

Centre for **EXPLORATION**  
**TARGETING**



# CET Overview 2023

**Steffen Hagemann**

Director, Centre for Exploration Targeting School of  
Earth Sciences  
University of Western Australia

**CET Member's Day,  
23rd November 2023**

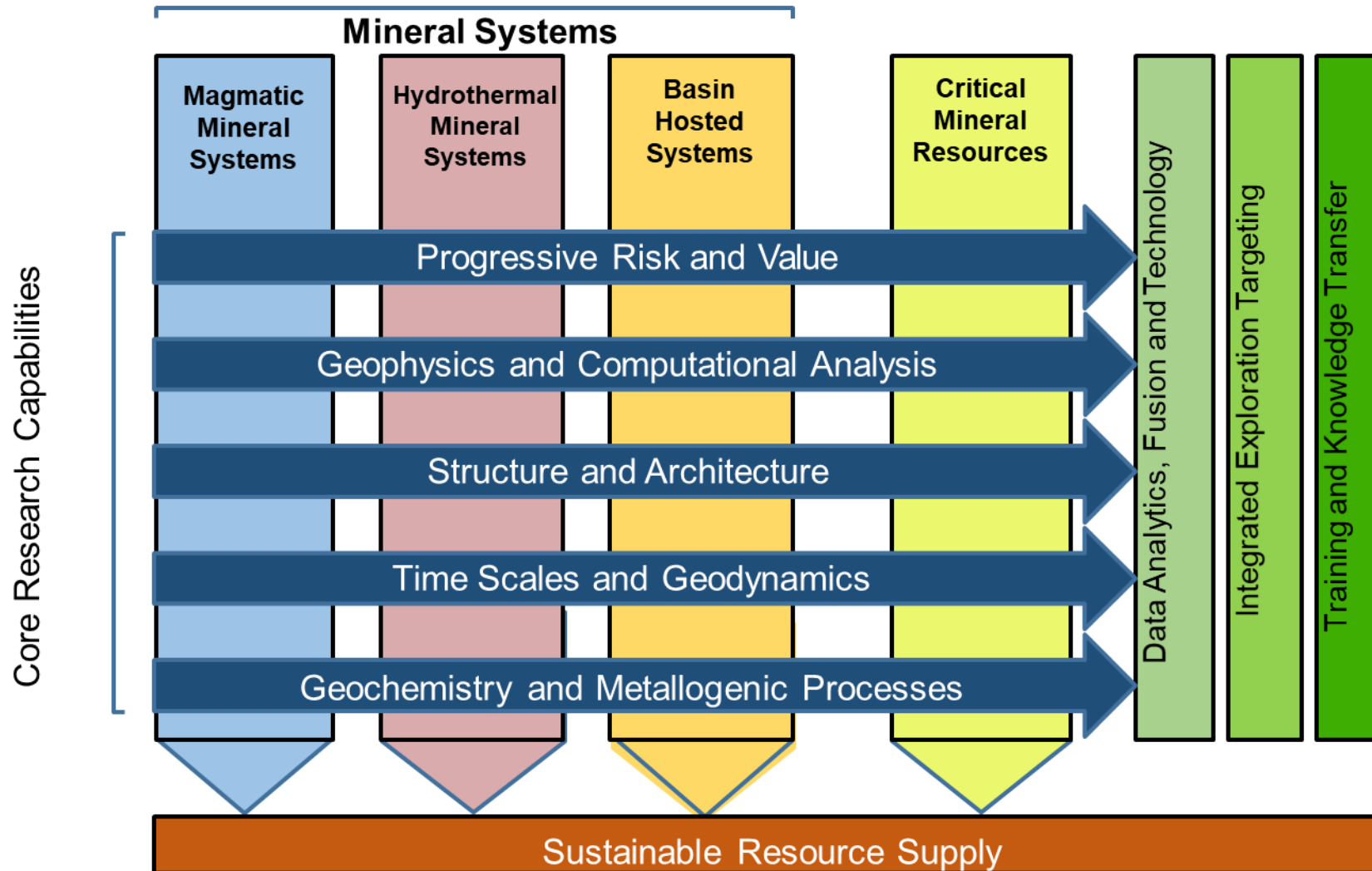


**THE UNIVERSITY OF  
WESTERN AUSTRALIA**  
*Achieve International Excellence*

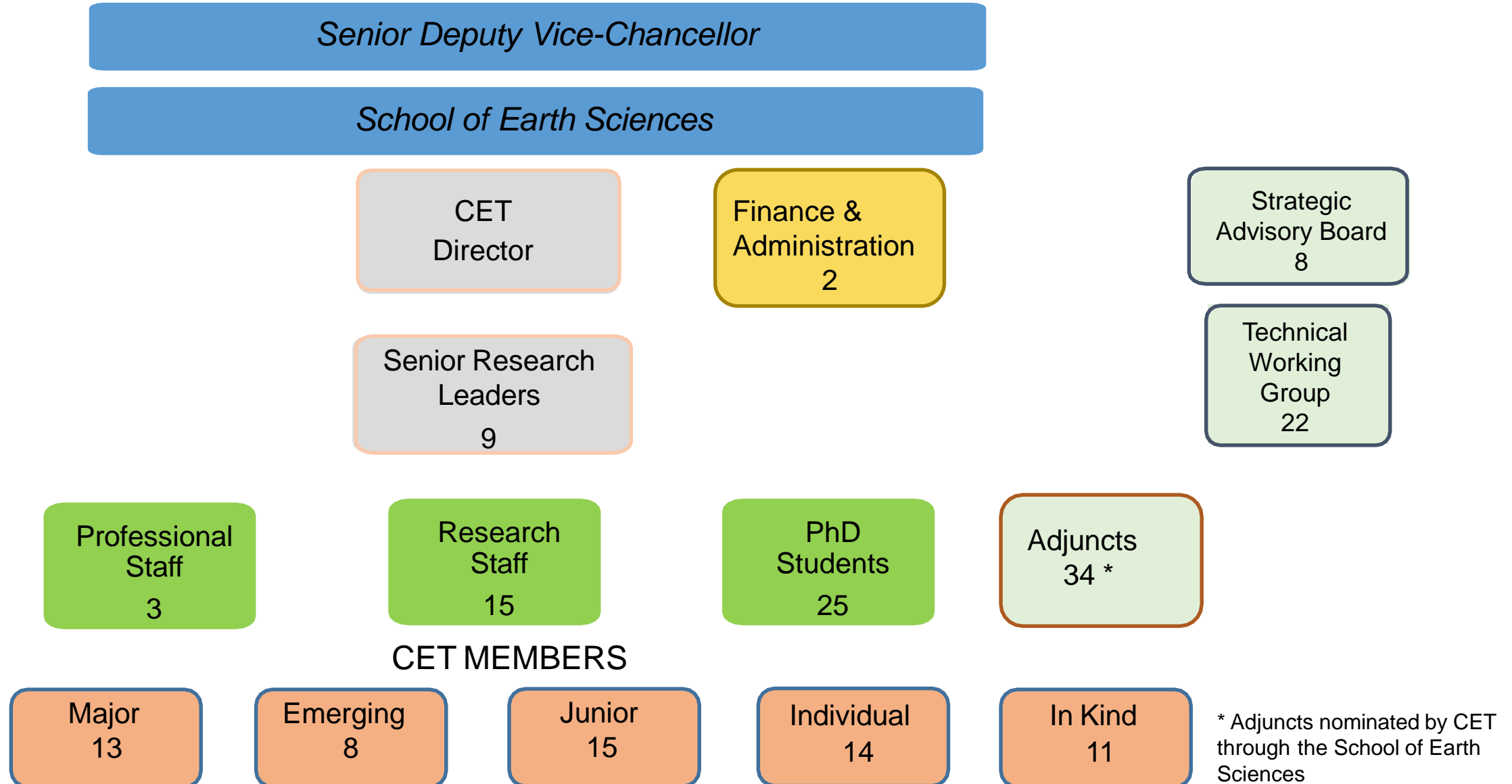
TIME	PRESENTER	TOPIC
08:00 – 08:30		<b>REGISTRATION</b>
08:30 – 09:00	Steffen Hagemann	Overview of 2023 and future CET activities
09:00 – 09:10	Marco Fiorentini	Industrial Transformation Training Centre (ITC) in Critical Resources for the future
09:10 – 09:35	Isra Ezad	Revisiting mantle sources for nickel sulfide deposits
09:35 – 10:00	Anne Virnes	Crustal S sources for komatiite hosted Ni deposits: implications for sulfide transport, deposition and exploration
10:00 – 10:10	Pietro Guj	Strengthening mining regulatory capacity in Africa
10:10 – 10:25	4 PhD Students	Speed talks – will highlight results captured in the posters: Lauri Virnes, Lucas Tatnell, Joshua Chong, Alex Eves
<b>10:25 – 10:55</b>		<b>MORNING TEA / POSTER DISPLAY</b>
10:55 – 11:20	Andrew Crawford	A revised stratigraphic model for the ~1910-1835 Ma Tanami Group: implications for gold exploration strategies
11:20 – 11:45	Sumail	Polyphased gold enrichment as a key process for high-grade gold formation: Insights from the 10 Moz. Jundee-Bogada gold camp in the Yilgarn Craton
11:45 – 12:10	Ravi Schreefel	Crustal evolution in the Archean and implications for orogenic gold mineralization in the Yilgarn Craton
12:10 – 12:35	Daniel Wiemer	Magmatic and structural evolution of the Peruvian lithosphere: Implications for favourable sites for gold-rich mineral systems through time
12:35 – 12:50	4 PhD Students	Speed talks – will highlight results captured in the posters: Jerry Dunga, Edmore Marima, Elina Kong, Matilda Boyce
<b>12:50 – 14:00</b>		<b>LUNCH / POSTER DISPLAY</b>
14:00 – 14:45	<b>Nora Rubinstein</b> <i>(Keynote Speaker)</i>	Porphyry Cu-Au mineral systems in Argentina - the next exploration frontier!
14:45 – 15:10	Walter Witt	The remarkable/enigmatic Burns Cu-Au deposit: porphyry, IOCG and orogenic mineralization in one deposit?
15:10 – 15:35	Brian Tattitch	Can sulfur isotopes help us untangle the multi-stage processes that lead to high-grade porphyry copper ore formation?
15:35 – 16:00	Giulia Consuma	Apatite inclusions in zircon vs. matrix apatite: exploring the magmatic-hydrothermal volatile evolution of high-grade, hypogene porphyry copper deposits
<b>16:00 – 16:30</b>		<b>AFTERNOON TEA / POSTER DISPLAY</b>
16:30 – 16:35	Nigel Brand	Tornado micro-XRF technique - the lab of the future
16:35 – 17:00	Weronika Gorozzyk	What modelling can bring to understanding of Proterozoic basins?
17:00 – 17:25	Mark Jessell/ Leonardo Portes	Combining feature engineering with machine learning to extract geological histories from geophysical datasets
17:25 – 17:35	Steffen Hagemann	Closing Remarks
<b>17:35 – 19:00</b>		<b>SUNDOWNER</b>

# 2023 CET Members' Day Program

# Centre for Exploration Targeting



# CET Organisation Structure





# Senior Researchers Leader

## Senior Researchers Leader

### CET Director



Steffen Hagemann



Mark Jessell



Mike Dentith



Pietro Guj



Tony Kemp



Nico Thébaud



Weronika Gorczyk



Chris Fisher

### CET Deputy Director



Marco Fiorentini

### Professional staffs



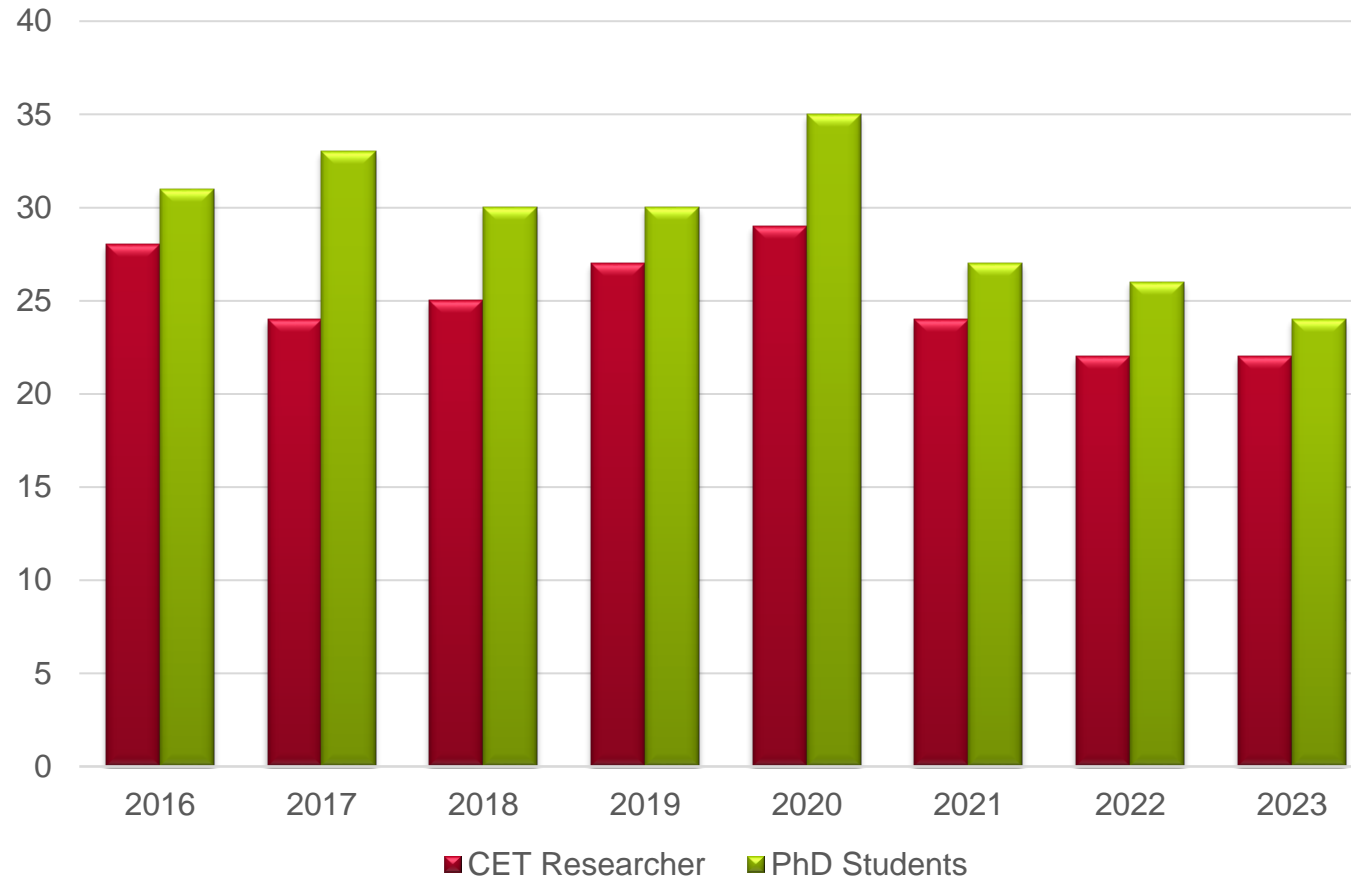
Keng Chai Ng



Mehak Madan

# Centre for Exploration Targeting

## CET Team



**World recognised leader in mineral exploration geoscience**

**22 Researchers (6 tenured researchers); Year 2023 – 2 new researchers**

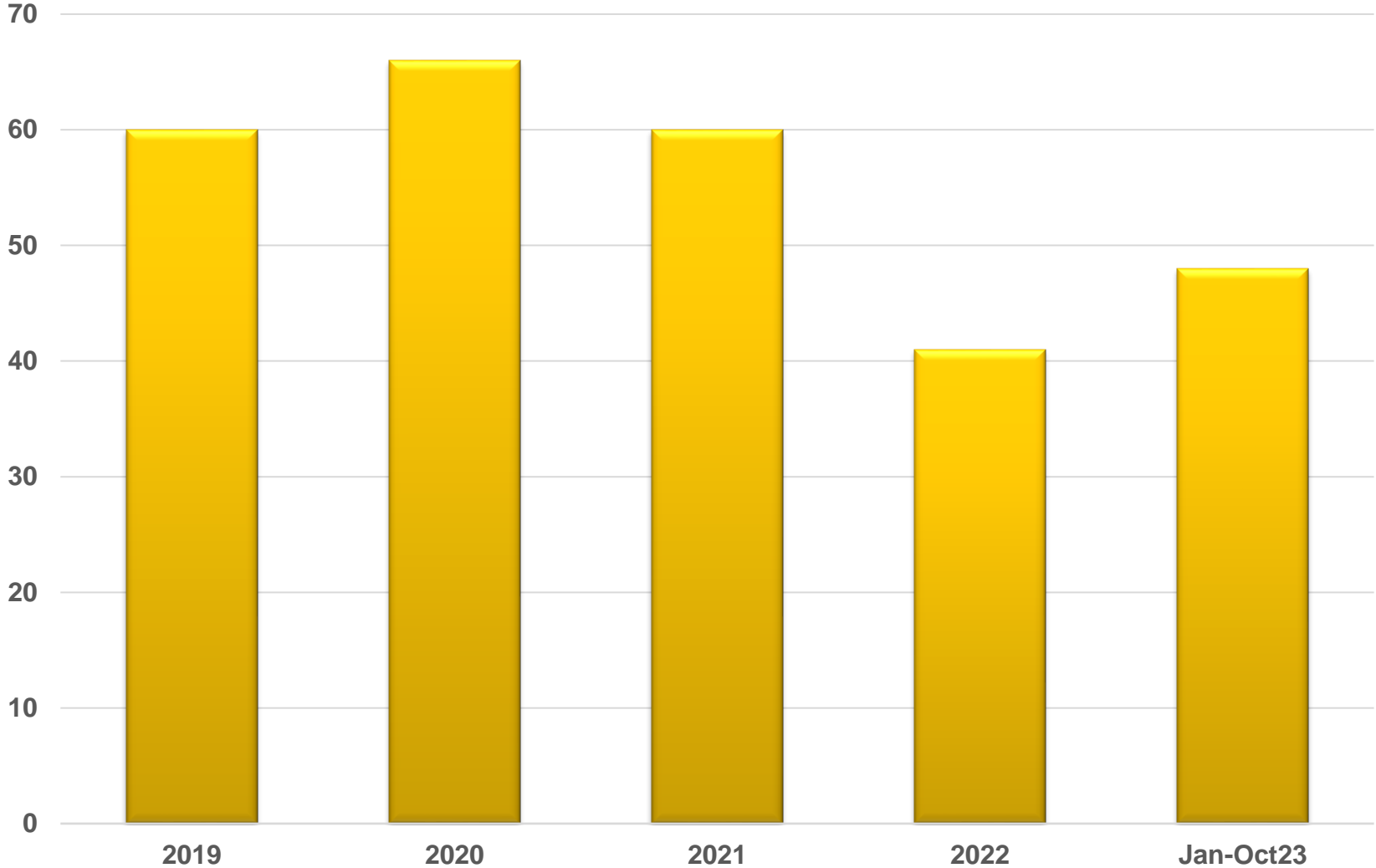
**24 PhD's (all scholarship-winning); Year 2023 – 4 new PhD's**

**33 Adjuncts, mostly in end-user organisations**

# Centre for Exploration Targeting



## Academic Performance: Publications



# CET Members

## Strong engagement through all industry sectors

Major Producers  
(13)

\$12k/member



Emerging  
Producers (8)

\$6k/member



Junior Explorers  
(15)

\$3.5k/member





# CET Members

## Individual Members (14)

\$450-\$100/member

Andrew Browne  
Bowen Mi  
Dr Atul Chandra  
Matthew Wheeler

Nick Franey  
Paull Parker  
Stephen Turner  
Wally Witt

Juhani Ojala  
Jonathan Munnikhuis  
Marcus Sweetapple

Jim Ross (Life Member)  
Cam McCuaig (Life Member)  
Peter Buck (Life Member)

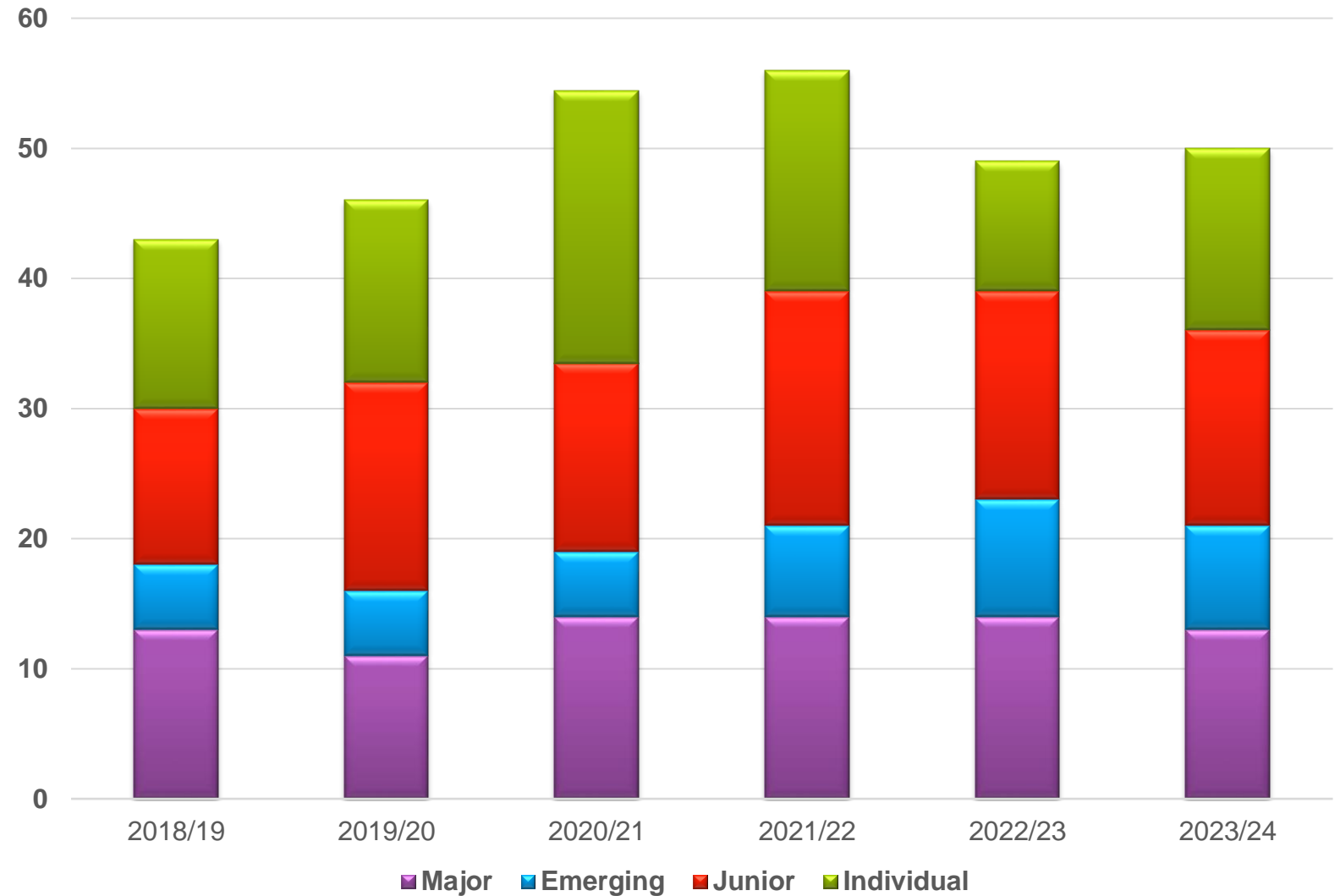
## Sponsors in Kind (8)



TIM  
CRASKE

# Centre for Exploration Targeting

## CET Membership



# Centre for Exploration Targeting

## 7 Flagship Initiatives



**\$2.0m**

BHP – Mineral Messengers and Chemical triggers – Marco Fiorentini, Anthony Kemp & Steffen Hagemann



**\$3.1m**

Loop Consortium: Open source 3D regional geological modelling platform  
MinEx CRC – Project 6 – 3D drilling for Discovery - Mark Jessell



**\$1.8m**

South American eXploration initiative (SAXI) – Mark Jessell



Australian Government  
Australian Research Council

**\$2.0m**

ARC Linkage – Evolution of Proterozoic multistage rift basins – Weronika Gorczyk



Australian Government  
Australian Research Council

**\$1.0m**

ARC Linkage – Experimental constraints on the genesis of gold-rich ore deposits  
– Marco Fiorentini



Australian Government  
Australian Research Council

**\$1.7m**

ARC Linkage - Defining the multi-scale controls on high-grade gold mineralisation – Nicolas Thebaud



**\$2.8m**

West African Exploration Initiative (WAXI) Stage 4 – Mark Jessell

# Centre for Exploration Targeting

## 20 Fundamental Science and Bread & Butter Projects



### 20 Fundamental Science and 'Bread & Butter' Project with a total revenue of \$3.9 million



**BHP**



**Teck**

**Newmont**



**CORE  
LITHIUM**



**CEANA  
LITHIUM**

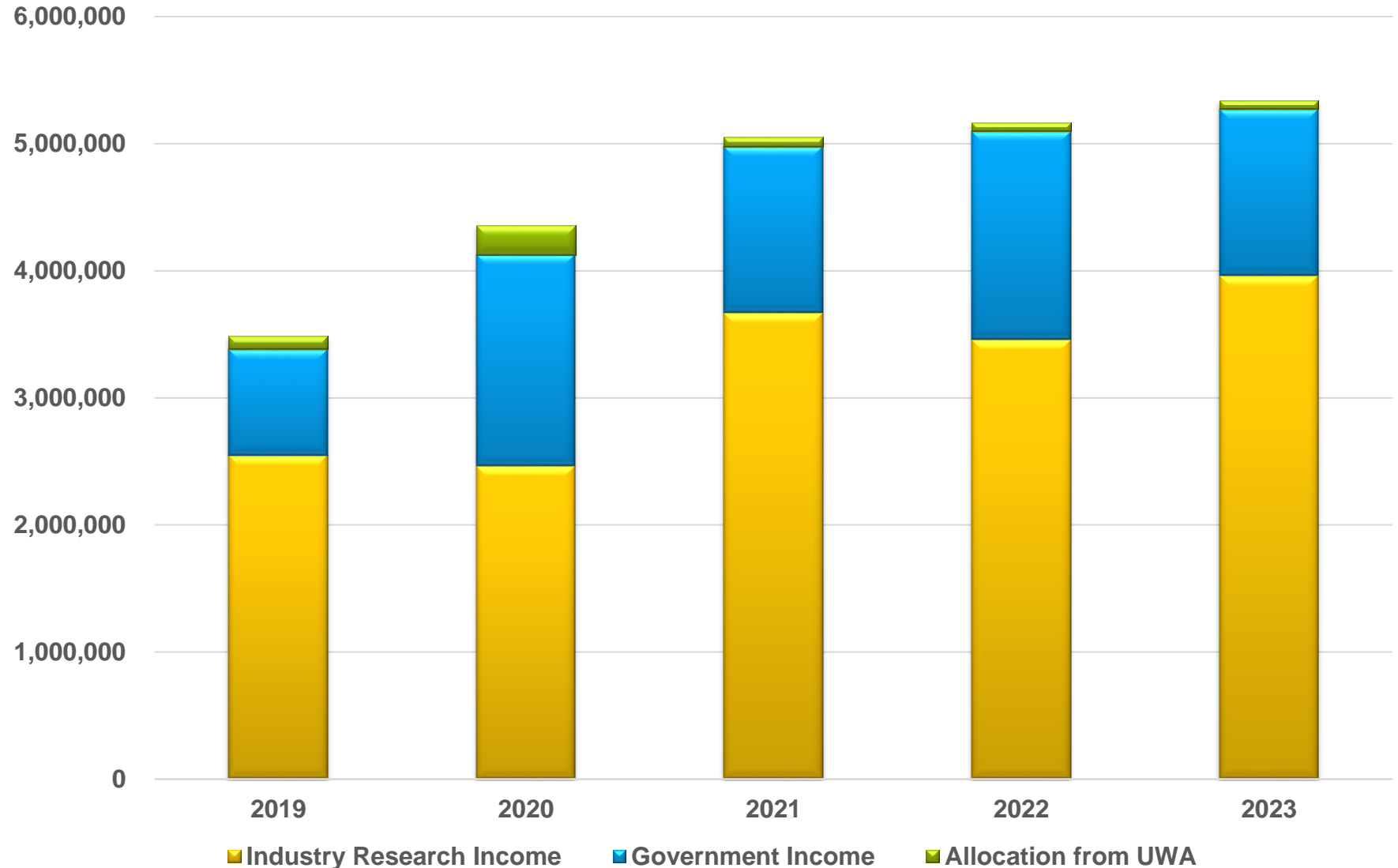


# Centre for Exploration Targeting

## CET Financials

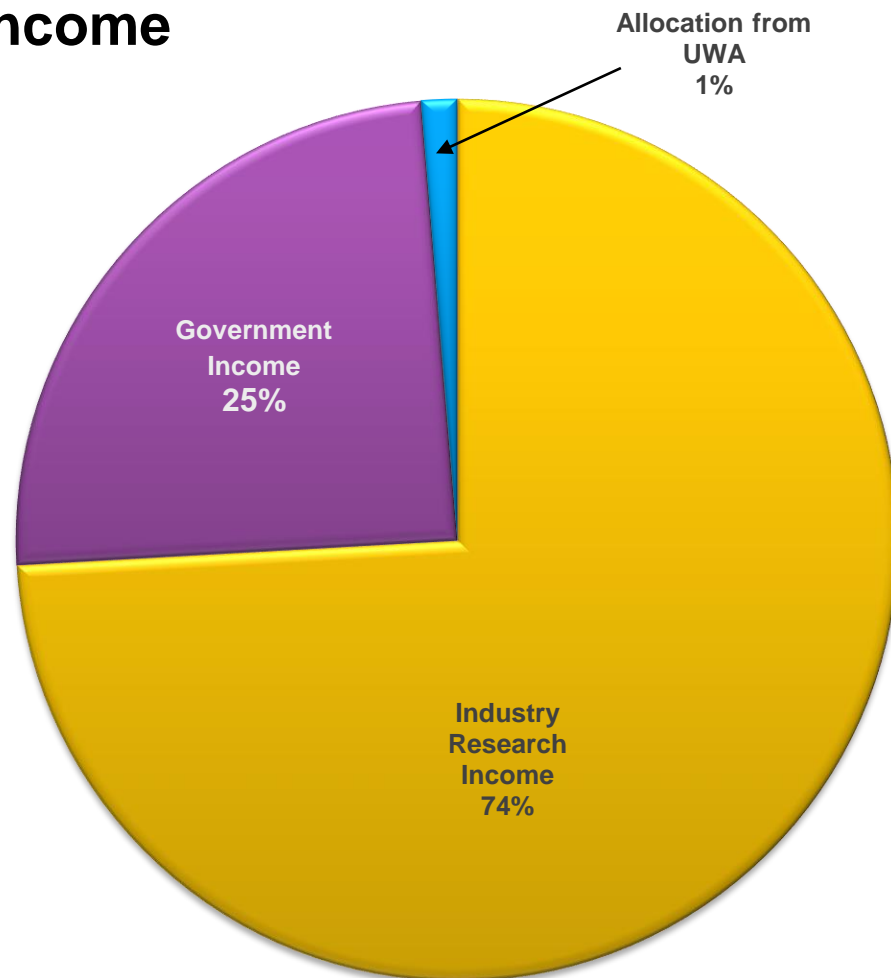
Last 5 years

\$23.4M in  
total research  
revenue

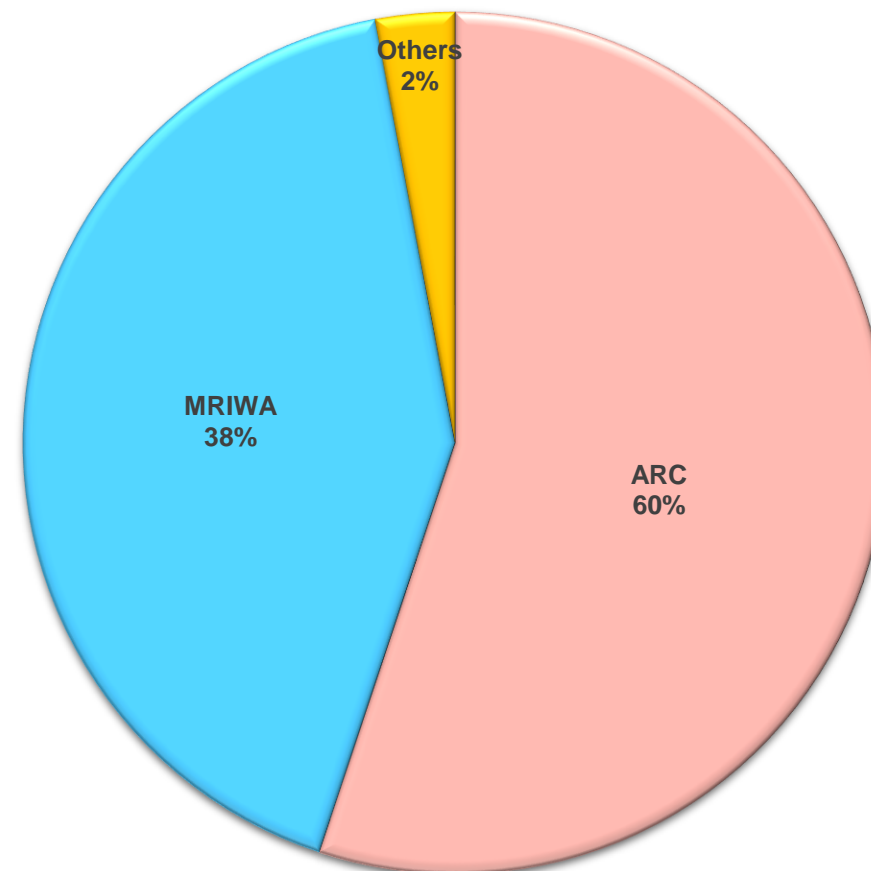


# Research Income – Funding Sources

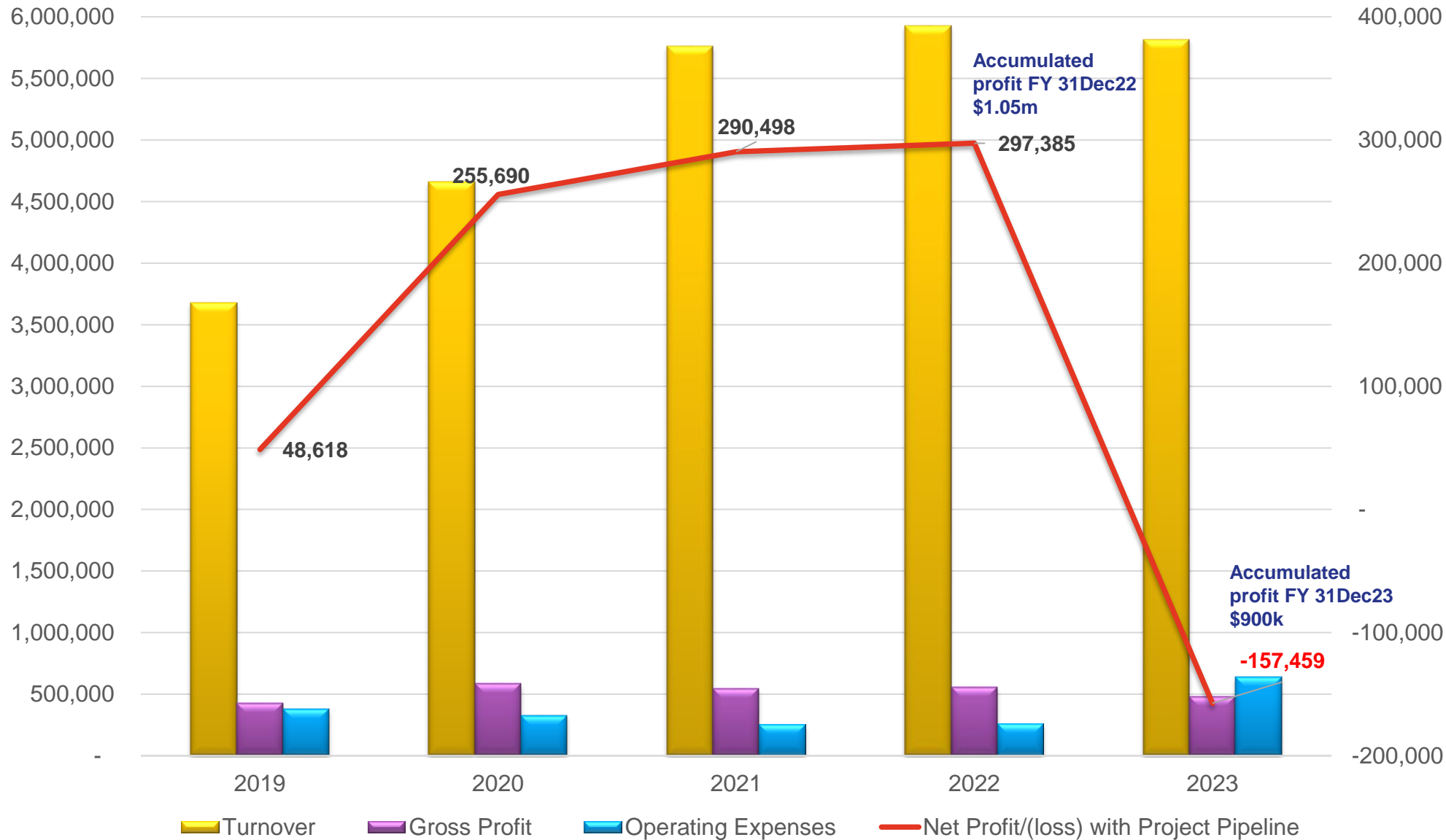
## FY 2023 – Total Research Income



## Breakdown of Government Research Income



# Turnover - > \$24 Mil in past 5 years



**Budgeted loss in year 2023 due to 2 CET sponsored postdoctoral salaries \$350k**

## Industry engagement is pivotal to the success of CET

### Strategic Advisory Board (8 members)

Steve Beresford(Chair)-	Consultant
Cam McCuaig	- BHP
Will Robinson	- Encounter Resources Ltd
Chris Wijns	- First Quantum Minerals Ltd
Simon Johnson	- GSWA
Deb Lord	- VRM
Annette George	- UWA
Steffen Hagemann	- CET Director

### Technical Working Group (22 members)

Chris Wijns (Chair)	- First Quantum Minerals
Mark Doyle	- AngloGold Ashanti
Asmita Mahanta	- BHP
Howard Golden	- Boromo Gold
Yulia Uvarova	- CSIRO
Lisa Vella	- FMG
Ed Baltis	- GenGold
Gary Snow	- GoldFields
Paul Polito	- IGO
Dave Lawie	- Index
Mark Miller	- Newcrest
Philippa Sivwright	- Newmont
Jamie Rogers	- Northern Star
John Hart	- Rio Tinto
Steve Garwin	- SolGold
Fiona Best	- South 32
Nick Hayward	- Teck Resources
Barry Bourne	- Terra Resources
Jon Hronsky	- Western Mining Services
Klaus Gessner	- GSWA
Simon Johnson	- GSWA
Tim Craske	- Geowisdom
Steffen Hagemann	- CET Director



## Awards & Achievements 2023

- **CET PhD students:** Student Industry Night – PhD's did great job at organising this event at UWA. It was a great success!!
- MinEx CRC Best paper award - Mark D Lindsay, Agnieszka M. Piechocka, **Mark W Jessell**, Richard Scalzo, Jeremie Giraud, **Guillaume Pirot**, Edward Cripps - Geoscience Frontiers, Volume 13, Issue 6, 2022
- **Alex Eves:** 2023 MRIWA Odwyn Jones PhD Scholarship and also a John Glover Research Support Grant
- **Jerry Dunga:** SEG Student grant for PhD work on Ok Tedi – New York breccia pipe
- **Maria Cherdantseva:** Best student presentation award at SEG (London) and International Platinum Symposium (Cardiff)
- **Steffen Hagemann:** Invited Keynote Speaker at FEME – Fennoscandian Exploration and Mining Conference in Levi, Finland

## Awards & Achievements 2023

- **Nico Thebaud:** Keynote at the SGA conference (Zuerich); Big Day Out GSWA (Kalgoorlie); Society of Resource Geology meeting (Japan); SEG student chapter of Akita University (Nov 2023)
- **Chris Fisher:** Target 2020 (Perth)
- **Tony Kemp:** Keynote at the Australian Earth Science Convention: Early growth of the Australian Continent from Hafnium and Neodymium Isotopes; Invited talk, MRIWA Net Zero Mining Conference: 'Future Geoscience Training initiatives for the WA Critical Minerals sector'; Invited talk, WA Government Department of Health research skills seminar series: 'Scientific writing - practical tips'
- **John Grigson:** Invited talk Quebec Mines and Energy Conference: 'Terrane to district scale controls on lithium pegmatites in Western Australia'



# 2023 PROJECT HIGHLIGHTS

Marco Fiorentini

Pietro Guj

Mark Jessell

Chris Fisher

Weronika Gorczyk

Tony Kemp

Steffen Hagemann

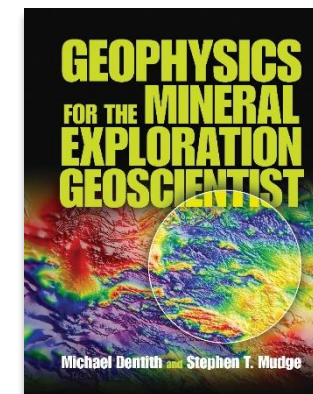
Nico Thebaud



## Targets, Maps and Mineral Systems: Geophysics in Modern Mineral Exploration

- Book and short course

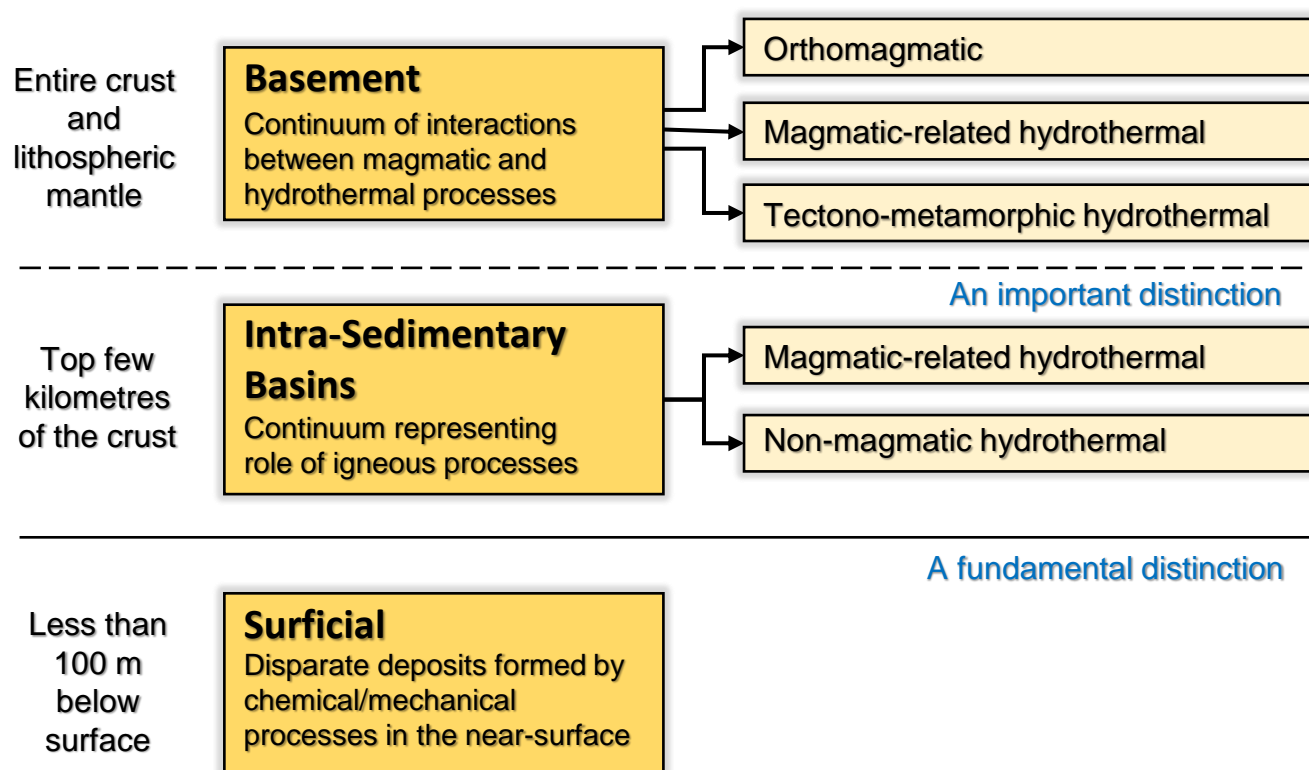
- Complement to *Geophysics for the Mineral Exploration Geoscientist*
- Nominal completion of book: end 2025 & Short course to be offered in late 2024?



### Criteria

- Depths at which mineral system operates - resolution, depth penetration (and cost) are crucial considerations in deploying geophysical methods
- Difference in using geophysical methods in relatively uniform, undeformed layered and weakly magnetised (basin) sequences versus more complex basement or cover geology

### A Geophysical Classification of Mineral Systems



### Contents

- A geophysical classification of mineral systems
- Petrophysical Consequences of Mineral System Processes
- Geophysical Characteristics of Mineral System Elements - Lithospheric to Terrain Scale
- Geophysical Characteristics of Mineral System Elements - District Scale
- Geophysical signatures of selected mineral systems



**MARK JESSELL**

**SAXI**

**South American Exploration Initiative**



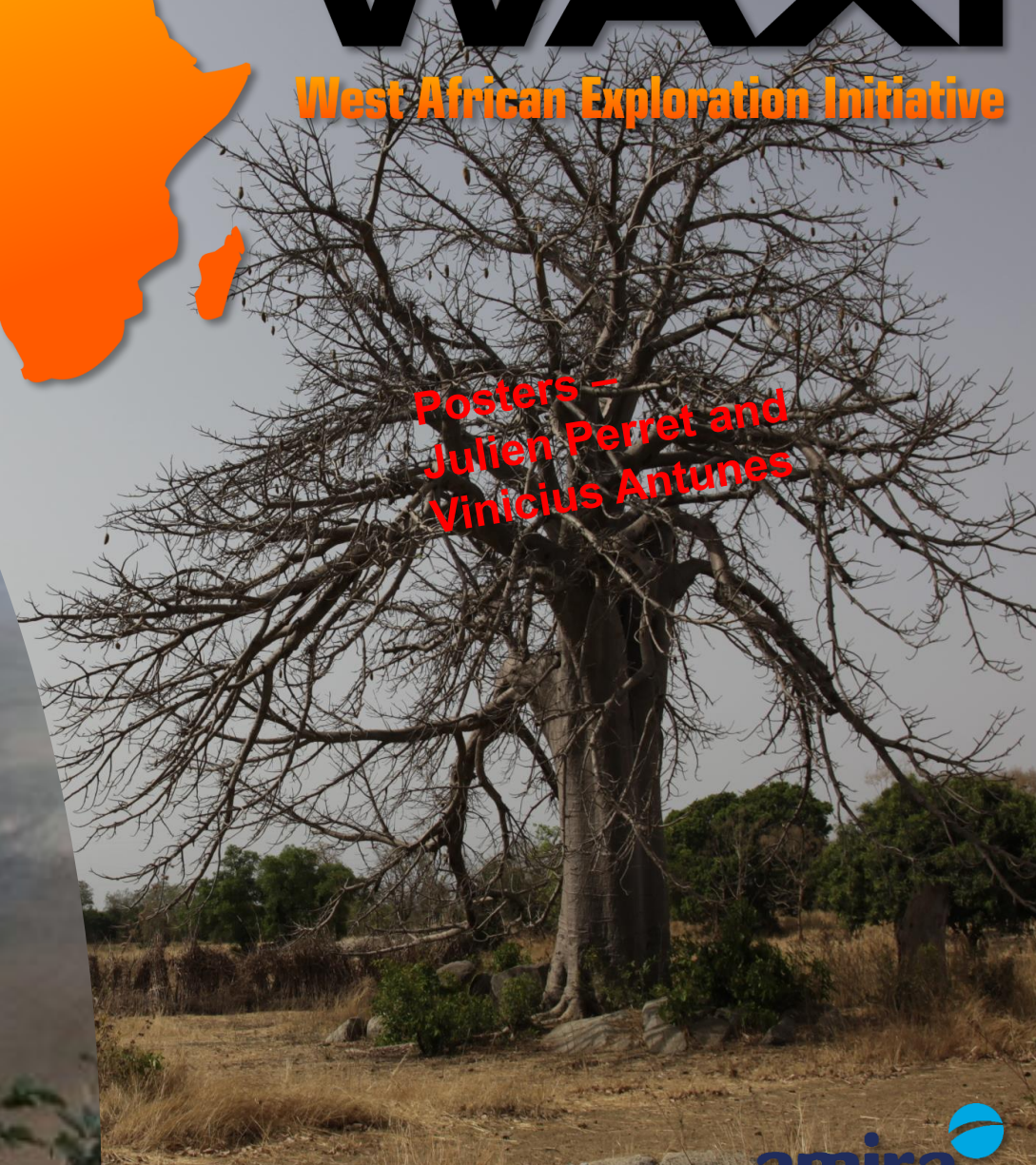
Final Meeting Stage 2  
April 2024



**WAXI**

**West African Exploration Initiative**

Posters –  
Julien Perret and  
Vinicius Antunes

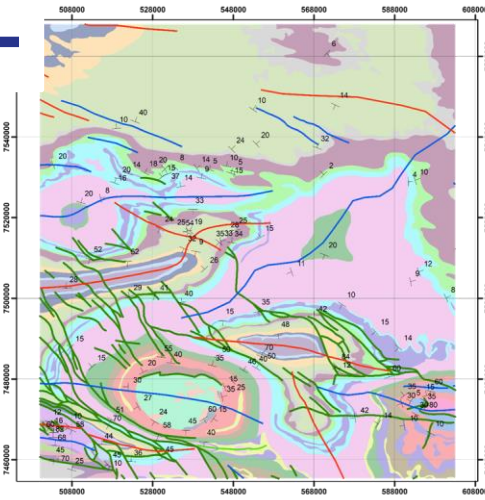




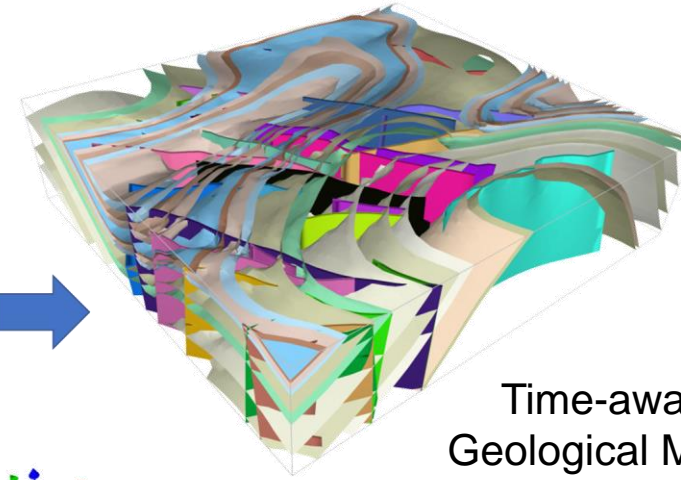
# MARK JESSELL

Posters:

Guillaume Pirot  
 Vitaliy Ogarko  
 Nuwan Suriyaarachchi  
 Ozgur Yedek  
 Kubra Akbulut



map2loop

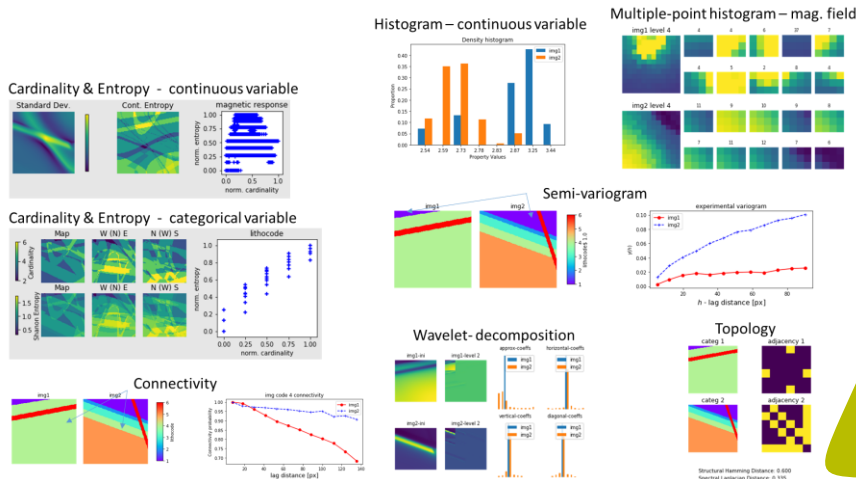


LoopStructural

Time-aware  
 Geological Model  
 Builder :  
*LoopStructural*



Uncertainty Analysis:  
*Uncertainty Indicators*



Geological  
 Knowledge  
 Manager

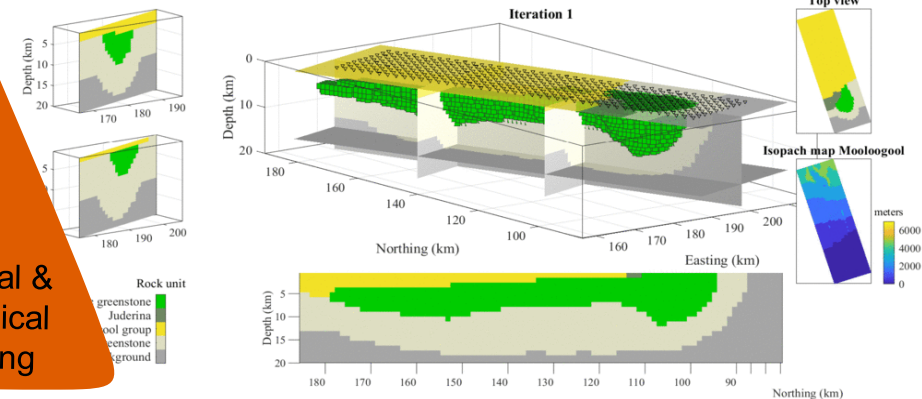


Uncertainty  
 Mapping &  
 Risk Mitigation

Geological &  
 Geophysical  
 Modelling

Geophysical Inversion

:  
*Tomofast-x*



## ARC Linkage Proposal in development

**CRATon ChrONicles: Exploring the Paleogeographic Relationship of Major Mineral-Bearing Proterozoic Cratons (CRATON)**

The *CRATON* project will focus on West African, Amazonian and Northern Australian Cratons and federates 7 active or recently completed Australian and international partnerships:

1. *WAXI* (Jessell; CET/SES/UWA; AMIRA Global)
2. *SAXI* (Jessell; CET/SES/UWA; AMIRA Global)
3. *Evolution of Proterozoic multistage rift basins – key to mineral systems* (Gorczyk; CET/SES/UWA; *ARC Linkage*)
4. *Unravelling the first Babbles of the Earth Inner Core History* (Antonio; U Oslo; EU ERC Starting Grant)
5. *Unlocking Earth's inner secrets in deep time using palaeointensities* (Li; Curtin; ARC Discovery)
6. *Earth's mid-life crisis: recipe for a habitable planet?* (Merdith; U Adelaide; ARC DECRA)
7. *Linking the deep carbon cycle with critical mineral deposits using a geochemical perspective* (Doucet; Curtin; ARC Future Fellowship)



World Bank support to the Saudi Arabian Ministry for Industry and Mineral Resources. Contribution to the **drafting and review on the new Mining Investment Law and related Implementing Regulations**. Support to improvements to their compliance and related administrative systems



Support to the Central Land Council to **facilitate negotiations for a number of Indigenous Land Use Agreements (ILUAs)** on behalf of the local traditional owners



**Research project: 'Mine closure guidance:** Review and comparative analysis' of international, national and states mine closure documents in support of the formulation of new mine closure guidance for the NT



In cooperation with the University of Queensland and Curtin University **organise and deliver residential training in 'Mining Governance'** to a delegation of 25 mid-career officers from 18 African jurisdiction under the auspices of the Australia Awards Africa program

ARC linkage - LP200200897



Beta Hunt high grade gold mineralisation

### Deposits investigated:

Fosterville (Victoria), Callie (NT), Jundee (WA) and Beta Hunt (WA).

### UWA Team:

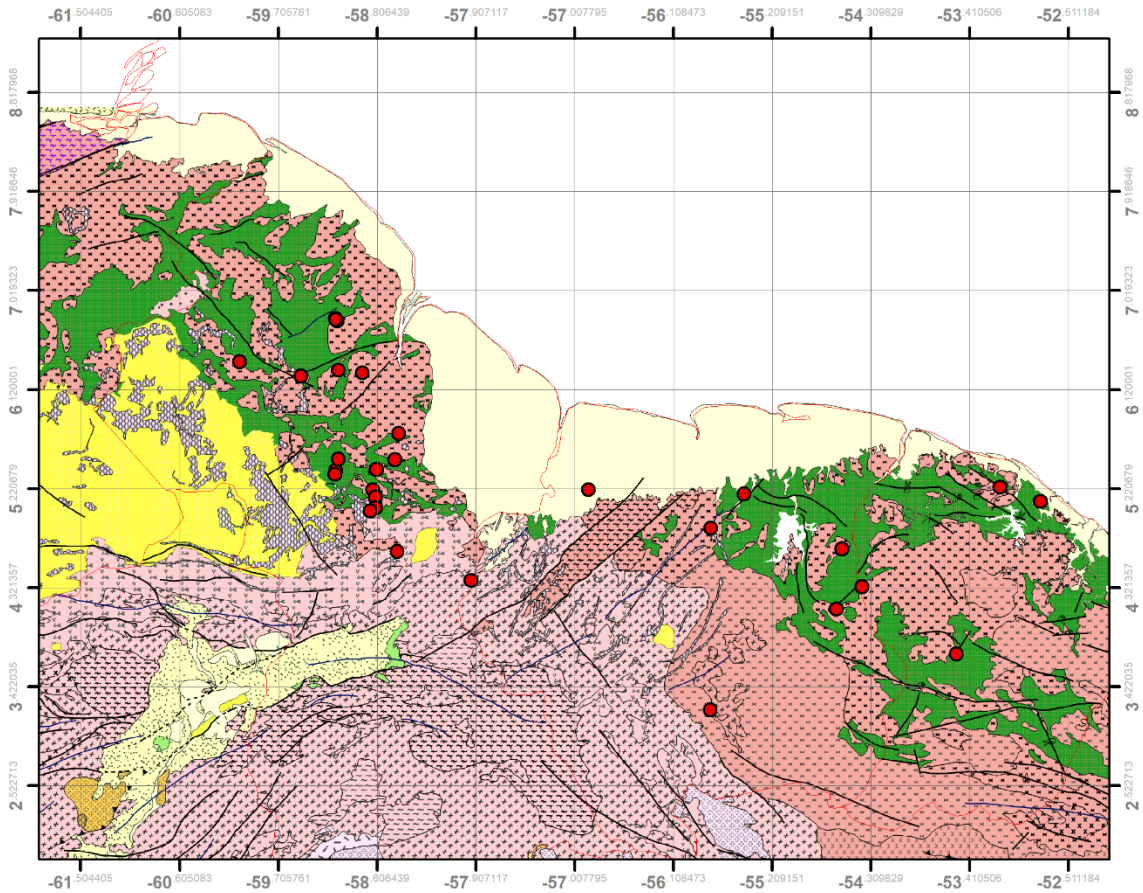
- Postdoc Laura Petrella
- Laure Martin
  
- PhD candidate Lauri Virnes **Speed talk & Poster**
- PhD candidate Andrew Crawford **Talk**
- PhD Sumail (Yilgarn 2020 - MRIWA) **Talk**



# Nico Thébaud, Mike Tedeschi, Chris Fisher, Bob Loucks, Paul Mason, Mark Jessell



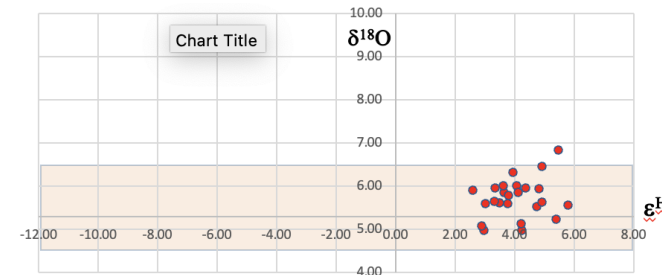
## Module 2: Magmatic evolution and petrogenesis



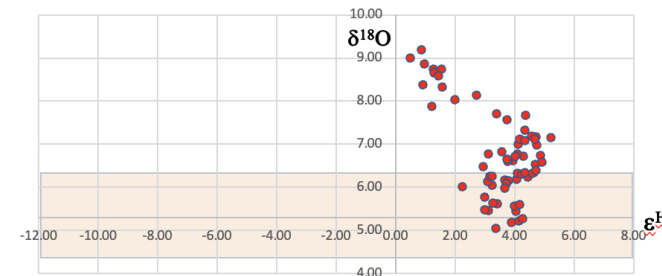
Sample distribution of samples analysed during SAXI2

Allows for a detailed review of the **crustal growth processes and associated lithospheric architecture** of the Guyana Shield.

$\delta^{18}\text{O}$  vs  $\epsilon_{\text{Hf}}$  data Tedeschi PhD (2200 - 2120 Ma)



$\delta^{18}\text{O}$  vs  $\epsilon_{\text{Hf}}$  data Tedeschi PhD (< 2120 Ma)

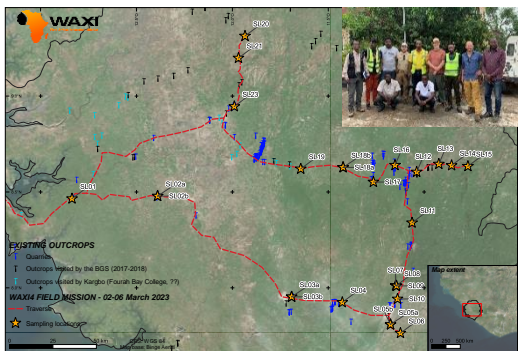
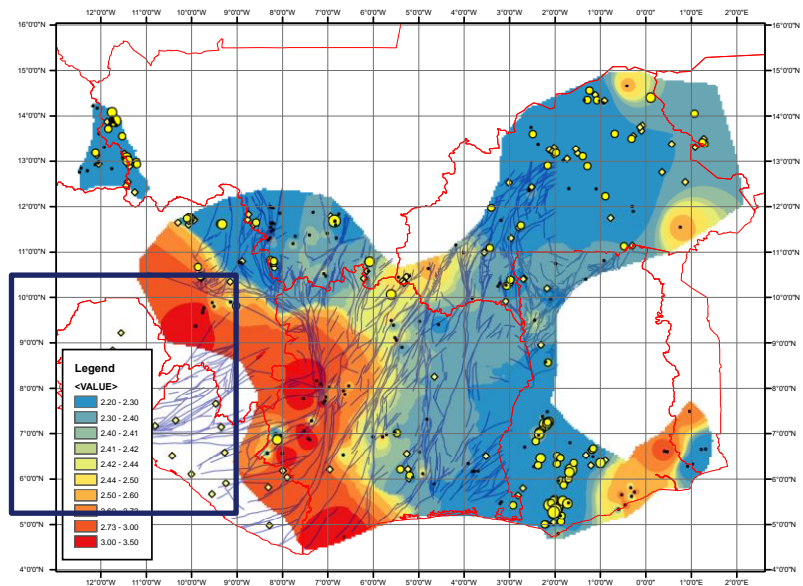


Work completed to date:

- U-Pb: 30
- Lu/Hf: 30
- O isotopic data: 32
- In situ trace elements: 39

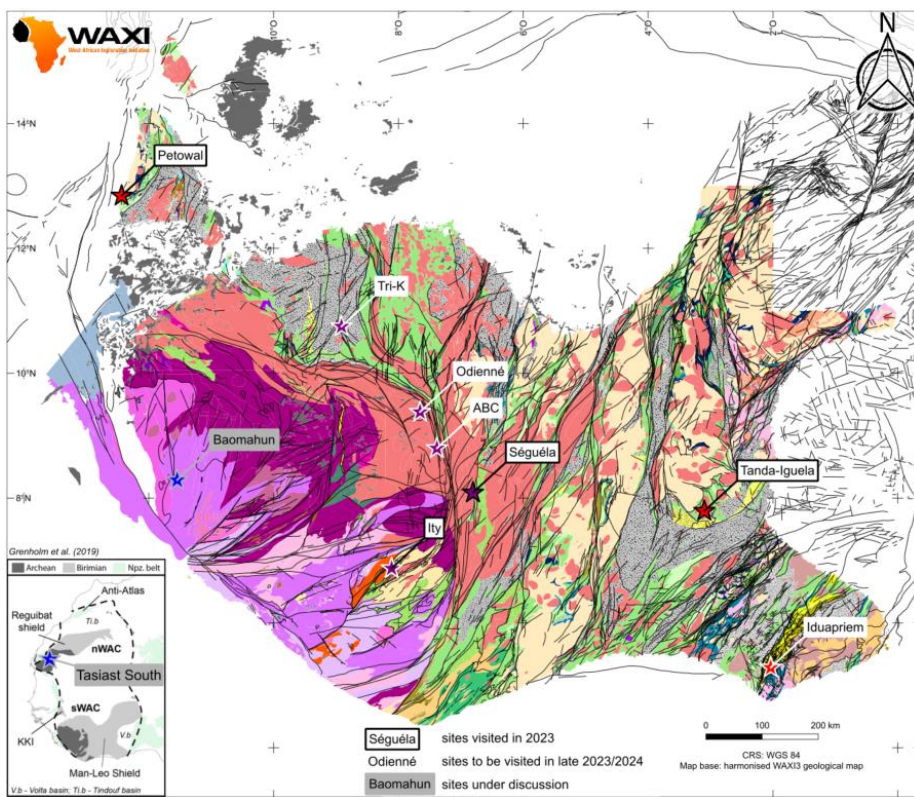


## Module 1.1 Archean crustal growth and lithospheric architecture



Initial regional traverse in Sierra Leone for geochemical, radiogenic and stable isotopes.

## Module 3.0 Gold mineral system and structural architecture



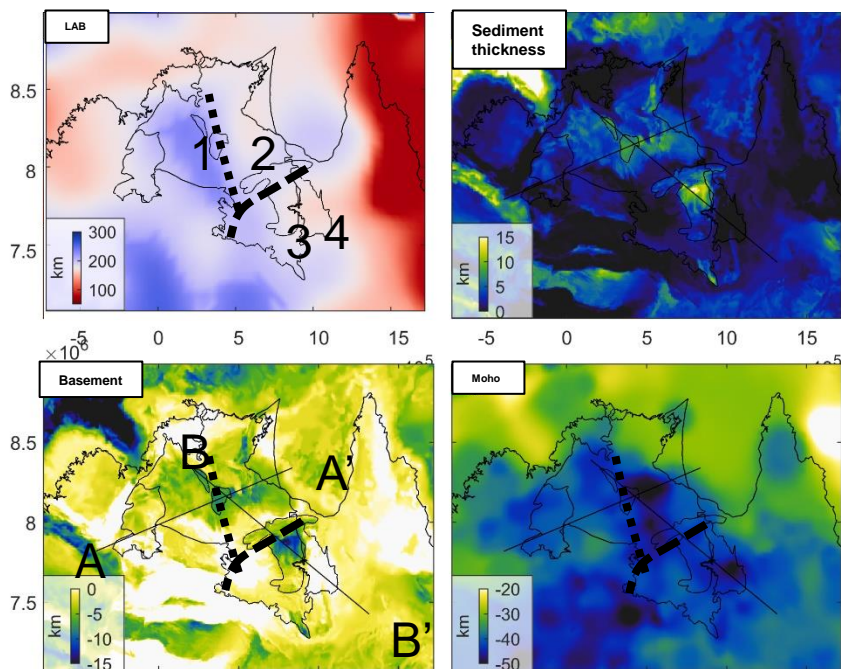
**New team member Dr Julien Perret (Poster on his previous research)**

Four deposit visited over the past 8 months across the West African Craton

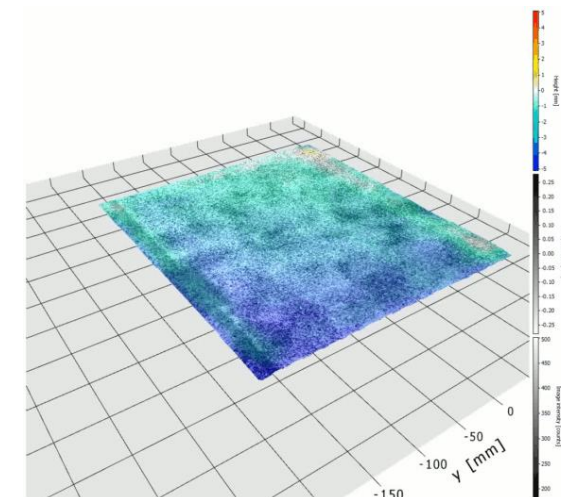
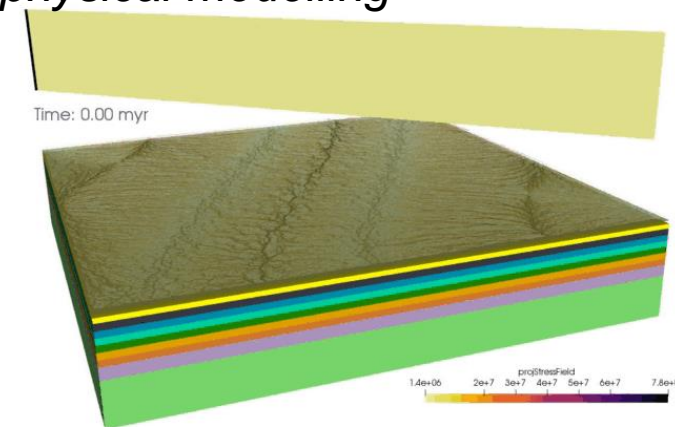
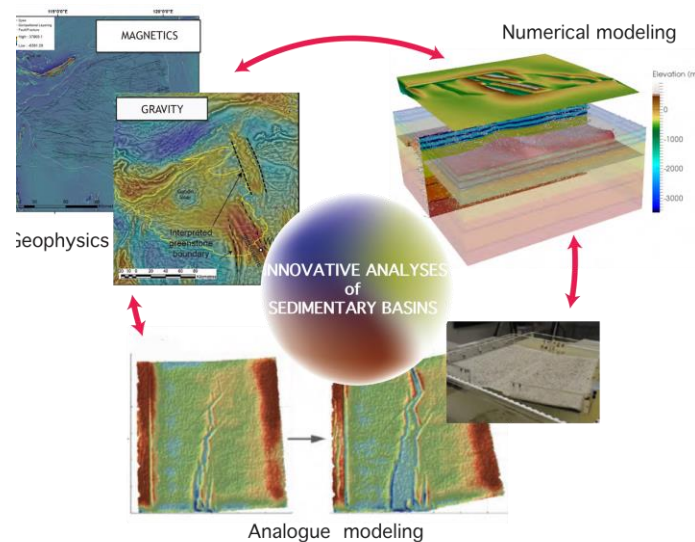


## ARC Linkage/MRIWA M554 – Evolution of Proterozoic multistage rift basins

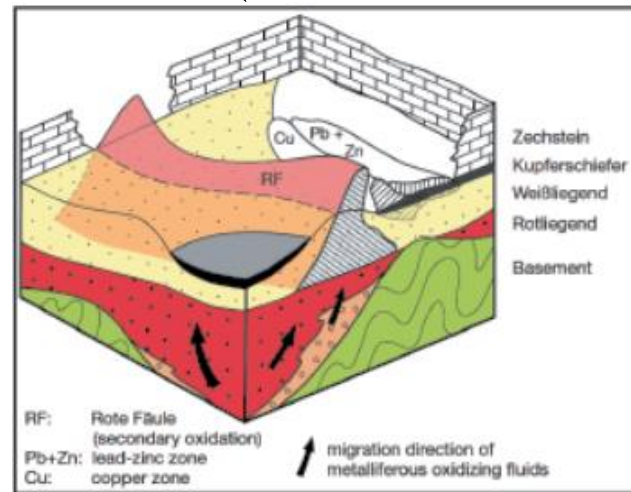
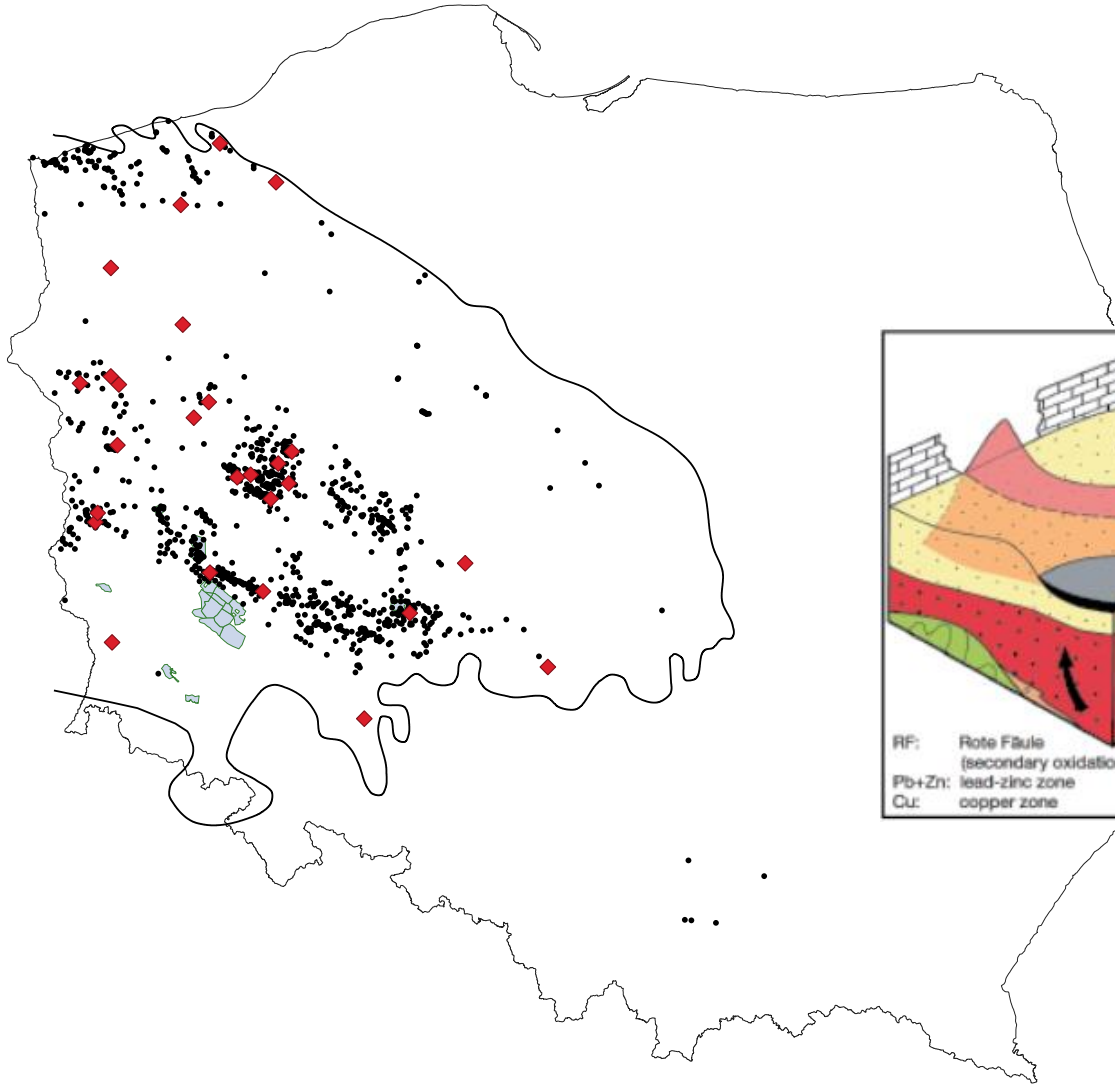
*A new quantitative and integrated exploratory framework for the mineral industry in Australia's frontier sedimentary basins by integrating the latest advances in laboratory experimental tectonics together with thermo-mechanical numerical, surface process and geophysical modelling*



**Talk: 16:35**



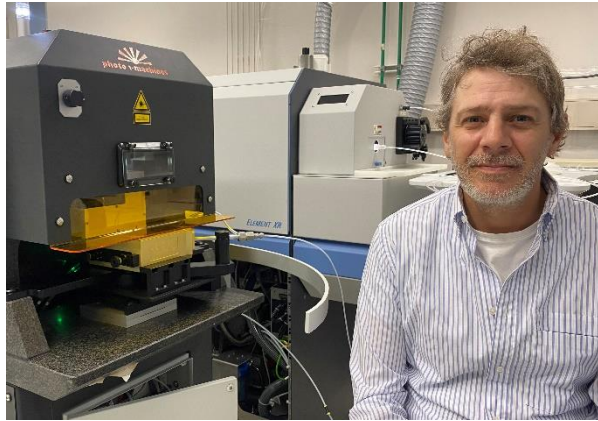
*Developing exploration workflows for the exploration of sediment-hosted stratiform copper-rich mineral systems utilising a holistic Mineral/Petroleum Systems Approach*



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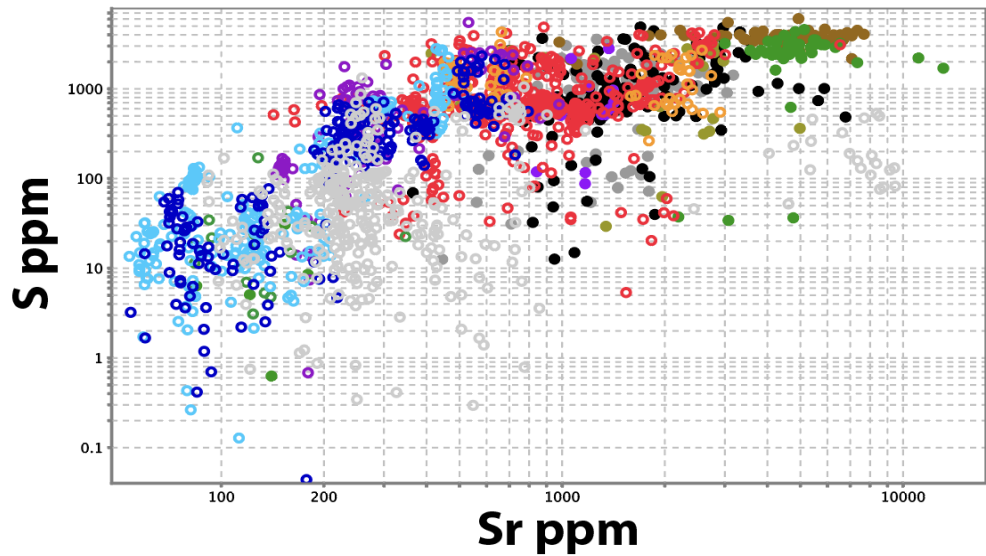
## Coordinating CET students and researcher's LA-ICPMS work



- **MRIWA** Yilgarn 2020
- South American Exploration Initiative (**SAXI**)
- West African Exploration Initiative (**WAXI**)
- Sr and Ca isotope study of Early Earth (Matilda Boyce)
- Role of volatiles in metal transport (Maria Cherdantseva)
- Origin of the Burn Intrusion (Wally Witt)
- The Youanmi - SW Terrane boundary (Cat Gill)
- Taca Taca porphyry Cu deposit (Madeleine Ince)
- Oberon deposit - Tanami (Andrew Crawford)
- Rare metal pegmatites (John Grigson, honors students)
- **Ongoing GSWA collaboration** - apatite across the Yilgarn
- ...several others



# CHRIS FISHER - Mineral Fertility

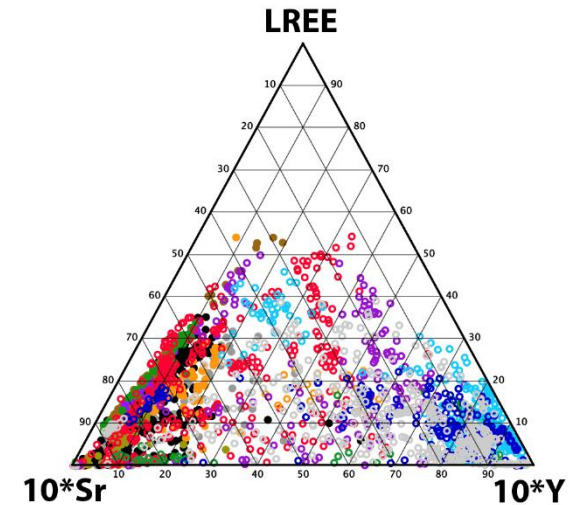


## Barren suite

- Sanukitoid
- Diorite
- High Ca granite
- Low Ca granite
- High-HFSE granite
- Syenites
- Lamprophyre

## Fertile suites

- Golden Mile (McDivitt)
- Burns Intrusion
- Carosue Dam
- Black Flag volcanics
- Wallaby Mine
- Porphyry Mine
- Jupiter Mine

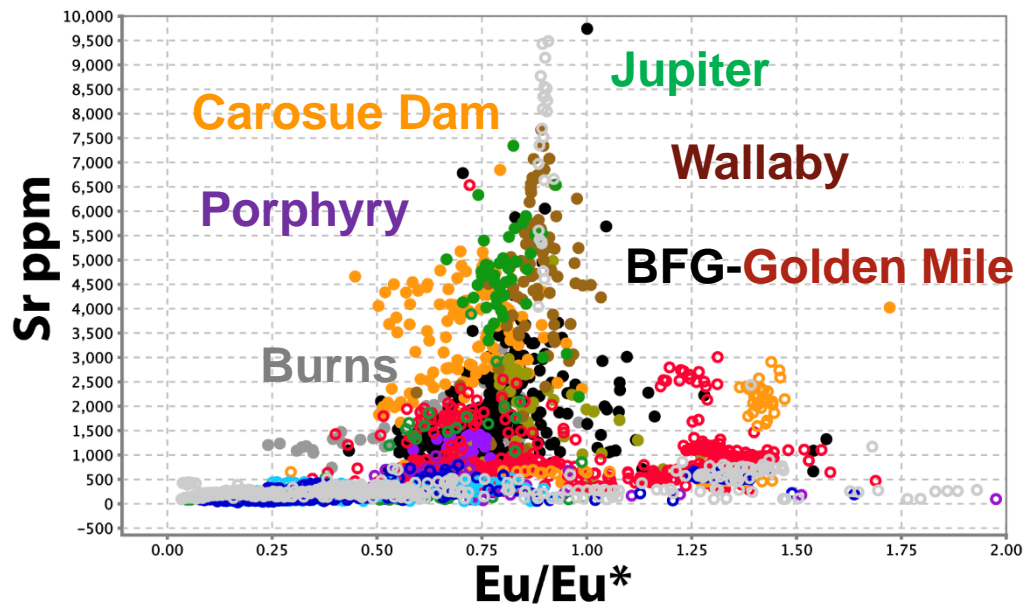


## Fertile apatite:

- High Sr (>1000 ppm)
- High S (300-4000 ppm)
- small Eu/Eu\* (higher than 0.5)
- plagioclase suppression in a hydrous and oxidized magma

**SEE POSTER!!!!**

**Analytical methods available to CET Members**



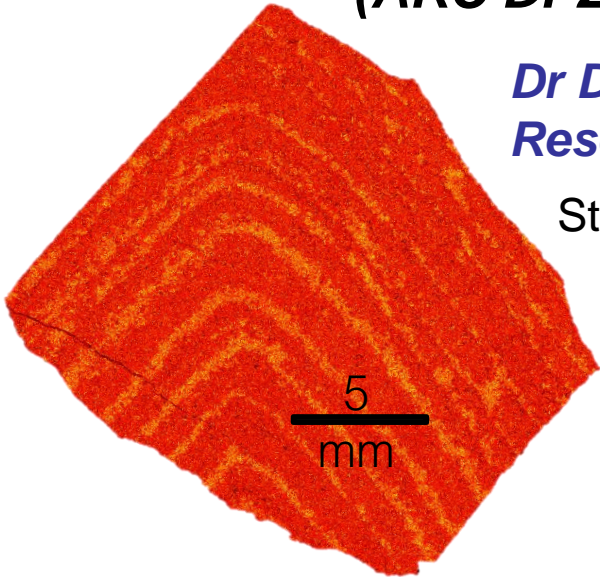
# Tony Kemp & research team

## - Ancient crust

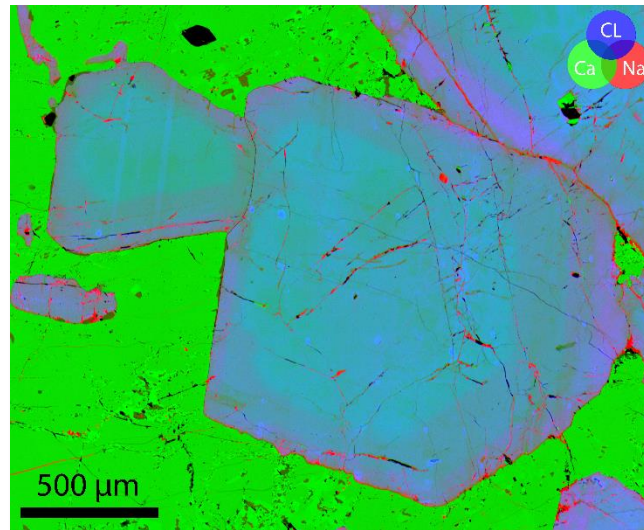
### Ancient crust-mantle-seawater evolution (ARC DP200103208)

*Dr Dan Bevan,  
Research fellow (2022-)*

Strelley Pool Stromatolite  
– Mn K $\alpha$  Map



Plagioclase EPMA



*Matilda Boyce* **Speed talk &  
PhD (2021-)** **POSTER**



ELSEVIER



A linked evolution for granite-greenstone terranes of the Pilbara Craton from Nd and Hf isotopes, with implications for Archean continental growth

Anthony I.S. Kemp<sup>a,\*</sup>, Jeffrey D. Vervoort<sup>b</sup>, Andreas Petersson<sup>c</sup>, R. Hugh Smithies<sup>d,e</sup>, Yongjun Lu<sup>a,d</sup>



nature communications



Article


<https://doi.org/10.1038/s41467-022-35208-2>

## Greenstone burial–exhumation cycles at the late Archean transition to plate tectonics

Received: 5 January 2022

Accepted: 23 November 2022

Published online: 22 December 2022

 Check for updates

Zibra Ivan<sup>1,2</sup>✉, Kemp Anthony I S<sup>3</sup>, Smithies R Hugh<sup>1,4</sup>, Rubatto Daniela<sup>5,6</sup>, Korhonen Fawna<sup>1</sup>, Hammerli Johannes<sup>3,6</sup>, Johnson Tim E<sup>4</sup>, Gessner Klaus<sup>1</sup>, Weinberg Roberto F<sup>2</sup>, Vervoort Jeff D<sup>7</sup>, Martin Laure<sup>8</sup> & Romano Sandra S<sup>1,3</sup>



Australian Government  
Australian Research Council



Geological Survey of  
Western Australia



# Tony Kemp & research team

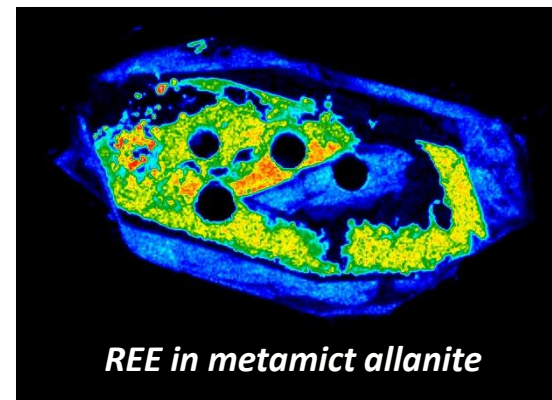
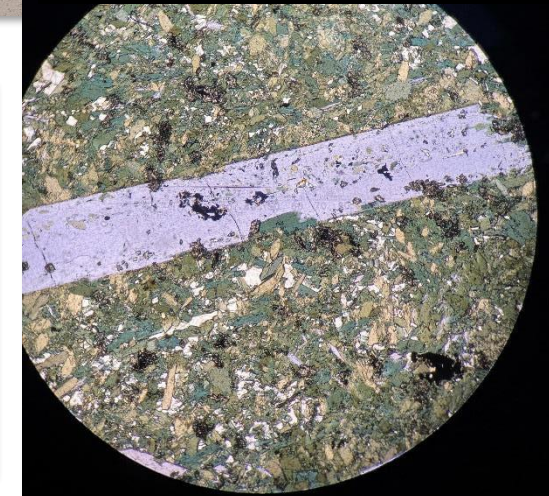
## - Critical Minerals

- Jack Stirling (Research Fellow) *North Arunta Pegmatite Province* (Australasian Metals Ltd) **NEW IN 2023**
- John Grigson (PhD) *Genesis of giant rare metal pegmatites in the Pilbara Craton* (Pilbara Minerals)
- Alistair Ryan (MSc) *Tantalum mineralogy and deportment in pegmatites at Pilgangoora* (Pilbara Minerals)
- Leavania Vignesvaran (MSc) *Indicator mineral chemistry, Greenbushes pegmatite* (IGO)
- Seth Morris (Hons) *Alteration haloes around LCT pegmatites* (Mineral Resources)
- Eddie Havlat (Hons) *Mica and garnet chemistry, Forrestania pegmatites* (IGO)

ARC Industrial Transformation Training Centre  
in Critical Resources **NEW for 2024**



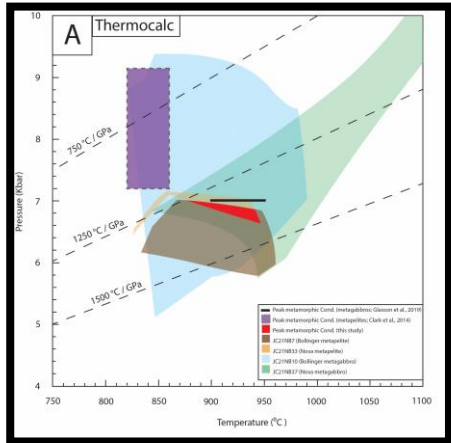
*Li-amphibole in amphibolite*



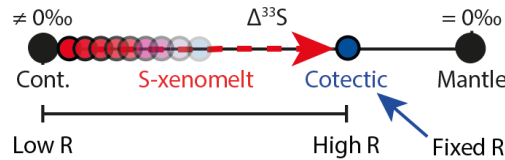
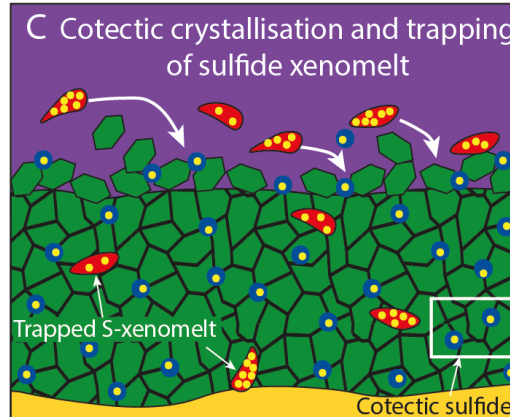
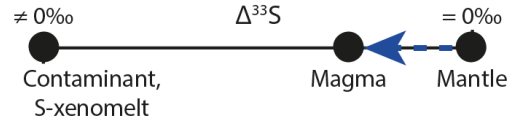
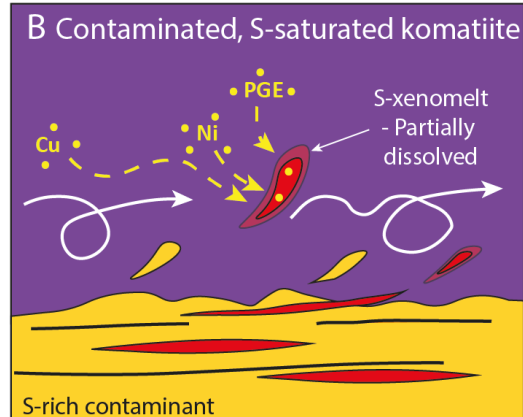
*REE in metamict allanite*



## Metal transport and volatiles in magmatic sulfide Ni-Cu-PGE systems

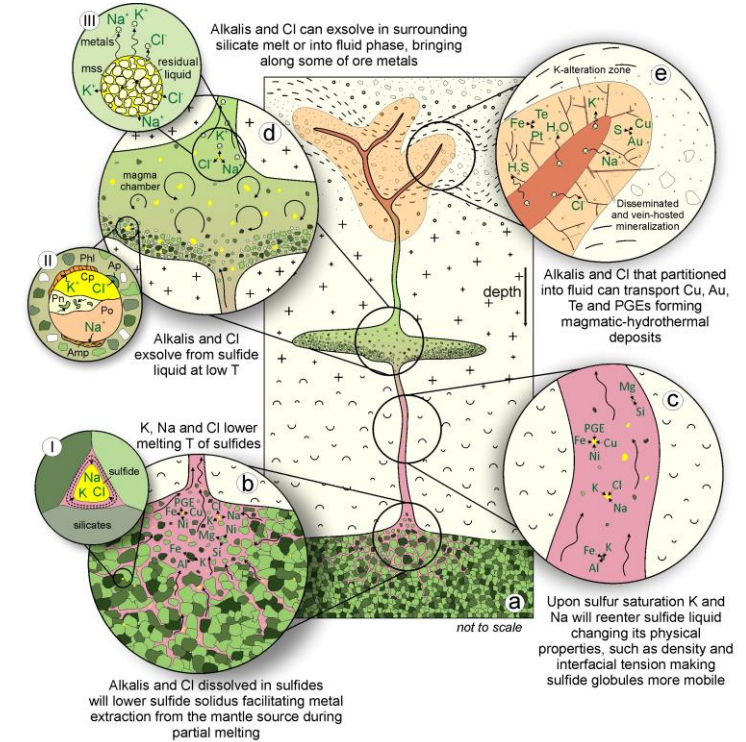


Chong et al. (in review)



Virnes et al. (2023)  
(Yilgarn 2020 - MRIWA project)

Anne Virnes talk



Cherdantseva et al. (in review)

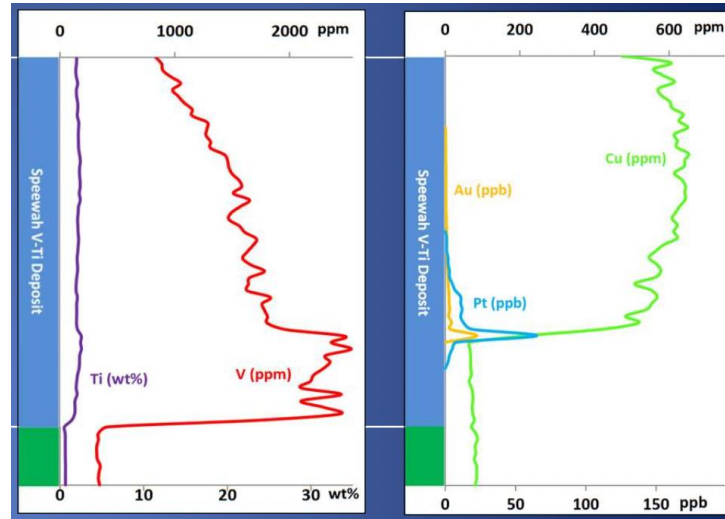
Maria Cherdantseva poster

# MARCO FIORENTINI

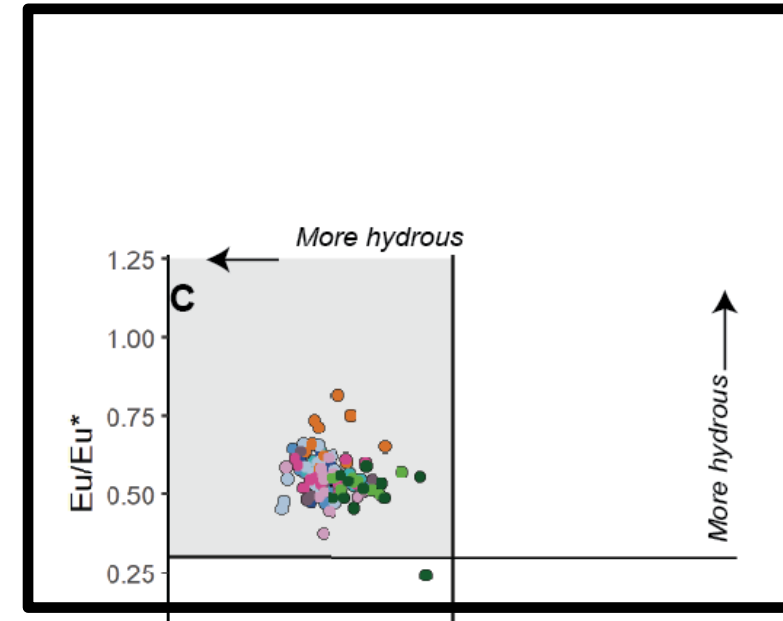
## Multi-scale fertility controls across mineral systems



Palozza et al. (in prep)



Eves et al. (in prep)



Ince et al. (2023)

Francesco Palozza poster

Alex Eves speed talk & poster

Madeleine Ince poster

# MARCO FIORENTINI

## Carbonatites and Critical Resources

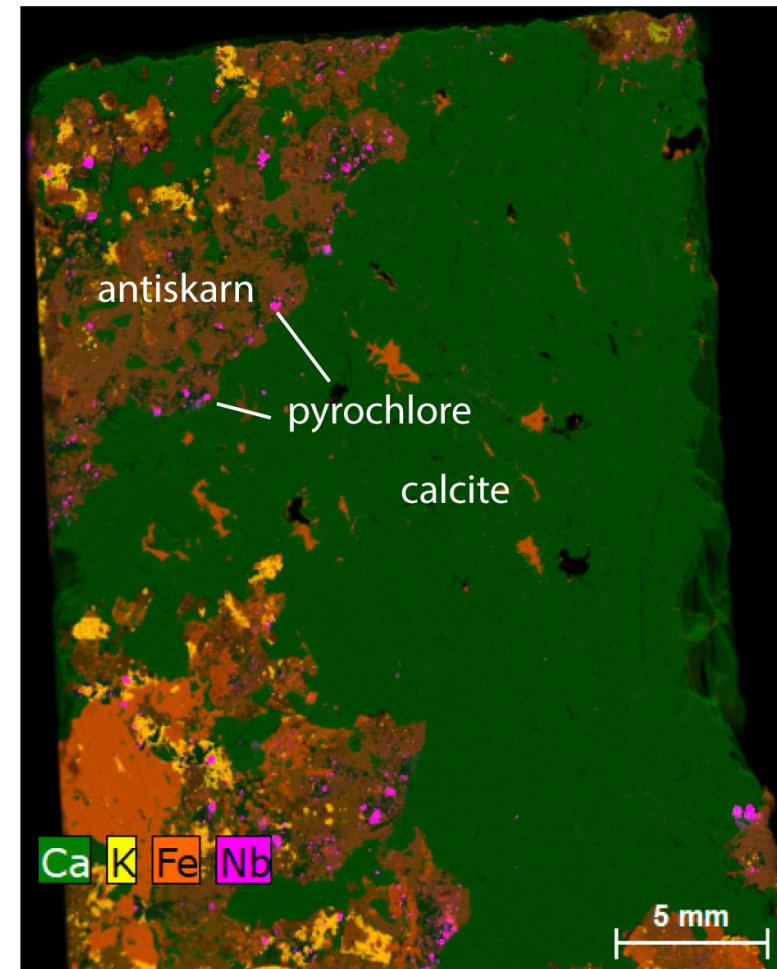
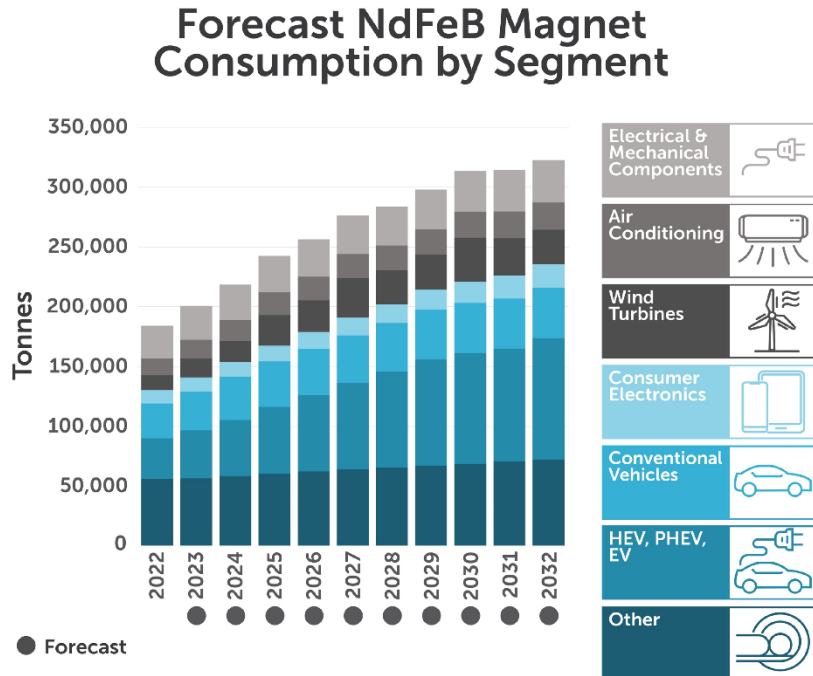


Australian Government  
Australian Research Council

### NEW ARC LINKAGE PROJECT

Realising the Rare Earth Resource Potential  
of the Gascoyne Region of Western Australia

Two billion years of alkaline silicate and carbonatite magmatism  
at the north-western edge of the West Africa Craton



Lucas Tatnell speed talk & poster



# Steffen Hagemann and Research Team

## – Orogenic Au/Intrusion related Au ± Cu



**Tectonic setting of Au-Cu systems in the eastern Andes (Poderosa)**

**Genesis of the Burns Au-Cu deposit (Lefroy Exploration)**

**Timing of Au at Gruyere (Yilgarn 2020 - MRIWA)**

**Talk: 12:10**

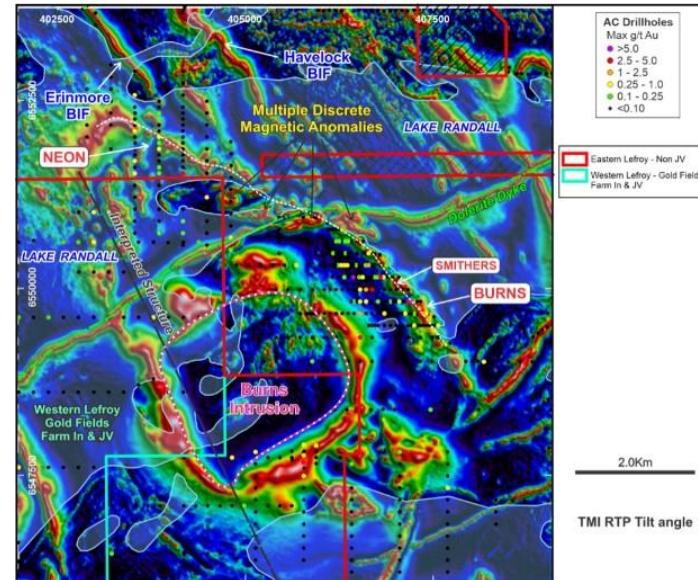
**Talk: 15:35**

**Talk: 11:45**



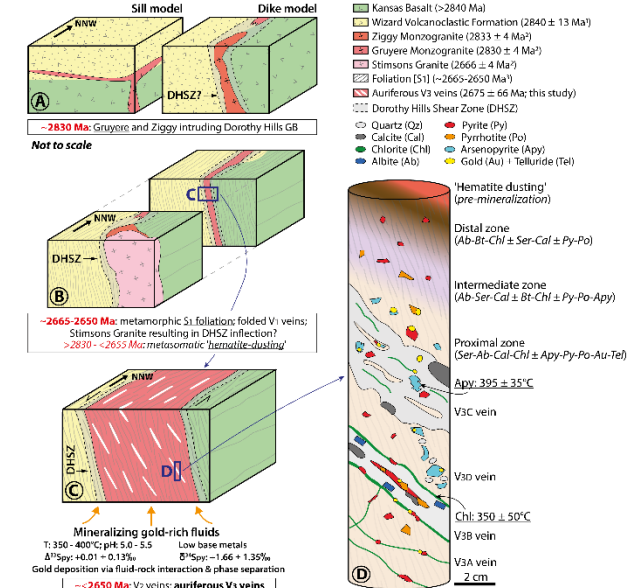
Map of South America showing inherited structures

**Dr Daniel Wiemer**  
Postdoctoral fellow



Magnetic image Burns Intrusive Complex

**Dr Walter Witt**  
Postdoctoral fellow



Geological model Gruyere gold deposit

**Ravi Schreefel**  
PhD student

**Brazil: Hypozonal Tucano Au deposit (SAXI project) – Gabriel Soares (UFMG)**

**NEW in 2023**

**Surinam: Marian Au deposit (SAXI-Newmont project) (MSc & PhD student)**

# Steffen Hagemann and Research Team

## - Porphyry/Epithermal

### *Archean*

**Boddington Au-Cu-Mo porphyry deposit in WA:**  
**(Newmont): Edmore Marima (PhD student):** Magma and metallogenic evolution

### *Late Cretaceous – Late Oligocene*

**High grade, hypogene porphyry systems (BHP):**

Resolution and Escondida Cu porphyries

Postdocs: Dr Giulia Consuma

(Supervisor team: T Kemp, M Fiorentini, S. Hagemann)

### *Oligocene*

- **Taca Taca Cu-Mo porphyry in NW-Argentina:**  
**(First Quantum): PhD student Madeleine Ince:**  
Magma evolution in back arc Cu-Mo porphyry system

### *Pliocene*

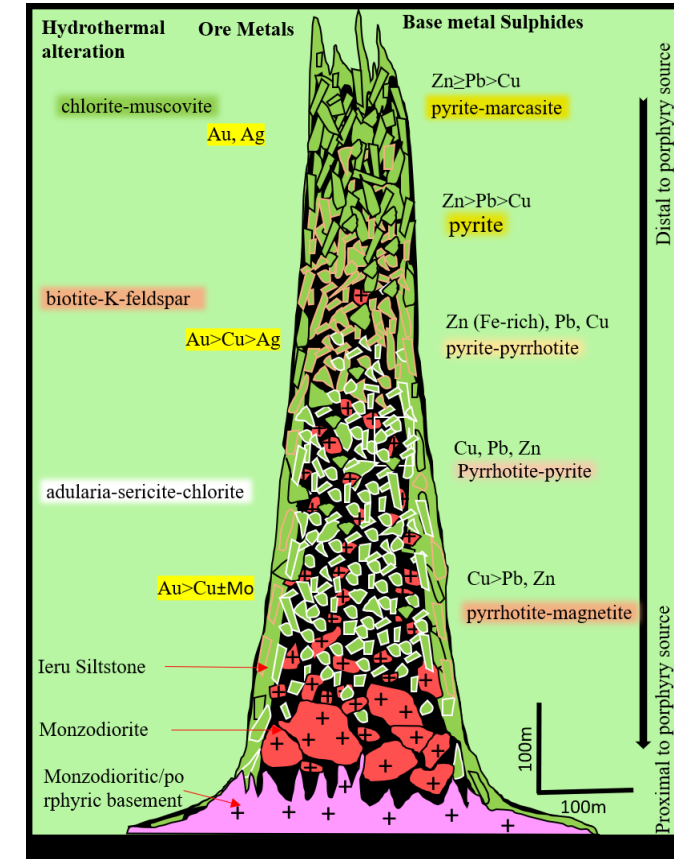
- **New York Au-Cu breccia pipe, Papua New Guinea:**
- **(Ok Tedi Mining): Jerry Dunga (PhD student):** New York breccia pipe: Timing, alteration and Au-Cu footprint

**Speed talk & poster**

**Talk: 15:35**

**Poster**

**Speed talk & poster**



Mineral Zonation in the New York breccia pipe - Ok Tedi – Jerry Dunga PhD student

# Steffen Hagemann and Research team

## LCT Pegmatite, BIF-FE ore, Strat Sed Cu

- **Li Pegmatites northern Pilbara:**  
(Pilbara Minerals)  
PhD student John Grigson  
*Supervisor team: T Kemp, S. Hagemann*
- **LCT Li Pegmatite in the Arunta pegmatite field**  
(Australasian Metals Ltd)  
Postdoctoral Fellow Dr. Jack Stirling  
*(Supervisor team: T Kemp, S. Hagemann)*



Pegmatite dikes/sheets in the Pilgangoora deposit-  
John Grigson PhD student

### **NEW in 2023**

- **BIF Fe Carajás in Brazil (Vale):**  
Prof. Figueiredo de Silva (UFMG at Belo Horizonte)
- **Kupferschiefer in Poland**  
(First Quantum Minerals, BHP, Teck, CET)  
Postdoctoral Fellow Dr. Weronika Gorczyk

### **NEW for 2024**

**STRUCTURAL AND HYDROTHERMAL ALTERATION EVOLUTION OF THE SUKARI GOLD DEPOSIT, EGYPT: *Sponsored by Centamin***





## CET ONLINE SHORT COURSE SERIES - COMPLETED

- 1) **Magmatic Mineral Systems – Recent advances & current multi-scale thinking on magmatic Ni-Cu-PGE sulfide** (124 participants - completed on 20 Nov 2020)
- 2) **Orogenic Gold System Analysis and Exploration Targeting** (127 participants - completed on 3 Dec 2020)
- 3) **Basin-hosted Base Metal Mineral System** (118 participants – completed on 10 March 2021)
- 4) **Critical Evaluation of 3D Geoscience Models** (59 participants - completed on 26 May 2021)
- 5) **Fundamentals of Project Evaluation & Risk Analysis** (40 participants - completed on 13 August 2021)
- 6) **Recent Advances** (115 participants – completed on 3 February 2022)
- 7) **Gold Mineralogy and Geochemistry** (63 participants – completed on 5 April 2022)

- 8) **Fundamentals of Project Evaluation & Risk Analysis** (28 participants – completed on 28 July 2022)
- 9) **Porphyry Cu-Au** (65 participants – completed on 20 March 2023)
- 10) **Exploration and mining of Li-rich LCT Pegmatities** (160 participants – completed on 29 September 2023)

## UPCOMING ONLINE SHORT COURSE SERIES

- 1) SGEG & CET: **Li workshop** (12 February 2024)
- 2) **Geochronology and ore deposit dating** (16 February 2024)
- 3) **Carbonatite & REE** ( 2nd quarter 2024)
- 4) **Structurally controlled hydrothermal alteration in gold systems** ( 4th quarter 2024)



Thank You