate Program coordinator. "It can also be tailored to the individual needs and interests of the graduate." The diversity of geoscience skills is vast at GSWA, as graduates can rotate to teams focusing on field mapping, geochemistry and geochronology, data science, critical minerals, basin studies, hydrogen or CO₂ storage (and more!).

The 2025 graduate cohort are only in their first rotations, yet they've already tried their hands in some extraordinary roles. One graduate, Alan Silva, worked 12-hour night shifts on a drill rig to collect samples to assess natural H₂ potential.

His primary role was within the Analytical Data branch of the GSWA at the Carlisle Core Library, where he learned to use a forklift, and interpret **HyLogger** data for a report in collaboration with CSIRO that will be published later this year.

Another graduate, Matt McAuliffe, developed code to replace a manual process of inspecting data and sorting files within the WAMEX database. Having developed the code from scratch with no prior experience, his rotation within GSWA's Geoscience Data Integration team provided him with valuable skills in software development. The resulting code will be implemented and used across GSWA.

In his rotation within the Energy Systems and Geological Storage branch, Alejandro Varela Munoz used well logs to determine water content and geochemistry of formation water in the Northern Perth Basin. His work has shown some potential for interconnected aquifers in the area and will be a contributor to an upcoming report.



Riley Rohrer (left), acting coordinator of the GSWA Graduate Program, and Bhavik Lodhia (right), former coordinator

"The graduates are doing real and valuable work that's going to have an output with their name on it," said Bhavik. "It's certainly not administrative work or job shadowing; everything is geared towards them to be in the best position to seek employment afterwards."

In addition to developing their geoscience and data skills, these graduates will also leave the graduate program with networking skills.

"Learning how to network and how to market themselves is really important," said Riley. This includes helping them tailor their CV and making themselves competitive in the job market.

A major advantage of joining the GSWA Graduate Program is the stipend, as it's the only program of its kind to pay the graduates before they start their contracted position with GSWA. "The funding they receive is very generous," said Bhavik. In the first year of the program Honours and Masters studies are supported by a stipend of \$35,000 – \$50,000, \$12,000 to \$20,000 of course fees and \$5,000 to \$15,000 of research support funds, depending on the type of degree. "Essentially, we fund them in their final year at university, and GSWA doesn't supply them with work until they join us in the following year. This lets them focus entirely on their studies."

"It's a weight off your shoulders to not have to worry about funding or scraping by while completing your degree," adds Riley. "A graduate joining us in 2026 was able to complete fieldwork in the Solomon Islands during her degree as it was supported by GSWA."

"Those who are eligible should definitely apply," said Riley. "It's a really unique program, and I encourage graduates to take advantage of the opportunities and make the most of their time here."

GSWA is looking for upbeat and enthusiastic people with a passion for geoscience. If you or someone you know is interested in applying, scroll to the bottom of the **GSWA Graduate Program webpage**, and keep your eyes on the **WA Jobs page** and **GSWA LinkedIn**.

Otherwise, if you would like more information, contact **Riley Rohrer**.



GSWA geoscientists and graduate program students in Canberra for the Science meets Parliament event. From left to right, Matt McAuliffe (graduate), Alan Silva (graduate), Rose Turnbull (Analytical Data Acquisition Manager), Bhavik Lodhia (former coordinator), and Alejandro Varela Munoz (graduate)

Nifty NDI campaign sampling workshop: distal footprints of sedimentary copper systems

As part of the participation in MinEx cooperative research centre (CRC) Program 3, the National Drilling Initiative (NDI), GSWA conducted a campaign of 10 drillholes up to 25km away from the Nifty copper deposit. These drillholes, using the RoXplorer coiled tube drilling platform, provide samples to allow GSWA and collaborators to understand distal footprints of sedimentary hosted copper systems. All research under the NDI will be made public, and is the result of collaboration between the CRC, Australian geological surveys and the research institutes who participate in the CRC.

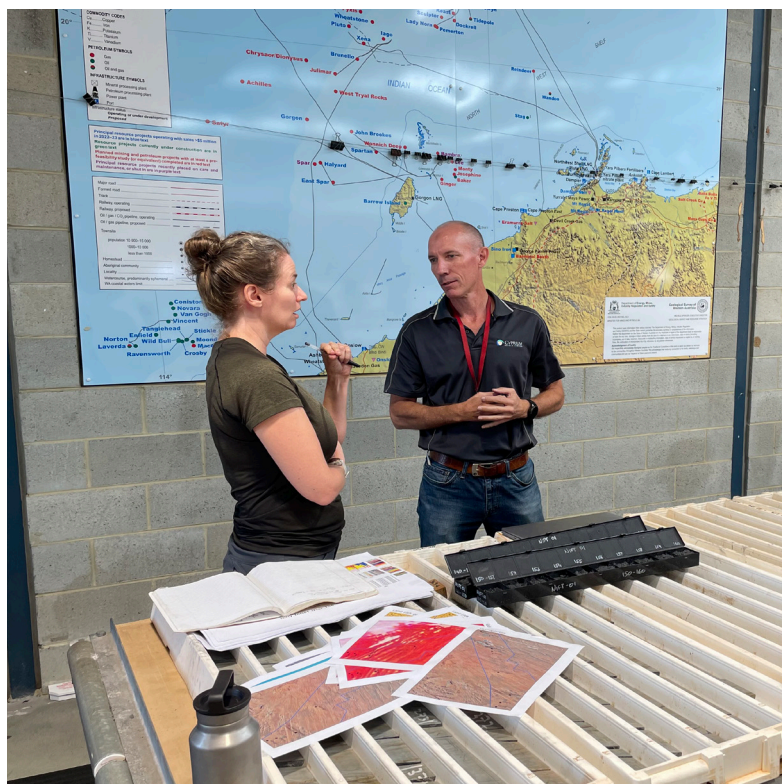
Globally, the search for copper is critical for the energy transition. There is predicted to be a significant shortfall in copper resources coming onto the market, and understanding how to help find the subtle distal signatures of copper systems is an important component for GSWA to be able to map the regional systems to help de-risk exploration.

One of the key benefits of working within the CRC framework is the leveraged collaborative research opportunities.

Along with the pull through of the technology deployment of the RoXplorer platform, novel research by MinEx partners such as CSIRO and universities allows use of the most up-to-date techniques for mapping mineral systems and to place distal samples in their camp-scale context.

At the end of February, GSWA hosted NDI researchers at the Carlisle Core Library to sample pre-existing EIS funded diamond drillholes, near-mine diamond core on loan from Cyprium Metals, and over 3500 chip samples from the coiled-tube drilling undertaken at Nifty in 2023 and late 2024.

These samples will provide new insights through isotopic, geochemical and geophysical studies to better define the camp-scale footprint of the system. By understanding a mineral system from the inside out, researchers will be able to help understand the value of information for exploring for similar sedimentary-hosted copper systems. Outcomes of research will now depend on the timeframes of chosen analyses but will be publicly released over the coming two years of research in the third (and final) phase of MinEx CRC.



Dr Jennifer Porter, University of South Australia/GSWA, and Mark Styles, Cyprium Metals, discussing local geology relating to both diamond core and coiled-tube drilling chips from a location south of Nifty

The Western Australian Mineral Exploration reports (WAMEX) database hosts open file company reports. In addition to the GeoView.WA search, the **WAMEX search website** allows you to search the text of all scanned PDF company reports.

Drilling and surface geochemistry data is extracted from WAMEX thus creating the Mineral Drillholes and Surface Geochemistry Database, which holds hundreds of thousands to millions of locations and downhole records.

1. 4,174,222 drillholes
2. 13,489,302 surface samples
3. Billions of analytical results.

A map of Australia showing the distribution of blue dots representing data points. The dots are concentrated in Western Australia and scattered along the northern coast. Labels include Dili, Timor Sea, Arafura Sea, Northern Territory, Western Australia, South Australia, and Queensland.

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We have made several recent improvements:

- ## But wait, there's more!

- Ground gravity 3D models
 - Consultants have extracted 50+ gravity surveys from the Mt Bruce 1:250,000 sheet as a test exercise We are now looking at automating the process from data discovery, extraction and harmonisation.
 - A selection of 3D models is being programmatically extracted from WAMEX;
- Geophysical surveys
- Ground magnetic surveys
- Ground electromagnetic surveys
- Magnetotelluric surveys
- LAS files
- Remote and proximal sense data, spectral data
- Core photos
- Orthophotos
- Drone photos.

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GSWA's upcoming discovery portal: advancing data discovery



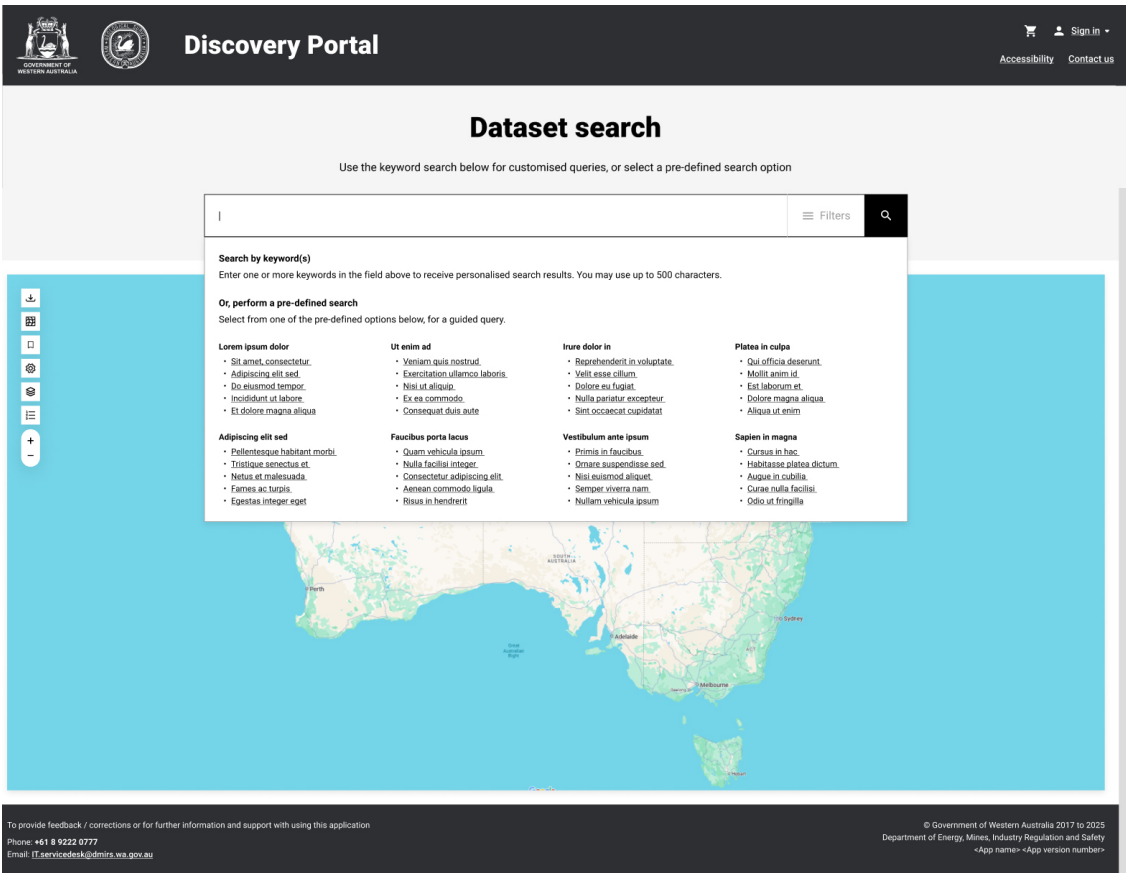
The Geoscience Data Transformation Program (GDTP) is developing GSWA's upcoming data discovery portal. The discovery portal aims to improve accessibility and usability of GSWA's geoscientific data through advanced search functionalities, user personalisation, and improved data retrieval mechanisms. This article outlines the initial functionalities under development and their implications.

GSWA's discovery portal is being designed to provide you with an intuitive and comprehensive user experience. You will be able to search and retrieve GSWA data like never before. By integrating free text and spatial search capabilities, along with user-defined filters and personalisation options, the portal will enhance data accessibility and efficiency. The integration of cloud-based storage solutions further ensures access to previously unavailable large datasets.

The current development phase focuses on several key functionalities to optimise data search and retrieval:

Enhanced search capabilities

- Free text searching within OCR-processed documents and images.
- Extended free text search across metadata stored in GSWA databases.
- Category and keyword-based searching for refined data retrieval, such as mineral exploration reports, seismic surveys, and many other data types.
- Spatial search functionality, allowing you to perform standalone spatial searches or combine them with text-based queries.



Initial search and spatial map with pre-defined searches concept

Advanced filtering and personalisation

- Additional filtering options to refine search results based on data type and relevance.
- Pre-defined searches showcasing data of potential interest.
- User personalisation features enabling the creation and saving of custom search results for future use.

Virtual Zip and shopping cart interface

- Virtual Zip functionality enabling you to preview the contents of Zip files before downloading.
- Selective file extraction from Zip files, allowing you to create customised data packages.
- A shopping cart-style interface for compiling and downloading selected files efficiently.

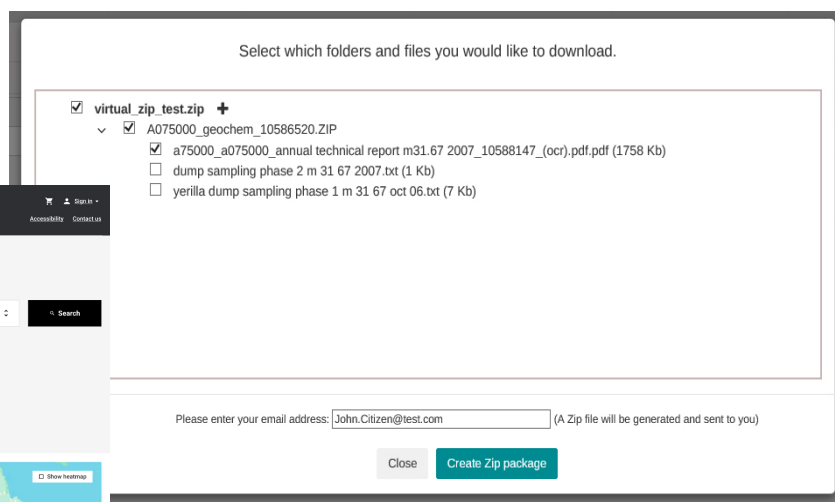
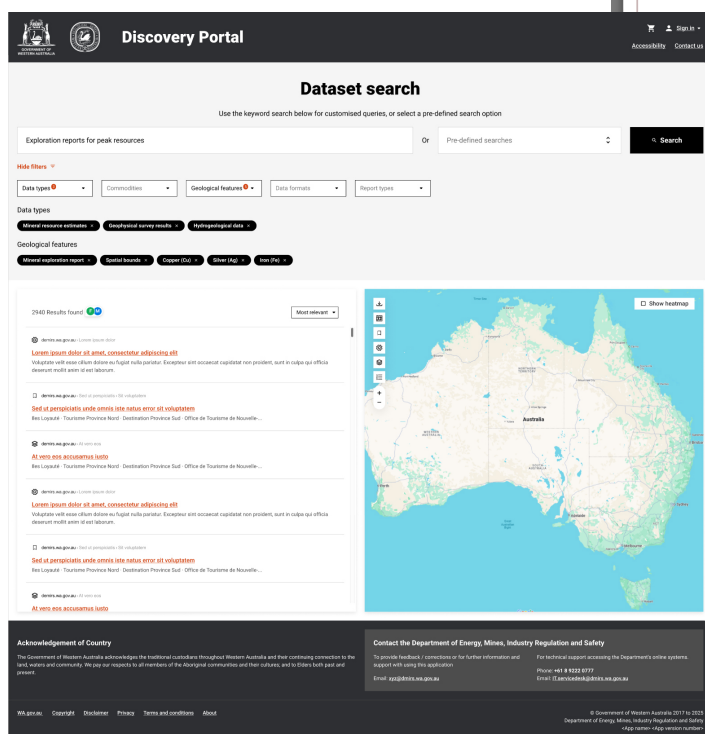
Cloud integration and device compatibility

- Previously inaccessible large files will be uploaded to Azure, making them searchable and downloadable.
- Device compatibility enabling you to search, download, and manage data conveniently from your PC, tablet, or mobile device.

Developing the GSWA discovery portal is a significant advancement in the Geoscience Data Transformation Program. Internal and external stakeholder engagement has been instrumental in informing this phase. We are proud to be developing a portal that will be integrated and user-friendly. By leveraging cloud-based technology, advanced search functionalities, and user customisation, the portal will streamline workflows and enhance data utilisation. As development progresses, further enhancements and refinements will be implemented to optimise user experience and data accessibility.

For more information about GDTP, visit the **GSWA Geoscience data transformation program page**.

You can contact GDTP directly through **GDTP Enquiry**.



Virtual Zip file concept

Initial search, results screen, and filters with map concept

GSWA Big Day Out showcases cutting-edge research and regional discoveries

Innovation, Exploration, Collaboration

The GSWA Big Day Out 2025 in Kalgoorlie was a resounding success, bringing together leading experts from the mining and exploration industry alongside GSWA geoscientists to share insights, advancements, and collaborative efforts. Held at the WASM Conference Centre on 20 March 2025, the one-day conference attracted a diverse audience of geologists, researchers, and industry professionals eager to engage with the latest developments in mineral exploration.

The event opened with a welcome from the GSWA Director of Geoscience, Fawna Korhonen. GSWA set the stage with presentations highlighting their role in driving innovation in mineral exploration. Speakers such as Fawna, Charlotte Hall and Julia Thom outlined how government initiatives, including the Exploration Incentive Scheme (EIS), are supporting the discovery of future ore bodies. The conference also showcased the power of geoscientific data, with Rose Turnbull emphasising the critical role of geochronology and geochemistry in exploration success.

A key highlight of the conference was the seamless collaboration between GSWA and industry representatives, featuring a well-balanced series of presentations on gold, lithium, nickel, and rare earth elements. These discussions underscored the critical role of these commodities in shaping the future of mineral exploration in Western Australia.



Attendees of GSWA Big Day out 2025

Mining leaders from companies such as Northern Star Resources (Sam Maloney) and Gold Fields Australia (Jay Stafford) shared real-world exploration case studies, highlighting the importance of updating geological models as new exploration data becomes available.

Will Candish from Mineral Resources explored the Mt Marion Deposit, offering a geological perspective on one of the region's key lithium projects, while Michael Outhwaite's expert analysis of komatiite nickel-sulphide systems in the Widgiemooltha District illustrated the structural influences that shape these valuable deposits over time. Matthew Demmer from Chalice Mining followed with an update on the Gonneville and broader Julimar Complex, showcasing one of Australia's significant nickel-copper-PGE discoveries. Marcelle Watson's presentation on the global significance of Mt Weld's rare earth elements emphasised the deposit's role in securing critical minerals for future technologies.

Throughout the day, discussions and networking sessions provided a platform for fostering partnerships. The Dr. Jack Hallberg geological map collection, now accessible to the public through GSWA, was displayed at the event and served as a testament to the lasting impact of collaborative geological research.

The day wrapped up with a captivating keynote presentation from Emeritus Professor Ray Cas, who took the audience on a journey through Earth's early history. His talk explored the volcanological, paleoenvironmental, and tectonic evolution of the Archean Kalgoorlie Terrane, highlighting its geodynamic significance for the Yilgarn Craton. By linking ancient processes to modern mineral systems, Cas provided a thought-provoking perspective on how Western Australia's rich geology continues to shape exploration success today.

Overall, the GSWA Big Day Out 2025 exemplified the strength of collaboration between GSWA and the mining and exploration industries. By uniting research and industry expertise, the event reinforced the shared commitment to advancing Western Australia's mineral exploration sector.

Product Releases

Publications

Report 256 WA Array Phase 1 - Southwest Western Australia

Murdie, RE

Report 253 Deformed Ni-Cu-(PGE) deposits: structures, remobilization, and exploration implications

Duuring, P

Record 2025/2 Pegmatite-hosted lithium prospectivity: Mineral system atlas explanatory notes

Bowman, N

Fieldnotes: GSWA newsletter January 2025 number 113



Maps

Major resource projects, Western Australia — 2025

Pal, T, Murrari, SI, D'Ercole, C, Johnston, A, Mathrubhavan Sasi, R and Jones, A

Mines — Operating and Under Development — 2025

Johnston, A, Murrari, SI, Pal, T, D'Ercole, C, Mathrubhavan Sasi, R and Jones, A



Flyers

Antimony: investment opportunities, Western Australia

D'Ercole, C and Taylor, J

Graphite–Gallium–Germanium: investment opportunities, Western Australia

D'Ercole, C and Taylor, J

Manganese: investment opportunities, Western Australia

D'Ercole, C and Taylor, J

Rare Earth Elements: investment opportunities, Western Australia

Johnston, A, D'Ercole, C and Taylor, J

