

ORE SOLUTIONS

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

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NEW COPPERBELT RESEARCH SET TO PUSH THE BOUNDARIES

'Sediment-hosted Cu-Co deposits: developing new mineral chemistry exploration tools': A new CODES research initiative

CODES has long been at the forefront of research on sediment-hosted ore deposits, working closely with industry partners to develop innovative exploration techniques. Building on more than two decades of research, a new project is set to push the boundaries of mineral chemistry as an exploration tool for sediment-hosted copper (Cu) and cobalt (Co) deposits. Led by Dr Sheree Armistead, Dr David Selley and Professor David Cooke, this initiative will leverage cutting-edge analytical methods to refine exploration models and provide industry with practical tools for identifying new deposits.

WHY SEDIMENT-HOSTED CU-CO DEPOSITS MATTER

Sediment-hosted Cu-Co deposits are some of the world's most significant sources of copper and cobalt – critical metals needed for renewable energy technologies, electric vehicles and global electrification. Despite their economic importance, these deposits



Core strategy: (L-R) Dr Sheree Armistead and Dr David Selley from CODES, and Dr Subaru Tsuruoka and Munshya Zimba from First Quantum Minerals (FQM), looking at the Fishtie drill core at FQM's exploration site in Ndola, Zambia, in October 2024.

remain challenging to explore due to the complex nature of sedimentary basins and the limitations of traditional geochemical tools.

The Central African Copperbelt, the world's premier sediment-hosted Cu-Co province, hosts deposits that demonstrate a unique interplay between sedimentary processes, tectonics and hydrothermal activity. Understanding these processes at a fundamental level is key to predicting where undiscovered

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deposits might be found, both within the Copperbelt and in analogous geological settings worldwide.

FROM THE DIRECTOR

Professor David Cooke applauds the success of the Ores in Magmatic Arcs Masters short course that ran in Indonesia recently, and outlines future Masters courses. And he congratulates staff and students on continuing research projects that engage with potential industry and research partners.

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Geologists from CODES and FQM in the core facility at FQM's Trident Project in Zambia (L-R): Professor David Cooke, George Nkonde, Dr Sheree Armistead, Keith Sikabonga, Fumba Phiri (hiding), Dr Tim Ireland, Emmanuel Phiri and Dr Rob Sievwright. (Photo: Ashleigh Ball)

CHALLENGES IN EXPLORATION

One of the biggest obstacles in exploring sediment-hosted Cu-Co deposits is the difficulty in distinguishing productive aquifers from barren ones. Hydrothermal alteration extends well beyond the orebody, making conventional chemical vectoring methods unreliable. Additionally, exploration in transported regolith-covered terrains is challenging because the primary geochemical signals become diluted or masked.

However, recent research has demonstrated that mineral chemistry – particularly of resistate minerals such as apatite, rutile and tourmaline – can preserve hydrothermal signatures and provide a new way to detect fertile hydrothermal systems. This approach was validated in the Amira P1206 pilot project, led by Dr Shaun Barker, which established that mineral chemistry can differentiate between high-grade and low-grade mineralised zones. The next step is to refine these findings and develop mineral chemistry tools that can be applied systematically in exploration programs.

PROJECT OVERVIEW AND RESEARCH MODULES

This research program is designed to build on the successes of the P1206 pilot project and further develop mineral chemistry as a tool for sediment-hosted Cu-Co exploration.

The project is structured into three key modules:

1. Defining the Footprints of Sediment-hosted Cu-Co Deposits

This module aims to characterise the mineralogical and geochemical signatures of high-grade Cu-Co deposits at the deposit scale. By analysing resistate minerals such as apatite, rutile and tourmaline, researchers will investigate whether mineral chemistry varies systematically with ore metal content and proximity to mineralisation.

Cutting-edge analytical techniques, including Laser Ablation-Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and cathodoluminescence imaging, will be used to assess trace element variations, rare earth element (REE) patterns, and inclusion populations within these minerals. This work will help define key geochemical parameters that could serve as reliable vectors for mineralisation.

2. Mineral Chemistry in Transported Media

Exploring for mineral deposits in areas covered by transported sediments presents a major challenge. This module will assess whether hydrothermal mineral chemistry signatures are preserved in detrital grains within transported sediments. If successful, this approach could revolutionise exploration in regions

with extensive cover by allowing mineral chemistry to be used as a vectoring tool in regolith environments.

By comparing mineral chemistry data from transported sediments with in-situ mineralisation, this study will help determine how far mineralised signals can be traced from their source and whether such signatures can be used to pinpoint buried deposits.

3. Identifying Prospective Basins Globally

The final module will apply the methodologies developed in Modules 1 and 2 to assess the fertility of basins worldwide. Using a combination of geochemical, mineralogical and structural data, researchers will evaluate whether sedimentary basins outside the Copperbelt, such as the Stuart Shelf (South Australia) and the Chu-Sarysu Basin (Kazakhstan), exhibit similar hydrothermal mineral chemistry signatures indicative of Cu-Co mineralisation.

A key aspect of this research will be the use of big data analytics and machine learning to synthesise large geochemical datasets. By applying advanced statistical approaches, researchers aim to develop predictive models that can help prioritise exploration targets in underexplored sedimentary basins.

KEY TECHNOLOGIES AND ANALYTICAL APPROACHES

The project will employ a range of advanced analytical techniques to uncover the subtle geochemical variations that define mineralisation signatures. These include:

- **LA-ICP-MS** for high-resolution analysis of trace elements and isotope ratios in resistate minerals.
- **Cathodoluminescence imaging** to differentiate between hydrothermal and detrital minerals.
- **Geodata analytics and machine learning** to automate the identification of geochemical patterns and mineral inclusion populations.
- **Fluid inclusion studies** to investigate the chemical composition of ancient hydrothermal fluids and trace their movement through sedimentary basins.

EXPECTED OUTCOMES AND INDUSTRY IMPACT

The outcomes of this research will provide tangible benefits to the exploration industry by:

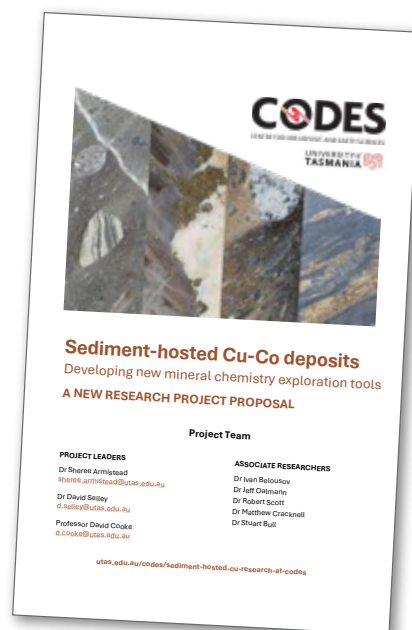
- Developing **cost-effective exploration tools** that help identify prospective Cu-Co mineralisation zones.
- Improving our understanding of **fluid dynamics in sedimentary basins**, leading to better prediction of ore-forming environments.
- Providing guidelines for **exploration under cover**, reducing risks and exploration costs in regolith-dominated terrains.
- Enhancing the ability to **differentiate between fertile and barren aquifers**, improving exploration efficiency.

By integrating mineral chemistry into exploration workflows, this research has the potential to transform how industry targets sediment-hosted ore deposits.

A COLLABORATIVE EFFORT

The success of this project will be driven by close collaboration between CODES researchers and industry partners. The project team includes leading experts in mineral chemistry, structural geology and basin analysis, ensuring a multidisciplinary approach to tackling key exploration challenges.

The research will be led by Dr Sheree Armistead, whose Australian Research Council DECRA Fellowship will provide additional scientific insights into the tectonic and climatic controls on sediment-hosted ore deposits. She will be joined by Dr David Selley and Professor David Cooke, along with a



This new research proposal from CODES is set to develop next-generation exploration tools, and the lead researchers invite participation from industry partners interested in collaborating on the project.

strong team of CODES researchers including Dr Ivan Belousov, Dr Jeff Oalman, Dr Robert Scott, Dr Matthew Cracknell, Dr Stuart Bull and Dr Zeb Zivkovic.

Industry collaboration will be critical to the project's success, and CODES is actively seeking partners to provide access to study sites, facilitate fieldwork, and contribute financial support.

Dr Sheree Armistead adds: "This project is a fantastic opportunity to apply new geochemical and mineralogical techniques to one of the world's most important copper deposit types. I'm excited to see how these tools can help us refine our understanding of ore deposit formation and improve exploration success".

JOIN US IN ADVANCING EXPLORATION

The demand for copper and cobalt is set to increase as the world transitions to a low-carbon economy. This research initiative represents a unique opportunity to develop next-generation exploration tools that will improve our ability to discover and sustainably extract these critical resources.

Industry partners interested in collaborating are encouraged to reach out to Dr Sheree Armistead (sheree.armistead@utas.edu.au) or Professor David Cooke (d.cooke@utas.edu.au) for further information.

CODES is excited to lead this innovative project and looks forward to working with industry to shape the future of sediment-hosted Cu-Co exploration.

MASTERS CLASS IN GEOLOGY

Master of Economic Geology Program Coordinator Dr Rob Scott outlines this year's upcoming short courses – and a task for the upcoming Ore Deposit Geochemistry short course participants.

The Master of Economic Geology (MEconGeol) degree program at CODES is entering its 37th year, and 2025 is shaping up to be another busy one for the program, with continued growth in student numbers and six coursework units to be delivered. As I write, David Cooke, Lejun Zhang and Rebecca Carey, together with two Indonesian colleagues, are leading a group of 16 Masters students and eight industry participants on the field-based Ores in Magmatic Arcs unit in Indonesia. A second offering of Ores in Magmatic Arcs delivered in South America (Chile and Peru) is planned for late October. Fundamentals of Economic Geology will be delivered online in two, week-long blocks in early April and early May (see back page). Mid-year, the Ore Deposit Geochemistry, Hydrology and Geochronology short course will again be delivered across two week-



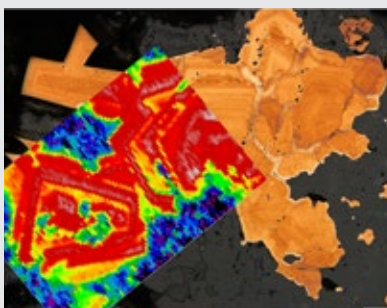
Dominic Murphy, Superintendent Exploration APAC at Newmont, pictured at Ngauruhoe volcano in New Zealand while doing the Tongariro Crossing during the KEA708 Volcanology Masters course in 2024.

long blocks in early June and July. Later in the year Matt Cracknell will deliver Geodata Analytics, and Angela Escolme will lead the Geometallurgy short course.

So far in 2025, there have been 14 new admissions to the MEconGeol program, and a further four students have signed up for the two-unit Graduate Certificate in Economic Geology (GCertEconGeol). If present trends continue, the 2025 intake is set to surpass that for 2024, when 24 new students commenced the program, and keep the total number of students in the program (MEconGeol + GCertEconGeol) above 80.

PYRITE SAMPLE TASK

A popular assessment task for the Ore Deposit Geochemistry unit involves participants interpreting trace element and lead isotopic data for a pyrite sample they had previously sent to CODES for LA-ICP-MS analysis. The textures and trace element content of pyrite reflect its growth history and the physio-chemical conditions under which it formed. Pyrite can be useful in fingerprinting deposit types, resolving deposit parageneses and hosts many important pathfinder elements for mineral exploration.



The photomicrograph here shows pyrite in a sample provided for the 2023 Ore Deposit Geochemistry short course by MEconGeol student Joel Sidoruk. A laser ablation mount is prepared for the sample, and pyrite in the mount is chemically etched to help identify the most interesting grains for analysis. Variations in tarnish intensity of the etched grains commonly reflect differences in trace element content. The copper content determined by LA-ICP-MS is shown superimposed over part of the image. In this sample, the most copper-rich growth zones in pyrite (shown as dark red fading to white) contain well over 1 wt% Cu. Participants for this year's short course are encouraged to send their pyrite samples to Robert Scott as soon as possible (see back page for contact details).

TWO STUDENT NEARING COMPLETION OF THEIR MEconGeol COURSES TELL OF THEIR EXPERIENCES:



DOMINIC MURPHY

Superintendent Exploration APAC – Newmont

The Master of Economic Geology course provided by CODES has been a thoroughly enjoyable and rewarding experience that I believe will have

a lasting impact on my life as an industry geoscientist. I embarked on the Masters program following several years of industry experience. This allowed me a great basis to take the practical elements of mineral systems knowledge and techniques for orebody characterisation, directly back into my professional life. The short course delivery (online and in-person) is well-rounded. The variety of geoscience disciplines is ideal for those seeking an applied approach in their postgraduate studies.

The course has improved my capabilities as an explorer both in early-stage and advanced project or mine settings, including multiple commodities. It has also provided great opportunities to see orebodies up close, throughout Australia and New Zealand.

In addition to the course content, I feel privileged to have interacted with some of the world-class educators and industry professionals through the Masters course. The diverse cohort of students that I've also met along the way, are a unique cross-section of explorers who will make future discoveries. I look forward to staying in touch.

"Thanks to the CODES team and Newmont-Newcrest for the support throughout the program. I hope to see it go from strength to strength in the future."



MEGAN WEATHERMAN

Senior Exploration Specialist at Gold Fields

Completing a Master of Economic Geology at CODES has been a long-time aspiration that I never thought I would achieve. Exposed to the high calibre of teaching at UTAS and the outstanding field programs some 20 years ago via an Honours mapping trip in western Tassie, I knew that if I ever went back to uni, UTAS was the only choice for me. In 2020, after spending



Meg Weatherman, who works for Gold Fields, is seen here atop Tarawera Volcanic Complex, at the northern end of the presently active Taupo Volcanic Zone on North Island, New Zealand, during a Masters field trip to the area. She has recently completed the MEconGeol.

years in support roles becoming increasingly disconnected from the rocks, I enrolled in the Masters coursework program as way to stay in touch with geology, immerse myself in a broader variety of ore deposits and strategies for finding them.

During what were quite unpredictable pandemic years for me, the design, flexibility and mixed delivery format of the CODES program offered me great freedom to complete my Masters at my pace – with me able to undertake many of the online units early on, before finishing up with fieldwork units. The breadth and scope of the full program provided a comprehensive theoretical overview of geological concepts, case studies, data workflows and exploration research pertaining to economic ore deposit geology from around the world. Field trips to New Zealand, Western Tasmania and (imminently) Indonesia have backed up the theory by providing up-close practical encounters and mapping exercises within geological terranes and ore deposits on the ground. Collectively these units offer exposure to the fascinating complexity of volcanic regions (i.e., Taupo Volcanic Zone; Mt Read Volcanics; Sunda Volcanic Arc) and their associated ore deposits in both older and modern forms. There is no way I could have experienced all of this, on my own.

The diverse exposure to a broad range of professors, educators and industry experts is unparalleled. Hearing the full spectrum of perspectives, explanations, examples and debates has allowed me to fully grasp the collective geological concepts at play in magmatic-hydrothermal systems. I felt as though all the puzzle pieces and half-conceived ideas from the field were finally being consolidated into a more holistic overview of economic geology.

Being able to indulge the time in reading and researching all the literature as part of many of the assessments was similarly a privilege not easily afforded to those in the exploration industry! Gaining increased rapidity in processing literature will help me for years to come.

"My time spent completing the Masters coursework quickly became the most enjoyable part of the past five years. This is in no small part due to the refreshing cohort of students and educators at CODES, amazing degree of organisation and thought put into the program, and the shared experience in the quest for understanding that might lead to that next big discovery. I'm very grateful to have been able to do this, and to have crossed paths with so many wonderful supportive professionals. Thank you."

CODES HONORARY RESEARCHER AWARDED PRESTIGIOUS FELLOWSHIP

Honorary Professor Khin Zaw from CODES has been invited to South Korea on a Brain Pool (BP) Research Fellowship by the Government of South Korea, and will be living in Seoul and carrying out research at Seoul National University throughout 2025.

This highly competitive fellowship recognises his outstanding contributions to the field of economic geology and supports his collaborative research efforts in Asia and Southeast Asia.

The BP Fellowship, administered by the National Research Foundation (NRF) of South Korea, aims to attract world-class scientists to collaborate with Korean research institutions, fostering innovation and advancing scientific frontiers. Through this fellowship, Professor Khin Zaw will engage in a research partnership with leading Korean geoscientists from Seoul National University, in particular with Professor Jung-Woo Park, from the School of Earth and Environmental

Sciences, to enhance understanding of chalcophile and critical mineral resources, particularly in the context of global tectonics, supply chain security and sustainable development.

Professor Khin Zaw has an extensive research background in economic geology, particularly in metallogeny, ore genesis and mineral exploration. With decades of experience, he has collaborated with various academic and industry partners worldwide, producing high-impact research that has contributed to modern mineral exploration programs.

The collaboration is expected to strengthen research ties between CODES at the University of Tasmania and South Korean geological institutions, fostering knowledge exchange and capacity building in mineral exploration and resource assessment. Additionally, this partnership will provide opportunities for student training and early-career researcher development, enhancing expertise in the field of economic geology.



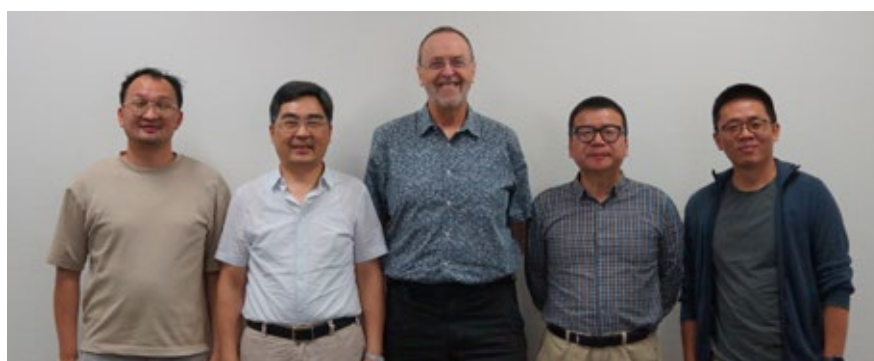
CODES Honorary Professor Khin Zaw is pictured in South Korean traditional costume while on a visit to the country prior to taking up his BP fellowship.

Professor Khin Zaw's selection for this prestigious BP Fellowship showcases his reputation as a leading geoscientist and highlights the importance of international collaboration in addressing challenges in mineral resource exploration and sustainability.

CHINESE ACADEMICS WELCOMED TO CODES

During the last week of February, CODES hosted two long-time academic collaborators from China, and both gave well-received talks to the staff and students, and were able to exchange research ideas and future plans.

Professor Huayong Chen is a former CODES postdoc research fellow, who is now a Full Professor of Economic Geology at the Guangzhou Institute of Geochemistry, Chinese Academy of Sciences (GIG-CAS). He is also the travelling lecturer for IAGOD (International Association on the Genesis of Ore Deposits) for 2025. Huayong gave two talks on consecutive days: 'Using minerals as a tool for mineral exploration' and 'New modelling of Cu mineralisation in the Chinese Central Asia Orogenic Belt'.



CODES hosted two Chinese visiting academics during February, both of whom have strong ties to the Centre. Pictured are (L-R): Dr Wei Hong from CODES, Professor Taofa Zhou (from Hefei University of Technology), CODES Director Professor David Cooke, Professor Huayong Chen (Guangzhou Institute of Geochemistry) and Associate Professor Lejun Zhang from CODES.

Professor Taofa Zhou from Hefei University of Technology is a long-time collaborator with several CODES researchers. He is also Associate Professor Lejun Zhang's former PhD supervisor. Taofa gave the following presentation: 'Pyrite in a porphyry-skarn Cu (Au) system and implications for ore formation and prospecting in

Xinqiao deposit, Middle-Lower Yangtse Belt, China'.

This talk gave a great perspective of the types of deposits that define the diverse and rich Yanshanian belt along this major crustal boundary in China, an area to which the CODES SEG Student Chapter is planning to travel later this year.

VIRTUAL TOURS TO SHOWCASE MINE REMEDIATION

Honorary staff member Dr Michael Roach's geology and mine visualisation project continues apace. He is now working on visualisations of the Iberian Pyrite Belt in Spain and Portugal, funded by a large EU grant from the Erasmus+ program.

In September–October 2024 Dr Michael Roach travelled to the Iberian Pyrite Belt (IPB) in Spain and Portugal to collect visualisation data for production of virtual excursions. This work is part of the IMMERSE project, funded through the EU Erasmus+ program. The project is a collaboration between UTAS and three European universities: Aachen University (Germany), University of Huelva (Spain) and The Technical University of Crete (Greece).

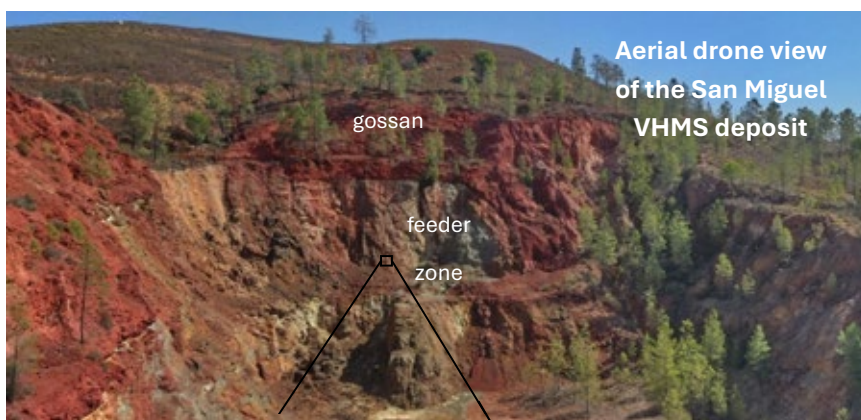
Work in the IPB was in partnership with staff at the University of Huelva, specifically Professor Jose Miguel Nieto and Dr Felipe Barrio. The IPB has been an area of intense mining activity since the Bronze Age and over 100 volcanic hosted massive sulphide deposits have been mined in this period. During the visit to the IPB, visualisation data were acquired from ten different past and current mining operations including the giant Rio Tinto deposits. Many of the sites visited were historical open pit mines and the focus at these locations was on documenting the geology exposed in the old pits as well as the environmental legacy associated with exploitation of these sulphide-rich deposits.

The extended mining history in the IPB means that it is a global hotspot for mine-related environmental impact, and a particular focus of the ongoing work will be to showcase the causes, characterisation and remediation of acid rock drainage and acid mine drainage.

Virtual tours of IPB sites are currently in production and these tours will be publicly available in the second half of 2025.



Top: Opening page for the Riotinto mine virtual tour, which will be made available later in 2025, and (bottom): an aerial drone view of the Cerro Colorado open pit taken from a 360-degree image in the tour.



Examples of visualisation data produced by Dr Michael Roach from the San Miguel VHMS deposit.



3D photorealistic virtual model of footwall stockwork pyrite veins in a matrix of altered volcanic rock
Model is approximately 2.5 x 3m

INDONESIA: AT WORK AND AT PLAY

This year's Ores in Magmatic Arcs Master of Economic Geology short course to Indonesia has proved highly popular with 16 Masters students, eight industry participants and five course leaders taking part. Two of the course leaders – Adi Maryono and Iryanto Rompo – are CODES colleagues who are based in Indonesia.



Participants on the Ores in Magmatic Arcs Master of Economic Geology short course pictured with a 'Welcome CODES' banner in the Onto Coreshed, one of the facilities belonging to Sumbawa Timur Mining.



All participants in the Ores in Magmatic Arcs short course enjoying a cultural event at the Pak Iwan Coffee House.



Professor David Cooke (orange vest) teaching Masters students on the foreshore adjacent to the Pulau Merah porphyry Cu-Au project, Java.

TRIPLE TREAT: SUCCESSES FOR STAFF AND STUDENTS



Life's a beach: CODES Honours student Ellyse Noy (middle row, fourth from right) pictured on Heron Island during her unforgettable ANZIC Marine Geoscience Masterclass, which took place in December.

MASTERCLASS IN QUEENSLAND

One of 2024's third-year Earth Sciences students, Ellyse Noy, who is now doing Honours at CODES, was invited to take part in a prestigious two-week ANZIC Marine Geoscience Masterclass during December.

The program is run jointly between the University of Queensland and Queensland University of Technology, and Ellyse was sponsored by the Australian and New Zealand International Scientific Drilling Consortium (ANZIC).

Ellyse said of the Masterclass:

"The course was incredibly eye opening! I learnt so much about underwater hazards and the stratigraphy that lies beneath the Great Barrier Reef system, and was fortunate enough to learn how to collect and prepare a core for sampling and testing at the UQ and QUT facilities. The Heron Island portion of the Masterclass was breathtaking, and I made many friendships and connections from the Masterclass...truly a once-in-a-lifetime experience."

The Masterclass included guest lectures and workshops followed by five days at the Heron Island Research Station on the Barrier Reef, and learnings from this course will inform her Honours study. Well done, Ellyse!

TEACHING APPRECIATION CERTIFICATES 2024

Congratulations to Izzy von Lichten, Dr Matt Cracknell and Dr Owen Missen for their Student-nominated Teaching Appreciation Certificates 2024!

Last year's cohort of students were able to nominate teaching staff (including learning support) for a 'Student-nominated Teaching Appreciation Certificate'. They were given a list of criteria from which to select their reasons for their nominations. Those with access to the staff pages of the UTAS intranet can view the positive comments made by students at: **Student-nominated Teaching Appreciation Certificates 2024**

Izzy said of her Teaching Appreciation Certificate: "I am very honoured and humbled to receive the Student-nominated Teaching Certificate. When I had read the citation, I was moved, happy in the knowledge that the effort is appreciated from the other side of the desk."



Deeply appreciated: Izzy von Lichten, Dr Matt Cracknell and Dr Owen Missen (inset) were presented with Student-nominated Teaching Appreciation Certificates for their work with students in 2024. Head of Earth Sciences, Professor Sebastien Meffre, said he was very pleased that the students felt motivated to nominate these lecturers for the certificates.

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CRITICAL MINERALS THE DRIVING FORCE FOR THIS CODES RESEARCHER



Dr Mohammad Fathi, pictured here on kunanyi/Mt Wellington, is keen to explore the potential of tailings as a key resource for critical minerals.

Dr Mohammad Fathi arrived at CODES from Iran at the start of 2023 and has been an integral part of the RRC project since its inception. He has also instigated the establishment of the first-ever mineral beneficiation and metallurgy lab at UTAS, and looks forward to developing the potential of tailings as a source of critical minerals.

My academic journey began with a BSc in Mining–Mineral Exploration from Sahand University of Technology, Tabriz, Iran (2001–2005), where I developed a strong foundation in mineral characterisation, ore exploration techniques and geological analysis. My undergraduate thesis focused on evaluating the lithology of the Avan region (Varzghan, East Azerbaijan, Iran) to assess the potential for processing copper-containing minerals.

Following my undergraduate studies, I pursued a Masters in Mining–Mineral Processing at Tarbiat Modares University, Tehran, Iran (2005–2007). My MSc thesis focused on removing major impurities from the Masod Abad talc mine using column

flotation, a project funded by the Iran Ministry of Industries and Mines. This research introduced me to advanced beneficiation techniques, particularly in flotation, which later became one of my core research interests.

After completing my MSc, I gained industrial experience in mineral processing, working on alumina extraction from nepheline syenite and copper and other metals processing. During this time, I worked as a process engineer at Arman Sanat Tadbir Andish (ASTA Co) in Tabriz, Iran (2008–2012), where I was involved in major copper and alumina production projects, particularly focusing on Sarab nepheline syenite ore processing. I also contributed to the expansion phases of the Sungun and Sarcheshmeh copper mine complexes, two of the largest copper deposits in the Middle East.

Following my time in industry, I transitioned into academia and took on a lecturer role at Urmia University, Iran (2012–2022). While in this role, I started my PhD in Mining–Mineral Processing at Amirkabir University of Technology (Tehran Polytechnic), Iran

(2013–2017), a leading institution in mining and metallurgy. My PhD focused on the kinetics and thermodynamics of rhenium extraction from copper leach solutions using ion exchange techniques, a project funded by the National Iranian Copper Industries Co (NICICO). Rhenium is an exceptionally rare and strategic metal, primarily used in high-performance alloys and catalysts. During my PhD, I successfully synthesised three novel ion-exchange resins with high selectivity for rhenium, significantly enhancing its extraction efficiency. These findings resulted in several high-impact publications in international journals.

During my PhD, I had the privilege of being awarded a scholarship for sabbatical leave at Curtin University, in Western Australia. Under the guidance of Dr Richard Alorro and Dr Laurence Dyer, I conducted innovative research on the beneficiation and extraction of rare earth elements (REEs) from coal fly ash, a promising resource for critical minerals. This work involved a combination of leaching, roasting and flotation experiments to establish an efficient processing route for REE recovery from industrial waste.

Upon completing my PhD, I continued as an Assistant Professor at Urmia University and led numerous industrial research projects focusing on the beneficiation of critical minerals, particularly magnesium, titanium and vanadium. These projects aimed to optimise extraction techniques and improve the environmental sustainability of critical mineral processing. I also supervised multiple MSc and PhD students, many of whom worked on industry-driven projects.

TRANSITION TO POSTDOCTORAL RESEARCH AT UTAS

In January 2023, I joined CODES as part of the Regional Research Collaboration (RRC) project as a key



Dr Mohammad Fathi carrying out sampling and analysis at the Kara mine processing plant circuit, Western Tasmania, in March 2023.

researcher in Element 2: 'Pathways to Production'. This initiative addresses barriers within the new workflows for cost-effective and environmentally friendly production pathways for critical metals and related challenges. My role involves supervising PhD theses and conducting research while collaborating with industry partners to translate research findings from the processing of critical minerals into practical industrial applications. These include projects in Tasmania focused on tungsten from the Kara mine, magnesium from Prospect Ridge, and potential critical and strategic minerals from the Mt Lyell tailings, integrated within larger case studies aimed at developing advanced beneficiation techniques and sustainable processing solutions.

As part of this journey, I am in the process of establishing the first-ever mineral beneficiation and metallurgy lab at UTAS. This lab will be a valuable resource for industry partners, offering access to advanced mineral processing equipment and expertise to support research, testing and process optimisation in Tasmania.

My experience with the RRC project has enabled me to expand my work and initiate new collaborations with Amira Global, Curtin University and the University of Missouri to engage



Dr Fathi with his students at a Bachelor's degree graduation ceremony for mining engineering students (Entry Year 2018, which is 1397 in the Iranian calendar), at the Mining Engineering Department, Urmia University, Urmia, Iran, prior to his move to CODES.

in large-scale industrial projects and collaborations. As a result, we have developed an industrial proposal titled 'Development of a geometallurgically-informed model for extraction of critical minerals (CMs) from sulfide and iron ore tailings piles', which has been submitted to potential industries and stakeholders, with roundtables planned for March 2025. These collaborations emphasise multi-institutional and industry-driven approaches to sustainable mineral processing, reinforcing the importance of innovative extraction and beneficiation techniques in the sector.

In addition, I am actively involved in scientific outreach and professional networking. I frequently present my findings at international conferences and contribute as a peer reviewer for high-impact journals in mineral processing and extractive metallurgy. In 2023 and 2024, I presented my research at several key conferences, including Critical Minerals '24, where I discussed 'Extraction of vanadium from the enriched slag of melting titanomagnetite ores', and at the Australian Earth Science Convention (AESC 2023) in Perth and MetFest! in Tasmania (2024). At Extraction 2025 in Arizona, USA, I will present my paper on 'Flotation kinetics of a low-grade scheelite sample', focusing on advancements in flotation for tungsten extraction from the Kara mine sample.

FUTURE GOALS AND ASPIRATIONS

Looking ahead, I aim to explore the potential of tailings as a key resource for critical minerals. With technological advancements, tailings can provide sustainable solutions to growing resource demands. By collaborating with industry, I will work to turn research into practical applications, advancing scalable extraction methods and promoting a circular economy. This will enhance resource efficiency, reduce waste and support the supply of critical minerals for future technologies.

Building on these aspirations, my career has been shaped by a commitment to scientific innovation, industry collaboration and sustainable mineral processing. As I continue my journey at CODES, I look forward to contributing to advancements in critical mineral beneficiation while mentoring the next generation of researchers in this essential field.

Outside my research, I am passionate about running and swimming, which I do regularly to stay active and focused. I also enjoy hiking and exploring nature, which often gives me a fresh perspective on geological formations and mineral landscapes.

WHERE ARE THEY NOW?

Recent CODES PhD graduate Dr Emily Smyk has returned to her hometown – Thunder Bay in Ontario, Canada – where she has found the perfect geologist's role combining her technical geological expertise and plenty of time in the field with some mentoring and outreach. Plus, it's the ideal place to fuel her search for vintage wool sweaters.

CANADA CALLS FOR COLD CLIMATE GEO!



DR EMILY SMYK

Project Geologist at Bayside Geoscience, based in Thunder Bay, Ontario, Canada

PhD completed at CODES in 2024, entitled 'Geology, geochemistry, geochronology and exploration footprints of the Christmas porphyry Cu-Mo deposit, Arizona' (supervised by Professor David R. Cooke, Dr Mike Baker, Dr Matt Cracknell and Dr Shaun Barker (MDRU))

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

I have been employed since 2023 as a Project Geologist for Bayside Geoscience, based out of Thunder Bay, Ontario, Canada. Bayside Geoscience is a relatively new, independent geological consulting company that supplies Canadian-based mineral exploration programs with personnel, management, equipment, reporting

and consultative services. My main roles involve managing field crews and mapping projects, and managing and supporting drilling programs, as well as generating greenfield and brownfield geochemical prospectivity and property assessment reports for clients in Northern Ontario.

What are the things you enjoy most about this role/when did you start it? Describe a typical day for you.

I'm very lucky in that I have several roles and responsibilities at Bayside, meaning no day is the same! I have had the opportunity to develop programs for many different hard-rock commodities, including gold, nickel, copper, REEs, lithium and graphite. It is interesting to note that some of our clients are Australian-based companies who are actively exploring in Canada.

In Canada, the field season is much shorter than it is in Australia. As the snow melts in April/May, we hit the ground running with mapping, prospecting and soil/till/biogeochemistry sampling programs. These programs are often remote and based out of small communities, hunting and fishing camps, mine sites or temporary tent camps. I have travelled to my fieldwork areas via truck, UTV, boat and helicopter. In the winter months, we switch our focus to data compilation and reporting, such as assessment work filings on a property or preparing NI 43-101 disclosure reports (comparable to a Joint Ore Reserves Committee Code in Australia). In the winter, a lot of our clients also shift over to diamond drilling programs, often focusing on new targets developed from data



Dr Emily Smyk, who works for Bayside Geoscience based in Thunder Bay, pictured looking for elusive outcrop under fallen trees on a grassroots pegmatite project near Atikokan, Ontario.

collected during the summer field programs. I have supervised a few of these drilling projects with a small team of fantastic geologists and geotechnicians.

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

I am originally from Thunder Bay and attended Lakehead University for my undergraduate degree. My first geology jobs were all centred in Northern Ontario and were focused on regional-scale mapping in Archean rocks. After my Masters (Lakehead/CODES) and PhD projects (CODES) which characterised porphyry Cu-Mo deposits in much younger rocks, it was strange returning to strongly deformed, metamorphosed greenstone belts in Ontario. However, the new perspective and knowledge base I gained from working in completely different rocks have definitely improved my understanding and approach to mapping in these important geological terranes. I now approach exploring orogenic gold and pegmatite-hosted lithium deposits with a broader appreciation of economic geology developed while working at CODES.

Your source of greatest satisfaction as a geologist?

I have found that almost all my joy in my job comes from working with incredible colleagues and clients. I have also been very lucky to work with several international companies, ranging from small junior companies with grassroots properties where I can strongly contribute to preliminary exploration plans, to major companies where I have incredible resources and data to support high-level exploration programs. I love getting the opportunity to contribute ideas and prospectivity reports to the clients and derive a lot of satisfaction when these potential exploration ideas are implemented by them!

The vast majority of Bayside's staff are younger, yet experienced professionals who value this encouraging and supportive work environment. The teams I have been a part of at Bayside have allowed me to help support and mentor younger or recently graduated geologists. Part of this aspect of my job comprises creating



Taking a lunch break on the edge of a felsic metavolcanic ridge while prospecting pegmatites near Armstrong, Ontario.

internal resources for colleagues such as geology/geochemistry seminars, research libraries, comprehensive field mapping guides and contributing to the design and development of our database platform. Outside of client work, I have enjoyed participating in several conferences, short courses, and community outreach programs in local schools and youth programs. In representing Bayside, I also serve as a representative and advocate for the local mineral exploration industry.

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?

My first collaboration that involved working at CODES was my Masters project (co-supervised by Professor David Cooke), which was completed

at Lakehead University under Professor Peter Hollings. This project focused on two porphyry deposits in Utah and Nevada, USA. My initial excitement for this project was the exposure to completely new rocks and geochemical techniques developed by CODES and the Amira research teams. My subsequent PhD project (Christmas porphyry Cu-Mo deposit, Arizona, USA) later expanded upon this knowledge base and I developed closer connections and a stronger appreciation of the people and ideas in the Amira P1202 (Far-field and near-mine footprints: Finding and defining the next generation of Tier-1 deposits) projects. An unexpected benefit of being a part of the Amira team and collaborating with industry partners was bolstering my confidence and

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ability to communicate ideas and reports to mineral exploration companies. I was not only involved in generating and interpreting new geological data, but also in conveying their implications to the client/industry partner.

As an extension of working with the industry partners, my favourite part of CODES was, and still is, the people I met and worked with there. There were so many incredible, brilliant and gracious staff, students and friends during my time at CODES. I will always be grateful to have had them in my life.

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

Since my PhD, and working with major companies and tried-and-true commodities such as copper and gold, I have worked with smaller companies and riskier, more volatile commodities such as lithium, rare earth elements, graphite and cobalt. It has shown me how quickly industry trends may change.

In Canada, challenges to industry include lengthy permitting processes and addressing environmental, social and governance (ESG) criteria. Furthermore, forested/swampy/snow-covered/till-covered/mountainous terrains limit the effectiveness of exploration techniques (e.g., remote sensing) often used in other countries. And there are always the bugs! However, Canada has tremendous potential for both traditional and new commodities. It will be interesting to see, for example, what the critical mineral sector looks like in five or ten

years. With an increasing amount of publicly accessible data, innovative applications of machine learning and AI to these datasets may lead to the development of exploration tools and identify prospective terranes that could produce some exciting new discoveries!

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

Take advantage of any opportunities to learn, travel and see as many rocks as possible! While travelling and working, always be kind and appreciate everyone you meet. The geology world really is small, and it is very likely that your paths will cross again! So many incredible opportunities can come from seemingly inconsequential meetings and acquaintances. Make a point to work with as many people as you can and embrace those gnarly field jobs every once in a while. They will be the most fun you'll have at work... or at least make for a funny story later!

Little-known facts about you

My application to be adjunct faculty member at Lakehead University has recently been accepted. I am hoping to mentor undergraduate and graduate students. I feel very lucky to have an opportunity to make a positive change in a young geologist's education and career.

Outside of work, I keep busy by collecting vintage wool sweaters, creating elaborate meat substitutes out of mushrooms and wheat flour, creating jewellery out of beads made from minerals and gemstones, and am training for a trail race this summer.



Emily is seen here battling with a saguaro while completing fieldwork and mapping for her PhD project in the warmer climate at Christmas, Arizona, USA.

I meet up every week with a lovely, keen Scrabble club at a local game café and recently won the Thunder Bay Literacy Group's Scrabble tournament with the support of James Tolley (another former CODES colleague and my patient partner who always has the time to listen to my convoluted wordplay strategies).

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SYNCHROTRON GRANT

CODES researchers have been successful in being awarded an in-kind grant from the Australian Nuclear Science and Technology Organisation (ANSTO) worth \$131,136.

The research project, led by PhD student Angela Costa and lecturer Dr Owen Missen, along with supervisors Dr Yamila Cajal, Dr Lejun Zhang and Professor David Cooke, represents an important step in understanding the

magmatic-hydrothermal processes that contributed to the formation of world-class tungsten resources on King Island.

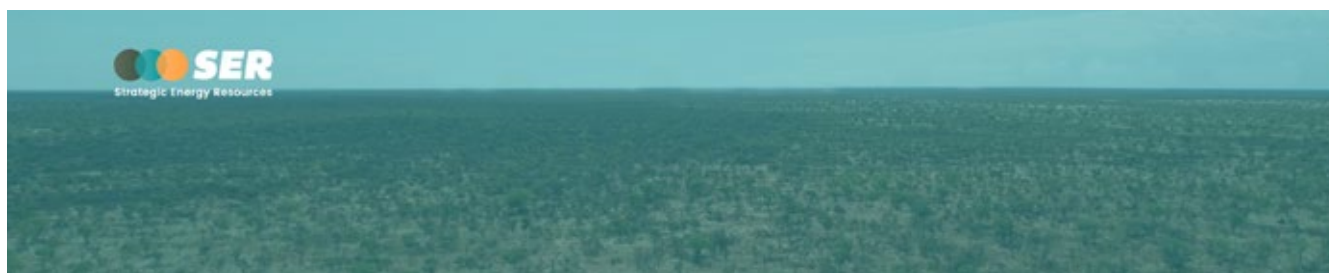
Angela said of the grant:

"We are pleased to announce that our proposal to conduct research at the XFM beamline at the Australian Synchrotron has been approved, with beamtime scheduled for 10–14 April 2025. This study will focus on characterising trace element zoning and Eu oxidation states in scheelite crystals from the Dolphin Tungsten (W) skarn deposit and exploration targets

on the western flank of the Sandblow Granodiorite, located on King Island.

By applying state-of-the-art techniques such as high-resolution X-ray fluorescence (XRF) and X-ray absorption near-edge structure (XANES) spectroscopy, we aim to gain new insights into metal deportment and redox conditions influencing tungsten mineralisation in these skarn systems.

"We are deeply honoured to receive the ANSTO in-kind grant and look forward to working with the Synchrotron's specialist research team."



CODES INDUSTRY COLLABORATION ANNOUNCED TO THE ASX

Strategic Energy Resources (SER), a specialised undercover mineral explorer, announced its new research collaboration with CODES to the Australian Stock Exchange (ASX) in January this year. The research collaboration, named 'Mineral chemistry of the Isa North project', is the first such between CODES and SER, and encompasses groundbreaking geochemical studies which will aid SER in its exploration targeting campaigns within this geologically complex area.

Dr Jeff Steadman, chief investigator on the collaboration, is eager to get started: "This project area has garnered

significant exploration attention in recent years – for instance, Newcrest drilled multiple geophysical anomalies in 2019–2020 that yielded encouraging results. Nevertheless, they withdrew from the region and no follow-up geochemical work has subsequently been performed by other companies.

"This area encompasses the northern extent of the Mt Gordon Fault Zone", explained Dr Steadman, "which hosts several significant Cu-Ag systems further south, such as Mammoth (the stomping grounds of CODES' PhD graduate Darryl Clark) and Esperanza South, currently mined by 29Metals. Unlike these deposits, which are at or

near surface, the target rocks of the Isa North project area are buried under significant cover, which has hindered previous exploration programs. However, given the favourable structural and lithological setting, mineral chemistry will certainly be a welcome addition to the explorer's toolkit here and will provide SER with cutting-edge data that can hopefully reduce the search space."

Dr Steadman continued, "This initiative also underscores the industry's continued trust in CODES as a world-leading centre for mineral exploration research, together with the CODES Analytical Laboratories."



The Isa North project future drill site in Queensland; Dr Jeff Steadman at CODES is spearheading a research collaboration with Strategic Energy Resources in a bid to uncover copper and gold.



Dr Jeff Steadman at the Prominent Hill copper-gold mine in South Australia.

THE BEST PART: OUT IN THE FIELD

Our researchers and PhD students have been out in the field – and the lab – far and near in the past few months. Here is a selection of what’s been happening...

PAPUA NEW GUINEA

December 2024

Olive Ponyalou’s first PhD fieldwork to Kainantu copper-gold mine, operated by K92 Mining, in the Eastern Highlands Province of Papua New Guinea, took place from 4–18 December, (accompanied by supervisor Dr Owen Missen for the first week of fieldwork). Olive is undertaking a project linking geology and mineralogy from three different parts of the Kainantu mineralised system to better understand the genesis and further exploration potential of the deposit.

We spent the majority of the fieldwork examining drill core at a core shed in a picturesque verdant valley, selecting samples highlighting ore textures including some intensely iridescent bornite, aided by exploration managers Paul Wiley and Thomas Adamson plus the friendly exploration shed team who worked hard to find and lay out core for us, as well as ensuring we remained hydrated in the intense daytime heat. Olive is approaching the one-year mark in her PhD and with several hundred samples to analyse, there’s plenty of work to do on this amazing deposit!

NORTHERN TERRITORY

January–February 2025

CODES PhD student Damian Braize headed off to the Northern Territory for a month in January–February to undertake fieldwork. His project focuses on the geochemistry of the Tennant Creek mineral field, a large mining province that has produced gold, copper and bismuth from more than 130 mines since the early 1930s. Tennant Creek being located 1,000km south of Darwin, the long drive south was an opportunity to explore the



Working with K92 Mining, in the Eastern Highlands Province of Papua New Guinea: pictured with the K92 exploration shed team are Dr Owen Missen (back left) and CODES PhD student Olive Ponyalou (far right).



Northern Territory sunset: CODES PhD student Damian Braize surveys the Tennant Creek province during his fieldwork to the area in January and February 2025.

landscape of the Northern Territory. Note the weather contrast with Tasmania: the wet season was a bit late this year in Tennant Creek, with an average temperature of 43°C while Damian was in the field.

On site, Damian was hosted by Emmerson Resources and their joint venture partner Tennant Mining. Over the weeks of sampling, he got

to access numerous core sheds across the province, sampling 50-year-old cores to recent new exploration holes.

Sampling was focused on the magnetite-chlorite±hematite bodies (called ironstones) hosting the Au-Cu-Bi mineralisation and the surrounding altered sediments. Selected samples will be used to answer the main research area such as (1) the use of

chlorite chemistry as a vectoring tool towards mineralisation; and (2) the use of hematite chemistry to differentiate barren from mineralised ironstones.

This trip was also an opportunity to visit and sample some of the numerous deposits and prospects around Tennant Creek, highlighting the importance of the province in the twentieth century, and its current potential for exploration. In short, nothing beats a visit to the field to better understand a project.

Damian would like to thank the staff of Emmerson Resources and Tennant Mining for their help during the fieldwork, and for making this trip memorable and successful.

MEXICO

January 2025

The Sierra Madre Occidental (SMO), located in northwestern Mexico, is one of the largest continental igneous provinces in the world and was probably formed during the opening of the California Gulf as part of an intense and explosive volcanism event. It is a rich metallogenic region with several events that host and produce world-class deposits from Sonora State (North) to Sinaloa (South).

As a part of the research project called 'Detailed petrography characterisation of Ag high-grade hydrothermal mineralisation, geochronostratigraphy and tectonic events of the San Marcial deposit, Mexico', sponsored by GR Silver Mining and developed at CODES, Dr Paula Montoya had the opportunity to travel to this area in early January. She was able to study, define and give insights into the discovery of a high-grade Ag system hosted on a tectono-hydrothermal breccia in the San Marcial Area. During the field trip Dr Montoya and the GR Silver geology team reviewed in detail key drillholes and field transections for sampling selection and future laboratory test work at CODES and in the UTAS Central Science Laboratory. The results will be presented in August at the 18th SGA Biennial Meeting in Colorado, USA.

NEW ZEALAND

February 2025

CODES PhD student Catherine Brown reports on her lab work in NZ:



Dr Paula Montoya took part in fieldwork in the Sierra Madre Occidental in northwestern Mexico and is pictured here with geologists from GR Silver: (L-R) Javier Villegas, Paula, Luis Coto, Miguel Diaz and Marlen Salgado.



CODES PhD student Catherine Brown in the Scanning Electron Microscopy (SEM) lab at the University of Otago in Dunedin on New Zealand's South Island. She is pictured examining ash from the 871 CE eruption from Torfajökull, Iceland.

At the University of Otago, Dunedin I spent a lot of time staring at tiny bits of volcanic ash, trying to figure out if magma had an explosive run-in with water or if it just got caught up in a gas-particle mixture. My research focused on silicic eruptions – both subaerial and submarine – and I worked with ash from places like Hatepe and Rotongaio in NZ, Kurose-Nishi in Japan, and Askja and Torfajökull in Iceland.

To make sense of it all, I did way too much dry sieving, took detailed SEM images (almost 1,000), and used software like PartiSAN to analyse particle shapes. Then came the stats –

Dendroscan in MATLAB helped break down shape and surface features, giving me a clearer picture of what these eruptions had been up to.

When I wasn't covered in volcanic ash, I made the most of Dunedin's wild coastline – one particularly memorable swim in the Southern Ocean involved a close (and slightly nerve-wracking) encounter with a very curious sea lion. Turns out, they're just as fascinated by humans as we are by them – though I'm not sure it was entirely convinced I belonged in its waters. Safe to say, Otago was an adventure both in and out of the lab!

TECHNICAL ASPECTS HIGHLIGHTED IN CODES TALKS

CODES academics and students have been criss-crossing the globe once again to disseminate knowledge about their research and to network with colleagues at various conferences and workshops. They have taken prominent roles at events, including PDAC, which is one of the world's major international exploration and mining conferences.

CRITICAL MINERALS '24

14–15 November 2024, Cape Town, South Africa

CODES Research Fellow in Geometallurgy/Engineering Geology Dr Mohammad Fathi attended this conference and writes:

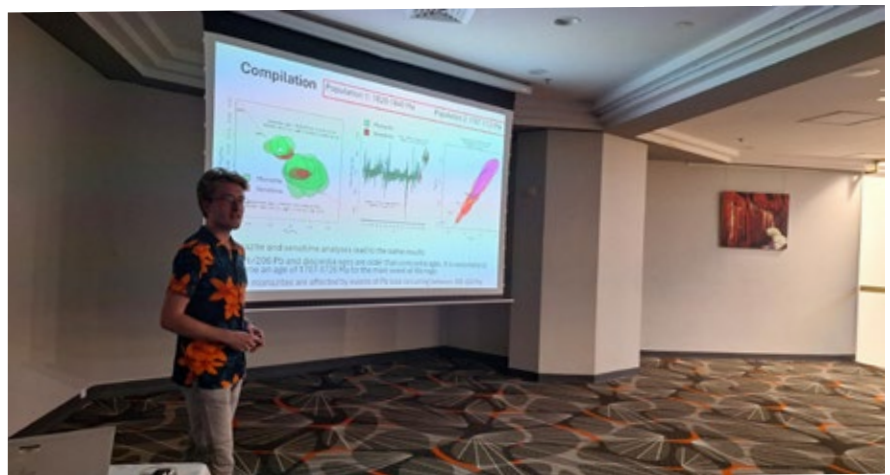
"The Critical Minerals '24 conference marked the inaugural International Symposium on Processing of Critical Minerals, organised by Minerals Engineering International (MEI). The event gathered delegates from 15 countries to explore innovative processing methods and flowsheets for critical minerals, focusing on both primary and secondary sources, including recycling from waste electrical and electronic equipment, a major obstacle to achieving a circular economy.

"I had the opportunity to present our recent findings in a talk titled 'Extraction of vanadium from the enriched slag of melting titanomagnetite ores'. Vanadium's unique properties and strategic significance make it a critical metal in modern technology. Given the limited availability of vanadium in primary ores such as carnotite, patronite, descloizite and roscoelite, along with the growing demand for the metal in various industrial applications, titanomagnetite ores have emerged as a key source for vanadium extraction as a by-product.

"In this process, vanadium-bearing magnetic concentrates are typically smelted in a blast furnace or pre-reduced in an electric arc furnace,



Dr Mohammad Fathi from CODES presents his talk on the extraction of vanadium at the inaugural Critical Minerals '24 conference, held in November 2024 in Cape Town, South Africa.



CODES PhD student Damian Braize gives a presentation to geoscientists at the Gabfest Geoscience 2025 gathering in Darwin during February.

enabling the selective partitioning of vanadium into the slag while molten iron is separated. However, conventional hydrometallurgical extraction and precipitation methods can lead to significant environmental impacts, posing risks to local ecosystems and communities. To address these challenges, this study applied green extraction techniques, including water leaching and air-exposed precipitation, for the recovery and concentration of vanadium (V_2O_5) from enriched slag samples.

"The findings and methodological framework established in this research are intended for integration into

our ongoing Regional Research Collaboration (RRC) project, with a particular focus on waste-derived resources such as magnetite processing tailings."

GABFEST GEOSCIENCE 2025

19–21 February, Darwin, Northern Territory

In late February, PhD student Damian Braize attended the Gabfest Geoscience 2025 in Darwin. This three-day conference, organised by the Northern Territory Geological Survey, brought together some 50 geologists from various Australian

Geological Surveys and universities, Geoscience Australia and the CSIRO for a series of technical talks on new research findings in the Northern Territory. Damian presented the latest results of his PhD in a talk entitled 'Dating mineralization at the Warrego deposit, Tennant Creek: what do the monazites tell us?'. Darwin's monsoon weather did not detract from the convivial atmosphere of the event, which also provided excellent opportunities for networking.

CET COPPER WORKSHOP

21 February 2025, Perth, Western Australia

CODES Director Professor David Cooke was a speaker at this event organised by the Centre for Exploration Targeting at the University of Western Australia – a one-day short course on 'Copper Mineral Systems and Exploration Methods'. David's talk was titled 'Exploration targeting criteria for porphyry copper and gold deposits'.

Presentations by international and interstate experts in their fields complemented talks showcasing the latest research being conducted at the Centre for Exploration Targeting (CET). The workshop was a collaborative effort between the Specialist Group in Economic Geology of the Geological Society of Australia, CET and the Centre in Critical Resources for the Future at the University of Western Australia.

PDAC

2–5 March, Toronto, Canada

The Prospectors & Developers Association of Canada (PDAC) annual conference is one of the major global exploration and mining conferences with almost 30,000 attendees from more than 130 countries attending.

CODES Director Professor David Cooke, and past director Emeritus Professor Ross Large, along with Dr Stephanie Sykora (PhD completed at CODES in 2016), presented a sold-out one-day workshop entitled 'Hydrothermal alteration and vectoring to ore in porphyry copper-gold environments'. The workshop provided up-to-date technical information about the key geological and geochemical



Professor David Cooke (checked shirt) in Toronto at the 2025 PDAC Conference is pictured while running a short course called 'Hydrothermal alteration and vectoring to ore in porphyry copper-gold environments'.



CODES alumnus Dr Stephanie Sykora presenting a session at PDAC in Toronto for the short course called 'Hydrothermal alteration and vectoring to ore in porphyry copper-gold environments'.

elements required for the discovery and assessment of porphyry Cu-Au deposits, to around 70 attendees.

David and Ross were also presenters for a morning Technical Session on 'Porphyry copper-gold deposits:

From exploration to discovery' when they each ran half-hour sessions covering the significance and types of porphyry copper deposits, and the geochemical approach to hydrothermal alteration.

PLANTS FOR MINE REMEDIATION: THE BOOK

CODES researcher Dr Paula Montoya has been instrumental in the production of a new book on aquatic plants for remediation, and their application to the mining sector.

On 16 January Dr Montoya attended the launch in Querétaro, Mexico, of a new book she has coauthored called *Plantas Acuáticas Mexicanas para la Remedación: Aplicaciones en la Sociedad e Industria Minera*. Written in Spanish, published by Fondo Editorial UAQ (Universidad Autónoma de Querétaro) and sponsored by GR Silver Mining, this book is designed for environmentalists, academics and professionals in the mining and ecological sectors. It offers valuable insights into practical solutions for pressing environmental issues.

This first volume in the series *Colección Humedales* provides a comprehensive study of aquatic plants, both native and introduced to Mexico, and their application in environmental remediation. With a particular focus on their use in the mining industry, this book examines how these plants can be utilised to mitigate the environmental impact of industrial activities and contribute to sustainable eco-friendly practices. The book addresses the distribution of 43 families, 87 genera and 171 species of aquatic macrophytes with potential for remediation, and presents data covering everything



Dr Paula Montoya from CODES took part in the launch of the book *Plantas Acuáticas Mexicanas para la Remedación* at the Aula Magna, Universidad Autónoma de Querétaro (UAQ), Mexico. It was attended by academics and was also open to the public. Left to right: Diana Rodríguez Sánchez (Director of Fondo Editorial Universitario at UAQ), Dr Tatiana Lobato de Magalhães (Editor-in-Chief of the *Colección Humedales*), Dr José Guadalupe Gómez (Director of the Natural Science Faculty at UAQ), Dr Paula Montoya (CODES Research Fellow) and Alejandro Cano (General Manager of GR Silver Mining).

from karyotype to phytotechnologies with aquatic plants. The book also includes botanical illustrations of 30 key species. Dr Montoya was key in securing funding for sampling selection, laboratory test work and data analysis. She also wrote specific sections on geochemistry and mining, and facilitated the integration of chapters and topics by the multidisciplinary team that contributed to the book. The project also led to an Honours thesis mentored by Dr Montoya at Universidad del Norte, Colombia.

In March Dr Tatiana Lobato de Magalhães arrived at CODES, and is working with Dr Montoya and Dr Owen

Missen preparing a proposal for a new project on Tasmanian aquatic plants for remediation and phytomining. The idea is to carry out a study of the relevant diversity of aquatic macrophytes in western Tasmania.

The details: T. Lobato-de Magalhães, M. Becerril-Bartolo and P. Montoya-Lopera. 2024. *Plantas Acuáticas Mexicanas para la Remedación: Aplicaciones en la Sociedad e Industria Minera*. Universidad Autónoma de Querétaro. <https://doi.org/10.61820/UAQ.978607513718666613-6>

REVAMPED GEOSCIENCE RESOURCE

The MRT Geoscience Library is the major repository for geoscientific material relating to Tasmania, dating back to 1860. Dr Lucy Hawthorne took over as the Geoscience Library Librarian just over a year ago and is in the process of giving it a bit of a revamp.

Focus subject areas include Earth sciences, mineral resources, land management, natural hazards,

infrastructure development and, to a lesser extent, mining history. The collection includes MRT and former Department of Mines publications, as well as books, journals, annual reports, theses (including some CODES theses), aerial photographs and unique items such as field notebooks.

The library is open to the public by appointment Monday–Thursday, 9am–5pm. Virtual reference services are also available.



The MRT Geoscience Library at Rosny is a mine of information for geologists.

To make a reference enquiry or book an in-person appointment, fill out the form on the library webpage: www.mrt.tas.gov.au/products/services/geoscience_library

BIG TURNOUT FOR THE HONOURS MAPPING CAMP



Students and teaching staff pose for a group photo at the new Horsetail Falls lookout, above Queenstown, before driving back to Hobart following the Exploration Field Skills (EFS) mapping camp in early February. The week-long excursion, now in its 26th year, is a compulsory component of the coursework program for UTAS students doing Honours in Earth Sciences. Via a reciprocal arrangement with the Victorian Institute of Earth and Planetary Sciences (VIEPS), EFS is also open to Victorian Earth Sciences students in Honours or coursework Masters programs. This year, EFS was attended by six students from Monash University, eight from the University of Melbourne, one student from Federation University and seven UTAS students. The mapping course was led by Professor Sebastien Meffre, Dr Sheree Armistead (pictured, centre of the front and middle rows, respectively) and Dr Robert Scott (photographer).



Exploration Field Skills (EFS) students mapping in the Cambrian Mount Read Volcanics, which are exposed along the banks of the Hall Rivulet canal, 20 km north of Queenstown. The Hall Rivulet canal is a Hydro Tasmania asset, and CODES again gratefully acknowledges Hydro Tasmania's continued permission to access this site. In the ~4 km² mapping area, the Hall Rivulet canal cuts through equivalent stratigraphy to that hosting the world-class Rosebery volcanic-hosted massive sulfide deposit, located 16 km further north. During the mapping camp, students combine insights gained from logging drill core, field mapping and structural and stratigraphic analysis to assess the remaining exploration potential of the area and propose new targets worthy of future drill testing.

GET IN THE KNOW WITH THE TASSIE AIG



Dr Tony Webster, a former CODES staff member and current CODES Honorary, is now editor of the AIG Tasmania Branch newsletter and plans to give it a bit of a makeover. He says the current AIG Tasmania committee would like to:

"beef up the content, and produce the newsletter on a more regular basis with a strong industry focus."...

The Tassie branch has been told by AIG HQ that it is one of the most active in Australia, although with members scattered across the state there are few opportunities for them to become as involved as they would like to be since most meetings are held in Hobart.

To keep all members up to date with what's happening, the plan is to include regular newsletter updates about any recent exploration or mining developments on the island.

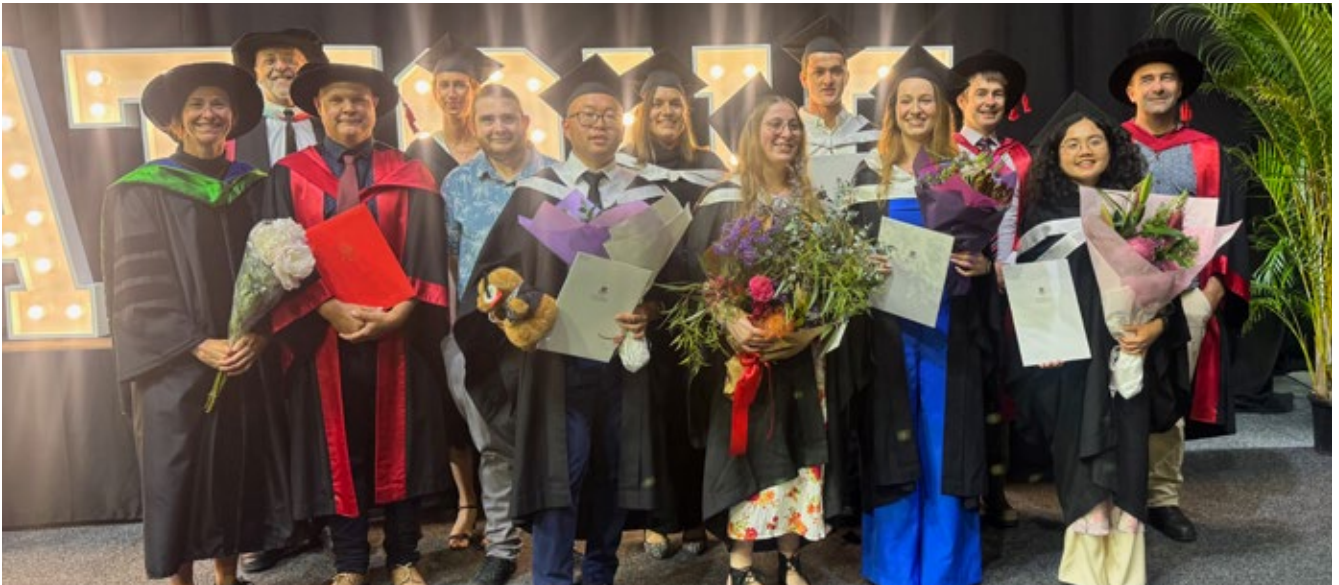
If you would like to let the rest of your Tasmanian colleagues know about the work your company is doing in Tassie, then please send a short summary (about 100 words) to the newsletter editor at tas@aig.org.au, for consideration for inclusion in the next quarterly update.

To see the February newsletter and to get involved, go to:

www.aig.org.au/index.cfm/communities/branches/tasmania/aig-tasmania-newsletter-february-2025/

ANOTHER BATCH OF BACHELORS AND PHDS...

...And of course, one Masters graduate...December was, as ever, a busy time for graduations, and again CODES/Earth Sciences made a good showing. Two more PhD students – Zeb Zivkovic and Alex Farrar – graduated from CODES, with some of their supervisors there to cheer them on. A number of BSc students and a single Master of Economic Geology student made up the complement.



Degrees of success: During December 2024 a group of CODES and Earth Sciences students received their degrees at a ceremony held at the Derwent Entertainment Centre in Hobart. Pictured here are the students and some of their supervisors (L-R): Associate Professor Rebecca Carey, Professor David Cooke, Dr Zeb Zivkovic (PhD), Brianna Clark (MSc), Daniel Watson (support person), Anthony Tai (BSc), Caitlyn Smart (BSc), Gabby O'Toole (BSc), Mitchell Hardy (BSc), Ellyse Noy (BSc), Dr Alex Farrar (PhD), Hien An Nguyen (BSc), and CODES/ES lecturer Dr Matt Cracknell.



PhDs in the spotlight: Newly minted CODES PhDs Dr Zeb Zivkovic (far left) and Dr Alex Farrar (third from left) at their graduation ceremony in December with two of their supervisors, Dr Matt Cracknell and Professor David Cooke.

CHANGING FACES

It's been a busy start to the year here at CODES as we welcome visitors and a returning staff member, as well as farewell another longstanding staff member. And welcome too to our new cohort of Honours students – plus the first PhD student of the year.

PHD STUDENT	START DATE	PROGRAM	PROJECT TITLE
	Jessica Askew 1 January 2025	Supervisors: Sebastien Meffre, Yamila Cajal, David Cooke; working within Program 1	The characterisation and genesis of the Cargo deposit, NSW, Australia

HONOURS STUDENTS

This year five new Honours students started with us – with William Sinclair making the move from NSW to Tasmania. They are:



Mitchell Hardie
The E28NE Cu-Au deposit, Northparkes District, NSW



Ellyse Noy
Volcanic processes in the Izu rear arc



Gabrielle O'Toole
Chondrites from NW Africa



William Sinclair
Evolution of the Eastern Louisiade Plateau



Anthony Tai
Carbonate species at Pajingo Au deposit, QLD

ARRIVALS



Dr Angela Escolme has returned to CODES this year as a Senior Lecturer and Researcher in Geology and Geometallurgy after taking an extended break for parental leave.

VISITORS



Professor Huayong Chen from the Guangzhou Institute of Geochemistry, China, visited CODES for several days in late February to take part in the CODES/ES Seminar Series and to discuss research with CODES collaborators.

DEPARTURES



Dr Julie Hunt retired from CODES at the end of January but will continue to be involved with projects here in an honorary role. She is thanked for her many years of service and dedication to the cause.



Professor Taofa Zhou from Hefei University of Technology, China, was at CODES for several days in late February to visit colleagues and give a talk in the CODES/ES Seminar Series.

CHANGING ROLES/PROMOTIONS



Dr Lejun Zhang was promoted to an Associate Professor in Economic Geology, taking effect from the start of 2025....Congratulations Lejun!!



Dr Pablo Farias from the Northern Territory Geological Survey visited CODES for a week in March doing research on zircon geochemistry in the CODES Analytical Laboratories.



Dr Bjorn von der Heyden from Stellenbosch University in South Africa visited CODES in March, when he gave a talk in the CODES Autumn Seminar Series.

PhDs MOVING ON UP



Malai Ila'ava submitted for examination his PhD thesis entitled 'Cambro-Ordovician Volcanic Facies, Stratigraphy, and Geochemistry of the Cowal Igneous Complex, New South Wales, Australia'.



Dr Tatiana Lobato de Magalhaes arrived at CODES in early March and will be staying until July, then returning in September for a further three months. She is working with Dr Paula Montoya on a publication in the series *Colección Humedales*.



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

It's been a busy start to 2025, with activity across a range of fronts. The Master of Economic Geology program is already well-underway for the year, with a notable increase in student enrolments. March saw our second-largest cohort of participants for the Ores in Magmatic Arcs – Indonesia short course enjoying the learning and cultural experiences, and amazing porphyry and epithermal deposits and diatremes of Java, Lombok and Sumbawa. A huge thanks to Iryanto Rompo, Adi Maryono and Lejun Zhang for all of their hard work in organising and leading the mine visits and regional field geology site overviews. In early April, the first week of our Fundamentals of Economic Geology short course was completed, again with very healthy participation that included a significant number of new

enrolments in our Graduate Certificate in Economic Geology. We are looking forward to further engagement with our large Masters cohort in the Ore Deposit Geochemistry, Geochronology and Hydrology course (June–July), Geodata Analytics (August–November), Ores in Magmatic Arcs – South America (October) and Geometallurgy (October–November) courses later this year.

On the research front, several of our team members are leading major new research initiatives, which are in various stages of development or implementation, some of which are highlighted elsewhere in this newsletter. Well done to all of our team members for their excellent work in progressing these research proposals and engaging with potential industry and research partners to bring them to reality. 2025 is the final year of the Regional Research Collaboration – Environmentally sustainable production of critical metals project. We will showcase some of the major research findings of this project in a seven-day post-conference field excursion around Tasmania as part of the Society of Economic Geologists'



Participants on the March 2025 Ores in Magmatic Arcs Masters short course viewing blue flames at the crater of Mt Ijen in East Java, Indonesia.

annual conference in October. There are many other great activities taking place this year, more of which will be highlighted in our next newsletter.

It looks like another busy and productive year for our team!

David Cooke

UPCOMING SHORT COURSES

FUNDAMENTALS OF ECONOMIC GEOLOGY (KEA716)

7–12 APRIL AND 5–9 MAY 2025

This unit teaches the fundamental skills needed by all economic geologists. Key geological concepts, mineralogy, paragenesis, geochemistry and geophysical characteristics of ore-forming environments, and the impact of these data sets on ore genesis and exploration are taught. The unit focuses on identifying and using key tools to recognise the sequence of events that have impacted ore-forming environments, and how these tools can be best used in an exploration context to solve exploration, mineral processing and environmental problems.

Unit leader: Professor David Cooke

Delivery mode/location:
Online

ORE DEPOSIT GEOCHEMISTRY, HYDROLOGY AND GEOCHRONOLOGY (KEA709)

2–7 JUNE AND 7–11 JULY 2025

This unit covers a variety of geochemical and geochronological techniques used to interpret environments of ore formation and processes of ore genesis, and discusses the implications of these data sets for mineral exploration. Topics include Ar–Ar, U–Pb and Re–Os geochronology, whole-rock and trace element chemistry of igneous rocks,

sulphide trace element chemistry, stable and radiogenic isotopes, fluid inclusions and hydrothermal geochemistry.

Unit leader: Professor David Cooke

Delivery mode/location:
Blended delivery (face-to-face and online)

For more details about these courses see the course flyers at: 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

Please see page 4 for details of a practical assessment for participants of the Ore Deposit Geochemistry course.