

ORE SOLUTIONS

NEWSLETTER OF **CODES** CENTRE FOR ORE DEPOSIT AND EARTH SCIENCES

> WINTER 2023 **No.46**

TRIFECTA: CODES PHD GRADUATE WINS THREE TOP ECONOMIC GEOLOGY AWARDS!

Dr Tristan Wells, who gained his PhD at CODES in August 2022, was presented with the Geological Society of Australia's A.B. Edwards Medals for 2020 and 2021, and the D.I. Groves Award for 2021 at the recent Australian Earth Sciences Convention in Perth. He won the awards for three separate papers, which were written in collaboration with several CODES academics and other geologists. Here Tristan recounts his path to economic geology glory.

I'd like to say it was a thirst for knowledge or a passion for science that got me started on my academic geology career. But, in all honesty, it was a product of multiple coincidences, a little misfortune and self-doubt, followed by a eureka moment.

I'd always been interested in rocks and had a 'phenomenal' collection of sandstone and – in hindsight – what was probably road base I'd collected from across Australia as a kid. The quirky collection went on mothballs after the age of about 12 and remained there through high school, and a fitting apprenticeship. It was the apprenticeship which

eventually led me back to the rocks. After completing the advanced trade certificate, I did what most Tasmanian tradies do: I jumped on the next flight to the mines.

I worked FIFO as a shutdown fitter across Australia and was blissfully unaware of the importance of some of the locations I worked at worrying more about the temperature and the tools than the rocks at Olympic Dam, Telfer, Rosebery and Cadia, among others.

My interest in throwing spanners waned quickly and I yearned for something a little more challenging.

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'Look what I've got!': Dr Tristan Wells holding his two A.B. Edwards Medals and the D.I. Groves Award following an awards presentation ceremony at the Australian Earth Sciences Convention in Perth held in late June.

FROM THE DIRECTOR

Professor David Cooke reflects on the busy first half of 2023, which has included a visit from a delegation from the China University of Geosciences, Beijing. He also acknowledges the hard work put in by everyone to make the flagship Master of Economic Geology courses such a success, and looks forward to progress on our major new projects.

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It was over a chance conversation with my parents that the topic of my long-forgotten rock collection was raised: ‘Why don’t you go and learn about all those rocks in the shed. You’ve always loved rocks’. While the sentence is probably misremembered the sentiment is accurate and was likely a ruse to get me to move boxes of rocks to my own house. This and a motivational conversation with my now wife led to me enrolling at the University of Tasmania and moving from the northwest to Hobart to learn about rocks. I was fortunate enough to be a recipient of the Larry Knight Memorial Scholarship after doing well in my first year which took the financial pressure off, another happy coincidence as my daughter was born at the end of second year (not advised as a study incentive, Georgia = 1/sleep).

Having a young family was the main factor for choosing to continue into postgraduate studies. Without realising the academic heavyweights I had as supervisors (David Cooke, Lejun Zhang and Mike Baker), I completed my Honours year researching the Two-Thirty breccia, a mineralised magmatic hydrothermal breccia near Parkes in NSW.

During my Honours year I found fresh challenges and new aspects of geology and was inspired by the passion of my site supervisors and now good friends, Jon Hoye, Corey Jago and Jeneta Owens. A serendipitous reading of two papers on zircon and apatite as fertility indicators during my Honours inspired my application for a PhD role in the Lachlan Arc Linkage led by Sebastien Meffre. I approached Sebastien with an idea for a derivative geochemical and mineral chemistry study on the Northparkes porphyries, a study which very nearly didn’t come to fruition – with limited budget for PhD scholarships I didn’t make the cut. It took the then-director of CODES Bruce Gemmell offering to co-contribute to funding my PhD to get me across the line. A debt I will never be able to repay and a kindness that will never be forgotten. And so it commenced; like all PhDs I had good days and bad, self-doubt, and the ever-present imposter syndrome.

It was one of the particularly challenging days in the mineral separation lab, where I reached the lowest point. No matter how hard I tried, I couldn’t seem to separate



Tristan (right) pictured after graduating in August 2022 with his supervisor Professor Sebastien Meffre at the Hotel Grand Chancellor in Hobart. Tristan is notoriously camera-shy, so we are running this photo of him again – it originally appeared in our Summer 2022 issue.



Marcus Willson (right), Chair of the GSA Specialist Group for Economic Geology, presents Tristan with the 2020 A.B. Edwards Medal.

any zircons. I contemplated quitting before asking Sebastien if there was something I was doing wrong, or whether I just wasn’t very good at geology. I’m uncertain whether the answer I got was an honest one, but it culminated with Seb and I working in the lab and neither of us being able to create a zircon separate, which raised a more important question:

‘Where are the zircons?’ It was this question that led to the eureka moment confirmed by geochemistry that the porphyry phases identified as the mineralising intrusions at Northparkes were all depleted in zirconium; a deeper dive into the data and conversations with Bob Loucks provided an insight that the depletion in zirconium in hydrous, potentially ore-forming porphyries was not unique to Northparkes but applicable on a global scale.

This led to the development of two of the three papers. The first was born from the initial question, and the second inspired by it, but driven by an ethos of functional frugality, a concept that sometimes gets lost in the academic world. Quick, cheap and a little dirty, trumps slow, expensive and hyper-precise in the land of the junior explorer. My research and a proclivity for failure, also engrained a measure of humility, and determination, which is why I decided to re-visit my Honours thesis and add more constraint to the arguments which culminated in the third of three – what are now – award-winning publications. I returned to industry after 2.5 years of my PhD and



Member of the GSA Specialist Group for Economic Geology, Alanis Olesch-Byrne, with Tristan after presenting him with the 2021 A.B. Edwards Medal.

completed the remainder of my thesis while working full-time, conducting porphyry exploration in NSW initially for junior explorers and eventually for one of the majors. Another chapter that is coming to a close as I head off to PNG to cut my teeth as an expat, do some exploration, and hopefully make some discoveries, because that’s what it’s all about at the end of the day: a thirst to find things, and do more.

Thanks to: Bruce Gemmell, David Cooke, Sebastien Meffre, Jeff Steadman, Lejun Zhang, Mike Baker, Jon Hoye, Marc Norman, Paul Olin, Irina Zhukova, Sasha Stepanov,



Dr Anita Andrew, one of the Editors-in-Chief of the *Australian Journal of Earth Sciences*, presents Tristan with the 2021 D.I. Groves Award.

Margy Hawke, Ayesha Ahmed, Tony Crawford, James Parslow, Carol Simpson, Yong Yi Zen, and numerous others. A special thanks to my parents for making me move my rocks, Danielle Pretty for agreeing to marry me despite how much I talk about rocks, Declan Radford for Friday thesis correction beverages, everyone from office 460 (especially Brian, Tom, and Young Tom) for being some of the best critical thinkers and academics I’ve had the pleasure of knowing, Brian Kay, Toby Erskine, Taylor Ogden and Dale Cameron for the industry insights and for keeping me grounded. All the best.

The three papers on which Tristan was lead author and which won him the awards are:

THE A.B. EDWARDS MEDALS FOR 2020 AND 2021:

2020: T.J. Wells, S. Meffre, D.R. Cooke, J.A. Steadman & J.L. Hoye (2020). Porphyry fertility in the Northparkes district: indicators from whole-rock geochemistry. *Australian Journal of Earth Sciences*, 67(5), 717–738.

<https://doi.org/10.1080/08120099.2020.1715477>

2021: T.J. Wells, D.R. Cooke, M.J. Baker, L. Zhang, S. Meffre, J. Steadman, M.D. Norman and J.L. Hoye (2021). Geology and geochronology of the Two-Thirty prospect, Northparkes district, NSW. *Australian Journal of Earth Sciences* 68(5), 659–683.

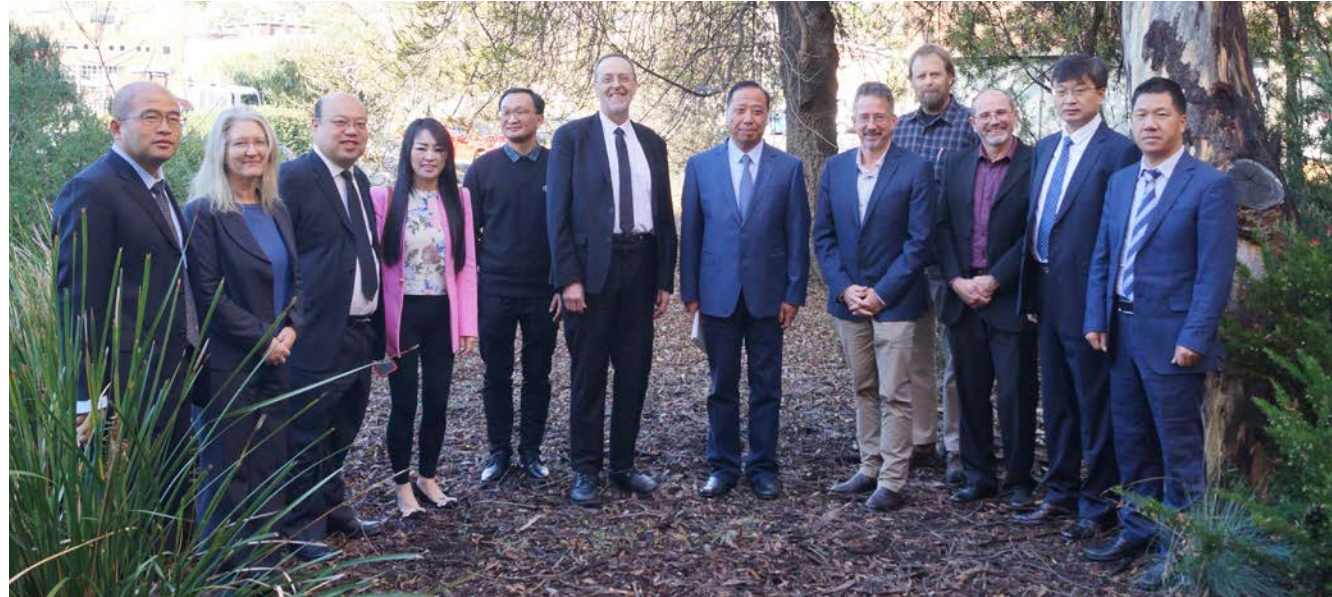
<https://doi.org/10.1080/08120099.2021.1861095>

THE D.I. GROVES AWARD FOR 2021:

T.J. Wells, S. Meffre, D.R. Cooke, J. Steadman & J.L. Hoye (2021). Assessment of magmatic fertility using pXRF on altered rocks from the Ordovician Macquarie Arc, New South Wales. *Australian Journal of Earth Sciences*, 68(3), 397–409.

<https://doi.org/10.1080/08120099.2020.1782471>

UTAS SIGNS AN MOU WITH CHINA UNIVERSITY OF GEOSCIENCES, BEIJING



Members of the CUGB delegation from Beijing pictured in the gardens outside CODES on the UTAS Sandy Bay campus. They are (L-R): Liang Yong, Director, Office of Laboratory and Equipment Management at CUGB; Ms Rachel Perkin, Business Development and Partnerships Lead, CoSE; Gao Zhiqian, Director of Academic Affairs Office at CUGB; Pian Huayan, Deputy Director of International Cooperation and Exchange Office at CUGB; Dr Wei Hong, CODES postdoctoral researcher; Professor David Cooke, Director of CODES; Professor Zhao Zhidan, Vice President, CUGB; Professor Simon Ellingsen, Dean of SNS at UTAS; Dr Paul Olin, Acting Leader, CODES Analytical Laboratories; Professor Sebastien Meffre, Head of Discipline of Earth Sciences, UTAS; Li Yalin, Dean, CUGB School of Earth Science and Resources; and Chen Jiawei, Director of HR, CUGB.

Professor David Cooke writes:

It was an honour and a privilege for UTAS to host Vice President Zhao Zhidan and his delegation from China University of Geosciences (Beijing) in late June. Vice President Zhidan and Executive Dean Terry Bailey of the College of Sciences and Engineering signed a Memorandum of Understanding between CUGB

and UTAS during the visit. This MOU will promote high-level cooperation and exchanges between the two institutions in terms of undergraduate programs and geoscience research joint field training, with CUGB students planning to join UTAS students on joint field excursions from 2024. Vice President Zhidan's delegation spent time touring CODES and its facilities, where they had the opportunity to visit CODES Analytical Laboratories and review some of our extensive teaching collections from mineral deposits around the globe, while also learning more about Tasmania's amazing geology. We look forward to welcoming our CUGB colleagues back soon for more fruitful discussions, collaborations, and training opportunities.



Terry Bailey Executive Dean, CoSE, (left) with Professor Zhao Zhidan, Vice President of the China University of Geosciences, Beijing, after signing a Memorandum of Understanding between UTAS and CUGB.

The CUGB delegation included a report of their trip to UTAS and CODES in their online news: <https://www.cugb.edu.cn/xynews/44237.jhtml>



Professor David Cooke hosts the CUGB delegation in his office at CODES.



Dr Paul Olin explaining lab equipment to Vice President of CUGB Professor Zhao Zhidan and his entourage during their visit to CODES in June 2023.

THE CLASS OF 2023: PHD COHORT EXPANDS RAPIDLY

This year has seen a large intake of new PhD students, many of whom are here to work on the new RRC critical metals and Amira P1249 projects. To date, 12 new students have joined us so far in 2023 and another five are due to begin their research in the next few months. They are drawn from 13 countries across the globe – making this one of the most multicultural PhD cohorts ever for CODES.

In addition, we have many PhD students well-advanced with their research and who have either just submitted their theses for examination (Xin Ni Seow and Elena Lounejeva) or are about to (Alex Farrar and Rhiannon Jones). Below, some of our current PhDs outline their projects and what they have gained from their time at CODES. We will feature the projects of our newly arrived PhD students when they are a little further advanced with their research.



Some of the many PhD students who have recently joined CODES from across the globe, and who will be working on two major new projects. They are: (L-R): Billy Beas (Peru), Jose Barillas Diaz (Mexico), Javier Gil Rodriguez (Colombia), Emrehan Yurdakul (Türkiye), Alfredtina Appiah (Ghana), Declan Higgins (Australia), Vinicius da Cruz (Brazil), Angela Costa (Brazil), Musa Emmanuel Dogara (Nigeria), Axel Cima (Argentina), Nelao Natukondje Naimbale (Namibia), Arka Sahu (India) and Isaac Evinemi (Nigeria).

The primary aim of my research is to improve understanding of eruption drivers and controls of large-scale explosive silicic eruptions. Specifically, I have been investigating conduit processes occurring in the early stages of the Kaharoa eruption that may result in unsteady eruptive dynamics. I have also mapped in great detail deposits from the later stages of the Kaharoa eruption which were emplaced during transient behaviour, to better understand this phase of the eruption.

A secondary aim of my research is to study the subaqueous deposits of large, silicic, caldera-forming eruptions. Deposits from large eruptions can reach distances of 100 km and consequently will often enter the

marine environment. How these deposits interact, are transported, and settle in this environment is somewhat unknown. The Minoan eruption of Santorini is an excellent example to investigate this, and I plan to use recently drilled cores from IODP expedition 398 to undertake this research.

"Both projects have given me the opportunity to undertake fieldwork in very spectacular places, and work with excellent volcanologists. For this I feel incredibly grateful and lucky."



ACACIA CLARK

Supervisors: Rebecca Carey, Martin Jutzeler, Jodi Fox

Project title: Dynamics of subaerial silicic explosive volcanism: The 1314 CE Kaharoa eruption and the Late Bronze Age eruption of Santorini

Funding: Australian and New Zealand International Ocean Discovery Program Consortium (ANZIC)

My research project is focused on two large, explosive, subaerial eruptions, the 1314 CE Kaharoa eruption from Mt Tarawera on the North Island of New Zealand, and the Late Bronze Age (Minoan) eruption of Santorini, Greece.



Acacia Clark at spectacular Mt Tarawera on the North Island of New Zealand. She is preparing to enter the fissure to map the 1314 CE Kaharoa deposits. Pūtauaki (Mt Edgecumbe) and Moutohorā (Whale Island) are in the background.



ALEX FARRAR

Supervisors: Matthew Cracknell, David Cooke

Project title: Tectonic and structural controls on the spatio-temporal distribution of giant porphyry copper deposits in the central Andes

Funding: First Quantum Minerals

Alex Farrar's PhD research is presented as three manuscripts, the first of which has recently been accepted for publication in *Economic Geology* and

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Alex Farrar (wide-brim hat) about to measure a fault exposed on the roadside in northern Chile, during fieldwork for his PhD. He is pictured with First Quantum Minerals Field Technician Wido Alvarez.

investigates the spatial distribution of giant porphyry Cu deposits in the central Andes. It focusses on the interpretation of and field evidence for long-lived regional-scale structural corridors, their role as pathways for ascending magmas and fluids, and their influence on the clustering and localisation of these mineral deposits.

The second manuscript uses time series data analysis techniques to compare conflicting plate reconstruction models by assessing the time series relationship between plate convergence processes and the development of the central Andean cordillera. It provides a novel approach for the selection of appropriate tectonic models and for the inference of causal processes that operate within cordilleran mountain belts.

The third manuscript employs machine learning to predict the spatio-temporal distribution of giant porphyry copper deposits in the central Andes. It reveals coherent and predictable tectonic sequences for



Max Hohl is happy to inspect heavily mineralised pyrite and magnetite drill core at Rosebery during a Masters course in 2021.

metallogenic and non-metallogenic processes, enabling the development of a continental-scale spatio-temporal mineralisation probability model for the region since the Late Cretaceous at 1 Myr temporal resolution.



MAX HOHL

Supervisors: Jeff Steadman, Jonathan Cloutier, Shaun Barker (MDRU)

Project title: *Defining the mineral chemistry footprints of the Starra Iron Oxide-Copper Gold Deposits in northwest Queensland*

Max is studying the mineralogy, paragenesis and mineral chemistry of the Starra Cu-Au deposit in northwest Queensland. His PhD was part of the 'Mineral geochemistry vectoring: uncovering northwest Queensland's hidden potential' research project and after the project was completed it was integrated into the new IOCG³ project led by Dr Jeff Steadman. Max's project aims to identify potential 'fingerprints' of the Cu-Au mineralisation at Starra using the chemistry of magnetite, hematite, pyrite, and Cu-sulphide minerals to identify characteristic geochemical signatures associated with hydrothermal processes typical for IOCG mineralisation.

In order to carry out his research, Max is using a combination of analytical methods, including petrographic and textural characterisation of minerals, electron probe microanalysis, laser ablation ICP-MS, and SIMS analysis of minerals. He has found some distinctive chemical signatures in pyrite and magnetite chemistry, which have implications for ore genesis at Starra. To aid in the interpretation of his mineral chemistry data, Max is applying data analytics tools and multivariate statistics to interrogate the datasets and provide new insights into the mineral chemistry changes. COVID-19 prevented completion of his

planned fieldwork in 2020, but he was able to visit the mine site in late 2022, just weeks after active mining at Starra was restarted. During this trip the latest results from the PhD study were presented to the exploration team.

"I enjoy my research at CODES as part of an international team working in an exciting corner of the world."



MALAI ILA'AVA

Supervisors: Martin Jutzeler, Raymond Cas (Monash), Rebecca Carey

Project title: *Volcanic facies architecture of the Ordovician Cowal Igneous Complex, NSW*

Funding: ARC Linkage grant and in-kind support from the Geological Survey of NSW and Evolution Mining

Malai's project is in the Ordovician Cowal Igneous Complex (CIC) in the Macquarie Arc of NSW. The CIC can be viewed in regional magnetic imagery as a north-northeast trending 40 x 16 km anomaly. It is completely buried under Cenozoic cover that is up to 100 m thick. Like the broader Macquarie Arc, the CIC records protracted but episodic volcanism and magmatism between 480–440 million years ago. This project focusses on the earliest volcanics of the CIC: i) to address the relative paucity of detailed



Malai Ila'ava (centre) in the Evolution Mining core yard at Cowal with his PhD supervisor Dr Martin Jutzeler (writing on board). Martin and Malai were teaching Evolution Mining geologists about volcanic textures and were also logging cores (photo: Zach Murphy).

work for the earliest history of the Macquarie Arc; and, ii) to assist industry with establishing stratigraphic and structural context for current mining operations at the E42 open pit and GRE46 underground mine, in addition to other satellite exploration prospects.

Approximately eight months has been spent in the field with 32 km of detailed graphic logging of drill core completed for basin-scale facies analysis and reconstructions. From 920 samples, a subset of thin sections and geochemistry data (whole-rock and trace element analyses at CODES) has been generated to support the reconstructions. Most significantly, 76 samples from various coherent and volcanoclastic rocks were panned for zircons – 10 were zircon-bearing, four relevant age-dates have been calculated so far and there is potential for two more age-dates. This is an exciting opportunity to establish LA-ICP-MS zircon U-Pb age constraints while using volcanic and sedimentary facies to interpret volcanic and tectonic setting at the CIC during the initial phase of volcanism in the Macquarie Arc.

"This has been such a challenging but rewarding project. I've enjoyed trying to piece together a story for the entire Cowal Igneous Complex but have gradually accepted that there are so many aspects to it that will have to be advanced by other students and researchers."



RHIANNON JONES

Supervisors: David Cooke, Lejun Zhang, Angela Escolme

Project title: *The significance of phyllic alteration at the E26 porphyry Cu-Au deposit, NSW, Australia*

Funding: Amira P1202 project

My PhD has focused on understanding the significance of phyllic alteration at the E26 porphyry Cu-Au deposit in the Northparkes district of New South Wales, Australia. This project is part of



CODES PhD student Jaime Osorio conducting fieldwork in the Chilean Andes at the Valeriano deposit.

the Amira P1202 project and began in March 2020; however, due to the COVID-19 pandemic, fieldwork was only possible from 2022. Since 2022, three field trips have been conducted at Northparkes, where we collected samples and verified paragenetic relationships by logging drill core.

At E26, phyllic alteration is particularly complex and it can be mineralised or barren. Understanding where mineralised phyllic alteration occurs and the processes responsible for its formation is of particular interest for exploration. During this study, we defined a phyllic paragenetic framework that had six stages of phyllic alteration. We investigated quartz and white mica chemistry, which suggested mineralised phyllic alteration occurred at depth and formed from higher temperature fluids with near neutral pH conditions, relative to barren phyllic alteration, which formed from lower temperature and more acidic fluids. We created a genetic model for phyllic alteration at E26 and using stable isotopes determined that magmatic vapours and brines played a role in the development of phyllic alteration at E26. Finally, we used whole-rock chemistry data to create a calculated mineralogy model that can be used to predict mineral proportions across the deposit.

"Over the past three years, I have thoroughly enjoyed unravelling the complexity of this deposit and I am truly lucky to have been given the opportunity to learn from such an amazing team of supervisors."



JAIME OSORIO

Supervisors: Lejun Zhang, David Cooke

Project title: *Anatomy of the porphyry-epithermal transition at the Valeriano deposit, Northern Chile*

Jaime's project started at the end of the Amira P1202 (Module 4) project and is currently part of the Amira P1249 (Module 1) collaborative research project. The Valeriano lithocap is located at the northern tip of the El Indio belt in Chile, where recent deep exploration drilling discovered concealed a porphyry Cu-Au system at depth, providing a unique 2-km-long vertical profile of alteration from the shallow lithocap to the porphyry environment. This relatively unique long profile of alteration reveals three distinctive and spatially separated styles of mineralisation. At depth high-grade porphyry-style mineralisation is associated with potassic alteration, at intermediate depth and at the base of the lithocap low-grade high-sulfidation state mineralisation is associated with short-wavelength white mica, and at shallow depths enargite-bearing high-sulfidation mineralisation is linked to advanced argillic alteration.

The aim of this project is to document the geology of this exceptional moderately telescoped porphyry-high

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PhD students Xin Ni Seow (left) and Rhiannon Jones using a portable TerraSpec Mineral Spectrometer to analyse minerals in one of the rock stores at CODES.

sulfidation system with emphasis on the vertical changes in textures, alteration mineral assemblages, and veins between the porphyry and lithocap environments. In addition, it aims to test and develop exploration tools. The first stage of the project included nearly five months of fieldwork in Chile conducting Anaconda logging of over 20,000 metres of core and surface mapping. The second and current stage has been focussed on textural and mineralogical characterisation based on wavelength infrared (SWIR) spectroscopy, scanning electron microscopy (SEM), electron microprobe analyses (EMPA), and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS).

"I am happy to be back in Tasmania, and I am enjoying the people here and the wonderful lab facilities at both CODES and the Central Science Laboratory that UTAS offers."



XIN NI SEOW

Supervisors: Lejun Zhang, David Cooke, Evan Orován

Project title: Geochemistry, mechanism of formation and exploration implications of alunite supergroup minerals

Xin Ni's PhD project was part of Amira P1202 studying alunite supergroup minerals from geological, geochemical, analytical and spectral perspectives to explore their application in aiding mineral exploration in lithocap and porphyry environments. There was a particular emphasis on the investigation of aluminium phosphate-sulfate (APS) minerals, whose existence was long known but their characteristics were poorly studied. Some of the highlights of her PhD project included the development of an improved LA-ICP-MS method for alunite, development of a new spectral library for APS minerals and recognition of new exploration tools using alunite supergroup minerals.

Xin Ni's research project has led to the submission of two manuscripts submitted to *Economic Geology*; both are in the process of revision. She also has another manuscript awaiting approval from the co-authors. Her PhD thesis was submitted for external examination at the University of Tasmania in June 2023.

"The expertise and resources at CODES have provided abundant opportunities for me to engage in collaborations with industry and academic experts from all around the world, even amidst the challenges posed by the COVID outbreak. I was super lucky to have a very supportive and knowledgeable supervisory team to guide me through my PhD journey."



PEERAPONG SRIRANGSIRIKUL

Supervisors: Sebastien Meffre, Khin Zaw, Punya Charusiri (Dept Mineral Resources, Thailand)

Project title: Tectonic evolution and related mineral deposits of mainland SE Asia: Insights from geochronology and geochemistry of zircons

The aim of Peerapong's research is to provide new insights into the tectonic evolution and ore deposit metallogeny of the magmatism in SE Asia by integrating new U-Pb zircon ages with zircon mineral chemistry. Specifically, the project involves constraining the tectonic evolution of the Loei and Truong Son fold belts. It aims to provide a more comprehensive understanding of fertility and assessment of the potential for magmatic-related mineral deposits in mainland SE Asia (i.e., porphyry-epithermal deposits), and will constrain the ages and trace elements from selected mineralised terranes.

His first paper has been submitted to the *Journal of Exploration Geochemistry* and is under review. It presents new zircon U-Pb ages and trace elements of potential fertile rocks in the Loei and Truong Son fold belts. The results provide useful information regarding mineral exploration. His second paper focuses on the tectonic evolution of magmatism in the same region; most of these analyses have been done at CODES and at Macquarie University, Sydney.

"Engaging in zircon LA-ICP-MS research has been an exhilarating journey. I have discovered a deep passion for solving the complex geological knowledge embedded within zircons, bringing me immense joy and satisfaction in my PhD."

MASTERS RETURNS TO INDONESIA!

The Ores in Magmatic Arcs (Indonesia) Masters short course ran during March for the first time since 2019 due to the COVID-19 pandemic. It was extremely well-attended with the 24 participants divided into two groups because of the high numbers. This course, led by Professor David Cooke and Dr Lejun Zhang along with Adi Maryono (CODES adjunct researcher) and Iryanto Rompo (J-Resources, Indonesia), included 12 Masters students, two PhD students and six industry participants. The sites visited included: Pongkor low sulfidation epithermal, Tujuh Bukit porphyry – high sulfidation epithermal, Batu Hijau porphyry, Elang porphyry, Lithocap prospects on Lombok islands, Onto porphyry – high sulfidation epithermal deposits and the Ijen active volcano field.



Participants on the Ores in Magmatic Arcs (Indonesia) field excursion, together with staff from Sumbawa Timur Mining (STM) during the site visit to the Onto high sulfidation Cu-Au deposit, Sumbawa, Indonesia. Course participants were split into two groups for logistical purposes; this photo shows only half the group.



Industry participant Renato Bobis highlighting key textural features to Masters students during a drill core review.



David Cooke and Masters students Alex Richards and David Portocarrero inspecting drill core on the Ores in Magmatic Arcs (Indonesia) field trip.



This photo shows all participants on the Ores in Magmatic Arcs (Indonesia) field excursion, together with staff from Sumbawa Timur Mining (STM) at their Onto coreshed, Hu'u, Indonesia.

WHERE ARE THEY NOW?

Dr Stephanie Sykora completed her PhD at CODES in 2017 on the Lihir (Ladolam) gold deposit in Papua New Guinea and now travels all over the world as an independent consultant exploration geologist – and loves the variety of cultures and terrains that she gets to experience first-hand.

STRIKING OUT



DR STEPHANIE SYKORA

Independent consultant exploration geologist based in British Columbia, Canada

PhD completed at CODES in 2017 entitled 'Origin, evolution and significance of anhydrite-bearing vein arrays and breccias, Lienetz orebody, Lihir gold deposits, Papua New Guinea' (supervised by Professor David Cooke and Dr David Selley)

What is your current job/employment and your work responsibilities?

I am an exploration geologist based in British Columbia, Canada, working as an independent consultant for the past several years. I work internationally and locally with mostly junior (and some major) exploration companies, in early-stage porphyry copper and polymetallic (silver, gold, zinc, lead, copper) epithermal deposit exploration. Typically, my role is very technical, and involves geological mapping (detailed or quick) and/or prospect evaluation in field visits and/or with drill core. This involves a mix of digital and classic data collection, and involves mostly fieldwork, but a fair bit of data analysis and reporting as well. I also am involved with some groups for training and leading large mapping programs.

What are the things you enjoy most about this role?

I enjoy the challenge of trying to piece together a story from all the bits of evidence you collect and analyse, with the aim to eventually help find a world-class ore deposit. It is very rewarding when things hold up and make sense, geologically. I also enjoy the travels and exposure to different countries and places you would never go to normally. And of course, I enjoy working with different groups of people from various backgrounds and with various levels of experience. The constant informal learning and teaching is very rewarding. The variability and flexibility as a consultant are nice as well, but the management is often stressful.

With my previous and current role, I have been a part of exploration projects in Australia, Papua New

Guinea, Japan, Serbia, Ireland, Peru, Chile, Ecuador, Jamaica, Mexico, USA and Canada. This has probably encompassed all forms of transport, including small planes, helicopters, atvs, horses, pick-up trucks, hybrid street cars and boats. Some of the experiences have varied from scary helicopter toe-ins on steep mountain faces when you get carried away looking at the rocks and not at the ground, to rapidly adapting to different cultural norms and safety protocols in higher risk areas. Not sure if I can pick a most memorable one; there are pros and cons to anywhere when you are in the field.

How did you get there/your past roles and how they shaped your path?

After completing Earth and Ocean Studies with a BSc with distinctions at the University of Victoria, BC, Canada, I worked for Teck Resources Ltd. prior to studying at CODES, as part of a greenfields exploration group for porphyry Cu+Au deposits, and production logging and brownfield exploration at the Highland Valley Copper mine in British Columbia, Canada. After my studies at CODES I worked for First Quantum Minerals Ltd., as part of a global generative exploration group for copper, and with the Latin American generative exploration group for porphyry copper deposits. Working with both major companies, and my time at CODES, helped shaped my path in terms of all the guidance and training and exposure in mineral exploration techniques and processes. When COVID happened, I started doing consulting and have been lucky to have been able to work with great groups and projects with collaborative and continuous relationships since.



Stephanie photographed recently in Alaska north of Fairbanks with the founder of CODES Professor Ross Large. Ross is the Chief Technical Advisor of Wiseman Metals, which with partners Doyon Ltd., hold large claims in the area. Ross travelled to site and was there for several days while Stephanie was working there. The helicopter was their mode of transport.

Your career highpoint/greatest achievement to date/source of greatest satisfaction as a geologist?

Probably some of the greatest satisfaction as a geologist has been successful results and advanced understanding of targets, especially when it is new mineralised drill holes, or newly discovered mineralised areas. There hasn't been a major new discovery, but I've been a part of teams with lots of successes, and things still to be fully defined. I am also satisfied with high-quality work outputs like maps and presentations, though it would be nice to share and publish these things more often. And it has also been very satisfying having ideas and knowledge being up taken and applied by others.

What did you specialise in at CODES and how did CODES help you to get where you are? What did you enjoy most about CODES?

I did my PhD on the Lihir (Ladolam) Alkaline Epithermal Gold Deposit in Papua New Guinea. Getting to study such a world-class deposit



Checking out recent diamond drill core at the rig on site in Zacatecas, Mexico. Stephanie was working with OreQuest Consultants/Defiance Silver Corp. exploring for intermediate sulfidation silver-lead-zinc veins.

and publish on it helped my understanding of these complex deposits and processes.

The CODES name in general is also well respected globally, and I have encountered and made many relationships on this.

From my time at CODES, I enjoyed the people the most, my supervisors, my colleagues, friends and all the staff. It was great to have such a diverse, smart group so that you can walk down the hall and ask questions about different aspects of your studies. I also loved

CONTINUED OVER PAGE



Stephanie carrying out exploration mapping work in southern Ireland for First Quantum Minerals.

Hobart, the many activities with the university like field trips, and all the other stuff Tassie has to offer.

How has the industry changed since you were at CODES? And how do you see it developing in the future?

It has been interesting in the past several years to see how the market and industry fluctuates. I have noticed the shifts and uptake for certain metals. I don't really have the best insight for future industry trends, but perhaps more mergers with companies and shifts for diverse portfolios, especially with an aspect of green energy metals and critical metals. For geologists, likely a shift towards more technology

use in the field and with processing, and the need for companies to adapt to changes quickly. And hopefully a positive trend to public perception, which comes with better practices and knowledge dissemination.

Words of wisdom for up and coming geologists graduating from CODES?

I guess, be prepared to adapt and constantly learn, even things you think you understand. Listen and learn from others, especially those with lots of experience. But don't be afraid to speak up and question ideas and present new ones. Be true to yourself. And try and finish your thesis and paper writing as much as possible before you leave.

Little-known facts about you?

I'm still golfing, with variable success, though is hard to be consistently good when you are away so much for work. I share lots of photos on Instagram (@stephaniesykora) of places where I travel to, such as for exploration work.

I learnt Spanish due to work in Peru and Mexico, which was a challenge at first, but very rewarding and fun in the end. I also have worked with other non-exploration groups like Smithsonian as a geology expert guide with high-school students, and I hope to continue more outreach involvement.

CODES CONNECT

CODES and Earth Sciences have many ways of keeping in touch with our researchers, staff, students, graduates, stakeholders, the mining and minerals research community, and industry bodies.

The CODES website (<https://www.utas.edu.au/codes>) is constantly being updated.

The Discipline of Earth Sciences webpage (<https://www.utas.edu.au/natural-sciences/earth-sciences>) has been updated and now has a link to the Earth Sciences Facebook page as well as short profiles with videos about some of our student researchers.

You can follow one of our Facebook pages:

f CODES: <https://www.facebook.com/CODES.UTAS/>

f Earth Sciences: <https://www.facebook.com/EarthSciUTAS/>

You can also follow our LinkedIn page:

in CODES: [linkedin.com/company/codes-utas](https://www.linkedin.com/company/codes-utas)

BECOME A SUBSCRIBER

If you want to join one of our mailing lists to receive regular updates (newsletters/annual reports/short course information/ PhD opportunities or job vacancies) please email us at:

CODES.info@utas.edu.au

CONFERENCES

CONFERENCE CIRCUIT ALIVE AND BUZZING

With the return of unrestricted international travel and face-to-face gatherings this year, CODES staff and students have been continuing to connect with collaborators and friends from across the globe at the many geology-related conferences that are such an important part of the calendar.

EUROPEAN GEOSCIENCES UNION GENERAL ASSEMBLY 2023

23–28 April, Vienna, Austria

Dr Sheree Armistead was invited to give a keynote presentation at the 2023 European Geosciences Union General Assembly, which is held every year in Vienna, Austria. As part of the Geodynamics session 'Cratons: Structure, Evolution, Chemistry and Life on the early Earth', Sheree presented a talk titled 'Pb isotope heterogeneities in the mantle and links to the supercontinent cycle'. This research used a global database of Pb isotopes from ore deposits to understand the evolution of the mantle and crust in the early Earth, how this was influenced by the supercontinent cycle and how these factors played a role in the development of Archean ore deposits.

This research began during Sheree's postdoctoral fellowship with the Geological Survey of Canada and Laurentian University between 2019 to 2021, with collaborators



Professor David Cooke giving his keynote address at the ProExplo 2023 conference in Lima, Peru, during May.



CODES Research Fellow Dr Sheree Armistead (right) attending the European Geosciences Union General Assembly poster session in Vienna with members of the IGCP648 Supercontinent Cycles and Global Geodynamics project. They are (front L-R): Professor Zheng-Xiang Li; Piero Sampaio; Dr Luc Doucet (all from Curtin University), and (back L-R): Professor Brendan Murphy (St Francis Xavier University, Canada); and Dr Phil Heron (University of Toronto, Canada).

Bruce Eglington (University of Saskatchewan), Sally Pehrsson (Geological Survey of Canada) and David Huston (Geoscience Australia). You can read the abstract here: <https://meetingorganizer.copernicus.org/EGU23/EGU23-4744.html>

PROEXPLO 2023

8–10 May, Lima, Peru

This gathering is the International Congress of Prospectors and Explorers to which Professor David Cooke was invited to give a keynote address. His talk was entitled 'Tools to aid porphyry exploration in diverse geological environments'.

The 2023 proEXPLO conference in Lima was an excellent showcase of exploration and research activities currently taking place in Peru, and provided excellent overviews of the latest innovations in exploration-related research and new technologies. Conference President and CODES alumni Sebastian Benevides and the organising committee did a superb job in organising what for many was the best ProExplo conference yet. Professor David Cooke had the honour of giving a plenary address at the conference, and Victor Torres presented on his PhD research at the Soledad tourmaline breccia-hosted Cu-Au deposit. David also presented a pre-conference



CODES PhD student Victor Torres speaking about his Soledad project at ProExplo 2023 in Lima, with David Cooke's profile photo used as a conference backdrop.



Dr Mohammad Fathi talking about scheelite at the AESC conference in Perth.

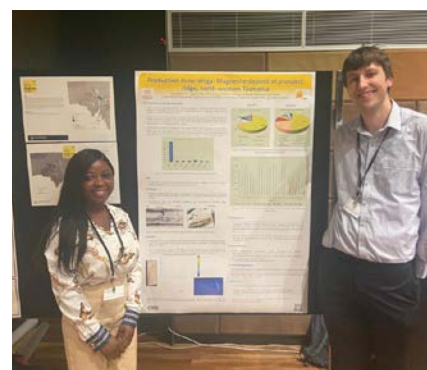
workshop on 'Ore-forming processes in hydrothermal systems – implications for ore genesis and exploration', as well as contributing to a panel discussion on education in Geology. He also co-lead a post-conference field excursion with Lisard Torro (PUCP) to the Antamina and Hilarion skarn deposits in the Central Peruvian Andes.

A publication covering the conference outcomes is available at: [conference e-book](#)

CRITCON2023

22–26 May, Adelaide

The inaugural Australian Critical Metals conference (CritCon2023) was held in Adelaide in May, chaired by Associate Professor Carl Spandler. The successful event attracted over 100 attendees working across different areas of critical metals, from government policy to exploration geology, to geochemical modelling and ore characterisation. CODES postdoctoral researcher Owen



CODES PhD student Alfredina Appiah (left) and postdoctoral researcher Dr Owen Missen at the CritCon2023 conference in Adelaide with Alfredina's poster about her Prospect Ridge research.



CODES PhD student Angela Costa giving a presentation about her King Island research at the AESC in Perth.

Missen delivered a talk on his PhD work on tellurium biogeochemistry, and CODES PhD student Alfredina Appiah presented a poster on her preliminary work at the Prospect Ridge magnesite deposit in Tasmania. The conference was a great chance to network with other Australian researchers working in the critical metals space.

AUSTRALIAN EARTH SCIENCES CONVENTION 2023

27–30 June, Perth

Dr Mohammad Fathi, who has recently joined CODES as a research fellow, recounts his experience of attending this conference:

Exploring for the future aims to develop an understanding of the potential for minerals and ways of employing new and innovative processing techniques. The Australian Earth Science Convention 2023 (AESC) was the best opportunity in this regard; it brought together a vibrant community of Earth scientists



CODES PhD student Javier Gil Rodriguez presenting his poster about his Renison Bell research at the AESC in Perth.

from Australia and worldwide, and provided the conditions for fostering collaboration and an understanding of the latest changes in geoscience research and updates relevant for the profession. During this event, I delivered my oral presentation – titled 'Environmentally sustainable production of critical metals: A mineralogical approach to tungsten recovery' – in the very interesting session called 'New advances in critical minerals systems'.

GOLDSCHMIDT2023

9–14 July, Lyon, France

Dr Ivan Belousov attended Goldschmidt, which is the largest conference in the field of geochemistry and attracts several thousand scientists from all over the world. This year it was held in person as well as online. Topics discussed range from planetary geochemistry to biogeochemistry and from mantle to surface geochemistry. Sessions were held in ~20 rooms simultaneously making it a very intense conference. Ivan gave a talk entitled 'Sulphides from mantle section pyroxenites from Voykar Ophiolite, Polar Urals', which discussed trace element and platinum group elements (PGE) concentrations in mantle Ni-Fe-Cu rich sulphides. This conference, being one of the first to be held without COVID restrictions, was well-attended and allowed Ivan to meet many colleagues and former CODES co-workers: Alexander Sobolev, Jay Thompson, Alexander Stepanov, Irina Zhukova, Indrani Mukherjee, Daniel Gregory, Anita Parbhakar-Fox, Ashley Norris and others.



Dr Ivan Belousov (right) photographed with Dr Sasha Stepanov (former CODES staff member) at the Goldschmidt2023 conference in Lyon, France.

STAFF FOCUS: YAMILA CAJAL

A WORLD OF OPPORTUNITY FOR A YOUNG CHILEAN GEOLOGIST



Following her PhD studies at ANU, Yamila Cajal has recently been appointed as a Research Fellow in Critical Minerals Characterisation at CODES. Working on both the Amira P1249 and RRC Critical Metals projects, she is looking forward to exciting fieldwork and research opportunities while working in Tasmania.

I am originally from Chile, where I studied geology in my home town at the Universidad de Concepcion. During that time, I was part of the Anglo American undergraduate program, which supported my studies and gave me the opportunity to do summer internships and my Honours project with them. For my Honours, I investigated the extension of the Eocene-Oligocene Cu-metallogenic belt in Northern Chile, where I had to define exploration targets, conduct fieldwork in remote locations, and work with geochemical and geochronological data. Then I worked as a mine geologist in a gold mine in Northern Chile, where I did a range of activities, from planning drilling campaigns, underground mapping and core-logging, to communicating

with the commercial labs. Although I really enjoyed my time there, I decided that I wanted to follow a research career path. However, my English was not good enough for studying overseas, so I moved to Melbourne to take an English course. After that, I went back to Chile and worked in exploration while I applied for research opportunities in Australia.

I got a scholarship to do a PhD at the Research School of Earth Sciences of the Australian National University in Canberra, where I worked with Professor Ian Campbell as part of the Petrology Group. As part of my research, I investigated the magmatic evolution and fertility of the supergiant porphyry copper deposits from Central Chile. For this, I used whole-rock geochemistry, including platinum group elements (PGE), as well as zircon geochronology and geochemistry. This

gave me the opportunity of working with some of the world's largest copper deposits, conducting fieldwork in the Andes and presenting my research at national and international conferences. I also had the opportunity to work as a demonstrator in undergraduate courses and volunteer in outreach activities, which were rewarding experiences for me. My research required extensive laboratory work, which got me the 'lab-rat' award from my PhD cohort. However, my progress slowed down when a hailstorm caused roof damage in our labs, and the repairs were delayed by Covid-19. Every person who did their PhD during Covid times knows how challenging it was, but we managed to make it (a big pat on the back to all of us!).

I moved to Hobart in February to work as a postdoctoral researcher fellow at CODES, where I am part of the Regional Research Collaboration Program (RRC)



Yamila Cajal pictured while visiting a gold mine at the Battery Hill Mining Centre, Northern Territory, on an ANU PhD student field trip.

and the Amira P1249 project. The opportunity of being part of a research team that works in collaboration with industry doing pioneering research on ore deposits was the main motivation for me to come here. These two projects allow me to work on topics that I am passionate about, such as magma fertility related to magmatic-hydrothermal deposits and learn about other topics in economic geology that I am interested in, such as critical metals.

Being part of Amira P1249 gives me the opportunity of continuing undertaking research in the Andes, where I am investigating magma fertility using the chemistry of different magmatic minerals. This will be applied not only to ore deposits but also to barren suites to further investigate what makes ore-forming magmas distinctive from 'normal' magmas. As part of the RRC, I have the opportunity of working with different ore deposits in Tasmania and investigating their magma fertility and critical minerals potential. The idea is to investigate the potential use of magmatic mineral chemistry as fertility indicators in different geological environments. One of the things I like about this project is its social component since it is done in collaboration with the UTAS School of Education and gives us the opportunity to work with the community in regional Tasmania. I am looking forward to learning more about different deposit types and the incredible geology of Tasmania.

I am very excited to be part of the CODES research team and I am looking forward to what is coming.

In August, I will be presenting some of my research at the SGA biannual meeting in Zurich, Switzerland. After that, we will be conducting fieldwork in Seville, Spain, with other researchers from the Amira P1249 team. In October, we will be running the Ores in Magmatic Arc Masters short course in South America. This will be a great opportunity to visit diverse ore deposits in Chile and Peru; I am particularly excited that the trip will start by visiting Rio Blanco and



Goldschmidt 2022 in Honolulu offered many professional networking opportunities for early career researchers. Yamila presented her PhD research on magma fertility at El Teniente at this conference.



Yamila is here performing laboratory work at the wet-chemistry lab of the Research School of Earth Sciences, ANU, during her PhD studies.

El Teniente, which are two deposits I studied during my PhD. I am thrilled with the opportunity to teach about Andean ore deposits, and to learn from the geologists that work in these places. During this trip, I will also have the opportunity of collecting rock

samples for my postdoc research in Northern Chile. This postdoc is a great opportunity for me to be part of one of the world's leading research groups in economic geology, and an interesting challenge to work across different projects and locations.

IZZY DELVES DEEP – AND COMES UP WITH SOME GEMS!

CODES/Earth Sciences Rock Curator Izzy von Lichtan was pleased to assist a Devonport organisation with their recent exhibition looking at the history of minerals and their influence in the Bass Strait area of Tasmania. She trawled through the massive UTAS Earth Sciences rock collection and came up with some fascinating exhibits for the show, as she recounts.

In early February, I was approached by the coordinator of the Bass Strait Maritime Centre –through the University of Tasmania Curatorial and Cultural Collections group – about the possibility of loaning samples from the Earth Sciences rock collection. The exhibition planned was called 'Strata: Metals, Minerals and Mining Along the Strait', focusing on how geology influenced the development of Devonport and the surrounding North-West Coast, changing it from a region focused on sheep and potatoes, to one exporting essential resources interstate and overseas.

After an initial consultation of what was needed, I looked through the archives as to what might be appropriate. In the end four large boxes of specimens of collection material, including rocks from the region, ores, and even glass flasks filled with Bass Strait oil were sent on loan for the exhibition. Some background information was also provided about each of the specimens.

The exhibition opened in Devonport on 8 May and ran through to 8 July. The show was reportedly a tremendous success with the local



A selection of rocks and minerals from the UTAS Earth Sciences collection on display at the Devonport exhibition.



Exhibition banner for the recent 'Metals, Minerals and Mining Along the Strait' show, held at the Bass Strait Maritime Centre in Devonport.

community and schools, and the tourist visitors seemed to appreciate it too. It was very much a positive outreach activity.

My favourite display in this exhibition was the one of old dip-pens, together with the small bottle of osmiridium from the Earth Sciences collection.



Fossils, gemstones and oil were among the items that CODES/Earth Sciences Rock Curator Izzy von Lichtan unearthed for the exhibition.



A flask containing osmiridium from the UTAS Earth Sciences collection is displayed alongside old pens and nibs. The highly prized osmiridium was mined in Tasmania and was used to make pen nibs: 'By 1919, almost every fountain pen nib in the world was made from Tasmanian osmiridium'.

The amount of osmiridium contained in the bottle could have made 30,000 fountain pen nibs!

UTAS was an exhibition sponsor as was Group 6 Metals, which is working with CODES on the Regional Research Collaboration Program research project into critical metals in Tasmania.

2023 SNS STUDENT RECOGNITION EVENING

In May, the School of Natural Sciences at UTAS held its annual Student Recognition Evening in the Stanley Burbury Theatre at which many students from across the science disciplines received recognition for outstanding achievements in their studies.

CODES PhD student Angela Costa was one of five students who gave a keynote address; she talked about her work on the Dolphin tungsten deposit

on Kind Island in the search for critical metals. Also from CODES, Javier Merrill Cifuentes (who has since graduated) received a PhD Award for Outstanding Performance during Postgraduate Studies in Earth Sciences/CODES. And CODES Honours student Felix Dobbin received the GSA S.W. Carey Prize for the best Honours thesis (see page 23).

Several other CODES/Earth Sciences students received honourable mentions or were awarded scholarships.



CODES PhD students Jose Barillas Diaz, Angela Costa and Musa Emmanuel Dogara at the SNS Student Recognition Evening.

An online booklet giving details of all prize winners is available at: <https://www.utas.edu.au/programs/natural-sciences-recognition>

AMIRA P1249: MAJOR PROJECT HALF-YEAR REPORT CARD



Amira P1249 project team members and sponsors gathered on the lawn in the CODES Rock Garden. The third Sponsors' Review Meeting, held on 13–14 June, saw a high turnout – both in-person and online – and good opportunities for PhD and Honours students to meet and interact with mining and mineral industry representatives.

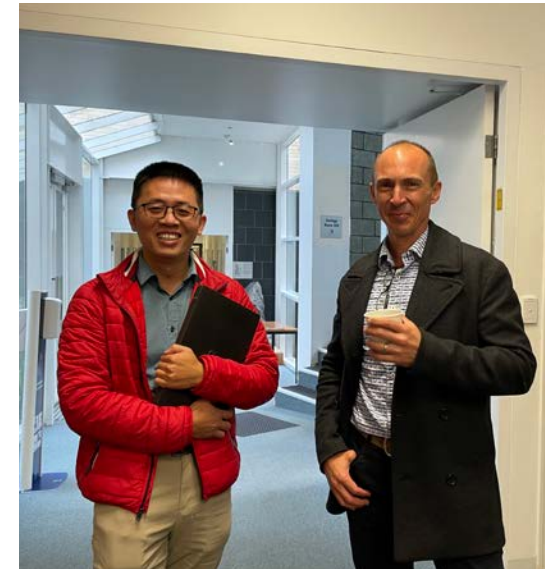
The Amira Global P1249 project, 'Exploring, characterising, and optimising complex orebodies – Integrated deposit knowledge to add value across the Mining Value Chain,' held its third Sponsors' Review Meeting (SRM) at CODES on 13–14 June, reports Dr Mike Baker. The SRM was well attended by both industry and researchers, with 30 representatives from sponsor companies, 17 CODES staff and students, and five Amira P1249 collaborators, including staff and students from Lakehead University, Universidad Austral de Chile, and Mineral Mapping consultancy attending either in-person or online.

Over the two days of the meeting, the Amira P1249 research team provided project sponsors with updates on the progress of their research activities across their study sites in Australia

(Cowan, Mount Isa, Northparkes E26 and E44), southeast Asia (Batu Hijau, Sunda-Banda Arc), central Asia (Kurpetai), and South America (El Teniente, Nolasco, Valeriano, Ventana). Technical talks were presented on the LocatOre 3.0 software and chlorite mineral chemistry. Three new P1249 study sites were also introduced to the sponsor group: the Magdalena VHMS deposit in the Iberian Pyrite Belt of southwest Spain; the Ocelot porphyry prospect in Arizona, USA; and the Porfido Norte porphyry deposit in the El Salvador district of central Chile. The meeting included several oral and poster presentations from postgraduate student members of the P1249 research team, and poster sessions for the wider CODES PhD and Honours student cohort, that gave CODES students the opportunity to meet and interact with representatives of the mining and mineral exploration

industry. The SRM concluded with a half-day technology transfer workshop on Fourier transform-near infrared (FT-NIR) and Fourier transform infrared (FTIR) spectroscopy, run in collaboration with Dr Thomas Rodemann from the UTAS Central Science Laboratory. On the first night of the meeting, a lively SRM dinner for sponsors and researchers was held at the Pancho Villa restaurant in North Hobart.

The Amira Global P1249 project is sponsored by Anglo American, AngloGold Ashanti, BHP, Boliden, CMOC-Northparkes, CODELCO, Evolution Mining, Fortescue Metals Group, First Quantum Minerals, Glencore (Mount Isa Mines), Newcrest, Newmont, Rio Tinto, Sandfire Resources, and South32. The next Amira P1249 Sponsors' Review Meeting (SRM4) will be held at UTAS, Sandy Bay, on 5–6 December 2023.



Senior Lecturer Dr Lejun Zhang (left) talks with Tim Ireland from First Quantum Minerals at the third Amira P1249 Sponsors' Review Meeting in June.



Full house: Amira P1249 meeting participants discussing their projects and posters during an afternoon tea break.



The Amira P1249 Sponsors' Review Meeting coincided with Dark Mofo and participants were treated to a suitably themed Pancho Villa restaurant in North Hobart for the SRM dinner.

CODES INDUSTRY PARTNERS 2023

Industry partnerships are still open for 2023 – please join us by contacting Professor David Cooke (d.cooke@utas.edu.au) or Helen Scott (helen.scott@utas.edu.au). By becoming a CODES Industry Partner your company will be contributing to important ongoing minerals research and will have access to significant research benefits.

PLATINUM



GOLD



SILVER



CODES RRC CRITICAL METALS PROJECT POWERS AHEAD



CODES students and staff with other speakers and guests pictured following the UTAS/CODES Mining Roadshow, which was held in the Gaiety Theatre, Zeehan, on 7 June. The event provided information for locals about CODES' research into critical metals on the West Coast and the work opportunities available within the mining industry. (Photo: Alan Jennison)



The Regional Research Collaboration project on critical metals is continuing to gather pace, with fieldwork to most of our partner sites in the west and northwest of Tasmania undertaken at least once, reports Dr Owen Missen.

Since our previous newsletter we have also had Nelao Naimbale join us to undertake her PhD on the Severn tin deposit in Zeehan. Several PhD students

are already progressing onto their first analytical measurements at CODES Analytical Laboratories (CAL) and Central Science Laboratories (CSL), and several team members have presented preliminary results at the CritCon and AESC conferences in May and June. The project steering committee met for the first time in June and received positive feedback on the direction of the project, setting us up well for the second half of 2023 as the project gathers pace. Fieldwork will continue in 2023 and we will be further analysing our samples using a variety of techniques.

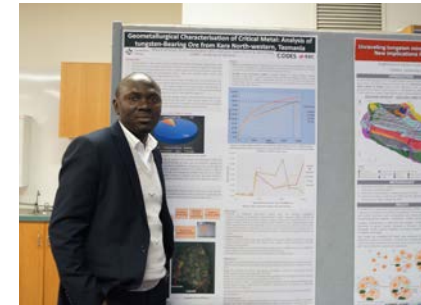
MINING ROADSHOW 7-8 JUNE 2023

UTAS/CODES held a Mining Roadshow as part of the RRC commitment to outreach and engagement, which travelled through Zeehan and Burnie in Tasmania's northwest in early June. Both events included a great mix of presentations by eight RRC PhD students and an industry panel, with fantastic attendance across both events. Key topics discussed included the job opportunities in mining, and how mining is adapting to be more environmentally sustainable. Owen Missen, postdoctoral researcher, said: 'it was fantastic to see the RRC students introduce themselves and their work to the community. Many people commented on the great team we have brought together at CODES.'

We are grateful to Belinda Martin (Regional Learning Officer) and Clarissa Forster (UTAS Regional Partnership Team Manager) for all their on-the-ground assistance in setting up the events. Clarissa wrote that 'the atmosphere and energy of the events was refreshing and all students, members of the community and industry partners seemed to enjoy the events'.



CODES PhD student Emrecan Yurdakul (right) gives a Mining Roadshow presentation about his research into the Western Tharsis Cu-Au deposit while Professor David Cooke (centre) and postdoctoral researcher Owen Missen look on.



Recently-arrived CODES PhD student Musa Emmanuel Dogara with his poster, which was presented at the first RRC Sponsors' Meeting on 7 July at CODES.



Leader of 'Element 2: Pathways to production' within the RRC critical metals project, Dr Julie Hunt (left), chats with Dr Lejun Zhang and Masters student Henry Schaumburg during the morning tea break at the RRC meeting on 7 July.

FIRST RRC SPONSORS' MEETING 7 JULY 2023

On 7 July, the first RRC Sponsors' Meeting was held in Hobart at the CODES offices. Attendees included both in-person and virtual industry and government partners, as well as the RRC team and wider members of CODES. The day featured 16 talks across all three elements



Postdoctoral researcher Yamila Cajal speaking at the first RRC Sponsors' Meeting for the Regional Research Collaboration critical metals project, held at CODES on 7 July.



CODES PhD student Javier Gil Rodriguez undertaking fieldwork in the Renison core shed for his research on the Renison Bell Sn deposit within the RRC critical metals project.



Kevin Robinson from MMG speaking with CODES PhD student Vinicius da Cruz during a break in proceedings at the first RRC Sponsors' Meeting for the critical metals project.



Nelao Natukondje Naimbale, who has recently arrived at CODES to do her PhD, working in the core shed at the Severn tin deposit in Zeehan.

of the project (Characterisation; Pathways to production; Education and engagement). Owen Missen, postdoctoral researcher, noted that 'across the first six months of the project, research projects have kicked off across Tasmania's west and northwest. Sponsor meetings are a great chance for everyone to share our progress'. Most importantly, there were several opportunities for discussion

around topics such as the genesis of unusual mineralisation in Tasmania's west, production metallurgy of carbonate minerals, opportunities for critical metals in mining wastes and future engagement activities.

We are looking forward to our next RRC update meeting, which will be held in Tullah on 29 November in conjunction with the Tasmanian Geosciences forum (30 November).

REGIONAL RESEARCH COLLABORATION PROGRAM: OUR PROJECT PARTNERS

The 'Environmentally sustainable production of critical metals' project, funded by \$3.5 million from the Australian Government, brings UTAS and CODES together with ten Tasmanian-based mining businesses, two academic institutions and two Tasmanian agencies to investigate environmentally sustainable critical metals and improve educational and job outcomes for regional Tasmanians.

We acknowledge and welcome the input of the collaborating companies and institutions.



COMMUNITY ENGAGEMENT

OUTREACH TO SCHOOLS AND COLLEGES PLAYS VITAL ROLE

CODES/Earth Sciences outreach activities for 2023 have been up and running for six months now and encompass all age groups from primary school to college level and the general public. Here's a taste of what our staff and students have been doing recently.

AGFEST

2-4 May 2023

Chris Allen, Harrison Keeble and Axel Cima

Agfest 2023 moved back to its May slot in the calendar this year. CODES students manned the 'gem-nasium', festooned with Tasmanian mineral specimens and popular polished gems. All three days were non-stop with interest from all ages, with kids showing off their prospecting/looting skills by spotting the gems from a distance. Rosie the dinosaur also made regular appearances to amuse or occasionally terrify the crowd, and even got to have a dance with the army band. A survey of visitors to the University pavilion showed the 'gem-nasium' was one of the most enjoyed activities.



Rosie the CODES dinosaur is always a big hit with the crowds at outreach events, and Agfest in May was no exception. CODES PhD students Chris Allen and Axel Cima along with Honours student Harrison Keeble ran the Earth Sciences booth at Agfest this year.



A Masterclass Day for Year 11 and 12 students was held at the UTAS Inveresk campus in June; Francisco Testa facilitated the Earth Sciences sessions and was pleased with the number of students who expressed an interest in following up by taking a geology unit at UTAS.



Francisco Testa and Sheree Armistead talking to a class of Year 3 students from Friends, one of many school outreach activities to have taken place this year.



Masterclass participants were able to examine rocks under the microscope and had to guess where the rocks were formed.

FRIENDS SCHOOL VISIT

29 May 2023

Sheree Armistead, Francisco Testa

Staff members Sheree and Francisco hosted a group of around 60 Year 3 students from Friends School in Hobart and spoke to them about the wonders of rocks and geology, and let them loose in the 'gem-nasium' so that they each were able to take home a souvenir of the day.

MASTERCLASS DAY 2023

28 June 2023, UTAS Inveresk campus, Launceston

Francisco Testa

This event is now in its fourth year and is designed to provide Year 11 and 12 students with information to help them consider university as an option. CODES Lecturer Francisco Testa ran two 50-minute masterclasses of 20 to 25 students. They were given an overview of geological sciences and the areas in which geoscientists' skills are needed for our daily life activities.

The students each did three activities:



- They had to organise a series of fossils from oldest to most recent based on the clues provided.
- They were given a series of minerals with their chemical formulae, and the students needed to work out which of these minerals were used to create items that we use every day, including mobile phones, solar panels, electrical wire, glass and porcelain plates, among others.
- They experienced what rocks under the microscope look like and were prompted to guess which of the three rocks provided were formed in the mantle, deep in the crust, and due to volcanic activity.

Before wrapping up, all the answers were provided for the activities and discussion was encouraged. Francisco suggested students considered enrolling in the KEA101 Planet Earth unit to see if they would like to become geoscientists. As this unit is delivered online, many students seemed quite keen. Last, but not least, they were invited to take two gemstones home, and that was probably the icing on the cake for them!

This event was mainly targeted at students from Years 11 and 12 in rural regions, many of whom had never had family members attend university previously. It was important to make sure they had a good experience and consider attending uni when the time is right.

CHANGING FACES

In the past three months we have had two further PhDs join us as well as a visitor who will be with us until October. And more PhD students continue to come to the end of their long and winding research road.

PhD STUDENT	START DATE	PROGRAM	PROJECT TITLE
 Nelao Natukondje Naimbale	20 April 2023	Supervisors: David Cooke, Lejun Zhang, Wei Hong, Robert Scott, Adam Frankcombe Working on the RRC project	Characterisation of the Heemskirk tin project, western Tasmania
 Isaac Evinemi	30 June 2023	Supervisor: Matthew Cracknell	Deep learning systems for porphyry copper deposits

VISITOR



Dr Eric Dominic Forson from the University of Ghana is visiting CODES for three months from early July. Dr Forson specialises in geophysics with a keen interest in mineral, hydrogeological and geohazards monitoring applications using machine learning, multicriteria decision making methods and geospatial approaches. He will be working with Dr Matthew Cracknell on applying machine learning models for mineral and hydrogeological studies.

PhDs MOVING ON UP



Xin Ni Seow has recently submitted her PhD thesis entitled 'Geochemistry, mechanism of formation and exploration implications of alunite supergroup minerals' for examination.



Elena Lounejeva has submitted for examination her PhD thesis entitled 'Geochemical signature of syngenetic and diagenetic pyrite from marine sediments as a paleo-environmental tool'.

CODES HONOURS STUDENT PRIZEWINNER

Felix Dobbin has won the GSA's 2022 S.W. Carey Prize for the best Honours thesis in the geological sciences at UTAS. He writes:

I was honoured to receive the news that I had been awarded the S.W. Carey Prize by the GSA. It was great to end my Honours year and project on this note. My thesis comprised the development of a geological and genetic model of Magmatic Resource's Kingswood porphyry Cu-Au prospect. It was a very rewarding experience that has helped me immensely as I begin my career in the mining industry. I would like to thank my supervisors, Professor David Cooke and Dr Lejun Zhang, who helped and guided me along the way.



Felix pictured at Northern Star Resources' Thunderbox Gold Mine in Western Australia, where he is currently working.



**A MESSAGE
FROM THE
CODES
DIRECTOR,
PROFESSOR
DAVID COOKE**

It's been a very busy but enjoyable past few months at CODES, as there's a great deal of enthusiasm and excitement here with our new research projects and fantastic cohort of graduate students and postdoctoral researchers, and our visit from the CUGB delegates. Delivery of our flagship Master of Economic Geology training program, and the Graduate Certificate in Economic Geology have been a major focus, with four intensive units delivered since February and another three being delivered in the next few months, making this the most teaching-intensive year of the Masters Program's 34-year history. Our training activities have included intensive field-based courses (Advanced Field Techniques: February; Ores in Magmatic Arcs: Indonesia – March), online training (Fundamentals of Economic Geology: April–May) and blended in-person and online training (Ore Deposit Geochemistry, Hydrology and Geochronology: June–July). A big thank you to our guest presenters Adi

Maryono, Iryanto Rompo, Scott Halley, Noel White, Larry Meinert, Cassady Harraden, Tim O'Callaghan, Karsten Goemann, Nick Oliver, Phil Blevin and Lesley Wyborn, who help to make these training courses such a rich and valuable learning experience. Thanks also to Rob Scott, Lejun Zhang, Francisco Testa, Mike Baker, Sheree Armistead, Sebastien Meffre, Jeff Steadman, Jeffrey Oalman, Alex Farrar and Wei Hong for their efforts in delivery of these units. A big thank you to Helen Scott, Karen Huizing and Caroline Mordaunt for all of their efforts to administer and manage the Masters units, ensuring excellent experiences for all of our participants and presenters.

Coming soon, our increasingly popular online Geodata Analytics unit will commence in August, and we will close off the year with two in-person Masters courses: the Tasmanian-based Geometallurgy unit, including a field trip to Western Tasmania, and Ores in Magmatic Arcs: South America in late October–early November in Chile and Peru. The Ores in Magmatic Arcs unit is fully subscribed with a waiting list, but registrations are still open for both Geodata Analytics and Geometallurgy – so if you are interested in joining our Masters or Graduate Certificate programs, then I encourage you to apply and sign up for these excellent training and professional development opportunities.

Significant advances have been made in all of our major research projects this year. Our Regional Research Collaboration (RRC) team did a great job of community and industry engagement in June, running Mining Roadshows in Zeehan and Burnie, with about 50 participants at each event. It was a pleasure to see strong engagement from local community and industry members as we discussed the global challenges facing society, and how mining of copper and critical metals is an essential part of tackling those challenges. The RRC team's first sponsors' meeting in Hobart in July went very well with strong industry engagement – we are looking forward to the second sponsors' meeting in Tullah this November, which will precede the Annual Tasmanian Geoscience Forum. The Amira P1249 team did a great job with the third Amira P1249 sponsors' meeting and workshop in June, with team members now preparing to travel to Europe in August to participate in the Amira Exploration Managers Conference and SEG Conference in London, and the SGA meeting in Zurich, before conducting fieldwork in Spain. It looks like a busy few months ahead for us all.

David Cooke

UPCOMING SHORT COURSES

GEODATA ANALYTICS (KEA713)

PART 1:

7 AUGUST–16 SEPTEMBER 2023

PART 2 (INTENSIVE):

18–22 SEPTEMBER 2023

PART 3:

25 SEPTEMBER–15 OCTOBER 2023

This unit will provide industry-based geoscientists with an understanding of the fundamental concepts of database handling and manipulation, statistical analyses, pattern recognition and machine learning for the processing, analysis and modelling of large volumes of multivariate geoscience data. This unit is divided into three parts delivered online and in succession.

Unit leader: Dr Matt Cracknell

Delivery mode/location:

Online, delivered via a combination of pre-recorded content, 'live' lectures and discussion 'forums'

GEOMETALLURGY (KEA711)

16–27 OCTOBER 2023

Geometallurgy involves a quantified and comprehensive approach to ore characterisation in terms of critical processing attributes: including blasting, crushing, grinding, liberation, recovery and environmental management. Key outcomes of improved geometallurgical knowledge are improved forecasting, reduced technical risk, enhanced economic optimization of mineral production, and improved sustainability.

Unit leader: Dr Julie Hunt

Delivery mode/location:

Face-to-face, Tasmania (Australia)

**ORES IN MAGMATIC ARCS
(KEA707)**

**25 OCT–11 NOVEMBER 2023
(SOUTH AMERICA)**

A field-based unit which includes visits to world-class deposits, studies of the regional and local geology, and detailed evaluations of ore deposit characteristics, mineralisation styles and genetic models. Exploration techniques are discussed and evaluated.

Unit leaders: Professor David Cooke, Yamila Cajal

Delivery mode/location:

Face-to-face, Chile and Peru

**COVID-19 travel restrictions permitting*

For more details of all these courses: See the course flyers at:
<https://www.utas.edu.au/codes/masters-short-courses>

For further information about short courses in general, please email:
CODES.Info@utas.edu.au OR Master of Economic Geology Program Co-ordinator,
Dr Robert Scott: **Robert.Scott@utas.edu.au**