ARC CRITICAL RESOURCES FOR THE FUTURE

ACTIVITIES 2025 Q1

THE UNIVERSITY OF WESTERN AUSTRALIA

THE UNIVERSITY of ADELAIDE

Australian National University

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Introduction

Welcome to the first edition of our quarterly newsletter, designed to keep you updated on the developments at the ARC Training Centre in Critical Resources for the Future. Please note that in the upcoming months, in addition to the quarterly newsletter, we will also start disseminating Centre information and research highlights and opportunities through a dedicated podcast channel, as discussed below.

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Our Team

Team updates

Research Fellows

We are pleased to introduce Olivia Mejías González, the first Research Fellow at the ARC Training Centre in Critical Resources for the Future.

While awaiting the finalisation of her PhD, Olivia is currently collaborating with AXT and CSIRO on research that will contribute to the ongoing efforts within Research Theme 2 Accelerating Characterisation. Olivia will officially begin her role as a Research Fellow in June 2025, based at the University of Queensland, where she will work under the leadership of Associate Professor Anita Parbhakar-Fox.

PhD Candidates

In 2024, we welcomed a talented group of PhD candidates who are already making great progress in their research.

Jemi Ahnaf supervised by Prof John Mavrogenes is investigating the "Formation Conditions of the LCT Pegmatites in Western Australia".

Matthew Demmer, supervised by Prof Marco Fiorentini, A Prof Wei Liu, and Dr Isra Ezad is investigating "The Petrogenesis of the Gonneville Ni-Co-PGE deposit, Western Australia".

Michael Wawryk supervised by Prof Tony Kemp and A Prof Nicols Thebaud is investigating "Hyperspectral-Geochemical Mineralogy and Alteration Footprints" in collaboration with GSWA.

In early 2025, we expanded our team with six new PhD candidates

Rachel Jones, supervised by Prof Marco Fiorentini and Dr Isra Ezad, will investigate the "Quantitative Exploration of Spatiotemporal Metasomatic Mantle Sources of metals".

Le Xi K'ng supervised by AProf Anita Parbhakar-Fox will investigate "Pyrite to Pyrrhotite transformations during roasting"

Cooper Fergusson supervised by Prof Carl Spandler will be "Exposing a New Rare Earth Element Mineralisation Province in the Western Margin of the Pine Creek Orogen in the, Northern Territory".

Rachman Fauzi supervised by Prof Marco Fiorentini and Dr Ria Mukherjee will be "Unveiling the cryptic relationship between Ural-Alaskan PGE systems and Cu-Au porphyries".

Collins Adoko, supervised by **A**/Prof Anita Parbhakar-Fox will be "Building geospatial models to inform critical mineral extraction from mine waste – towards a new industry standard".

We are also pleased that an additional eight PhD candidates have been selected for scholarships to work on a range of exciting Centre projects and are currently completing their application processes. More information in the next newsletter

Research Activities

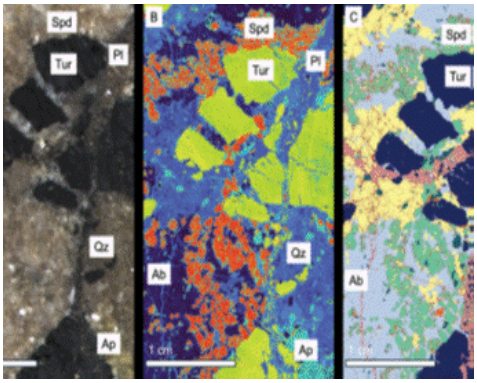
PhD Research Updates

Our Centre's research continues to evolve with projects tackling a broad range of critical resource challenges. Check out what our PhD students are finding in their first year of their PhD.

FORMATION CONDITIONS OF THE LCT PEGMATITES IN WESTERN AUSTRALIA

Jemi Ahnaf recently conducted LA-ICP-MS trace element analyses on muscovite from several LCT pegmatite localities including Greenbushes, Forrestania, Pilgangoora, and Bynoe. The preliminary results seem to indicate that each pegmatite is the product of highly fractionated melts. Based on muscovite trace elements, Greenbushes formed from the most evolved melts, followed by Pilgangoora, Forrestania, and Bynoe. Jemi is also currently analysing melt inclusions in quartz and tourmaline, to uncover the elusive pegmatitic melt compositions.

This study aims to help explorers discover more lithium resources for the energy transition



THE PETROGENESIS OF THE GONNEVILLE NI-CO-PGE DEPOSIT, WESTERN AUSTRALIA

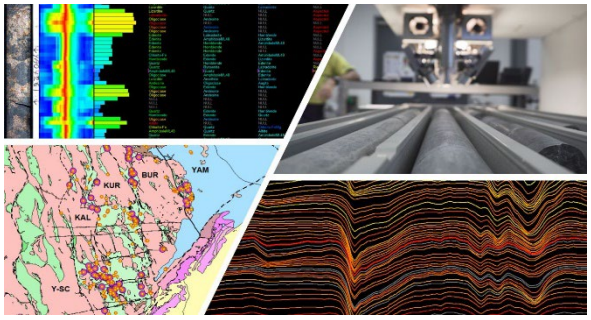
Matthew Demmer recently completed a bright-phase search of samples from the Gonneville-Julimar PGE-Ni-Cu-Co deposit, finding that most platinum-group minerals are palladium-bismuthotellurides (Pd-Bi-Te).

Paired with last year's sulfur isotopic data, which show no local assimilation, the results suggest intriguing commonalities to other 2.65 Ga deposits, including the Kalgoorlie-Kurnalpi gold deposits. This project aims to help future exploration by understanding the mineralising processes that are crucial to forming intrusions enriched in precious and base metals.

The study is designed in such a way that the characterisation work can help refining exploration targeting protocols and enhance processing and metallurgical recovery.

HYPERSPECTRAL-GEOCHEMICAL MINERALOGY AND ALTERATION FOOTPRINTS

Michael Wawryk successfully delivered his PhD research proposal, outlining his project on hyperspectral geology applied to the Yilgarn Craton of Western Australia. This milestone marks a key achievement in his PhD journey.



To date, Michael has made significant progress, including:

Building spatial datasets for mineral analysis

- Testing scanning workflows and algorithms
- Collecting powders and billets from storage for analysis
- Identifying gaps in the spectral reference library (e.g., chloritoid)
- Extracting and sanitising assay data from reports
- Testing laser profilometry for grain size analysis

These foundational steps are not only advancing hyperspectral analysis but also providing valuable insights for mineral exploration across the Eastern Goldfields Superterrane. This work will improve the accuracy of mineral identification and enhance exploration efficiency by integrating hyperspectral data with geochemical analysis, ultimately supporting more targeted and cost-effective resource discovery

THE ROLE OF GEOSCIENCE IN AUSTRALIA'S CRITICAL MINERALS FUTURE

December 2024 saw the release of a thematic issue of Volume 71 of *Australian Journal of Earth Sciences*, entitled "The Role of Geoscience in Australia's Critical Minerals Future".

This special issue, co-edited by Carl Spandler, showcases recent research from a number of the Centre team members from University of Adelaide, UWA and ANU, as well as our partners from Geoscience Australia

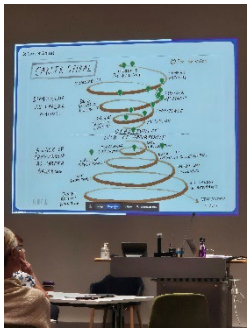
This capture of research activities is an update on the start of the important work that is underway in the Centre. The diverse research areas contribute to the development of innovative approaches for the exploration and extraction of critical resources vital for the future.

Workshops Delivered

Workshops Delivered

This quarter, the Centre successfully delivered two workshops aimed at enhancing skills and fostering collaboration in the critical resource sector:

WORKSHOP ON INCLUSIVITY AND SPONSORSHIP



This session emphasised the importance of inclusivity in research and industry and offered tools to create more diverse and supportive environments for up-and-coming researchers and professionals.

A number of centre-wide activities will be implemented across the various nodes to promote mentorship and sponsorship at multiple levels.

2025 COPPER MINERAL SYSTEMS WORKSHOP

This one-day short course in collaboration with the Centre for Exploration Targeting explored the key multi-scale mineralising drivers that are manifested in a range of currently known mineral systems, including porphyry, IOCG, and sediment-hosted systems.

Geoscientists of all levels had the opportunity to engage with experts, learn the latest insights from our research, and collaborate with colleagues in the field. This program enhances participants' understanding of copper systems, which are critical for future resource development.

The workshops offer significant benefits by fostering professional development, promoting inclusivity, and advancing the expertise needed for future resource exploration and mining.

Check out this linked in post by the Centre for Exploration Targeting

Centre Activities

Centre Activities

2025 SPACE BOOT CAMP INITIATIVE

Prof Marco Fiorentini presented to 35 high school students in Western Australia, discussing the wealth of information that is stored in meteorites and remote sensing data from space. His session emphasised how understanding extraterrestrial geological processes can help us unlock Earth's mineral potential and inform strategies for addressing climate change and resource extraction. Importantly, in the framework of the Centre's goal to enthuse the young generations to take an interest in STEM and specifically in the geosciences, we aim to inspire and educate high school and primary students, hoping to reinvigorate interest in geosciences and develop robust pipeline of future students who are ready to pursue PhDs and careers in this critical field. We need this interest to secure the necessary expertise to address future challenges in critical resource exploration and sustainability.

PDAC 2025 CONVENTION

The Centre strategically partnered with the CET attending the prestigious PDAC Convention in Toronto, where our team, including Matthew Demmer, showcased our research and explored opportunities to promote student engagement. This event provided an international platform for building connections with other key players in the mineral industry.

AUSTRALIAN CRITICAL MINERALS R&D

Prof Carl Spandler and **Prof John Mavrogenes** participated in the "Australian Critical Minerals R&D Priorities Symposium" organised by **CSIRO** in Melbourne, 11 and 12 February where they discussed priorities to scale up and commercialise critical minerals research, coordinate national efforts, and foster international collaboration to support clean energy and Australia's net-zero goals.

MIEX PROGRAM STUDENTS AT SUSTAINABLE MINERALS INSTITUTE

A/Prof Anita Parbhakar-Fox and Le Xi K'ng recently hosted over 20 undergraduate students from the **MiEX program** at the **Sustainable Minerals Institute (SMI)**, supported by our industry partners **BHP**, **Rio Tinto**, and the **Minerals Council of Australia (MCA)**. The students toured SMI's cutting-edge labs, including flotation, microCT, hydrometallurgy, and advanced microscopy, gaining hands-on experience with key technologies in sustainable resource extraction.

This outreach activity gave students valuable insight into sustainable minerals research. By engaging students early, we hope to inspire them to consider pursuing careers in this critical field, fostering a potential future pipeline of skilled professionals ready to tackle resource extraction, sustainability, and climate change challenges.

Up and coming events

Up and coming events

2025 - CCRF ANNUAL WORKSHOP – SAVE THE DATE

SEG 2025 BRISBANE, AUSTRALIA September 28-28, 2025

2025 - The **CCRF Annual Workshop** is tentatively scheduled for **24 September 2025** in **Brisbane**, ahead of the **SEG 2025 Conference**, which will take place from **26-28 September**. The Centre will host a full day of activities, including two workshops, bringing together all members—PhD candidates, Postdoctoral Fellows, Chief Investigators, and Partner Investigators—to meet in person, engage in discussions about our research and explore exciting future opportunities.

Further details about the workshops will be shared in the upcoming newsletter.

2025 - PODCAST SERIES: A NEW INITIATIVE TO SHARE OUR RESEARCH

On April 7, 2025, Marco Fiorentini, Dr Isra Esad, and ANU researcher Dr Ross Chandler will collaborate with Geo Co. to launch a series of podcasts under Wonder Podcasts, focused on geoscience and the research conducted at the ARC Training Centre in Critical Resources for the Future.

Throughout 2025, we aim to release one Centre-sponsored episode each month, with the first episode slated for June. After six months, we will evaluate the success and impact of the podcasts.The primary goal of this podcast series is to engage a broader audience and spark greater enthusiasm about the importance of geoscience. By sharing our research in an accessible format, we hope to attract a wider group of listeners and inspire more people to take an interest in the Centre's work and its vital contributions to the future of critical minerals.

2025 - PLENARY LECTURE AT THE 18TH SGA BIENNIAL MEETING (SGA 2025)

A/Prof Anita Parbhakar-Fox will deliver a plenary lecture at the 18th SGA Biennial Meeting 2025. This conference will bring together geoscientists worldwide to discuss the latest research in mineral exploration and geology. The lecture will highlight cutting-edge findings and their potential impact on the mining industry.

AEGC Australasian Exploration Geoscience Conference Perth2025 8 – 11 September 2025

2025 - KEYNOTE AT THE AESC IN PERTH (AEGC 2025)

A/Prof Anita Parbhakar-Fox has been invited to give a keynote address at the Australian Earth Sciences Convention (AESC) in Perth as part of AEGC 2025. During this session, A/Prof Parbhakar-Fox will share insights into Earth science advancements and the future of technology in the industry.

2026 - GORDON RESEARCH CONFERENCE (GRC)

2026 - Professor Marco Fiorentini, Director of the ARC Centre in Critical Resources for the Future, will be chairing the 2026 Gordon Research Conference (GRC) on Geochemistry of Mineral Deposits. The GRC will be held in Castelldefels, Barcelona Spain on 24-29 May 2026 . Information on scientific program and conference logistics will be available soon on the website (https://www.grc.org/geochemistry-of-mineral-deposits-conference/2026/). Save the date!

2026 – THE 11TH INTERNATIONAL SYMPOSIUM ON GRANITIC PEGMATITES (PEG 2026)

2026 – The 11th International Symposium on Granitic Pegmatites (PEG 2026) will be hosted by UWA on 16-17 August 2026. Led by an organising committee involving Professor Tony Kemp, the event will be the first international scientific meeting on granitic pegmatites held in Australia, with 150-200 delegates expected, including global experts, academics, and industry members. The program will feature presentations, poster sessions, exhibitor displays, and field trips in WA, with Centre researchers actively participating.

Future Opportunities

Opportunities we are pursuing

2025 - THE RAW MATERIALS WORKFORCE REVOLUTION

Invited talk at the European Union Raw Material Summit. Marco will be presenting on behalf of the ARC Training Centre in Critical Resources for the Future during Day 1 of the EIT Summit in Brussels, taking place from May 13-15. The session, titled The Raw Materials Workforce Revolution – Transforming Skills Gap to Skills Growth, will focus on addressing the growing need for skilled professionals in the raw materials sector. This summit presents a valuable opportunity for showcasing the transformational nature of our Centre, further strengthening our collaborative efforts in addressing these critical workforce global challenges.

2025 - UNLOCKING INDIUM IN MINE WASTE

Olivia Mejías González and A/Prof Anita Parbhakar-Fox, in collaboration with Dr Thomas Jones at CSIRO, have been awarded a grant to investigate the potential of indium in complex tin-rich mine wastes through the use of the X-ray fluorescence microscopy (XFM) beamline at the Australian Synchrotron. The project, titled "Unlocking Indium in Complex Tin-Rich Mine Wastes: A First Step Toward Designing a Remining Process," will run from 4 June 2025 to 8 June 2025, with an in-kind ANSTO grant valued at $131,136. The project aims to explore the potential for remining and recovering indium from mine waste, which holds significant scientific and national value. The proposal was praised for its clear plan, impressive supporting data, and feasibility, particularly with the commissioning of the XFM DMM and the introduction of the new Mirion Ge detector. This research can potentially contribute to developing more sustainable mining practices and resource recovery, aligning with the broader goals of addressing challenges in critical minerals and resource extraction.

MINERAL CHEMISTRY BIG DATA FOR AI REGIONAL MINERAL POTENTIAL ASSESSMENT

The Centre is exploring the use of big data and machine learning to assess regional mineral potential, particularly for critical minerals. This collaboration could revolutionise how we approach exploration, improving accuracy and efficiency. This initiative is being currently discussed with a number of researchers at UWA and GA. Input from other stakeholders is sought as we hope to provide further information in the near future.

TRANSPORTABLE CHARACTERISATION LAB PILOT PROJECT

This initiative aims to deliver real-time, onsite mineralogy and elemental trend data, helping inform drilling decisions and optimise critical infrastructure deployment in remote areas. The ability to analyse data onsite will significantly enhance operational efficiency. Exciting talks are currently being held between researchers from the various research institutions and stakeholders, primarily AXT and GA. Input from other stakeholders is sought as we hope to provide further information in the near future.

NEW CCRF HIGH-PRESSURE LAB FACILITY

This state-of-the-art facility will target key knowledge gaps, advancing our understanding of critical mineral systems under extreme conditions. The facility is currently being assembled and is expected to be fully operational by Q3 this year. We invite stakeholders to get in touch to identify suitable experimental projects that may address some of their current questions.

For more information, please visit our website on ARC Centre in Critical Resources for the Future

criticalresources.org.au

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