

# ORE SOLUTIONS

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

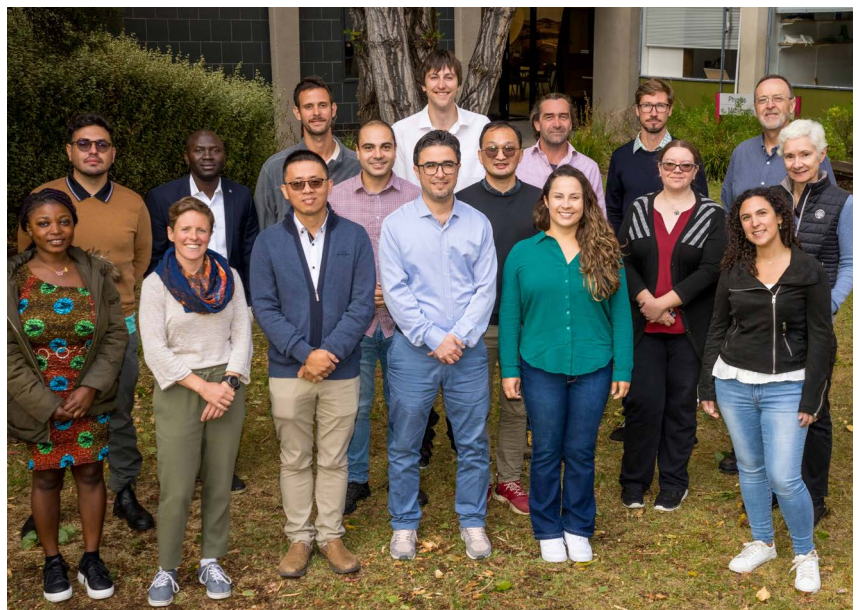
> AUTUMN 2023 **No.45**

## CODES' NEW CRITICAL METALS COLLABORATION UNDERWAY IN TASMANIA

### FINDING INNOVATIVE SOLUTIONS TO EXTRACT CRITICAL METALS FROM ORES, GANGUE, TAILINGS AND WASTE ROCK

As 2023 gets into full swing, CODES staff and PhD students involved in the 'Environmentally sustainable production of critical minerals' project – funded by \$3.5 million from the Australian Government's Regional Research Collaboration Program – have been hard at work. Here we outline the scope of the project in more detail and provide an update on progress.

The project is a collaboration between staff in UTAS' College of Science and Engineering (CODES and the Central Science Laboratory) and College of Arts, Law and Education (School of Education), together with staff from the University of Queensland's Sustainable Minerals Institute and Université de Liège's GeMMe research group, the Tasmanian Government (MRT within the Department of State Growth), the Tasmanian Mining, Manufacturing and Energy Council (TMEC) and partners from Tasmanian mining companies. The project consists of three elements that cover unlocking critical metal resources, pathways to production and education and engagement.



**Team spirit:** Some of the RRC team working on the 'Environmentally sustainable production of critical metals' project including some of the new PhD students. They are (L–R) front row: PhD student Alfreddina Appiah, Dr Clare Miller (CODES adjunct), Dr Lejun Zhang, Dr Mohammad Fathi, PhD student Angela Costa and Dr Yamila Cajal; middle row: PhD students Jose Barillas Diaz, Musa Emmanuel Dogara and Emrehan Yurdakul, Dr Wei Hong, Helen Scott (admin) and Dr Julie Hunt; back row: PhD student Vinicius Da Cruz, Dr Owen Missen, Dr Matthew Cracknell, Dr Ivan Belousov and Professor David Cooke.

Ten new PhD students have now been recruited from across the globe (9 in CODES, 1 in Education), and together with one existing student, will be carrying out research at the project's nine industry partner mine sites in Tasmania and on King Island, and with local mining communities. In addition, four new postdoctoral research fellows have been recruited

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#### IN THIS ISSUE

Masters update	4
Staff focus: Dr Ivan Belousov	7
Where are they now?: Assistant Professor Dan Gregory	11
Fieldwork photos:	15
New Economic Geology Senior Lecturer	18

#### FROM THE DIRECTOR

Professor David Cooke acknowledges the appointment of Dr Lejun Zhang as Senior Lecturer in Economic Geology, outlines the recent changes to staffing and PhD numbers, and thanks those staff who have stepped into the breach, particularly those in the CODES Analytical Laboratories.

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P24



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On site: L-R: CODES PhD student Emrecan Yurdakul with postdocs Dr Owen Missen and Dr Mohammad Fathi in front of the Prince Lyell Open Pit at the Mt Lyell Mine in December 2022. They were examining the old open pit mine, located nearby Emrecan's PhD mapping area, and scoping sites for examining critical metal content in waste rock, slags and tailings. (Photo credit: Geoff Cordery)

to work on this three-year project alongside the three project leaders from CODES: Professor David Cooke, Dr Julie Hunt and Dr Lejun Zhang. Professor Sharon Fraser from the UTAS School of Education will be leading the education element of the project. The four new postdocs are Dr Yamilla Cajal, Dr Mohammad Fathi, Dr Wei Hong and Dr Owen Missen. Other UTAS staff also involved in the project include Dr Kim Beasy, Dr Ivan Belousov, Dr Connie Cirkony; Dr Matt Cracknell, Dr Angela Escolme and Dr Thomas Rodemann.

## THE WORK BEGINS

CODES' research with the RRC project began in earnest late last year with introductory field trips to Tasmania's west coast for new staff and PhD students to mine sites and exploration projects. With additional PhD students and staff arriving early in 2023, individual field campaigns have now been completed by students at six sites, with the seventh commencing in late March. The team have collected initial sample suites and are now preparing samples for analyses, while awaiting their first whole rock analytical results from external laboratories. Team members are also preparing presentations for conferences across Australia and further afield to communicate the aims, objectives and initial findings of the project.

"The Regional Research Collaboration is a significant project from both its research aims and the number of researchers and HDR students focused on Tasmanian critical elements research. With the welcome influx of HDR students, our first port of call has been introducing them all to both Tasmania as a whole (including a western Tasmania field trip) and the many facilities available at CODES for all kinds of analysis", said Dr Owen Missen.

Research is focusing first on unearthing western Tasmania's considerable critical metals potential that lies in its existing mines, mine tailings and waste rocks. Understanding the deportment and reserves of critical metals in existing tailings and waste rock is key to unearthing new finds and helping Australia to become more self-sufficient in these resources, which will be vital for the future as the world transitions to a sustainable green energy future.

*"With one of the RRC aims being the completion of nine PhD theses covering many of Tasmania's most famous metallogenic deposits, the RRC will require a concerted research effort. I am very much looking forward to the challenge!"*

Dr Owen Missen, CODES Research Fellow in Environmental Geochemistry and Mineralogy

The important existing deposits that our researchers are examining

in Tasmania for their critical metals potential include Devonian granite-derived tin at Renison Bell, Mt Bischoff and Severn; nickel at Avebury; tungsten at Dolphin and Kara; magnesium at Prospect Ridge, REE at Deep Leads, and by-product critical metals potential at the Cambrian polymetallic VHMS deposit at Rosebery; and the copper-gold deposit at Mt Lyell. Extractable levels of critical metals such as antimony, bismuth, cobalt, gallium, germanium and indium may be found in these tailings and waste – and in new ore bodies as well. Potential new industry partners are currently reaching out to expand our portfolio of potential critical metal occurrences in Tasmania to assess, including lithium and other battery metals.

CODES is using analytical techniques such as automated mineral liberation analysis, X-ray fluorescence (XRF) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) to characterise the deportment of critical metals in fresh and weathered tailings at several sites.

Postdoctoral researcher Dr Owen Missen said that the colder and wetter climatic conditions found in Tasmania mean there are differences in mineralogy and rates of weathering of metals found in tailings storage sites compared to those in warmer climates on the Australian mainland.

## RESEARCH RENEWAL

One of the great opportunities being provided by the Regional Research Collaboration is the wealth of new geological data being provided through our new PhD studies. This is a real renewal of CODES' research into the geology and mineral resources of Tasmania, and we are excited to see the following PhD studies getting underway that will reveal the critical metal potential of many of Tasmania's most significant mineral resources:

1. Characterisation of W mineralisation at Grassy, King Island, Tasmania – Implications for ore genesis, exploration, and pathways to production (PhD student Angela Costa).
2. Characterisation of complex orebodies in the southern part of the Rosebery–Hercules district, Western Tasmania (PhD student Vinicius Da Cruz).



The end game: CODES staff and students inspecting the processing plant at Savage River Fe ore mine, December 2022.

3. Characterisation of the Heemskirk tin project, Zeehan, Western Tasmania (PhD student Nelao Naimbale, arriving shortly into Tasmania).
4. Characterisation of the Avebury nickel deposits, Zeehan, Western Tasmania (PhD student Jose Barillas Diaz).
5. Characterisation of Renison Bell tin deposit, western Tasmania (PhD student Javier Gill Rodriguez).
6. Orebody knowledge of the Western Tharsis Cu-Au deposit, Tasmania (PhD student Emrecan Yurdakul).
7. Pathways to production – magnesite deposits at Prospect Ridge, northwest Tasmania (PhD student Alfredina Appiah).
8. Recovery of critical metals from legacy mine waste facilities – Savage River Fe deposit, northwest Tasmania (PhD student Pratiche Mondal, arriving shortly into Tasmania).
9. Pathways to production – Kara W-Fe mine, NW Tasmania (PhD student Musa Emmanuel Dogara).

In addition, given the synergies of geoenvironment PhD candidate Chris Allen's existing PhD study of 'Optimising remediation of legacy mines – Mineralogical controls on long-term waste rock weathering and mine drainage (Mt Bischoff and Mt Lyell)', Chris will be joining the team to increase the collaborative research effort to involve 10 geoscience PhD studies in Tasmania. And capping this collective research effort is PhD student no. 11, Jane Hall-Dadson, who will

be shortly commencing her research project in the School of Education on 'Addressing regional barriers to engagement in STEM – Education and outreach strategies relating to critical metals production'. All of the staff and students at CODES are looking forward greatly to collaborating with Jane and her supervisory team on this vitally important issue, which is so critical for student retention in west coast communities, and for community engagement and social licence for the critical metals industry.

CODES project leader Professor David Cooke concludes: "This project aims to provide new methods and approaches to critical metal processing from existing mines and from legacy mine wastes leading to improved environmental outcomes. The enthusiasm with which all of the research partners have embraced the concept of this project, and the collaborative opportunities it provides is testament to the importance of the pressing societal issues that this project seeks to address. We look forward to delivering game-changing research results that contribute to the Renewables Revolution that will be underpinned by more environmentally sustainable mining and processing of copper and critical metals resources."

See page 13 for a full listing of all the collaborating institutions and companies on this project.

See 'Changing Faces' on page 22 for a listing of the latest PhD students and postdocs to join CODES for this project.



# CHANGES AFOOT AND CHALLENGES OVERCOME



Out west: Participants of the 2023 MEconGeol two-week Advanced Field Skills in Economic Geology short course pictured in February at Donaghys Hill lookout en route to Queenstown.

## Master of Economic Geology Program Co-ordinator Dr Robert Scott outlines the UTAS restructure of our highly successful MEconGeol offerings, and introduces three current students.

The past few years have seen quite a few changes in the delivery of the Master of Economic Geology degree program, including the COVID 19-imposed move to online delivery of most units, as well as increases in both the total and annual coursework unit offering (up from 6 to 9; and 3 to 6 or 7, respectively). This year sees some further changes, with the rollout of a new degree structure required as part of a university-wide restructure of postgraduate coursework degrees. One of the main changes affecting students is the introduction of core units, to be completed by all students admitted to the degree from 2023 onwards. The core units are KEA716 – Fundamentals of Economic Geology (offered annually in April/May) and KEA712 – Ore Deposit Models and

Exploration Strategies (offered biannually in June, even-numbered years). All new students (2023 onwards) must also complete at least one of the three field-based training units:

- KEA707 – Ores in Magmatic Arcs
- KEA708 – Volcanology and Mineralisation in Volcanic Terrains
- KEA718 – Advanced Field Skills in Economic Geology

Previously, almost all MEconGeol graduates have completed both KEA712 and at least one of the field-based units, so in practice, the introduction of compulsory units is unlikely to significantly impact student study choices. Other changes to the degree include the requirement that all students complete either a two-unit research thesis (KEA724 and KEA725), or any two of the following four units: KEA709 – Ore Deposit Geochemistry, Hydrology and Geochronology); KEA710 – Exploration in Brownfield Terrains; KEA711 – Geometallurgy; and KEA724 – Thesis Project (Part A). As in

previous degree structures, the thesis is compulsory for full-time students. The units KEA709, KEA710 and KEA711 all involve major assessments requiring students to undertake a significant piece of independent research and/or analysis addressing real-world topics, issues and data sets. As such, these units provide capstone experiences in the degree and allow student performance against the five course learning outcomes to be fully assessed.

Another important change in the new degree structure is that KEA724 can be either:

1. the first half of a two-unit (50-credit-point) research project, which culminates in a thesis, roughly equivalent to an Honours thesis in scope and length (i.e., 30,000 – 50,000 words); or
2. a stand-alone 25-credit-point research project and <20,000-word report.

Thus, KEA724 both serves its original role (i.e., first half of a two-unit thesis)



MEconGeol student David Mallon and his partner Nara Saisud mapping magmatic – hydrothermal transition features at Bluestone Bay on the east coast of Tasmania as part of the Advanced Field Skills in Economic Geology short course in February.

and replaces the unit KEA717 – Special Topics in Economic Geology, introduced in 2021, which allowed students to undertake their own research project without committing to a full, two-unit research thesis. In the new course structure, MEconGeol students may complete up to three units by cross-institutional study at either UWA (e.g., eight units available through the Master of Ore Deposit Geology program) or Curtin University (from a selection of four minerals finance units offered by the Graduate School of Business).

In 2023, the Masters program aims to build on the successes of recent years, and also see an increase in the amount of face-to-face delivery. In June, the first intensive week of the Ore Deposit Geochemistry, Hydrology and Geochronology unit will be delivered face-to-face in Hobart, with live-streaming via Zoom available for students who choose not to, or are unable to, travel. In October, Geometallurgy will return to full, in-person face-to-face delivery. Delivery of Fundamentals of Economic Geology (April/May) and Geodata Analytics (August–October) will remain fully online. At the time of going to press, two of three field-based

units delivered this year were either underway (Ores in Magmatic Arcs – Indonesia) or completed (Advanced Field Skills in Economic Geology), but in October/November (exact timing to be confirmed), David Cooke will lead a second delivery of Ores in Magmatic Arcs in South America.

## STUDENT FOCUS



### DAVID MALLON

The past two years have been record years for graduations and completions in the MEconGeol program. Eleven students graduated in 2021, and in 2022, seven graduated with a further four completing their degrees. This year should be another good year for completions, and David Mallon is expected to be amongst them. David successfully completed Advanced Field Skills in February this year, and now only needs to complete Fundamentals

of Economic Geology, which he will do in April/May, to finish his degree. David suffers from an eye condition called nystagmus, which affects his focus and depth perception. Nystagmus limits David's ability to spend long hours in front of computer screens and it makes traversing rough or unevenly lit ground much more difficult and potentially dangerous. However, with his trademark dogged determination, he has not let these difficulties be a barrier to his study plans. David was also fortunate to receive a special bursary from the AusIMM, which has covered the additional costs of having his partner Nara join him for each of the field-based Masters units. Nara acts as David's personal field assistant and guide; helping ensure he covers the ground safely. With Nara's help, David was able to complete the challenging Mount Tarawera and Tongariro Crossing walks on the Volcanology and Mineralisation in Volcanic Terrains short course in New Zealand in 2018, as well as the pre-dawn climb to the summit of Mt Ijen Peak (2,148 m) during the 2019 Ores in Magmatic Arcs short course in Indonesia. It will be great to see David finally achieve his dream of graduating from the MEconGeol program, and all at CODES who have got to know him, and Nara, over the duration of his studies here, certainly wish him and Nara well for the next chapter in their career.



### ASHLEIGH BALL

For her MEconGeol research thesis Ashleigh Ball will be investigating the structural history of First Quantum Minerals' Enterprise Ni deposit in Zambia. Her work will examine the relative timing of deformation fabrics and Ni sulfides, and the extent to which deformation controlled the distribution, style and grade of the Ni sulfide mineralisation. The Enterprise deposit is located in the Central African Copper Belt on the southeastern edge of the Kabompo Dome, 12 km NW of the Sentinel Cu mine, in the North-Western Province of Zambia. The ore body is hosted by complexly deformed

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amphibolite facies metasedimentary rocks of the Neoproterozoic Katangan Supergroup. As the deposit was originally 'blind' (i.e., no surface exposure), the current geological and structural understanding is based solely on the interpretation of drill core. However, following the commencement of mining in late 2022, access to in situ exposures in the new open pit is now possible. Ash's study will involve detailed pit mapping, production of cross-sections and a new 3D structural model, and sampling for subsequent petrographic and microstructural analysis. The updated structural model should assist both grade distribution modelling at the deposit and future nickel exploration in the area.

Ashleigh says: "Deciding to commence a Masters in Economic Geology with CODES has been one of the best career decisions I have made. The expertise offered from the lecturers and PhD students as well as fellow students is exceptional. I've had exposure to numerous ore deposit styles, have had the opportunity to visit world-class deposits on amazing field trips in Australia, Indonesia and South America and have had a lot of fun along the way! I am excited to commence the Enterprise project to see yet another new deposit style and to further extend my skills in economic and structural geology."



#### JOEL BLAKE

For the unit Special Topics in Economic Geology, MEconGeol student Joel Blake is investigating the trace element composition and paragenesis of pyrite at Rio Tinto's Devoncourt IOCG prospect in NW Queensland. In 2019, drill testing of a coincident magnetic/gravity anomaly beneath ~200 m of Cambrian cover identified widespread IOCG type alteration and low-grade Cu mineralisation centred on a subvertical breccia body in the Early Mesoproterozoic Wimberu Granites. Breccia infill primarily consists of



CODES MEconGeol student Ashleigh Ball mapping folded paragneiss at the Pogo gold project, Alaska.

magnetite + quartz + pyrite ± copper sulfides + specular haematite. Using a combination of optical and scanning electron microscopy and LA-ICP-MS analysis, Joel is investigating spatial variations in the composition, texture, growth and deformation history of the pyrite, to assess its usefulness as a vectoring tool within the system. Although this unit will be discontinued as a result of the recent course restructure, MEconGeol students wishing, like Joel, to complete a small research project as part of their degree may still do so, by enrolling in KEA724, which can now be done as either a stand-alone, 25-credit-point research unit or as the first half of the two-unit research thesis.



Joel Blake, a Master of Economic Geology student, is undertaking research in the unit Special Topics in Economic Geology. He is investigating pyrite at Rio Tinto's Devoncourt IOCG prospect in NW Queensland.

#### STAFF FOCUS: DR IVAN BELOUSOV

## GEOLOGY IS IN THE BLOOD

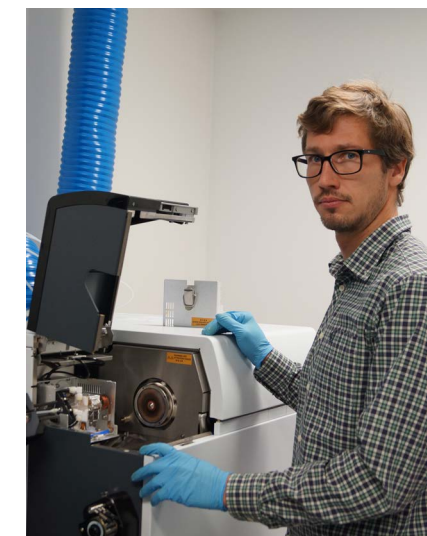
**Senior Research Fellow in Mineralogy and Geochemistry**  
**Dr Ivan Belousov talks about his path into geology, his strong family connections with the subject and his work within the CODES Analytical Laboratories.**

My introduction to geology started very early with both of my parents being volcanologists; I am from the fourth generation of geologists in our family! The first ten years of my life were spent living in the far east of Russia on a volcano observatory in remote Kamchatka nestled between the most active and highest volcano in Eurasia – Klyuchevskoy – and another very active volcano – Shiveluch.

Before joining the University of Tasmania, I studied experimental petrology for my BSc and then worked with melt inclusions from Karymsky volcano (Kamchatka) for my MSc. I also did a three-month internship at the University of Alaska, Fairbanks, which involved a field trip to the Valley of Ten Thousand Smokes near Mount Katmai volcano in southern Alaska.

I completed my PhD at the Vernadsky Institute of Geochemistry and Analytical Chemistry in Moscow, Russia, under the supervision of Professor Alexander Sobolev and Dr Valentina Batanova. My thesis was on the mantle section of the Voykar Ophiolite and involved two years of fieldwork riding on personnel carriers and collecting rocks while covered in mosquitoes in the inhospitable region of the Polar Urals, the northern section of the Ural mountains. A substantial part of the project was completed at the Max Planck Institute for Chemistry in Mainz, Germany. That is where I was first introduced to the LA-ICP-MS technique. I have also briefly worked for De Beers doing kimberlite exploration and for Schpaz (Satka) doing manganese exploration in Africa (Zambia, Namibia and Ghana).

Originally, I came to CODES in early 2013 to work with Professor Ross Large on pyrite and magnetite compositions from the Yilgarn craton, Western Australia. That study involved doing a lot of LA-ICP-MS analyses and quite quickly I switched to working full-time at the CODES Analytical Laboratories. It is a truly unique setup. We are currently hosting four LA-ICP-MS systems and doing a lot of external work for mining companies as well as internal work for UTAS researchers. I do only part of the work, but since 2013 I have completed several hundred reports to industry myself, mainly on U/Pb geochronology (zircon, apatite, titanite, epidote, rutile, monazite, calcite, etc.), mineral chemistry vectoring and fertility studies as well as deportment of different elements in sulphide and silicate minerals. Each year we process ~800 samples for U/Pb geochronology alone.



Apart from doing analyses for companies outside CODES we also do research in areas of the fundamentals of ICP-MS and laser ablation, development of calibration standards for LA-ICP-MS, development of LA-ICP-MS instrumentation, U/Pb dating, LA-ICP-MS data reduction software and interpretation of LA-ICP-MS time-resolved signals. Unfortunately, most of the outcomes of this research remain unpublished as we need to spend most of our time on analyses and reporting to our external partners. I'm currently a



Dr Ivan Belousov (right) pictured in July 2007 while doing fieldwork for his PhD on the mantle section of the Voykar Ophiolite – it involved riding on personnel carriers (as there were no roads and many swamps) in order to get to the field site, and collecting rocks while covered in mosquitoes in the inhospitable region of the Polar Urals. With him is Dr Nikita Mironov, a Research Fellow at the Vernadsky Institute, who was assisting with sampling during the fieldwork.





Ivan on a snowboarding trip to Kamchatka in 2014 with Koryaksky volcano behind him.

Leader of CODES Program 5: Analytical Research, and hope to increase our publication numbers in this space.

Since 2014, I have also been a part of four Amira Global footprints projects (P1060, P1153, P1202 and currently I'm part of the research team on project P1249: Exploring, characterising and optimising complex orebodies – upscaling orebody knowledge to add value across the Mining Value Chain). This pipeline of projects provides

another stream of work to the LA-ICP-MS labs in addition to the U/Pb geochronology – mainly in the mineral chemistry space. One of the exciting projects we are currently doing with my CODES PhD student Axel Cima involves exploring the distribution of microinclusion populations in alteration minerals around porphyry Cu deposits. Hopefully this study will generate new exploration tools for porphyry Cu deposits and improve existing ones.

I'm also involved in the Regional Research Collaboration project known by its short title of: 'Environmentally sustainable production of critical metals'. The aim of this project is to build capacity in regional Australia in order to enhance Australia's economy through research, training and the environmentally sustainable production of critical metals. In my opinion the LA-ICP-MS technique is very important in determining the deportment of critical metals.

During a typical day, I spend my time either running one of the LA-ICP-MS instruments, doing data reduction or writing reports. We also do most of the instrument maintenance ourselves and try to dedicate at least one day per fortnight for doing R&D work. Work within the AMIRA P1249 and RRC projects and PhD student supervision also takes up quite a bit of my time.

My wife and I came to Tasmania ten years ago and now we have two young children (two and five years old) who take up all my spare time. I think Tasmania is a great place for raising kids with plenty of activities such as fishing and camping available. When living in Russia I used to snowboard a lot; while in Tasmania I try to keep up with surfing as it is not easy to find enough snow here!

## HAPPY CAMPERS AT THE CODES/EARTH SCIENCES BASE CAMP



In early March, just after our intake of new PhDs and postdocs, we decided it was time for another big group photo, since our last one was taken way back in 2018 – so here we all are in the CODES Rock Garden once more.

# MICHAEL ROACH'S BUCKET LIST ACCOMPLISHED!

## DEVELOPING IMMERSIVE DIGITAL TOOLS IN MINERAL RESOURCE EDUCATION

In February 2023, Dr Michael Roach visited the Institute of Mineral Resources Engineering at RWTH Aachen University, Germany, a visit that was facilitated by CODES collaborator Professor Bernd Lottermoser. The aim of his visit was to exchange expertise and information on digital teaching tools and to initiate grant applications with European partners. The grant application to the European Commission Erasmus+ scheme will be to obtain funding to develop shared virtual and digital educational materials for mining engineering and Earth science students in Europe and Australia. The intention is to combine immersive technologies and inspiring pedagogic content for optimal learning results on mineral resources and mining across continents.

During his visit to Aachen, Michael interacted with RWTH staff and PhD students and also participated in field trips to view mining operations and environmental rehabilitation projects at the nearby Hambach lignite mine. A highlight of the mine visit was a tour of a bucket-wheel excavator, the largest mobile land-based machine in the world which weighs over 10,000 tonnes and moves up to 250,000 cubic metres of material per day. Michael collected 360-degree imagery during the excavator tour and has integrated this imagery to produce a virtual tour. The virtual tour will be available for public access once final permission has been granted by the mine owners, RWE.

*All photos courtesy of Bernd Lottermoser.*



Hambach lignite mine, Germany. Dr Michael Roach taking 360-degree imagery on a bucket-wheel excavator in the open pit. Bucket-wheel excavators, like the ones in the background, are used for soft rock overburden removal and lignite mining. The imagery collected by Michael is being used to create a virtual tour of the mine.



Dr Michael Roach (second from right) and staff of the Institute of Mineral Resources Engineering (Nina Küpper, Professor Bernd Lottermoser and Johannes Emontsbots) in front of Paffendorf Castle, Germany. The castle is owned by RWE, a multinational energy and mining company, and is used by RWE for its CEO office and the company's mine site recultivation group.



Sophienhöhe waste rock dump, Germany. Dr Michael Roach and staff of the Institute of Mineral Resources Engineering in the field, inspecting a perched lake and surrounding nature reserve, which has been established on top of a major recultivated waste rock dump. The dump represents the largest artificial hill worldwide (>200 m in height), covers 13 km<sup>2</sup> and was created by surface mining from the adjacent open-pit lignite mine. RWE received an award from the United Nations for achieving outstanding biological diversity for its world-class recultivation efforts of the dump.



# THANKS FOR THE MEMORIES... WITH MORE TO COME!



**CODES Environmental Geology lecturer and researcher Dr Clare Miller is moving to the Environment Protection Agency, but we hope that professional collaboration between CODES and the EPA will develop into the future. On her very last day at CODES, she reflects on her time here and the many people she has met and places she has visited.**

Today marks the end of one chapter and the beginning of a new one as I step away from my role as a lecturer at UTAS and begin a role as a Scientific Officer at the EPA Tasmania, focused on the rehabilitation of Savage River legacy mine wastes.

This new position provides an exciting opportunity to expand collaborations and build capacity to better understand and support sustainable resource development in Tasmania; however, as I transition between roles, I can't help but reflect on the incredibly rewarding experience of being a part of the team here at UTAS.

Three years ago, I relocated to Tasmania to join CODES and begin the adventure of a lifetime. As an early career researcher and the new Environmental Geology lecturer here at UTAS, I aimed to build on the strong foundations of CODES' research and teaching and contribute to the growing knowledge of improved mine waste characterisation and sustainable resource development (and have some fun while doing it). I can very happily say, I think we did just that!

Over my time at UTAS, I have had the chance to explore and learn from the perfect 'laboratory' for us geologists – Tasmania's remote wilderness, complex geological diversity and long history of mining. I've scrambled down river beds, paddled jarringly blue lakes, collected samples while rain blew both horizontally and seemingly vertically, watched dolphins while studying beach sediments... and somehow still managed to avoid horizontal scrub... suffice to say that, overall, it's been an incredible adventure.

To KEA348 and Honours students past and present, your enthusiasm and curiosity has been a highlight of my time here at UTAS – thank you for the laughs, the snacks and the stories... but most importantly, thank you for the lessons along the way. I've learned more from teaching and working with you than I could ever learn from a book (or MyLO module). I wish you all the best of luck with your next chapters and hope to see you down the road, wherever those next steps take you. And to the academic team at CODES, thank you for the opportunity – this has been an incredible journey and hopefully it only marks the start of exciting friendships and collaborations here in Tasmania.



**Top Honours:** Clare (right) at the Endurance legacy mine site, northeast Tasmania, with former Honours students, Wei Xuen Heng and Olivia Wilson, planning for the drilling and installation of boreholes and piezometers.



**Off duty:** Former CODES staff member Dr Indrani Mukherjee and Clare catch up at Goldschmidt 2022, Hawaii. Conferences were a thing once more last year, and networking an important aspect of academic progression.

## WHERE ARE THEY NOW?

Nearly ten years have passed since Dan Gregory completed his PhD here at CODES, and in that time he has returned to his native Canada and embraced fatherhood, while all the while maintaining his academic edge by being appointed to an assistant professorship. But he still misses the collegiality and camaraderie engendered by the CODES tea room!

## QUIET ACHIEVER



### ASSISTANT PROFESSOR DAN GREGORY

**Assistant Professor of Economic Geology in the Department of Earth Sciences at the University of Toronto, Canada**

PhD completed at CODES in 2014 entitled 'The trace element content of sedimentary pyrite: Factors affecting uptake and uses of the data for determining paleo-ocean conditions' (supervised by Ross Large, Sebastien Meffre and Stuart Bull).



Dan Gregory pictured hiking in Bryce Canyon National Park, Utah, USA, in January 2018 with his daughter: "I'd like to say it was baby's first geologic mapping trip but we had her mapping long before then".

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

I am an Assistant Professor in Economic Geology at the University of Toronto and have been doing this role for the past four and a half years. I teach mineral deposits and advanced field geology while maintaining a research group that is investigating the formation of strata-bound critical metal deposits and orogenic gold deposits. The research group is made up of two PhDs, two MScs and two undergraduates. As part of this research I am a co-PI for a laser ablation laboratory at the university.

### What are the things you enjoy most about this role?

I am still very interested in learning how different mineral deposits form and my current position allows me to develop new ideas and utilise new

analytical techniques to enhance our understanding of ore systems. However, I also really enjoy mentoring students, both in research but also as an undergraduate teacher. I especially like teaching field courses because I feel that's the best way to experience geology. The University of Toronto is a great place for this because we have quite a lot of funding available to take students on field trips. In the past few years I have co-led field trips to both South Africa and the IOCG belt of Chile. These trips involve a mixture of investigating geological interest and going to existing mine or exploration sites. One of the parts I found most effective to teach the students was showing them from a lookout the relative position of IOCG deposits along a regional fault that demonstrated the importance of structural geology in the Chilean IOCG belt. I was also going to take a group of students to





Dan up close with orbicular granite in Chile, north of the town of Caldera, in November 2022: "One of the stops on the geology field trip as part of our Igneous Petrology and Mineral Deposits classes" run at the University of Toronto.

Western Australia; unfortunately that trip needed to be cancelled because of the pandemic.

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

During my undergraduate years I worked doing mineral exploration in the Yukon Territory over the summers and continued doing that full-time for three years. This gave me some perspective on what is needed by industry as well as a number of contacts that have helped me develop research programs. While at CODES I learned further what is required in academia which I think has helped me develop a research program that prepares my students for fruitful

careers in both industry and academia.

The technical skills I developed at CODES have also been invaluable. I still routinely use LA-ICPMS in my research and have a laser ablation lab of my own. Also, the observational skills developed in hand samples and reflected light microscopy I use daily in my research. Further, the exposure to many different research projects, investigating many different mineral systems has given me the background knowledge needed to expand my research into other directions.

I did my post-doc at the University of California, Riverside, focusing more on past ocean chemistry than economic geology. The skills developed there in sedimentary rock geochemistry (not

associated with hydrothermal fluids) coupled with the skills developed in hydrothermal deposits at CODES have really helped me in my current research area investigating highly metalliferous shales.

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

I don't think I have a single greatest achievement. I think that whenever I get to a point in a research project when I've answered the question that I set out to answer and have come up with the next set of questions, there's a feeling of accomplishment. Also, whenever I have a student defend their thesis successfully there's also a pretty strong feeling of accomplishment.

#### 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 specialised in laser ablation of sulphide minerals and applying this to understanding the chemistry of the fluids from which the sulphides formed. We have applied this both to using it as a proxy for past ocean and atmospheric chemistry and to understanding ore systems. While at CODES I enjoyed the SEG trips to different ore districts around the world – we ran trips to China, Southern Africa and Russia. Each of which was an amazing experience that taught me much about geology and the different deposits we visited, but also about the different countries we went to. I also really enjoyed the informal science discussions that came out of the tea room; I've worked at other universities since and every department has tried to do something similar but never with as much success. The chance to have informal discussions about ideas can really help develop something great, and avoid much wasted time.

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

There was a big emphasis on large tonnage low-grade base metal deposits when I was at CODES. I think that in the future there will be a greater diversity of deposits that will be of

interest. Currently critical metals are of interest but I think that also higher-grade deposits that can be exploited underground will make a comeback due to their lower environmental impact.

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

Always keep your eyes open for opportunities and when you are able, embrace them. A third of my PhD came out of a decision to help with sampling on the Derwent River and my post-doc came out of helping a visiting researcher for a week or so. Also, one of my recent projects came out of knowing someone from an afternoon geology hiking trip I put on in Sandy Bay in Hobart. You never know what things you do are going to be important in the future, so do as much as you can.

#### Little-known facts about you?

I trained my three-year-old daughter to identify some minerals for a talent show; it's surprising how quickly they can pick it up!



Fieldwork on the Rau gold project, Yukon Territory, Canada, in July 2019: "This was part of my first MSc students' project".

## 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:



University of Queensland  
Université de Liège – GeMME  
Tasmanian Minerals, Manufacturing and Energy Council (TMEC)  
Tasmanian Government (Mineral Resources Tasmania)

Group 6 Metals Limited  
ABx Group Limited  
Bluestone Mines Tasmania Joint Venture  
Tasmania Mines Pty Ltd  
Mallee Resources Ltd

GWR Group Ltd – (Tasmanian Magnesium Pty Ltd)  
Copper Mines of Tasmania Pty Ltd  
Grange Resources (Tasmania) Pty Ltd  
MMG Australia Ltd  
Stellar Resources Ltd



## CONFERENCES

# CODES PLAYS ITS PART AT INTERNATIONAL GEOLOGY CONFERENCE

The IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) Scientific Assembly 2023 took place in Rotorua, New Zealand (30 January–3 February), and was attended by several CODES staff and HDR students. It's the largest volcanology conference in the world and typically occurs every four years hosted by a different country each time. Attendees from UTAS were: Associate Professor Rebecca Carey, Dr Martin Jutzeler, Dr Karin Orth, CODES PhD students Hannah Moore, Malai Ila'ava and Declan Higgins, Dr Jodi Fox (IMAS adjunct researcher), Meg Harlan (IMAS PhD student) and Emily Conn (future CODES Honours student).

Despite some difficulties in travelling to the venue due to the heavy rainfall event at that time, it was a highly successful conference with CODES staff giving several presentations and running post-conference field trips.

Karin and Jodi participated in conference field trips related to how to build and destroy stratovolcanoes, and exploring volcanic facies associated with composite volcanic cones. A break from cloudy and rainy weather on the weekend after the conference enabled Rebecca, Hannah and Declan to visit Tarawera, Taupo and Ruapehu volcanoes.

This face-to-face conference opportunity was important for students to begin their networking and discuss their science with a broad international group of volcano scientists. Staff enjoyed the opportunity to be in the field again learning about volcanic processes, discussing old, current and possible future projects and field plans.

The next IAVCEI meeting will be in Geneva in 2025. There are no active volcanoes in Geneva, but the UTAS volcano team are already scoping locations in Spain, Iceland and Greece where we can observe volcanic deposits that are relevant to topics and questions in our current projects.



A conglomerate of geologists: there were more than 1,000 participants at IAVCEI 2023 (including those who attended virtually).



CODES PhD student Hannah Moore presenting at IAVCEI 2023 on the 1886 eruption at Mt Tarawera.



Associate Professor Rebecca Carey describing the geology and eruptive history of the Okataina Volcanic Centre at the summit of Mt Tarawera, on an unofficial post-conference field trip with University of Hawaii volcanologists.



Dr Karin Orth with CODES Honours student Till Gallagher's poster outlining his Honours topic research at the IAVCEI 2023 conference.

## HEADING OUT: HUGE VARIETY IN FIELDWORK AND STUDY TOURS

The past few months have seen our field trips, fieldwork and study tours gear up a notch as the shackles of COVID restrictions are finally lifted. Tasmania, New Zealand and Greece are featured here, but students are also in the field in Indonesia as we go to press (watch this space!). Studying and working at CODES presents students and staff with unparalleled opportunities to do geology in interesting ways. And it also provides plenty of challenges for Executive Officer Karen Huizing, who has to arrange all the travel!



Big skies: CODES students and staff reviewing the facilities at Mt Lyell Cu-Au mine, western Tasmania, during the December 2022 tour of the West Coast for the RRC project.



Knowledge transfer: Professor David Cooke in the Renison Bell tin ore shed explains features in the Renison Bell tin ore to the RRC team during their December 2022 familiarisation tour of the West Coast.



On dry land: CODES PhD student Acacia Clark and Columbia University graduate student Ally Peccia by the RV *JOIDES Resolution* after docking in Heraklion, Greece, on completion of IODP Expedition 398. The first touch of land in 62 days! The voyage involved drilling the seafloor at various sites around Santorini, Greece, to collect tephra from previous eruptions in the area. The two main goals of the expedition were to use the tephra to generate a complete eruption history, and gain insight to the tectonic history of the area. During the voyage Acacia and Ally were core describers so their role involved looking very closely at the freshly split core sections and logging these in high detail, cm by cm.



Helping hand: CODES PhD student Malai Ila'ava sieves pumice from the Taupo Volcanic Centre, New Zealand, to be used in experiments by fellow CODES PhD student Shannon Frey. Malai was in New Zealand to attend the IAVCEI 2023 conference (see page 14).



Camping out: Professor Sebastien Meffre (checked shirt) gives a night tutorial round the camp fire to third-year Earth Sciences students at the Study Hub West Coast. (Photo: Sheree Armistead)





**The start of it:** First-year students at Blinking Billy Point, Lower Sandy Bay, get a taste for the outdoors with one of their first field trips for the year in February 2023. Here Izzy von Lichten talks to them about the geological history of Hobart. (Photo: Clare Miller)



**Research project:** Honours student Issi Port undertaking fieldwork near Lake Pedder for his project on the structure and metamorphic history of Precambrian rocks of the Eastern Tynnan Domain, southwestern Tasmania. Issi is pictured near Mount Sprent, standing on an outcrop of cross-stratified Proterozoic quartzite, with Detached Peak and Lake Pedder behind him to the southeast. A major aim of Issi's study is to determine the age and tectonic significance of major shear zones exposed in the Bell Basin (centre left of photo, in the middle distance) and Hermit Basin areas. Hermit Basin, on the eastern shore of Lake Pedder, is barely visible in the far distance to the left of Detached Peak. Issi's project is supervised by Dr Robert Scott and Professor Sebastien Meffre. (Photo: Robert Scott)



**Masters at work:** Advanced Field Skills in Economic Geology Masters short course participants mapping in the Mount Read Volcanics, northwest of Queenstown in western Tasmania, during February 2023. (Photo: Robert Scott)

## 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:

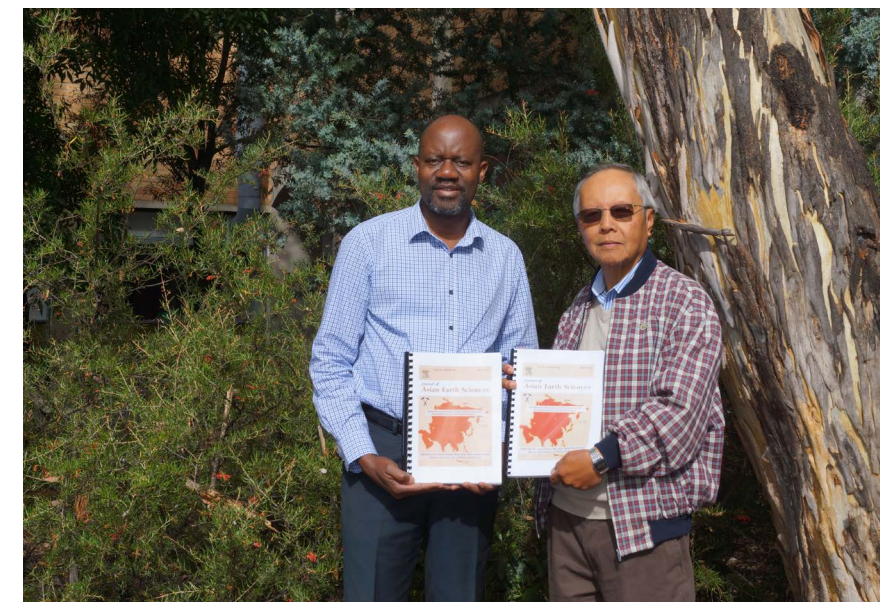
**CODES.info@utas.edu.au**

# CRITICAL METALS SEARCH IS THE TOPIC FOR JOURNAL SPECIAL ISSUE

A *Journal of Asian Earth Sciences* two-volume special issue on Southeast Asia has been published by a research team led by Professor Khin Zaw and Dr Charles Makoundi from CODES together with Dr Mohd Basril Iswadi Basori (a former CODES PhD student) and his group from the National University of Malaysia (UKM).

Southeast Asia is home to an abundance of mineral resources, including porphyry, skarn, epithermal, VHMS, sediment-hosted/orogenic gold, vein-type W-Sn, lithium and critical metal deposits, as well as significant onshore and offshore hydrocarbon deposits. This special issue contains 40 articles that focus on three different themes: Petrogenesis and Magmatism (10 papers), Tectonic Environment and Geodynamics (15 papers), and Ore deposits, Hydrocarbon Reserves, and Environmental Sustainability (15 papers).

The SE Asia region has tremendous potential for the discovery of world-class porphyry copper-gold-molybdenum and granite-related lithium and other battery minerals. However, there is a scarcity of comprehensive information and regional-scale studies on the critical minerals and metal systems that are vital for the region's future green energy and low-carbon development and modern technologies such as



**Search party:** Professor Khin Zaw (right) and Dr Charles Makoundi holding the two volumes of their *Journal of Asian Earth Sciences* special issue on 'Emerging trends in Earth sciences for sustainable futures in the SE Asia region'.

communication, health, computing and transport. More research is needed to characterise the controls on tectonic-magmatic history, ore formation, exploration strategy and ore extraction with zero environmental impact for the transition from fossil fuels to clean energy in the future.

With the currently available geochemical and geochronological data, new studies based on big data on the abundant, voluminous granitic intrusions and volcanic rocks and

sedimentary sequences would be an innovative approach to revealing the tectonic settings and geodynamic mechanisms for the sustainable development of the magmatic rocks and associated ore deposits, as well as basin formation to understand hydrocarbon and metal accumulation.

**Download the special issue at:**

<https://www.sciencedirect.com/journal/journal-of-asian-earth-sciences/special-issue/10MNZ1M9572>

## 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. The unit will focus on rigorous approaches of the above methods for extracting and visualising meaningful information from geochemical, geophysical and geological information.

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'

CONTINUED ON PAGE 24



# NEW SENIOR ECONOMIC GEOLOGY LECTURER APPOINTED

**We welcome the appointment of Dr Lejun Zhang to this important teaching role. Here he recounts the research and teaching experience that led him to this new challenge.**

I first arrived at CODES in 2009 when doing my PhD on a skarn Cu-Fe district in the Middle Lower Yangtze River belt in Eastern China. During my time at CODES, I worked with a group of the world's leading economic geologists to unravel the complicated paragenesis of the deposit I was researching. I was exposed to CODES' state-of-the-art laser ablation ICP-MS facilities, which helped me when diving into the complex chemistry of skarn minerals. I still remember David Cooke's comment when I was giving my final thesis wrap-up presentation at CODES: "Whether the deposit you worked on is a skarn or IOCG deposit depends on whether you talk to Zhaoshan Chang or Huayong Chen."

In December 2011, I was given the opportunity to become a postdoc research fellow at CODES working on an Amira project P1060 (2011–2014) – 'Enhanced geochemical targeting in magmatic hydrothermal systems'. This was the beginning of my career working in the lithocap environment – the volumetrically significant domains of hypogene silicic, advanced argillic and argillic-altered rocks that form between the paleo water table and the shallow-crustal hydrous intrusive complexes...so I was pretty much lost in an ocean of clays and quartz. With David Cooke and Noel White's support, I have been given plenty of opportunities to visit lithocap projects, scratch as many rocks and lick as many clays as possible to expand my knowledge in lithocaps. I have been working on lithocaps in various environments including the high Andes, Tibet, in both jungle and desert. All our hard work led to a breakthrough in the lithocap research space during the Amira P1153 project (2015–2018): the research team developed a new



New Senior Economic Geology Lecturer Dr Lejun Zhang conducting fieldwork in Kazakhstan; here he's holding up a piece of volcanic rock with strong quartz-white mica alteration.

lithocap exploration model.

Since 2018 I have led the lithocap research module in ongoing Amira projects. During Amira P1202 we applied and refined the lithocap model, as well as developed tools (proximitors, bathymeters and fertility indicators) to help us navigate across the ocean of clays and quartz. The new Amira P1249 project started in early 2022; I am now the leader of module 1 (vectoring and fertility), working with fantastic industry sponsors, internal and external researchers and students. I am very excited about the research directions of our project.

Critical metals (including rare earth elements, tin, tungsten, cobalt and nickel) are essential during the world's transition to green energy. I am currently involved in the new Regional Research Collaboration project (2022–2025) on critical metals, and am one of the research leaders on this project, working with a large cohort of researchers and PhD students. We aim to develop and apply novel characterisation and deportment toolboxes and workflows for effective critical metal resource evaluation.

As a Research Fellow at CODES, I have been actively involved in teaching and creating new Master of Economic Geology short courses, such as Ores in Magmatic Arcs – Indonesia; Fundamentals of Economic Geology; and Advanced Field Skills in Economic Geology. I have always enjoyed teaching, and I am grateful for the opportunity to inspire young economic geologists.

I value the inclusive culture at CODES, which promotes equality and diversity; I am one of the SEG's Diversity, Equity, and Inclusion (DEI) committee members representing the Asian/Australasian region. While working at UTAS, I aim for our community to be a safe and inclusive environment for all of us.

It has been exciting to conduct economic geology research at CODES. With my new role as a Senior Lecturer in Economic Geology, I look forward to continuing to deliver high-quality research outcomes and training of direct relevance to the mining industry to enhance the reputation of CODES – a global leader in ore deposit research and training.

# SOCIAL SCIENTISTS

**CODES continues to ensure that its students and staff have plenty of opportunities to socialise in order to contribute towards maintaining a healthy work/life balance and to foster good relationships within the CODES/Earth Sciences community.**



The CODES Christmas BBQ was an indoor affair in December 2022 due to inclement weather. Christmas decorations replaced the beautiful trees that normally surround us. Here (L–R) Dr Jeff Steadman and Dr Ivan Belousov have a relaxed chat surrounded by work colleagues and PhD students in the CODES Conference Room.



The CODES Volcanology group got together for a BBQ at Sandy Bay in early March to farewell visiting Masters student Janne Scheffler (far left) from Germany. She had been at UTAS for several months working with Dr Martin Jutzeler.



Enjoying the 8 March morning tea were CODES stalwarts Dr Robert Scott (left) and Dr Peter McGoldrick.



CODES PhD student Xi Ni Seow is happy with her prize for the best photo in the 'Social' category of the CODES Annual Photo Competition! Competition prizes were presented at the CODES Christmas BBQ.



The 2023 Women in STEM Day combined with a celebration for Pride Week took place on 21 February, and was a good excuse for a bake-off in the CODES tearoom. Enjoying the results of other people's cooking are (L–R): Janne Scheffler (visiting MSc student from Germany); CODES PhD student Hannah Moore; Head of the Discipline of Earth Sciences Professor Sebastien Meffre; CODES PhD student Isaac Brown; Rock Curator Izzy von Lichten; Lecturer Dr Clare Miller; and CODES PhD student Emrehan Yurdakul.



A morning tea was held on 8 March at CODES to welcome all our new PhD students and to farewell Clare Miller, who has left to work at the EPA. Here CODES PhD student Chris Allen listens intently to Professors David Cooke and Sebastien Meffre during their speeches.



Among the many new PhD students who have joined CODES this year to work on the Regional Research Collaboration critical metals project are: (L–R) Jose Barillas Diaz (Mexico), Musa Emmanuel Dogara (Nigeria), Angela Costa (Brazil) and Alfredina Appiah (Ghana). They are pictured at the CODES welcome morning tea in March.



## OBITUARY

# VALE DR JAN CENT VAN MOORT

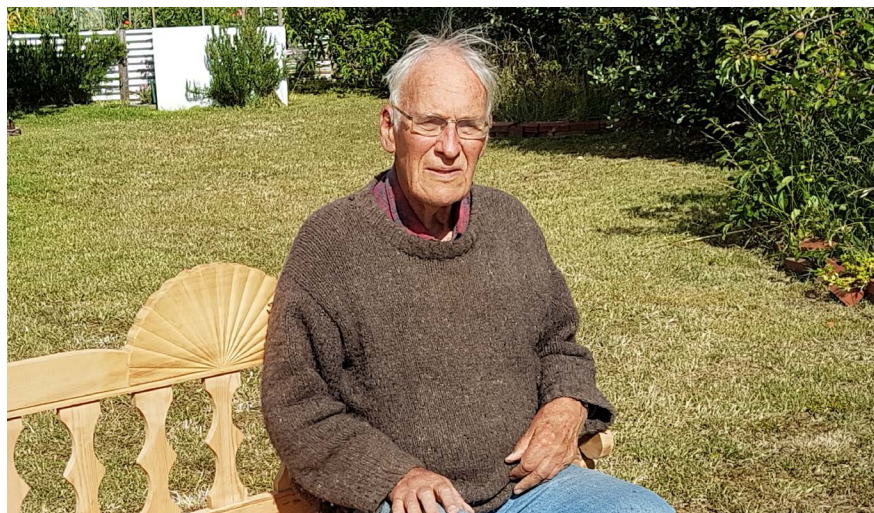
27 February 1933–20 January 2023

**ASSOCIATE PROFESSOR RON BERRY AND DR GEOFF GREEN (previously with MRT) recall Dr Jan Van Moort's career, geological connections and tenacious character following his death in January. As a UTAS lecturer, Jan was a familiar figure in the Earth Sciences corridors for many years from the 1960s to the 1990s.**

Dr Jan Van Moort was born in Haren, the Netherlands. He studied geology at Utrecht, starting in 1951, and graduating with a Doctorate in 'Mathematics and Natural Sciences' on the geology and geochemistry of a French granite (February 1965). After a winter in the Northern Territory, Jan came to Tasmania, based on the strong recommendation of Professor Rein van Bemmelen, a colleague of Professor Sam Carey, and took up a lecturing position at UTAS in Hobart in November 1965.

In 1969, Jan was unable to attend the annual Geology Students Club annual dinner, the highlight of our social calendar. Instead, Jan donated the cost of his two tickets to be the prize for a singing contest at the dinner and thus formalised a tradition that remains an essential part of the dinner. Another key tradition of the dinner is that the students are expected to highlight the idiosyncracies of the staff. Jan went to Europe on study leave in 1979 and 1986. After these trips he came back with his Dutch accent renewed. It was the year after his 1986 trip that the students gave Jan a prize at the dinner for the 'best lecturer in a foreign language'.

Jan was well known as a contrarian who would never back down from an issue if he thought he was right. In 1970 he demanded the right to be able to view the birth of his child, as was common practice in Europe. This attracted a lot of publicity and became something of a *cause celebre*. Eventually the matron of the Queen Alexandra Maternity Hospital, a very



Dr Jan Van Moort, who worked for many years as a lecturer in Earth Sciences at UTAS, pictured in his garden at Kingston in his latter years.

formidable woman, was forced to change the hospital's policy. This was to the benefit many young fathers throughout Tasmania.

Jan's academic interests were in geochemistry and mineralogy. In the 1970s he was interested in soil geochemistry, including the clay deposits of Tasmania and the oxidised zone above the Broken Hill deposit. This led to his most influential paper with Simon Gatehouse and Dave Russell on the application of sequential soil analysis in exploration geochemistry. He went to Gottingen on a Humboldt Fellowship in 1972 and worked with Professor Wedepohl leading to a paper on secular changes in the composition of pelitic rocks in 1973.

Many will recall his great interest in the electron spin resonance (ESR) of quartz through the early 1990s. We remember many seminars on ESR, and the correlation of this spectra with the trace element composition. Then there was that special zoned quartz crystal from the Mt Cameron tin deposit, that he held up in many seminars as he proselytized about ESR applications in exploration. Other projects were based in Rosebery, Beaconsfield, Rotorua, Chile and Germany.

Jan retired in July 1999. For a few years he continued working with Aung Pwa using quartz composition (trace element and EPR) in exploration but mostly he enjoyed retirement. However, in 2014 he showed a renewed interest in the geology of various tin granites in NE Tasmania. This was spurred along by his partnership with Neil Allen, Dave Duncan and Ralph Bottrill. He reported on this work at Goldschmidt 2019 and other international conferences. He was still working on these projects up to his death.

Jan had many interests outside geology. He spent many weekends in the 1980s terracing the garden in his Battery Point home. After retirement he concentrated on developing the garden of his new home at Kingston, including building a garden retreat. As well, there were many family vacations throughout Australia and overseas, including a recent trip to South Africa. Throughout all these years he was a stalwart of the St Georges Anglican Church, Battery Point. Jan was keen on meeting his own goals. He would have been very unhappy about dying one month short of his 90th birthday.

## COMMUNITY ENGAGEMENT

# REACHING OUT TO THE WEST COAST

**Outreach activities for the year got off to a flying start in February with a visit to Zeehan that included a presentation to keen young primary school students, and (not strictly outreach) also included lectures to UTAS students at the Study Hub West Coast, as BELINDA MARTIN explains.**

Over a week in mid-February, 12 third-year BSc students from Earth Sciences, a Masters student visiting CODES and two staff – Professor Sebastien Meffre and Dr Sheree Armistead – headed to the West Coast for some on-the-ground geology fieldwork investigating some of the richest geology in Australia.

During the week, the group worked in the field in brilliant sunshine and pouring rain interpreting geological maps, cross-sections, erosion and sedimentation events but also undertook night tutorials in the Study Hub West Coast and by the camp fire as well (see page 15)!

Students from CODES generously donated their time by sharing information about their study experiences on the West Coast and with the University of Tasmania, with the then-interim Deputy Vice Chancellor (Academic), Martin Grimmer, who was also visiting in the same week.

Professor Sebastien Meffre accompanied by CODES visiting Masters student Janne Scheffler from Germany were kind enough to donate their time to undertake a wonderful schools engagement presentation with students from Zeehan Primary



Eager to learn: Students from Zeehan Primary School finding out about geology with Professor Sebastien Meffre and visiting Masters student Janne Scheffler from Germany.



West Coast team: (L-R) Nicky Bolt (Regional Manager at Study Hub West Coast), Janne Scheffler (visiting Masters student from Germany), Belinda Martin (Regional Learning Officer (West Coast) for UTAS) and Professor Sebastien Meffre (UTAS Earth Sciences Head of Discipline). All took part in facilitating outreach at Zeehan Primary School, as well as with sessions at the Study Hub West Coast.

School. The children were totally fascinated, engaged and had a wonderful time learning about rocks, fossils, meteorites and much, much more. The microscope was a hit and the University's Regional Learning Officer based on the West Coast is now sure we have some new and budding geologists in the making!

A big thank you to Sebastien Meffre and the CODES staff and students for their generosity whilst visiting the West Coast and to the Study Hub West Coast which, in partnership with the University, plays a vital role in education on the West Coast. It was wonderful to have the continued presence of CODES on the West Coast.

# CODES INDUSTRY PARTNERS 2023

**Industry partnerships are now 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



RioTinto










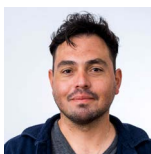
## SILVER







# CHANGING FACES

Over recent months there has been a huge influx of PhD students and new postdoc staff to CODES, some of whom were mentioned in our last newsletter. Many of the PhD students have been recruited to help out with the big Regional Research Collaboration project ('Environmentally sustainable production of critical metals') but some will be working on other projects including Amira P1249. We also have a new part-time Technical Officer.

PhD STUDENT	START DATE	PROGRAM	PROJECT TOPIC
 <b>Emrecaan Yurdakul</b>	29 November 2022	Supervisors: Lejun Zhang, Mike Baker and Rob Scott – working 50% on the Regional Research Collaboration Critical Metals project	Orebody knowledge of the Western Tharsis Cu-Au deposit, Tasmania: implications for ore processing and mineral exploration
 <b>Angela Costa</b>	1 December 2022	Supervisors: David Cooke, Julie Hunt, Lejun Zhang and Yamila Cajal – working on the Regional Research Collaboration Critical Metals project	Characterisation of tungsten mineralisation at Grassy, King Island, Tasmania – implications for ore genesis, exploration, and pathways to production
 <b>Javier Gil Rodriguez</b>	1 December 2022	Supervisor: David Cooke – working on the Regional Research Collaboration Critical Metals project	Characterisation of skarn-type deposits: Renison Bell Sn deposit, Western Tasmania
 <b>Declan Higgins</b>	1 January 2023	Supervisor: Rebecca Carey – working on volcanology project on Mt. Tarawera, New Zealand	Volcanic and sub-surface volcanic architectures: How and where are eruptions initiated in large caldera volcanoes?
 <b>Arka Sahu</b>	5 January 2023	Supervisors: Matt Cracknell, Lejun Zhang and Thomas Rodemann (CSL) – working on AMIRA project P1249	Multiscale hyperspectral mineral chemistry, P1249
 <b>Alfredtina Appiah</b>	25 January 2023	Supervisors: Julie Hunt, Owen Missen, Mohammad Fathi and Lejun Zhang – working on the Regional Research Collaboration Critical Metals project	Pathways to production: Magnesite deposits at Prospect Ridge, north-western Tasmania
 <b>Vinicius Da Cruz</b>	26 January 2023	Supervisors: David Cooke, Lejun Zhang and Rebecca Carey – working on the Regional Research Collaboration Critical Metals project	Characterisation of the complex orebodies in the Rosebery Middle Mine
 <b>Jose Barillas Diaz</b>	1 February 2023	Supervisors: David Cooke and Lejun Zhang – working on the Regional Research Collaboration Critical Metals project	Characterisation of the Avebury Ni ore deposit

PhD STUDENT	START DATE	PROGRAM	PROJECT TOPIC
 <b>Musa Emmanuel Dogara</b>	2 March 2023	Supervisor: Julie Hunt – working on the Regional Research Collaboration Critical Metals project	Pathways to production for the Kara Fe-W skarn type deposits
 <b>Jane Hall-Dadson (School of Education)</b>	24 March 2023	Supervisors: Sharon Fraser, Connie Cirkony and David Cooke – working on the Regional Research Collaboration project	Addressing regional barriers to engagement in STEM – Education and outreach strategies relating to critical metals production

## ARRIVALS



**Dr Mohammad Fathi**  
I gained a PhD in Mining Engineering– Mineral Processing from Amirkabir University of Technology, Tehran, Iran, in 2017, and have five years' industrial experience. In my new role as a Research Fellow in Geometallurgy/ Engineering Geology at CODES I will be working on the new RRC project, within Element 2: pathways to critical metals processing.



**Dr Yamila Cajal**  
I did my PhD at the Research School of Earth Sciences of the ANU on the supergiant porphyry copper deposits from Central Chile. At CODES I will be working as a Research Fellow in Critical Minerals Characterisation as part of the RRC program and the Amira P1249 project.



**Jonathon Traynor** started at CODES/ Earth Sciences as a much-needed part-time Technical Officer on 20 March and will be handling the many and varied technical tasks within the department.

## PROMOTIONS AND NEW ROLES



**Dr Lejun Zhang** has moved from his role as a Senior Research Fellow, and has recently been appointed as Senior Lecturer in Economic Geology.



**Dr Ivan Belousov** has moved from his role as Laboratory Analyst and was recently appointed as Senior Research Fellow in Mineralogy and Geochemistry within CODES.

## PhDs MOVING ON UP



**Rob Davidson** has recently had his PhD passed. It is entitled 'Geology and genesis of the San Sebastian vein system, Durango, Mexico'. He is now working at Hecla Mining.



**Dr Colin Jones** (Colin is a medical practitioner) has recently submitted his PhD thesis entitled 'Petrogenesis of northeast Tasmanian granites'.



**Joe Knight** has recently had his PhD thesis passed; it is called 'The geodynamic and metallogenic setting of the base- and precious-metal mineralisation in Myanmar: Implications for Cu and Au exploration'.



**Annah Moyo** has submitted her thesis entitled: 'Controlling acid and metalliferous drainage at legacy sites in Tasmania using industrial wastes'. She is now working at the University of Queensland.



**Sible Nascimento**, who completed her PhD recently entitled 'Geoenvironmental characterisation of historic mine tailings: Evaluating opportunities for reprocessing' has secured a job as a research officer at the University of Queensland.



**Emily Smyk** has recently submitted her PhD thesis on the characterisation of intrusive rocks and magmatic minerals at the Christmas porphyry Cu deposit in Arizona.

## DEPARTURES



**Dr Clare Miller** left CODES in early March and has taken up a new challenge working as a Scientific Officer for the Environment Protection Agency based in Hobart (see page 10 for more about Clare).





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

Since the last newsletter, there have been major changes to our staff and student profile at CODES. We are thrilled that Dr Lejun Zhang was appointed to the role of Senior Lecturer in Economic Geology in March 2023. Lejun is a specialist in lithocaps and high sulfidation epithermal deposits with over a decade of impactful industry-focused research that has delivered major new innovations in lithocap exploration. Lejun is also one of the major contributors to CODES' Master of Economic Geology program, and a popular supervisor of many of our PhD, Masters and Honours student cohorts. His appointment helps to provide CODES with long-term stability in terms of leadership in Economic Geology research and training.

As highlighted throughout this newsletter, we've had an unprecedented influx of new PhD students join us, to work with our volcanology, Regional Research Collaboration and AMIRA P1249 project teams. It's been revitalising to have so many fresh faces coming into campus, helping to break what was proving to be something of a cycle of

isolation created during the pandemic as people worked from home, only connecting with their colleagues remotely via Zoom or Teams. Our four new postdocs (Yamila Cajal, Mohammad Fathi, Wei Hong, and Owen Missen) have rapidly made significant impacts and very positive impressions since their arrival, helping to manage our large new student cohort, and embracing their many new fieldwork and supervision opportunities. Welcome also to Jonathon Traynor, who has recently commenced his new role as Senior Technical Officer in the Discipline of Earth Sciences.

While the past few months have been revitalising in many ways, the unexpected departures of Dr Clare Miller in March and Professor Leonid Danyushevsky late in 2022 provided us with some significant short-term challenges, not the least being the loss of considerable supervision and research capacity and capability. I thank all our staff (ongoing and new) who stepped up to help shoulder the unexpected increase in workload for the group as UTAS works through the administrative processes of providing short-term backfill to cover these departures. We hope to see UTAS advertise soon for new profile staff positions to provide the long-term solution to these ongoing staffing challenges. Thanks also to Sheree Armistead, Martin Jutzeler, Jeff Steadman and Francisco Testa, for stepping up to help cover the teaching and research shortfall that we are currently

contending with as we await the new appointments.

I would particularly like to thank Dr Paul Olin for stepping up to the leadership role in CODES Analytical Laboratories late in 2022. While Paul neither asked for nor sought out this role, he has performed exceptionally when asked to take it on, ensuring that the Laboratories underwent minimum disruption during this period of transition, and that our lab staff felt respected and secure during a challenging time. Indeed, all the lab staff have gone above and beyond during this period of transition to keep the labs fully operational. They have developed a distributed leadership and management approach, collaboratively determining the best ways for the labs to operate going forward, and so I extend my heartfelt gratitude to Ivan Belousov, Michele Chapple-Smith, Al Cuisson, Fanghua Dai, Elena Lounejeva, Michelle Makoundi, Maxwell Morissette, Jeffrey Oalman and Claire Rutherford for their resilience and persistence during a period that proved particularly challenging for the lab staff. Your efforts are greatly appreciated by all at CODES – you help us to achieve sustained excellence in analytical research – thank you for all that you have done and continue to do.

**David Cooke**

CONTINUED FROM PAGE 17

**UPCOMING SHORT COURSES**

**FUNDAMENTALS OF ECONOMIC GEOLOGY (KEA718)**

**WEEK 1: 17–22 APRIL 2023**

**WEEK 2: 8–12 MAY 2023**

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 focusses 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)**

**WEEK 1: 29 MAY–3 JUNE 2023**

**WEEK 2: 3–7 JULY 2023**

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

**Unit leader:** Professor David Cooke  
**Delivery mode/location:** Blended delivery

**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**