

Industrial Transformation Training Centre in Critical Resources for the Future



The challenge and opportunity



- A rapidly increasing inventory of strategic metals, non-metals, and minerals is required for both **technological** advances and clean and affordable **energy solutions**
- **Social, environmental, governmental constraints** are increasing for the resource industry
- Current **exploration and extraction strategies** are not only less sustainable, but are less efficient for the growing list of known ore deposit types
- Current '**value-chain**' **approach** treats each subspecialty as separate and distinct, meaning fewer opportunities to maximise value and yield while minimising damage and waste

Geoscientists of the future will need broad skills to face these challenges²

Critical Resources for the Future



Australian
National
University



Australian Research Council Industrial Transformation Training Centre

- ✓ 4 University Partners
- ✓ 5 Geological Surveys, GA, CSIRO
- ✓ 7 Minerals Companies
- ✓ 7 Service/tech providers



Australian Government

Australian Research Council

Critical Resources for the Future

The ARC Industrial Transformation Training Centre (ITTC) in Critical Resources will **bridge the gap** between mineral systems science, mineral exploration protocols and ore processing/metallurgical extraction.

It aims to **train the next generation of geoscientists** with an essential understanding of the whole value chain of the critical resources of the future, as needed to unlock Australia's critical mineral potential and to enable the transition to a high-tech, clean energy society.

The Geoscientists of the Future



Vision to transform industry-ready geoscience training

- ✓ Establish a new pathway for highly skilled personnel to sustain Australia's resource sector
- ✓ Skills to discover the new viable resources of the future
- ✓ Build expertise across the critical minerals 'value chain' from exploration to ore characterisation and processing, to mine waste recycling and remediation
- ✓ Include: Big data science, on-country knowledge, ESG, mineral economics



Broader Centre Goals

- ✓ Develop ***new exploration strategies to accelerate discovery of*** critical mineral resources
- ✓ **Accelerate** the development of innovative methods for rapid ***characterisation of ore minerals*** and impurities from nano- to kilometre scale
- ✓ Develop cost effective procedures for mineral processing and metal recovery from mine wastes
- ✓ Build **next-generation skillsets that are transferrable across commodities**
- ✓ **Accelerate education** for the general public/other stakeholders on the burgeoning critical minerals sector for Australia
- ✓ **Accelerate translation of fundamental research into applied outcomes**
- ✓ **Contribute to sustainable, ethically-sourced supply chains of Critical Minerals**



The Centre

Research and Training Themes

	Mining Life Cycle Assessment	Theme 1	Theme 2	Theme 3
		Exploration Models	Ore Characterisation	Metallurgical Processing
Science Approaches	Fieldwork	✓	✓	
	Geoscience	✓	✓	✓
	Advanced Mineralogy	✓	✓	✓
	Chemical Engineering and Metallurgy		✓	✓
	Mine Waste/ Tailings		✓	✓
	Data Analytics	✓	✓	✓

✓ Training elements and outcomes



Research & Training Programs

RTP1: Pegmatites - formation to detection, through characterisation and processing

RTP2: Alkaline magmas - Formation to detection, through characterisation and processing

RTP3: Detection and expression of critical metal deposits in and through cover

RTP4: Critical metal recovery from secondary resources

RTP5: Traceability and sustainable extraction of critical minerals

RTP6: Geo-data science and data analytics

➤ > 20 new PhD projects

➤ 5 new Postdoctoral Research Fellows



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Geosciences for the Future


- Funded initiatives to promote the global relevance of geoscience, aid in **recruiting and retaining students**
- **Multidisciplinary** research/training programs – geoscience, data analytics, chemical engineering, environmental management...
- Geoscience students working with experts in cognate subjects, and with **industry and government** partners
- Build a workforce with relevant skillsets, and **accelerate transfer of expertise** to industry to address 21st Century grand challenges



Links to other training initiatives



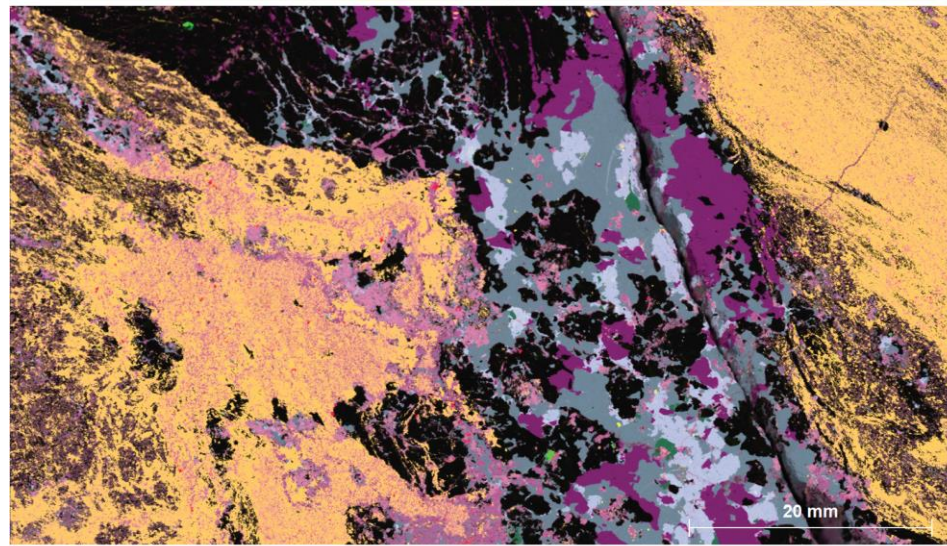
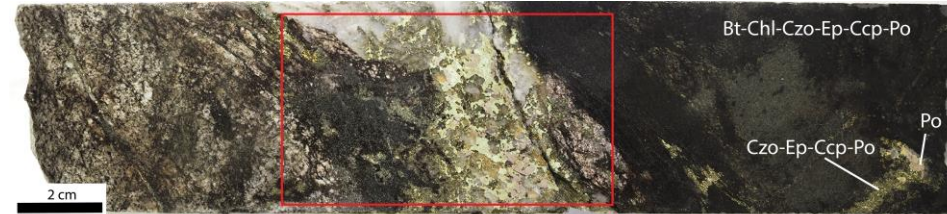
GSWA Industry Ready Graduate Program



Geological Survey of Western Australia



On site CM training – Honours/MSc (Greenbushes, WA)



Legend

Quartz	Clinzoisite-epidote	Plagioclase	Chalcopyrite	Scheelite
Calcite	Biotite-chlorite	Pyrrhotite	Sphalerite	Apatite

M4 Tornado (Brukker +PSS): Lab of the Future

Chemical/mineral mapping in undergrad and postgrad programs



CSIRO Discovery Internships in Critical Minerals

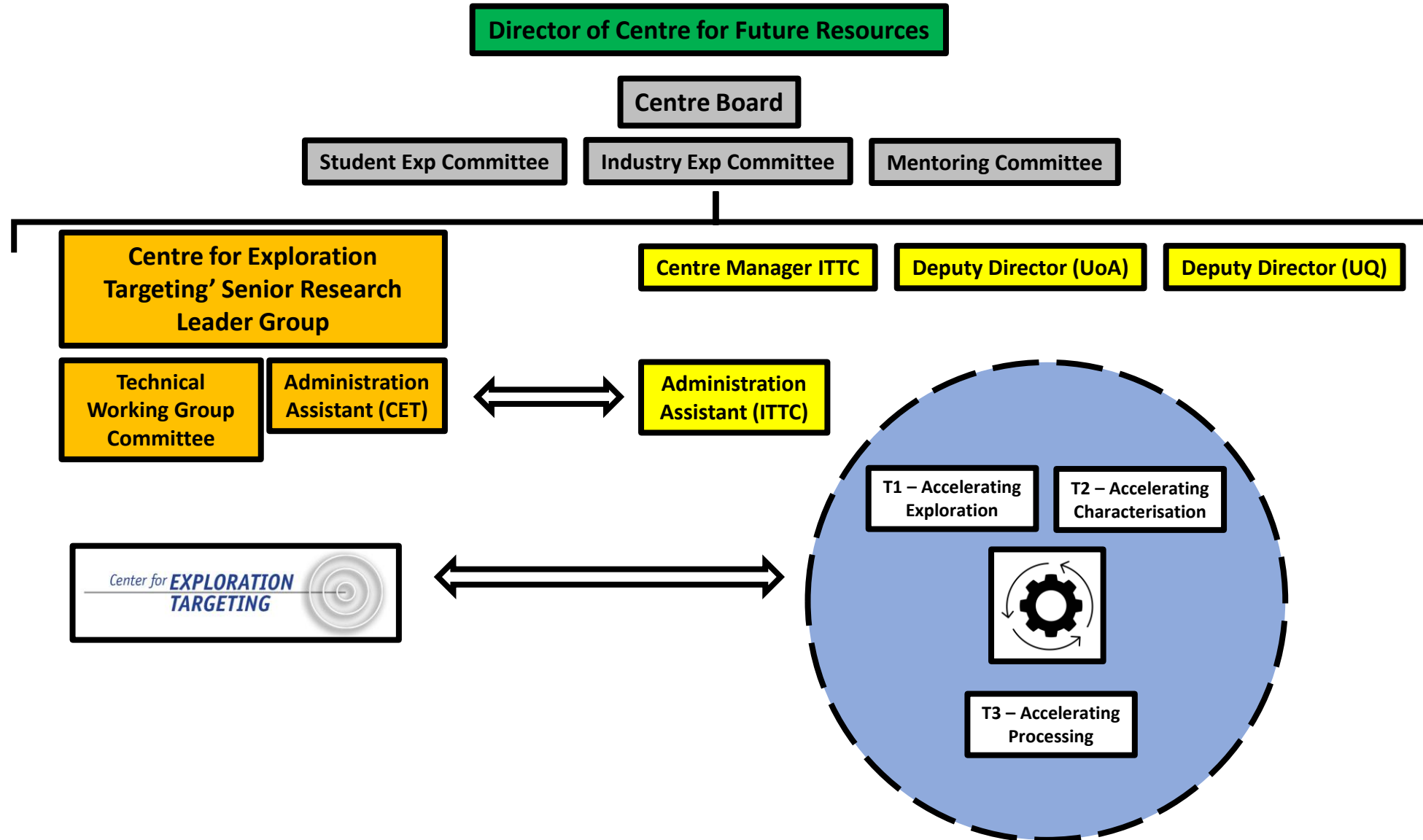
Critical Minerals Research & Development Hub

Timelines



1. The set-up of ITTC has commenced with the goal to have the legal framework of ITTC fully functional and the key governance people (ITTC manager and administrative assistant) appointed by early 2024.
2. The official start of ITTC is anticipated to be 1st of July 2024 (or any time earlier if possible).
3. Partnership between the ITTC and CET ... a proposed new governance structure and a vision for the future

ITTC-CET: a partnership towards the establishment of the Centre for Future Resources



Take Home Messages

- The next generation geoscientists will need to understand the full value chain of critical resources, including knowledge of data analytics and ESG factors
- Research and training infrastructure has to be closely aligned with relevant and applied outcomes
- It is imperative that the academic community works closely with industry to provide the human resources vital for Australia's economic growth and energy security
- The establishment of this ITTC is a significant first step to address challenges related to the future of workforce in Australia and globally

Upcoming GRC next year



Gordon Research Conferences *frontiers of science*

Announcing the 2024 Gordon
Research Conference on:



**Geochemistry of
Mineral Deposits**
for a low carbon society

More details and online application are available at:

<https://www.grc.org/geochemistry-of-mineral-deposits-conference/2024/>
<https://www.grc.org/geochemistry-of-mineral-deposits-grs-conference/2024/>

**June 23 - 28 2024,
Jordan Hotel at Sunday River,
Maine, USA**

Chairs: Isabelle Chambefort and Natalie Caciagli
Vice Chair: Marco Fiorentini



The world is quickly adapting to counter the effects of climate change. The future of renewable energy sources is strongly dependent on critical elements and the mining industry is answering. Innovations in geochemistry applied to exploration, detection, and extraction will be fundamental to secure resources for a growing population. At this conference we will bring together participants from academia, government and industry to discuss the latest concepts and brainstorm new ideas concerning the fundamental geochemical processes to predict, detect and enable responsible mining and support a changing society.



This GRC 2024 will be preceded by the early career Geochemistry of Mineral Deposits Gordon Research Seminar (GRS). Please apply separately for GRC and GRS