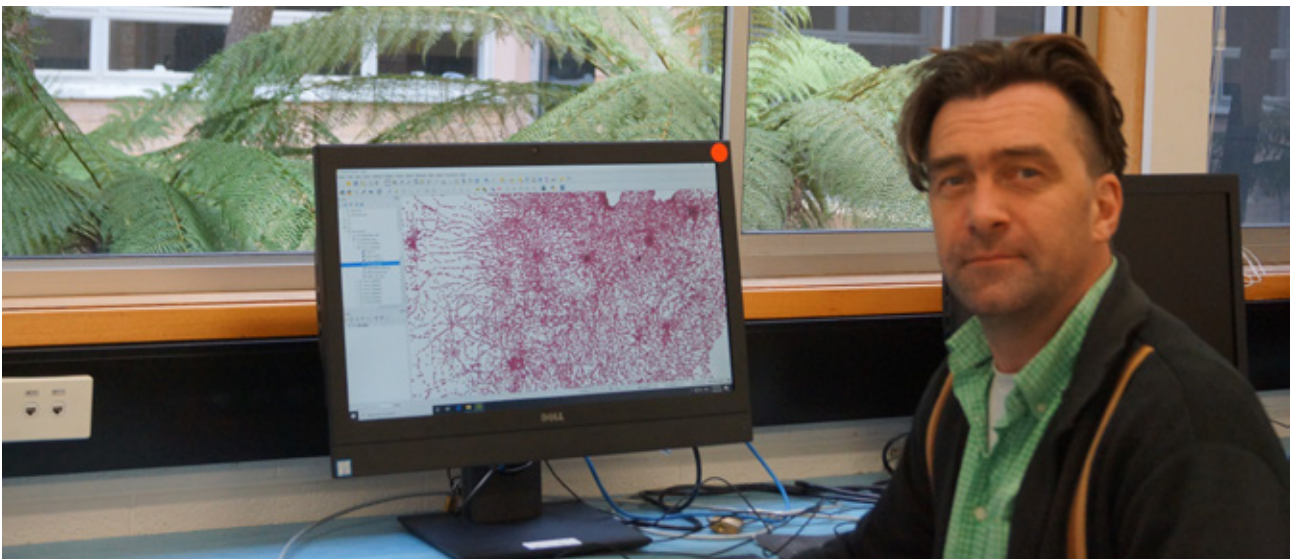


# ORE SOLUTIONS

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

> Spring 2020 **No.37**

## EXPANDED MASTERS PROGRAM OFFERS NEW SKILLS



This year **CODES** introduces a new Masters short course – **Geodata Analytics** – which 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 course will be led by Dr Matthew J. Cracknell, Research Fellow in Earth Informatics, ARC TMVC Research Hub.

### GEODATA ANALYTICS

#### **CODES** course leaders:

Dr Matthew J. Cracknell,  
Associate Professor Shaun Barker

The analysis and interpretation of digital geoscience data is a vital skill for the modern geoscientist. In recent years the expectations on industry-based geoscientists

to use increasingly sophisticated software to process and visualise large amounts of multivariate digital data have increased. This rapid and ongoing shift from manual methods to automated methods for modelling complex geological phenomena has resulted in a knowledge gap. This limits the possible degree of understanding and knowledge to be gained from data or, in the worst case, poor choices for analyses may lead to erroneous interpretations.

The Geodata Analytics short course is a timely addition to the **CODES** Master

of Economic Geology degree and will focus on rigorous and reproducible methods for extracting and visualising meaningful information from geological data. Participants will learn data science fundamentals, how to design and construct automated workflows and communicate resultant models to aid collaborative interpretation and facilitate decision making.

In a first for a **CODES** Masters short course, this course is divided into three modules **delivered online and in succession**.

**CONTINUED P.2**

#### IN THIS ISSUE

Online Masters success	3
Where are they now?	
Dr Alan Wilson	5
2020 PhDs	8
Blast from the past	20

#### FROM THE DIRECTOR

Professor David Cooke congratulates staff and students at **CODES** on their resilience and success in the face of COVID-19 restrictions.

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**P24**



**TMVC**

**CODES**



**UNIVERSITY of TASMANIA**

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## PROGRAM

### Module 1 – Fundamentals

Online self-directed learning,  
5 October–13 November 2020

This online module will introduce basic statistics, databases and exploratory data analysis, data formats and data preparation such as filtering and transformation, clustering, classification, image analysis and segmentation. Students will be assessed via online quizzes, and participation in an online forum where brief literature reviews will be discussed.

### Module 2 – Methods and tools

Online lectures and practicals, 16–20  
November 2020

In this one-week intensive module students will be given an opportunity to identify, integrate and process relevant data to produce models, carry out analysis and visualisation with an emphasis on reproducibility and reporting outcomes. Course datasets will focus on mineral exploration or mining-related problems. Assessments will be based on the development of several data analytics workflows that address common geological problems.

### Module 3 – Collaboration, interpretation and communication

Online self-directed and collaborative learning, 23 November–18  
December 2020

This module will require students to collaborate in small teams to carry out a series of data analytics methods to, for example, identify and predict rock

properties and interrogate geochemical databases to identify domains. Students will be required to summarise their analyses and findings in a report and contribute as a team to an online seminar.

## COURSE PRESENTERS

In addition to the CODES course leaders listed above, a number of experts in the field of geological data analysis and modelling have been confirmed as presenters for the Geodata Analytics course:

- Rocky Barker, Waikato University
- Natalie Caciagli Warman, Senior Manager, Resource Geochemistry at Barrick Gold Corporation
- Michael Gazley, Principal Geochemist, RSC Mining and Mineral Exploration
- June Hill, Senior Research Scientist: Mathematical Geosciences and Structural Geology, CSIRO
- Dr Shawn Hood, Chief Technology Officer, Goldspot Discoveries Corporation
- Kyen Knight, Database Geologist, Mineral Resources Tasmania, Department of State Growth, Tasmanian Government.
- Javier Merrill, TMVC/CODES
- Angela Rodrigues, Monash University

## REGISTER NOW!

Further details about costs and registration are available on the CODES website ([www.utas.edu.au/codes](http://www.utas.edu.au/codes)), or contact Dr Robert Scott: [Robert.Scott@utas.edu.au](mailto:Robert.Scott@utas.edu.au)

## CODES SHORT COURSES 2021

Ores in Magmatic Arcs

Ore Deposit Geochemistry, Hydrology and Geochronology

Geometallurgy

Advanced Field Skills in Economic Geology **NEW**

The schedule for these courses is yet to be confirmed due to the uncertainty (especially for field-based units) of COVID-19-related border restrictions. Field-based units are planned to be run in the latter part of the year, with other courses being offered in online mode where feasible/practicable. Information on upcoming courses will be available on the CODES website and distributed on CODES social media channels as it becomes available.



**Above** A total of 229 participants logged in from across the globe to take part in this two-week intensive Masters online short course. Many were based in the same centres. Several participants from Barrick logged in from locations in the USA and several from Rio Tinto logged in from locations in Australia.

#### MAP SHOWING THE GEOGRAPHICAL LOCATIONS FOR ONLINE PARTICIPANTS IN THE CODES 'ORE DEPOSIT MODELS AND EXPLORATION STRATEGIES' MASTERS SHORT COURSE HELD IN JUNE 2020

- Participants
- Several Barrick Employees
- Several Rio Tinto Employees

## GLOBAL AUDIENCE FOR CODES ONLINE MASTERS SHORT COURSE IN JUNE

A recent CODES Master of Economic Geology short course – adapted at the last minute to run online because of the Covid-19 pandemic – attracted a huge number of participants from across the world including academics, working geologists and students at all levels. This large turnout benefited from lectures, online practicals and panel discussions that covered a range of ore deposit styles.

Ten times more participants than usual completed the 'Ore Deposit Models and Exploration Strategies' two-week intensive online short course (1–12 June). A total of 229 participants from 20 countries, 17 universities and institutes, 23 mining and exploration companies and three geological

surveys took part. Several sessions were run twice to accommodate different time zones.

Participants logged in from six continents including from several countries in South America, and from the USA, Canada, Europe, parts of Southeast Asia as well as from Mongolia, Kazakhstan and several African counties including Cameroon and Kenya (see map above).

Participants worked with high-resolution photographs and 3D imagery of samples rather than handling the rocks themselves. Dr Michael Roach from the Discipline of Earth Sciences was instrumental in putting together a virtual tour

of the geology of Bluestone Bay on Tasmania's east coast for use in the course. This is the first time an online field tour of this complexity has been used for teaching by CODES. It utilised the online 3D sharing platform Sketchfab to enable participants to view virtual rocks.

Complimentary comments rolled in after the course wrapped up, with many tagging the CODES LinkedIn account to share their enthusiasm.

The next CODES Masters short course, 'Geodata Analytics', will start on 5 October as an online course (see pages 1–2). And 'Exploration in Brownfield Terrains' will be held online 19–30 October (see page 22).



# SHAUN BARKER HEADS NORTH

**Associate Professor in Economic Geology Shaun Barker will leave CODES in November and take up the position of Director of the Mineral Deposit Research Unit (MDRU) at the University of British Columbia in Canada.**

Shaun joined CODES in July 2018 as an Associate Professor in Economic Geology. He has led a strong industry-linked research program, focussing on exploration vectors for the Mount Isa Copper deposit, the mineral chemistry of iron oxide copper-gold (IOCG) deposits and sediment-hosted base metals deposits in northwest Queensland, and the development of new resistate indicator mineral tools for sediment-hosted copper deposits. He has also been a key member of the AMIRA P1202 research team, making critical contributions to the green and white rock research program.

Prior to joining CODES Shaun completed his PhD at the Australian National University in 2007, then worked for five years as a postdoctoral research fellow at MDRU, developing novel tools for vectoring towards Carlin-type gold deposits, and new stable isotope methods suitable for the mineral exploration industry. In 2012, he joined the University of Waikato in New Zealand as a senior lecturer in Earth Sciences, conducting research on low-sulfidation epithermal gold deposits at Waihi.

All staff and students at CODES will be sad to see Shaun depart. During his two and a half years here Shaun has profoundly impacted CODES, making critical insights and significant transformations to several key aspects of our research activities, and helping to shape how our staff and students conduct their research. He has been a driving force in the expansion of the Master of Economic Geology



Associate Professor Shaun Barker has thoroughly enjoyed his time at CODES and looks forward to continuing interaction with our staff and PhD students when he moves to MDRU.

program and made excellent contributions to undergraduate and postgraduate teaching. He took on the significant administrative role of Graduate Research Coordinator for our PhD students, and has provided sound mentoring and guidance to our early career researchers.

We wish him every success in his new role at MDRU – he is ideally suited to the role. We look forward to strengthening ties and future research collaborations between our two groups.

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*Shaun will take up his new role at MDRU on 1 January 2021.*

## ...AND SO DOES EVAN

**Dr Evan Orovan is moving on from his research role at CODES – although Covid is keeping him here a little longer than he planned...**

As a Canadian, I was well aware of CODES' world-class reputation in ore deposit research and the unique wilderness offered by Tasmania. After reading inspiring work on porphyry deposits produced by David Cooke and his team, it was a no-brainer for me to reach out and apply for a PhD under his supervision.



Dr Evan Orovan examining drill core at the Waihi Gold Mine, New Zealand.

My experience began as a PhD student in early 2011 working on porphyry Cu-Au deposits of the Namosi district, Fiji. It was immediately obvious what

a privilege it was to be involved in such a multi-disciplinary and diverse group at CODES and to be exposed to a wide array of ore-forming environments across a range of scales. As a testament to my positive experience, I transitioned from PhD candidate to Research Fellow in Ore Deposit Footprints as part of the ARC TMVC Research Hub where I worked for nearly 4.5 years before moving on to the British Columbia Geological Survey in mid-2020.

I am currently the mineral potential geoscientist for British Columbia Geological Survey. My responsibilities include designing the technological framework and method development for mineral potential modelling across British Columbia, and driving mineral system science and its application to land-use management and exploration activity in the province. Due to the COVID-19 crisis, I have been working remotely from Tasmania since 1 July.

## WHERE ARE THEY NOW?

In our continuing series of short interviews with past alumni, we talk to Dr Alan Wilson who, having completed a PhD at CODES in 2003, is now running an economic geology consulting business called GeoAqua Consultants, in partnership with his geologist wife, from the idyllic Caribbean island of Anguilla.

## MY ISLAND HOME

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

Presently I am a consulting economic geologist to the mineral exploration industry, offering both technical, and strategic/commercial advisory services through my consulting company, GeoAqua Consultants Limited. The company is named GeoAqua as my wife, Aveline, is a consultant in the integrated water management sector (in addition to being a geologist). Aveline and I are both directors and co-owners of the company, which is based in Anguilla, a British Overseas Territory in the West Indies.

My responsibilities are to provide clients (principally listed major, mid-tier and junior mining and exploration companies, but also prospectors and private mineral exploration companies) with solutions to specific geological problems they may have with exploration properties, as well as to provide recommendations with regards to the exploration potential of these properties and work programs to effectively test exploration targets. Additionally, I provide training to geologists either on an ad-hoc basis during consulting assignments or through more structured delivery of short courses. Finally, on the business side of things, I advise company management and boards, as well as private individuals/prospectors with high-potential mineral exploration properties in the areas of strategy, business development and the commercial partnering of properties.

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

I most enjoy the freedom that independent consulting delivers, which allows me to better manage the work-life balance. This role has allowed Aveline and I to base ourselves where we want to live (Anguilla is Aveline's most recent childhood home, and a

part of the world I feel privileged to have been able to enjoy sporadically for 30 years) after having spent nearly 30 years working with many of the major mining companies in seven different locations throughout South America, Australia and North America. I also revel in the ability to focus on the parts of the mineral exploration business where I feel I can most make an impact with regards to safe and effective discovery; using geology to solve exploration problems, training younger geoscientists in practical exploration tools using real-life examples (and lots of rocks!) and using my business development and commercial experience to help companies advance their projects with credible and capable partners.

The flip side of this independence is that when the markets turn, the workflow can easily dry up to nothing. 2020 has certainly been an interesting year so far, with international travel becoming next to impossible meaning the field component of consulting has simply disappeared for the foreseeable future. But my independence has allowed me to help clients with desktop evaluations of projects as well as develop training materials, in addition to co-authoring a number of papers that would likely never have seen the light of day had travel continued unabated.

### How did you get there and how have past roles shaped the path to where you are now?

My career has been a series of crossroads, some of which appeared unexpectedly (such as the opportunity to do my PhD at CODES...) and others that I saw coming and could plan for (such as setting up GeoAqua). The key point about crossroads is to make a decision that you think will advance your career in the direction you'd like it to go, and that is acceptable for your significant other(s), take that decision and never look back. You can always



Dr Alan Wilson, pictured on a beach in the Caribbean island of Anguilla, with a background of Eocene – Miocene reefal limestone.

### DR ALAN WILSON

#### Co-director and co-owner of GeoAqua Consultants Limited

PhD completed at CODES in 2003 entitled 'The geology, genesis and exploration context of the Cadia gold-copper porphyry deposits, New South Wales, Australia'.

change the future but you can only learn from the past.

The first decade of my career (1990s) was largely spent in South America, principally with Rio Tinto (RTZ in those days) in Ecuador and Bolivia, and then Billiton and a couple of other groups in Peru. Moving to South America from the UK with essentially not a word of Spanish was a challenge, but also a huge amount of fun and tremendously interesting. Not only was the Andean geology amazing, but the local cultures and customs were (and still are) fascinating. Working with highly experienced and motivated geologists was a great learning opportunity, whilst a high degree of autonomy in many of these roles exposed me to project management and business development at an early stage.

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As noted above, the decision to commence my PhD in 2000 was an unexpected crossroads involving Dick Sillitoe, a satellite phone in the Peruvian cloud forest and an opportunity to live in Tasmania. Aveline was similarly keen and so off we both set with our 18-month-old daughter safely under one arm. CODES, and my peer group throughout my time there, was a fantastic learning opportunity and one that set me up for the next stage of my career (more on that below).

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

Being directly involved in the discovery of an economic deposit has to be the most satisfying part of being an exploration geologist, and sadly I can't claim to have experienced that yet. I've been on the periphery of a few discoveries and can see the thrill of an evolving discovery on the faces of those involved, and hopefully that is something I can experience in the near future.

In the absence of being part of a discovery team, the highlight of my career thus far was working with a fantastic team of successful exploration geologists at Antofagasta Minerals. During my nine years in the role of International Exploration Manager, I was fortunate enough to work on a diverse range of copper exploration targets in five continents that ranged in style from porphyries and stratiform sediment-hosted copper deposits to VHMS and IOCG systems and magmatic Cu-Ni-PGE targets. Working globally on systems that ranged in age from Paleoproterozoic to Pliocene was a great learning opportunity, as was both learning from seasoned colleagues and mentoring younger geologists.

I was also fortunate to be named the Society of Economic Geologist's International Exchange Lecturer in 2018, an award that afforded me the opportunity to present 24 technical and exploration-related talks at 17 universities, conferences and geological surveys in nine countries throughout North America, South America and Europe. This opportunity allowed me to meet with both undergraduate and graduate students



Winter drilling for magmatic Cu-Ni-PGE sulfide deposits in northern Finland – one of the many countries Alan has had the opportunity to work in as a geologist.

and learn about their research interests, in addition to sharing practical tips with regards to sustaining a career in the mineral exploration industry.

**What did you specialise in at CODES and how did CODES help you to get where you are?**

My PhD research at CODES used geology and geochemistry to understand how the largest cluster of alkalic gold-copper porphyry deposits

on the planet formed, and presented practical exploration tools to assist with exploration for similar deposits elsewhere in the Macquarie Arc of New South Wales and beyond. Learning how to critically interpret and assess the results of my research allowed me to re-enter the exploration industry post-PhD at a higher level than before, with my first major 'step-up' in terms of responsibilities being when I started work with Anglo American

in 2006 as its copper commodity leader, with responsibility for technical excellence in all its copper exploration programs globally and oversight on applied research relevant to copper exploration projects and business development opportunities. The skills and experiences learnt on that job then led to my International Exploration Manager role with Antofagasta which in turn gave me the experience, contacts and confidence to try my hand at independent consulting in 2019.

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

The biggest non-technical change in the industry since leaving CODES has been the increased awareness and prioritisation of environmental, social and governance (ESG) issues from the earliest stage of exploration. Rightly so; gone are the days when you could turn up at an exploration project in a remote corner of Bolivia, for example, meet and consult with the local community, employ a few of the local villagers and start drilling. Through progressive ESG practices and initiatives, companies globally should improve their relationships from the start of exploration programs, building solid foundations for successful and mutually beneficial relationships if exploration leads to discovery.

On the technical side, the advent of mineral chemistry, hand-held XFR and SWIR field spectrometers and spectral scanning tools such as CoreScan have delivered a whole new set of geological and geochemical information to help exploration geologists better understand alteration zonation and vectoring for exploration targeting purposes. The availability of high-precision geochronology (U-Pb on zircon, Re-Os on molybdenite) at a non-prohibitive cost to the exploration industry has also been critical in determining, at an early stage, the absolute age of ore-forming events, thereby helping to better define metallogenic trends and belts. These new layers of data, when used in conjunction with well-constrained geological information gathered from outcrop and drill core, can only lead to better informed decisions at the exploration stage, hopefully resulting

**“CODES remains one of the top applied economic geology research centres globally, and the expansion of research activity into the broader mining value chain can only be a good thing.”**

in more efficient deployment of scarce exploration dollars.

As for future developments, automation of the assaying of drill core and RC chips at the drill rig (technology already available and under further development) will allow for real-time decision making during target evaluation, and new drilling technologies, such as coil tube drilling developed by the (now closed) Deep Exploration Technologies (DET) CRC, will allow for deeper and faster drilling, potentially turning a drill rig into a tool for cost-efficient geochemical sampling of basement through thick pre- or post-mineral cover. Finally, there is much in the news about the application of machine learning and artificial intelligence to mineral exploration. I'm not personally familiar with these developments, but so long as a 'black box' approach is avoided and experienced geologists critically assess both the inputs and outputs of these processes, anything that improves the efficiency of exploration and reduces our odds of success can only be a good thing.

### **Words of wisdom for up and coming geologists graduating from CODES (especially given the Covid-19 pandemic and how this might change things in the future)?**

CODES remains one of the top applied economic geology research centres globally, and the expansion of research activity into the broader mining value chain can only be a good thing.

Consequently, graduates of CODES have the opportunity to enter industry with somewhat unique training and experience if exposed to this cutting-

edge research during their time there. But there is one key aspect of our business that does not change, irrespective of new applied research tools and technologies that are being developed. Don't forget how to make a geological map. Don't forget how to use your hand lens and how to critically assess and interpret what you see at the hand specimen scale. Don't forget how to effectively log and interpret drill core, and how to use these observations to develop and test geologically reasonable exploration models. All of the rest is meaningless if the basic geology isn't done well.

The COVID-19 pandemic has upended almost every aspect of life globally, with the restriction in both international and domestic travel being one of the biggest impacts on the exploration industry. With no clear end in sight, we all need to look at opportunities closer to home whilst improving our networking of contacts and technical skills by taking advantage of the myriad of webinars that have appeared since the pandemic started. Geology is largely a field-based science, mineral exploration even more so, so once again, exploration practitioners will have to be resilient and creative, taking any opportunity to gain experience and upskill as the pandemic unfolds. Undoubtedly, economic realities will result in the loss of geologists to other sectors with active opportunities, but the global transition to a green economy will only result in increased demand for the natural resources the exploration industry delivers to society. So, for those that can, hang in there, grab any and every opportunity, and you will be well-placed to restart (or start) your career once the pandemic passes.

### **And any little-known facts about yourself?**

Not much to say here!! I'm a family-oriented person who enjoys travel, cooking and photography when not thinking about geology!

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Visit the GeoAqua website at: <https://geoaquaconsultants.com/>

See the DET CRC YouTube channel at: <https://www.youtube.com/channel/UC7Raxrfgae-DWz8fdRKhkEg>



# CODES PHD STUDENTS LOCK DOWN ON THEIR RESEARCH

CODES Director Professor David Cooke reports on how our current cohort of PhD students has adapted to carrying out their research in lockdown – and how they are making good progress, despite the difficulties.



CODES PhD student Hannah Moore is researching the 1886 basaltic Plinian eruption of Tarawera volcano, New Zealand, and is supervised by Associate Professor Rebecca Carey and Dr Martin Jutzeler. Here she is pictured at Santa Maria/Santiago volcano, Guatemala, on a 2018 volcanology course while acquiring samples for her MSc project.

A foundation of CODES's success has long been its PhD research and training program. Despite the significant disruptions created by the COVID-19 pandemic in 2020, our PhD cohort continues to conduct high-quality and innovative research across the spectrum of fundamental to applied activities, while dealing with the unique circumstances of adapting to travel restrictions, periods of working from home, and other significant changes in their daily working and personal lives.

Our staff are incredibly proud and impressed with the resilience and fortitude shown by our PhD students this year – they have demonstrated great capacity for adapting to changing circumstances, while maintaining enthusiasm and passion for their research during uncertain times. This year has probably been most challenging for our newest PhD

**“Our staff are incredibly proud and impressed with the resilience and fortitude shown by our PhD students this year.”**

recruits, some of whom did not get the opportunity to conduct any fieldwork prior to lockdown. Those students and their supervisors have needed to work particularly hard to adapt research projects and modify workplans to ensure that significant research progress can be made while we await the easing of travel restrictions. Some of our new students have benefited considerably from strong support by their external research partners, who have conducted remote sampling and shipped samples to Hobart,

allowing the students to get analyses underway in cases where fieldwork has been curtailed due to the pandemic. We greatly appreciate this strong support from our industry partners and external collaborators, as it ensured that our students could make significant research progress whilst locked down in Tasmania. Of course, all of our students are looking forward to the time when we are able to travel again (as are we all), but they are making the most of these times by conducting a significant component of their laboratory work, and also by tackling the hardest aspect of a PhD – writing!

In this edition of *Ore Solutions*, we showcase PhD students from each of our research programs to celebrate their research efforts and to highlight some of the great student research being conducted at CODES.





## TAKESHY COAQUIRA

**Supervisors:** David Cooke, Lejun Zhang, Angela Escolme

**Project title:** Resolving multiple generations of white mica and clay alteration at the Resolution porphyry Cu-Mo deposit, Arizona

Takeshy is working with Resolution Copper Corporation and Rio Tinto Exploration within AMIRA P1202 to investigate the evolution of the giant Resolution Cu-Mo porphyry deposit in Arizona. Takeshy is evaluating the relationships between intrusions, hydrothermal fluids and mineralisation, and investigating whether one or several paragenetic stages formed the high copper grades that characterise this giant deposit. There is a particular emphasis on understanding the mineralogy, paragenesis and grade relationships of white mica and clay alteration. As Takeshy's research has ore genesis and exploration implications, along with significant insights into geometallurgy, it spans two of the CODES research programs: **Program 1: Ore deposits and mineral exploration**, and **Program 2: Geometallurgy, geoenvironment and mining**.

Together with his supervisory team, Takeshy conducted fieldwork at the start of his PhD in August 2019. Since moving to Tasmania in November last year, Takeshy has made significant progress through painstaking and detailed hand specimen and petrographic investigations of veins and altered rocks from Resolution. Takeshy is creating a strong paragenetic framework through the upper parts of the ore deposit upon which to overlay his detailed mineral chemistry datasets. He has made significant inroads into his analytical program in 2020, generating a large volume of LA-ICP-MS and SEM data that are helping to address his major research questions.



TMVC PhD student Takeshy Coaquira (right) reviewing drill core with his supervisor Dr Lejun Zhang at the Resolution Cu-Mo porphyry deposit, Arizona. They are looking at volcanoclastic rocks with strong phyllic alteration and copper mineralisation during fieldwork undertaken in August 2019 for Takeshy's TMVC research.

*"After working for seven years in the industry, five of them for Rio Tinto, exploring and evaluating porphyry systems in South America, the USA and Australia, I have acquired expertise in geology and project management, and had the opportunity to be a project manager in Peru and to participate in the discovery of Winu [Eastern Pilbara] in Australia. However, in late 2018 an exceptional opportunity arose – a PhD at CODES – which was always my first choice for a postgraduate degree. This chance was made even more attractive with Professor David Cooke as a supervisor and being part of an AMIRA research team, with its remarkable students and the highly regarded facilities of the Discipline of Earth Sciences/CODES.*

*"My core objective is to lead exploration activities in a practical, easy and cost-effective way by combining cutting-edge lab techniques and field observations that only a geologist with the right expertise can make. The development of my research skills at this high level will enable me to help the industry in discovering new tier-1 deposits. The most captivating part of the research is trying to decipher the main controls of high-grade mineralisation in porphyry systems."*



## MAX HOHL

**Supervisors:** Shaun Barker, Jonathan Cloutier, Jeff Steadman

**Project title:** Defining the mineral chemistry footprints of IOCG deposits in northwest Queensland

Max is studying the mineralogy and mineral chemistry of the Starra Cu-Au deposit in northwest Queensland. His PhD is part of the 'Mineral geochemistry vectoring: uncovering northwest Queensland's hidden potential' research project. Max's project aims to identify potential 'fingerprints' of the Cu-Au mineralisation at Starra using the chemistry of magnetite, pyrite, chlorite and carbonate minerals to identify characteristic geochemical signatures associated with mineralisation.

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CODES PhD student Max Hohl is researching the mineralogy and mineral chemistry of the Starra Cu-Au deposit in northwest Queensland within CODES Program 3. He is pictured in Scotland during fieldwork on a skarn deposit for his Masters prior to arriving at UTAS.

These studies will then be extended spatially to try to define the mineral chemistry 'footprint' of the deposit and identify potential vectors towards mineralisation.

In order to carry out his research, Max is using a combination of analytical methods, including petrographic and textural characterisation of minerals, electron probe microanalysis and laser

ablation ICP-MS analysis of minerals. Max has found some distinctive chemical signatures associated with chalcopyrite, and this information is being relayed to Chinova Resources (who are providing logistical and in-kind support to the project) and the Geological Survey of Queensland who have funded the northwest Queensland research project.

To aid in the interpretation of his mineral chemistry data, Max is applying data analytics tools and multivariate statistics to interrogate the datasets and provide new insights into the mineral chemistry changes. Max has identified two distinctive chemical signatures in magnetite, and is currently investigating what processes might be causing this chemical variability.

Covid-19 has prevented Max from completing his planned fieldwork in 2020 but, due to a highly productive field season in 2019 and the ongoing support of Chinova Resources in supplying new samples, Max is making excellent progress on his PhD project.

*"My research focusses on the Mount Isa Inlier in northwest Queensland, where I am working on the characterisation of iron oxide copper gold (IOCG) deposits based on mineral chemistry. My PhD project offers an exciting opportunity to work on this relatively newly described class of ore deposits. My work will help to improve our understanding of the processes leading to the formation of IOCG deposits. For my research I can utilise the excellent laser-ICP-MS facilities at CODES, which are central to my work on mineral chemistry. As part of the project I have the freedom to try out various analytical methods and pursue different paths to answer my research questions."*



Recently arrived PhD student Rhiannon Jones (left) with a fellow student during a fieldwork trip to the Spanish Pyrenees, during her undergraduate days at Imperial College London. For her PhD at CODES/TMVC she will be investigating the significance of phyllic alteration in the Northparkes district in New South Wales. She has as yet been unable to undertake any fieldwork within Australia.





## RHIANNON JONES

**Supervisors:** David Cooke, Angela Escolme, Lejun Zhang

**Project title:** The significance of phyllic alteration in the Northparkes District, NSW, Australia

Rhiannon's project is part of AMIRA P1202 and includes research within **Program 1: Ore deposits and mineral exploration**, and **Program 2: Geometallurgy, geoenvironment and mining**. She is studying phyllic alteration domains in the Northparkes porphyry Cu-Au deposits, NSW.

Four types of phyllic alteration have been described previously from Northparkes, each with distinctive spatial and mineralogical implications (Smith et al. 2004). The characteristics of each phyllic alteration type and the relationship with grade is still an area of uncertainty, with both grade-additive and grade destructive zones of phyllic alteration recognised (Smith et al. 2004), giving the mineralogy and distribution of white micas at Northparkes significant implications for geometallurgy and exploration. Rhiannon is investigating the significance of phyllic alteration at the Northparkes district using a range of techniques including petrography and trace element mineral chemistry of samples within a range of phyllic-altered samples from around the E26 and E48 porphyry deposits at Northparkes.

Rhiannon was the last international PhD student to arrive at CODES prior to Tasmania's borders closing in March 2020. As such, she is yet to travel to site, but her industry sponsor Northparkes Mines kindly sampled systematically downhole and shipped Rhiannon several hundred drillcore samples to work on, and so her work is progressing apace.

*"I was driven to study at CODES due to the opportunity to work with world-*

CODES PhD student Bridie Le'Gallais studying a dredged rock on a research voyage to the Kerguelen Plateau aboard RV *Investigator* undertaken in January–March this year. Although Bridie will not be using the rocks she is examining as part of her PhD research into mafic/ultramafic igneous rock in western Tasmania, she gained valuable experience from the voyage. (Photo courtesy of David Dieckfoss)

*leading experts in ore deposit research and to gain valuable skills as an economic geologist. I am really enjoying being a PhD student at CODES. It has been great to meet so many people from all over the world and learn about the diverse projects that others in the department are working on. Living in Hobart and experiencing the nature on my doorstep has also been a real highlight of moving to Tasmania."*



## BRIDIE LE'GALLAIS

**Supervisors:** Leonid Danyushevsky, Paul Olin

**Project title:** The tectonic significance of mafic/ultramafic igneous rocks in western Tasmania

The main objective of Bridie's project is to investigate the rock and mineral chemical compositions of the Cambrian mafic/ultramafic and related rocks of western Tasmania, with a focus on the Andersons Creek, Whyte River, Beaconsfield and Betts Track area complexes. The project will utilise modern micro-analytical instrumentation such as the laser-ablation microprobe and field-emission gun electron microprobe to provide a comprehensive set of major and trace element contents in magmatic minerals such as olivine, pyroxene and spinel. The project is conducted within CODES Research **Program 4 'Magmatic and volcanic processes'**.

The project aims to determine: 1) the number and geographical spread of different magmatic series that



exist within western Tasmanian mafic/ultramafic complexes and related rocks, and possible genetic links between the different series; 2) the nature of parental magma compositions of these complexes and their likely mantle sources; 3) modern analogues of these rocks and the tectonic setting(s) in which they form; and 4) reconstruct possible tectonic settings at which these Tasmanian mafic/ultramafic complexes have formed prior to emplacement into their current positions.

The project involves fieldwork in western and northern Tasmania to collect samples from different locations, and also sampling of available rocks from the rock library at Minerals Resources Tasmania, which is also providing funding to this project. Mineral Resources Tasmania staff are co-supervising the project.

*"Deciding to start a PhD within the Discipline of Earth Sciences at UTAS was a surprisingly easy decision for me. I had completed my undergrad in the same discipline and was familiar with the staff and students; I knew that I would be supported there. For me, familiarity was very important; I feared if I set up shop elsewhere, I might be overwhelmed with living in a new place, surrounded by people I don't know. Continuing my studies at UTAS has allowed me to bypass those issues so I could start my PhD with more confidence. I would like to continue to research Tasmania's Cambrian mafic/ultramafic complexes, but I am open to researching igneous rocks from a variety of tectonic settings."*

CONTINUED ON NEXT PAGE





## HANNAH MOORE

**Supervisors:** Rebecca Carey, Martin Jutzeler

**Project title:** The 1886 basaltic Plinian eruption of Tarawera volcano, New Zealand

Hannah's research addresses an outstanding scientific question within the volcanology-geochemistry-petrology community: how does low viscosity basaltic magma erupt violently in similar fashion to the largest silicic eruptions of the twentieth century? Hannah focusses on the 1886 eruption at Tarawera volcano, New Zealand; the only basaltic high intensity 'Plinian' eruption with quantitative constraints and historical observations of the eruption dynamics and timing. Hannah's current study focusses on microtextures of volcanic clasts from three key sites to determine magma storage, ascent and eruption conditions. Future work for Hannah's project includes fieldwork at Tarawera to uncover conduit wall and vent environment processes and determine what effects they had on the eruption style. This research furthers our understanding of a poorly understood and hazardous end-member of basaltic volcanism.

*"I am so glad I made the decision to study at CODES as I am now working on a PhD project that matches my research interests with some fantastic supervisors [Rebecca Carey and Martin Jutzeler] who are experts in volcanology. I am excited about my research because it will further our understanding of a poorly understood and hazardous end-member of basaltic volcanism."*

*"There is a real sense of community within all areas of CODES, from student colleagues to staff; it's a super friendly environment and people are always*



TMVC PhD student Nanda Mrabawani is researching mineral characterisation using LA-ICP-MS. These photos illustrate her work with plagioclase. The first photo (**top**) shows the original plagioclase crystals. The second (**above**) shows an epoxy mount containing 100 clean fragments of crushed plagioclase that were hand-picked under an optical microscope to avoid any inclusions. These fragments have been analysed by LA-ICP-MS.

*happy to help or just have a chat! A highlight of studying at CODES so far has been the 'Volcanology and Mineralisation in Volcanic Terrains' short course: a field-based course which took us to Victoria and NW Tasmania. I am excited for future fieldwork opportunities with CODES!"*



## NANDA MRABAWANI

**Supervisor:** Leonid Danyushevsky

**Project title:** Method development for laser-ablation ICP-MS applied to complex matrices

The main objective of Nanda's project is to design a workflow for developing fully quantitative and accurate methods for analysis of major and trace element composition of minerals using laser ablation inductively coupled mass-spectrometry (LA-ICP-MS), and develop such methods for the minerals plagioclase, apatite and clinopyroxene. The project utilises the state-of-the-art micro-analytical and bulk rock analytical equipment within CODES Analytical Laboratories and the UTAS Central Science Laboratory. The project is supported by the ARC TMVC Research Hub and is part of CODES Research Program 5 'Analytical research'.

The project aims to develop approaches to accurate analysis of mineral compositions without the need to analyse matrix-matched reference

materials. The requirement for matrix-matched calibrations is currently one of the main limitations of the laser ablation technique. The project involves investigation of the fundamental aspects of laser ablation, such as the effects of downhole elemental fractionation and plasma loading, by assessing the impacts of laser pulse width, laser beam fluence, and laser beam diameter. The outcomes of the project will improve our understanding of the laser ablation technique and allow for a rapid expansion of the range of mineral types that can be accurately analysed by this technique without a requirement for prior information from other methods, such as electron microscopy, thus increasing throughput and decreasing costs of analyses.

*"Doing my PhD at CODES allows me to learn new skills, to grow my knowledge, and to prepare myself before serving the greater community as a young researcher. And I am glad to have a supportive research team as well as to be surrounded by influential figures (one of them is my supervisor!). The results of my PhD project research will contribute directly to the growth of CODES Analytical Laboratories, as I aim to create a fully quantified analytical method for plagioclase and apatite by LA-ICP-MS. I hope the outcome will not only benefit CODES but also contribute to the future development of wider applications for LA-ICP-MS."*



TMVC PhD student Jaime Osorio is currently working remotely from South America on his PhD research into the Rincones de Araya porphyry deposit, San Juan, Argentina. He is pictured here during a field mapping course at Yerington, Nevada, USA, prior to commencing his research at UTAS.



## JAIME OSORIO

**Supervisors:** Lejun Zhang, David Cooke, Angela Escolme, Jose Piquer (Universidad Austral de Chile)

**Project title:** Anatomy of a phyllic overprint and structural evolution at Rincones de Araya porphyry deposit, San Juan, Argentina

Jaime's project lies within **Program 1: Ore deposits and mineral exploration** and **Program 2: Geometallurgy, geoenvironment and mining**, and is also part of the AMIRA P1202 Module 4 research. Jaime commenced his PhD remotely in Chile in June 2020. When the pandemic is over, and international travel restrictions lift, Jaime will move to Hobart to continue his studies.

Jaime's study area is Rincones de Araya porphyry Cu-Au system located in San Juan Province, Argentina, which is part of the N-S trending porphyry Cu belt of Miocene-Pliocene age, located along the high Andes. Sericitic alteration is widespread throughout the study area, within this zone cross-cutting relationship among several generation of D-type veins, suggest multiple episodes of sericitic alteration occurring at Rincones. Rincones is an excellent site to study the nature of late alteration overprinting and geochemical variations among the different alteration assemblages, as well as the relationship between telescoping and regional uplift. In this project Jaime will use a combination of fieldwork, structural analysis, geochronology and geochemistry analysis to characterise the geology and to constrain the forming process of the system. The results of this research should provide geological and geochemical data to develop vectoring tools towards mineralisation and also to evaluate the impact of late alteration overprinting in former mineralised zones.

*"I am excited about this project because it will be a perfect combination of field and analytical work. The results of this research should provide geological and geochemical tools to vector towards mineralisation and to evaluate the impact of late alteration overprinting in former mineralised zones, as well as the relationship between telescoping and regional uplift. I am happy to be part of the CODES research team and its great collaborative research environment, where I can learn about different types of ore deposits and different aspects of economic geology."*



## XIN NI SEOW

**Supervisors:** Lejun Zhang, Leonid Danyushevsky, David Cooke, Evan Orovan

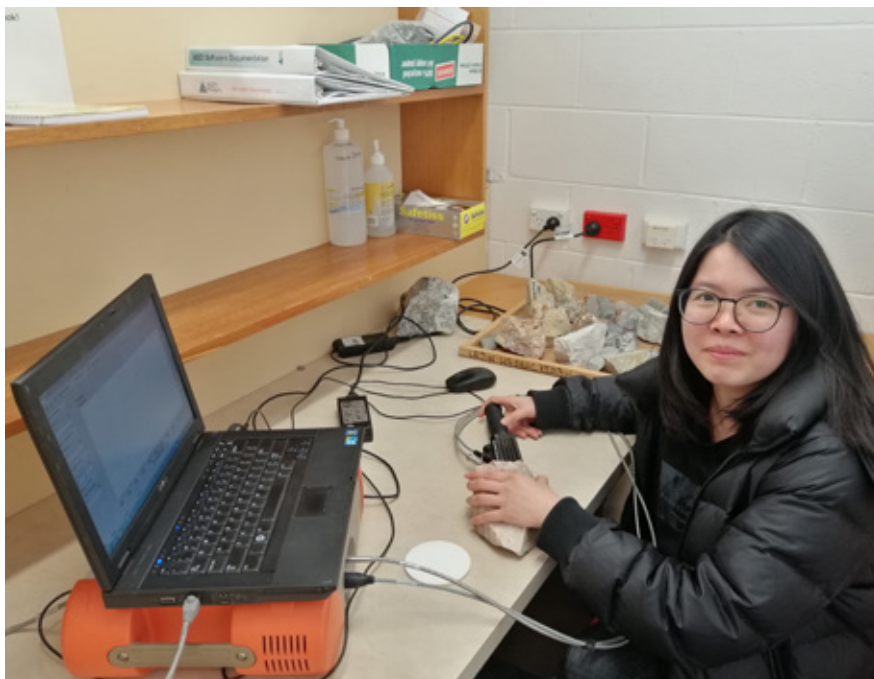
**Project title:** Chemistry and mechanism of the formation of alunite supergroup minerals: Implications for mineral exploration

Xin Ni Seow's project lies within **Program 1: Ore deposits and mineral exploration**, and the TMVC, and is part of the AMIRA P1202 Module 2 research.

Alunite,  $KAl_3(SO_4)_2(OH)_6$  is one of the key constituents of advanced argillic alteration zones. This alteration type is a key component of lithocaps and can be intimately associated with high sulfidation epithermal gold deposits that form under low pH and highly oxidised fluid conditions. Alunite can form by several mechanisms in the epithermal environment, either from hypogene magmatic condensates, steam-heated processes, or supergene oxidation. Understanding the chemical composition and the formation processes of alunite group minerals, and how the chemistry and spectral responses of alunite vary as a function of these formation processes has important implications for ore deposit genesis and exploration.

Xin Ni's studies involve field mapping and laboratory studies using SWIR,





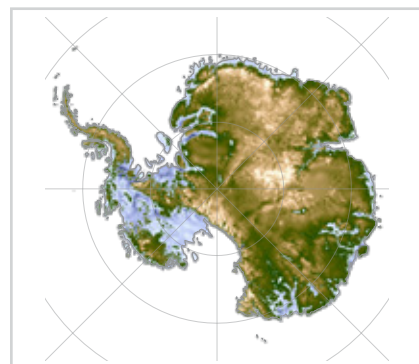
trace elements chemistry and isotopic signatures of alunite group minerals. The aims of the project are to: 1) investigate chemical signatures of the alunite supergroup minerals related to ore-forming processes; 2) test and develop geological and geochemical vectors to high-grade mineralisation zones and the causative porphyry sources in the porphyry-epithermal system; and 3) develop and refine analytical methods and standards for alunite analyses.

*"I'm studying the alunite supergroup minerals and their roles in mineral exploration. I'm also working on analytical method development. This*

**Above** TMVC PhD student Xin Ni Seow is studying alunite supergroup minerals. Here she is collecting short wave infrared (SWIR) data of her samples from the Seongsan district, South Korea, using TerraSpec in one of the labs at CODES. The SWIR data are used to identify the hydrothermal minerals present in the rocks.

**Top right** The results of CODES PhD student Tobias Staal's research: a map showing Antarctic topography corrected for complete glacial isostatical adjustment, taken from a forthcoming journal article by Tobias Staal et al. (*Frontiers in Earth Science*, in review).

**Right** CODES PhD student Tobias Staal sampling glacial erratics in the Vestfold Hills, Antarctica, for surface exposure dating for his research into the Antarctic lithosphere. (Photo: courtesy of Nick Morgan, Australian Antarctic Division)



## TOBIAS STAAL

**Supervisors:** Anya Reading (Physics), Jacqueline Halpin (IMAS), Joanne Whittaker (IMAS)

**Project title:** The Antarctic lithosphere revealed by multivariate analysis

The Antarctic continent, at 14 million km<sup>2</sup>, is larger than Australia, and yet, due to the ice cover and inaccessibility, its geology and lithospheric structure are to a large extent unknown. Since the International Polar Year of 2007–08, a growing number of studies have provided new and improved datasets



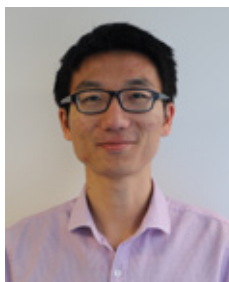


of the continent's surface, cryosphere, crust and upper mantle. Through this project, supported by the Antarctic Gateway Partnership, questions such as the following can now be addressed: What are the extents of tectonic domains and affiliations with former neighbours in Gondwana? What is the spatial distribution of geothermal heat flow in the deep interior?

Tobias has used multivariate methodology to reveal the presence of deep-seated lithospheric boundaries in this enigmatic continent. Such methods show advantages over previous univariate studies with better constrained results and quantified uncertainties. He has also developed a new heat flow map for the continent based on a multivariate approach. Both studies have been enabled by a newly written software environment, which will have lasting impact through enabling collaborative studies of the interaction and feedbacks between the changing ice sheets and solid Earth beneath.

*"CODES is a hub of knowledge and experience, covering many aspects of Earth science. Moreover, there are strong links to the industry, universities all over the world, and other schools and institutes at UTAS. My research is mainly in collaboration with IMAS (Institute for Marine and Antarctic Studies), and Mathematics and Physics. I'm applying probabilistic and statistical methods to study the unknown subglacial geology of Antarctica. Recently, my main focus has been methods development and to produce deliverables for the interdisciplinary community, e.g. mapping geothermal heat flow, that impacts the properties of the Antarctic ice sheets. Understanding of geology has applications far beyond what we usually associate with the field."*

CODES PhD student Chuang Wang arrived at UTAS only in August after having to quarantine due to Covid-19 rules. Here he is pictured in one of the labs at CODES where he was using a PUNDIT Plus instrument to measure P and S wave velocities for research connected to his PhD on volcanic architecture.



## CHUANG WANG

**Supervisors:** Martin Jutzeler, Rebecca Carey, Michael Roach, Gerrit Olivier (Institute of Mine Seismology)

**Project title:** Seismic interpretation of sediment waves at Macauley, Havre and Healy submarine caldera volcanoes (Kermadec arc)

Chuang Wang started his PhD in July and will work on three main projects with passive and active seismics applied to reconstruct volcanic architecture. His first project will use passive seismics north of the Hellyer mine in Tasmania to evaluate the depth of Tertiary basalts overlaying Palaeozoic formations. This study will hopefully provide better context on the filling of paleovalleys by extensive lava flows and allow for future targeted exploration. Existing drill cores in this area will be jointly used with seismic data to constrain the depth of the Tertiary cover.

Chuang's two other projects will be focussed on Krakatau caldera volcano in Indonesia. Chuang will analyse the

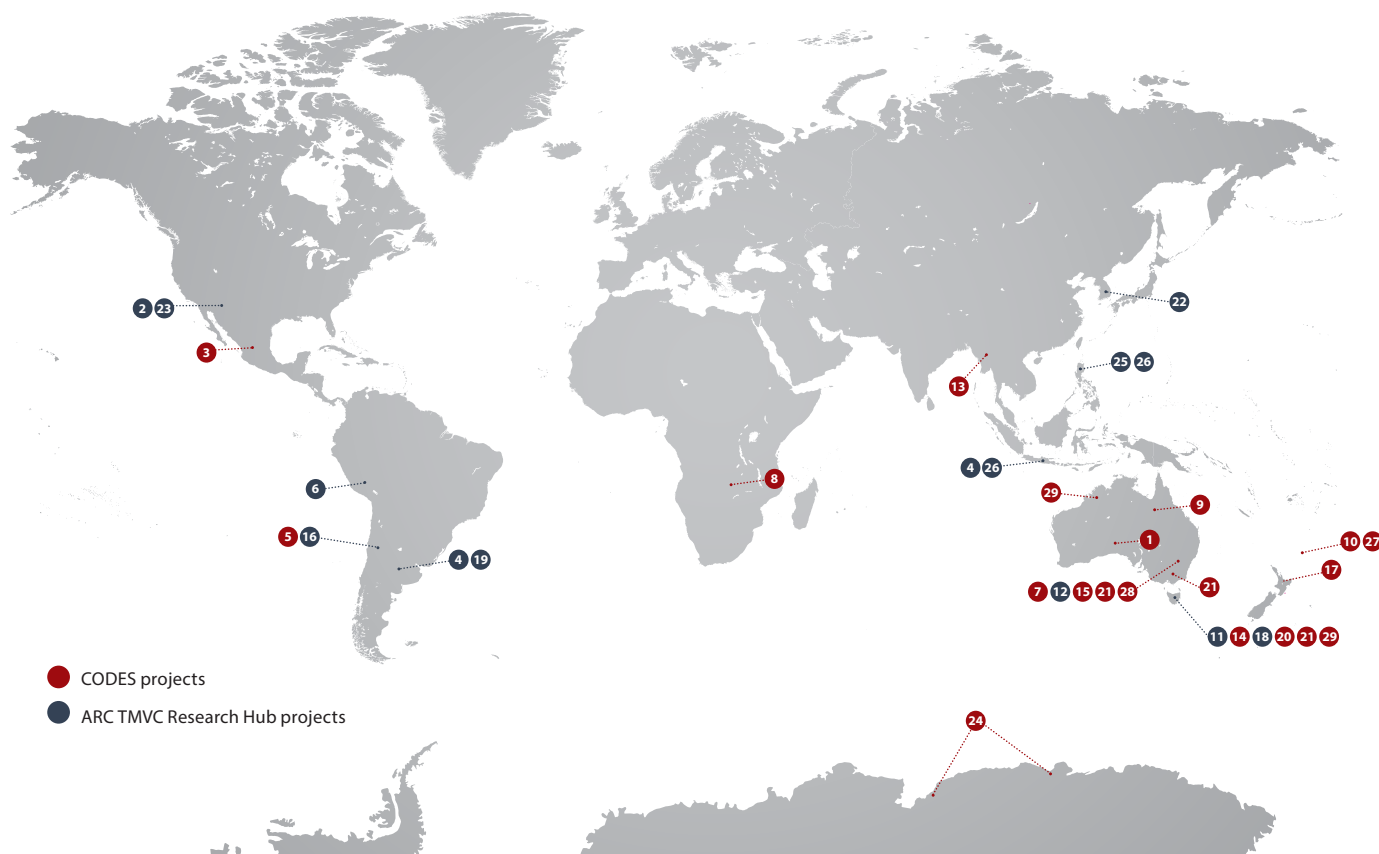
deep structure of Krakatau volcano using passive seismic interferometry, using data from local and regional seismic stations. This study will allow him to deduce the complex geology beneath the volcano, and possibly image magmatic sources. His third project will be associated with an RV *Investigator* voyage to Krakatau in October 2021. The volcanology team will study the submarine deposits produced by the December 2018 tsunamigenic landslide at Anak Krakatau, and Chuang's role will be to reconstruct deposit morphology based on a seismic reflection dataset acquired during this voyage.

*"My research on the volcano project started in July at UTAS. I am impressed by the outstanding and encouraging scientific atmosphere at CODES, where I believe doing a PhD will be an enjoyable and rewarding process. In August I undertook my first field trip at CODES, when we visited a core shed on the west coast of Tasmania. I learnt how to use instruments on cores, record data and discovered some new science. In the first year of my PhD, I will study the passive and active seismic interpretation of volcanic architecture on Tasmanian Tertiary basalts and the structure of Krakatau volcano in Indonesia."*



CONTINUED ON NEXT PAGE

## Location of current CODES/TMVC PhD projects



**1. NATHAN CHAPMAN**  
GAWLER CRATON, SOUTH AUSTRALIA

**2. TAKESHY COAQUIRA\***  
ARIZONA, USA

**3. ROB DAVIDSON**  
DURANGO, MEXICO

**4. KYLE EASTMAN\***  
INDONESIA/ARGENTINA

**5. ALEX FARRAR**  
CENTRAL ANDES, CHILE

**6. AMOS GARAY\***  
LAS BAMBAS, PERU

**7. UMER HABIB**  
LACHLAN OROGEN, VICTORIA, NSW

**8. JACOB HEATHCOTE**  
ZAMBIA

**9. MAX HOHL**  
MOUNT ISA, NORTHWEST QUEENSLAND

**10. FUMIHIKO IKEGAMI**  
HAVRE VOLCANO, OFF NEW ZEALAND

**11. COLIN JONES\***  
EASTERN TASMANIA

**12. RHIANNON JONES\***  
NORTH PARKES, NSW

**13. JOSEPH KNIGHT**  
MYANMAR

**14. BRIDIE LE'GALLAIS**  
WESTERN TASMANIA

**15. CHRISTOPHER LESLIE**  
COWAL DISTRICT, NEW SOUTH WALES

**16. JAVIER MERRILL\***  
CHILE

**17. HANNAH MOORE**  
TARAWERA VOLCANO, NEW ZEALAND

**18. SIBELE NASCIMENTO\***  
TASMANIA

**19. JAIME OSORIO\***  
ARGENTINA

**20. THOMAS OSTERSEN**  
TASMANIA

**21. THOMAS SCHAAP**  
TASMANIA/NSW/VICTORIA

**22. XIN NI SEOW\***  
SOUTH KOREA

**23. EMILY SMYK\***  
ARIZONA, USA

**24. TOBIAS STAAL**  
ANTARCTICA

**25. YI SUN\***  
PHILIPPINES

**26. JENNIFER THOMPSON\***  
INDONESIA/PHILIPPINES

**27. CHUANG WANG**  
KERMADEC ARC, PACIFIC OCEAN

**28. TRISTAN WELLS**  
LACHLAN FOLD BELT, NEW SOUTH WALES

**29. ZEBEDEE ZIVKOVIC**  
WEST KIMBERLEY, WA/WESTERN TASMANIA

### Lab- and computer-based projects

- 30. PETER BERGER**
- 31. STEWART JACKSON**
- 32. STEPHEN KUHN\***
- 33. ELENA LOUNEJEVA**
- 34. PETER MORSE**
- 35. ANNAH MOYO\***
- 36. NANDA MRABAWANI\***
- 37. JAY THOMPSON**

\*ARC TMVC Research Hub projects



# AT THE FOREFRONT: COVID-CRITICAL VISUALISATIONS

**Dr Michael Roach from the Discipline of Earth Sciences talks about the work he is doing in creating what is one of the world's largest libraries of geological visualisations, and how it has been critical for teaching during the Covid-19 pandemic.**



Dr Michael Roach from the Discipline of Earth Sciences undertaking data acquisition at Bluestone Bay in Freycinet National Park to generate virtual educational material for use in the CODES Masters program and for undergraduate teaching. This trip was undertaken during the early Covid lockdown and Dr Roach received special permission to travel to the area.

We have been working on visualisation in geology for seven or eight years through the AusGeol project, which created a virtual library of Australia's geology, and we have progressively been making teaching resources to accompany that library, particularly in the context of what's been happening during Covid.

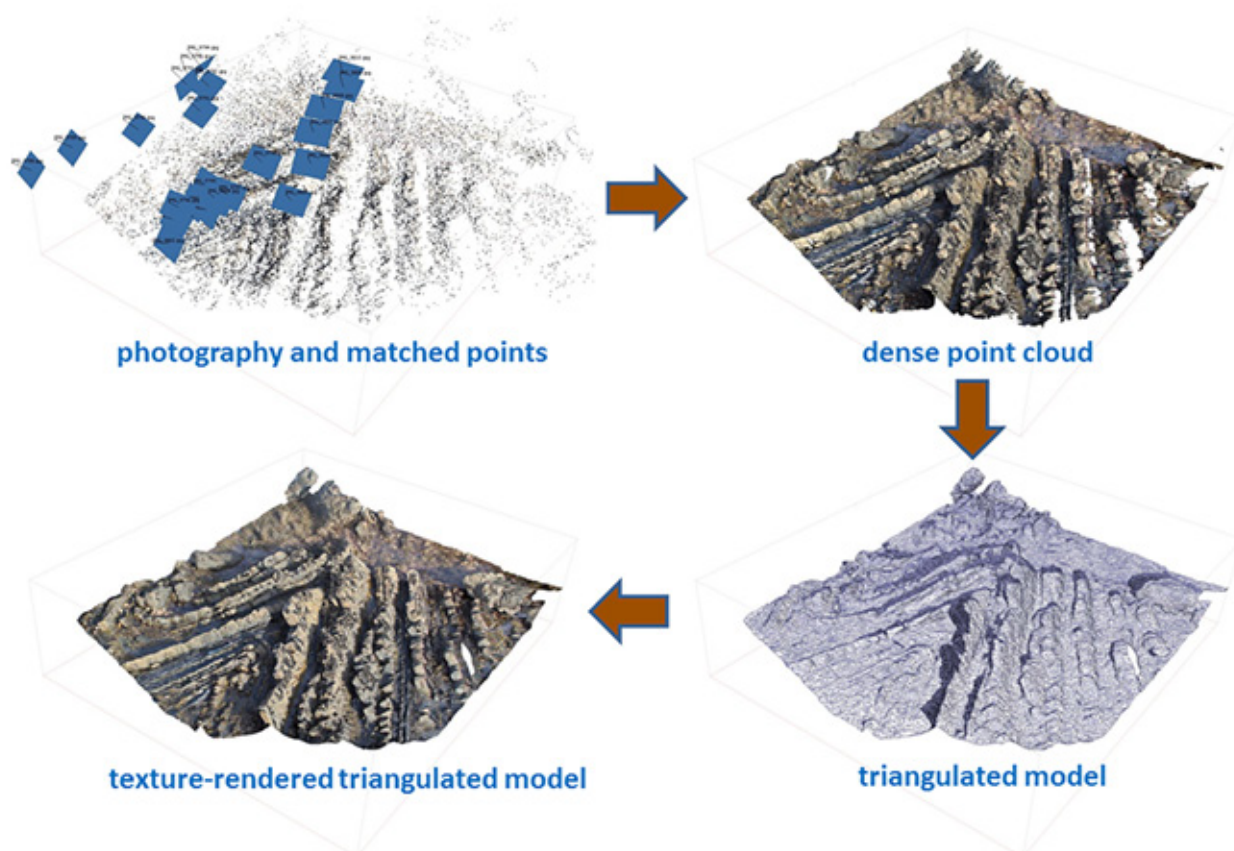
To a large extent the practicals within the recent ODM Masters short course in June depended upon not only the

work we were doing at Bluestone Bay [to create a virtual tour] but on the work we were doing digitising our other rock samples. Many of the Masters course practical sessions were reliant upon three-dimensional representations of samples from the UTAS collections, and were critical for being able to effectively do practicals. Without that work it wouldn't have been possible for people to see those rocks. But it was also important for

us to be able to take people out into the field and hence we generated the virtual tour of the site that we would otherwise have taken people to on a real excursion – Bluestone Bay.

I already had some of the material for the Bluestone Bay tour, but I went up there for a dedicated day of data acquisition and got a lot more material. It took multiple days to put it all together after the data were acquired.





These diagrams (clockwise from top left) illustrate the digital photogrammetric process used to create geometrically-correct, photo-realistic 3D models of outcrops and hand specimens that are now being used by Earth Sciences and CODES for delivery of geology courses.

There are other places around the world that are creating virtual tours. But we would regard ourselves pretty much at the forefront of geological visualisation in that we have probably the largest library of geological visualisations anywhere in the world.

I have people doing casual work helping to digitise samples...I coordinate that work, however. We were able to continue doing this work through Covid – it was absolutely critical for us to be able to continue to teach both at undergraduate level and postgraduate level, at the Masters level. So, across the course of the time of Covid we have in essence now digitised our entire undergraduate teaching collection...we can in a sort of fashion deliver many of the practicals that we have done in the past. The thing that visualisations are really good for is displaying textures and geometries but they are not so good for mineral identification because for mineral identification you really need to be able to assess hardness and lustre – things which are difficult to portray in visualisations.

UTAS has recognised what we have been doing in Earth Sciences and recognised the potential of it and I have been funded for an initial project to develop a resource which we have entitled Virtual Tasmania. Virtual Tasmania, if it continues to its full extent, will include documenting

Tasmania through visualisations and virtual tours across a whole range of disciplines. In 2020 we're going to be working to make our representation of Tasmania's geology more complete but we will also be looking at Tasmania's native vegetation and landforms.

If UTAS then decides that this is worth funding subsequently, the plan in 2021 is to look at Tasmania's primary and secondary industries...so we will look at things like mining, metallurgical processing, forestry, aquaculture, agriculture. And all of this material will be made available through a single free-access online portal.

*This project is part of UTAS's Digital Futures Program. Of the \$90,000 funding for the project, \$75,000 will be used by Dr Roach for the Virtual Tasmania project and the remainder will be used to digitise the UTAS cultural collections including artworks and items in the John Elliott Classics Museum.*

*See the spectacular virtual tour of Bluestone Bay created by Dr Michael Roach at: <http://www.ausgeol.org/assets/media/uploads/tours/bluestone1/index.html>*

*To date there have been around 220,000 downloads from the AusGeol Virtual Library of Australia's Geology. Check it out at: <http://www.ausgeol.org/>*

# SEG TREASURE HUNT

CODES SEG Student Chapter president Kyle Eastman reports on a pre-Covid-19 lockdown fossicking trip south of Hobart



The SEG Student Chapter spent a day at the Lune River Fossicking Area and Hastings Caves in southwestern Tasmania in early March; it was our last chance to get out and see some rocks before the Covid-19 lockdown. About ten SEG members took part, some staying for only part of the day but others staying to enjoy the caves.

The Lune River area produces high-quality petrified wood and agates out of a gravel layer in the shallow subsurface, and a bit of easy digging yields plentiful material. The plant fossils and agates are Jurassic, with the ultimate prize being agatized fern wood with preserved steles (cylindrical vascular tissue).

The agates show fine fortification banding and a variety of colours, with red (carnelian) being a highly sought-after lapidary material. After a successful morning of fossicking, the group headed to Hastings Caves for a cave tour before returning to Hobart.



**Top** CODES SEG Student Chapter members (L–R) Master of Science student Karla Morales Leiva, CODES PhD student Max Hohl, CODES PhD student Peter Berger and then-Master of Science student Zebedee (Zeb) Zivkovic at Hastings Caves.

**Above** CODES PhD student Peter Berger uses a pick to search for agates at Lune River.

**Left** Lune River agate found by TMVC PhD student Kyle Eastman during the day's fossicking.

**Far left** This piece of Lune River fern wood was also found by Kyle.





# BLAST FROM THE PAST



CODES Honorary Associate Dr Peter McGoldrick found this oldie but goldie photo during the Covid-19 lockdown and judged it very appropriate for our current circumstances with the reference to Corona prominently displayed.

Peter took the photo in October 2010 while he was in the US state of Colorado for the SEG Conference held at Keystone, at which he was a keynote speaker. The event was a surprise 40th birthday party for Andrew Wurst held at a Mexican restaurant – organised by his wife Cari Deyell-Wurst. Enjoying a glass or two of Corona during the evening back in the day were several CODES staff and postgraduate students, most of whom have moved on to new roles:

1. Dr David Selley (Adjunct Senior Researcher, CODES)

2. Dr Darryl Clark (Technical Director, Peako Ltd)

3. Peter Lewis (Exploration Manager, Eldorado Gold)

4. Dr Lindsey Ageneau (a director at Cognition Learning)

5. Dr Neil Martin (Executive Director - Exploration & Development at BMC (UK))

6. Dr Matt White (Director and Consultant Geologist, White Geoscience)

7. Dr Alan Wilson (GeoAqua Consultants, Anguilla)

8. Dr Olga Vasyukova (Postdoctoral Fellow, McGill University)



9. Dr Jamie Rogers (General Manager – Exploration, Northern Star Resources)

10. Dr Andrew Wurst (Chief Geologist – Project Generation, Innovation and Research, Barrick)

11. Dr Mathieu Ageneau (Exploration Manager, Resolute Mining)

12. Cari Deyell-Wurst (Chief Geologist, Corescan)

13. Dr Roisin Kyne (Project Geologist, Teck Resources)

14. Professor David Cooke (Director of CODES and the TMVC)

15. Dr Dan Gregory (University of Toronto)

16. Professor Huayong Chen (Chinese Academy of Sciences)

17. Dr Anthony Harris (Chief Geoscientist at Newcrest Mining)

If you have photos from CODES' past you are willing to share please email us (CODES.Info@utas.edu.au)

## CODES INDUSTRY PARTNERS 2020

### PLATINUM



### GOLD



### SILVER





# SOCIALLY-DISTANCED FIELDWORK ON THE WEST COAST

In early September seven third-year Earth Sciences students undertook the KEA348 Environmental Geology field trip to Tasmania's west coast; the group was led by Dr Clare Miller, Dr Jonathan Cloutier and Professor David Cooke. Covid-19 protocols were observed throughout, but this did not hinder the group from learning a huge amount about the mining-related environmental issues that exist here in Tasmania.

Dr Miller said: "This course is a really exciting part of KEA348 as it helps to equip these students with skills that will contribute to making future mining in Tassie more sustainable."



**Top left** Hamish Dore tests physical parameters (pH, electrical conductivity, temperature, oxidation reduction potential) in water from the King River.

**Top right** Gypsy Mahar and Hamish Dore completing a levelling survey on a bank of the King River where tailings from legacy mining have accumulated.

**Above left** Dr Clare Miller (field trip coordinator) and Hamish Dore discussing the geochemistry of the Queen and King rivers and the impacts of legacy copper mining on the mineralogy and water quality.

**Above right** Patrick Geale examines a bailer filled with groundwater retrieved from monitoring wells installed in the bank of the King River.

**Left** Joshua Resta measuring the rate of flow of the King River at a background location, before it is impacted by legacy mining.

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19–30 OCTOBER 2020

COURSE LEADERS: JONATHAN CLOUTIER, ROBERT SCOTT

Exploration in data-rich environments, close to existing mines, has become a preferred method of increasing company resources in recent years. With this exploration philosophy in mind, CODES is proud to present a Masters-level short course designed to bring participants up to date with the latest exploration techniques.

Presented by a mix of CODES staff and invited minerals industry professionals, Exploration in Brownfield Terrains will be delivered entirely online for the first time in 2020. Introductory content will be available from 5 October, with intensive interactive delivery from 19–30 October 2020.

The unit has been redesigned to allow for effective delivery in an online environment, involving a mixture of lectures, self-directed and guided learning activities. Just as in previous deliveries, the short course will cover a range of cutting-edge technologies in geophysics, geochemistry, hyperspectral reflectance and 3D visualisation demonstrated using near-mine to district-scale data from significant mineralised districts.

The revised, participant-centred approach will bring the practical exercises and project work to the forefront in a dynamic, interactive online learning environment. Practical exercises will be related to a series of case studies on



different mineral systems, each undertaken over several days. Practical work will be supported by lectures, workshops, tutorials and panel discussions involving invited industry and academic experts. Confirmed invited industry experts participating in the unit include, Scott Halley (Mineral Mapping), Ned Howard (Evolution Mining) and Shaun Schneider (Newmont Corporation). Keep an eye on our website and social media for further updates.

For further information about short courses, please email: [CODES.Info@utas.edu.au](mailto:CODES.Info@utas.edu.au) OR Master of Economic Geology Program Co-ordinator, Dr Robert Scott: [Robert.Scott@utas.edu.au](mailto:Robert.Scott@utas.edu.au).

## CONGRATULATIONS TO RECENT PHD GRADUATES

During the past few months we have been unable to gather to mark important occasions within the CODES community. However, the following students have received their PhD degrees since March and are becoming accustomed to their newfound status!

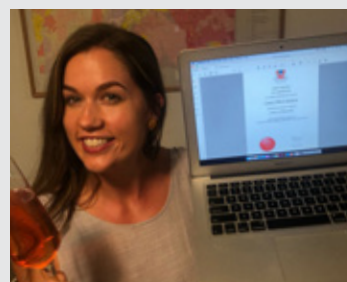
Dr Francisco Testa (PhD conferred in April)

Dr Matthew Ferguson (virtual PhD presentation on 14 August)

Dr Laura Jackson (virtual PhD presentation 14 August)

Dr Erin Lawlis (virtual PhD presentation 14 August)




**Top** Dr Laura Jackson celebrates her PhD in lockdown. **Right** Dr Erin Lawlis (second from left) and Dr Matthew Ferguson (second from right) celebrate their long years of toil on their PhDs with Dr Evan Orovan (left) and Jasmine Yeates at a Hobart restaurant.





# CHANGING FACES

Since March the COVID-19 pandemic has caused travel delays for several of our new PhD students. However, two of them have made it to Tasmania and are beginning work on their research, while Jaime Osorio is working remotely in South America. In addition, other staff have left and joined CODES, changed roles, or been promoted!

PHD STUDENT	START DATE	PROGRAM	PROJECT TOPIC
 <b>Rhiannon Jones</b>	March 2020	TMVC, Theme 1, P1202 project (Module 4), supervised by David Cooke	Investigating the significance of phyllic alteration in the Northparkes district in NSW, Australia
 <b>Jaime Osorio</b>	June 2020	TMVC, P1202 project (Module 4), supervised by David Cooke	Anatomy of a phyllic overprint and structural evolution at Rincones de Araya porphyry deposit, San Juan, Argentina
 <b>Chuang Wang</b>	August 2020	Program 4, supervised by Martin Jutzeler Gerrit Olivier (Institute of Mine Seismology), Michael Roach and Rebecca Carey	Seismic interpretation of sediment waves at Macauley, Havre and Healy submarine caldera volcanoes (Kermadec arc)

## Arrivals



**Maxwell Morissette** joined the CODES team in March as a laboratory technician for LA-ICP-MS.



**Meagan Porter** has joined CODES as a part-time Maintenance and Field Equipment Officer.

## Departures



**Dr Margaret Hawke** finished her six-month assignment working with Professor Ross Large on 'Pyrite vectors for the Cobar Basin', and in July moved to WA to work for Kalamazoo Resources.



**Troy Finearty** will leave his role as Maintenance, Field Equipment and Safety Officer at CODES and take up a secondment position as Facilities Services Officer – Electrical at UTAS in late September.



**Dr Evan Orovan** resigned from his position as Research Fellow in Ore Deposit Footprints within the ARC TMVC Research Hub, and in and in July took up a position with the British Columbia Geological Survey.



**Dr Adam Abersteiner** who recently finished his PhD at CODES, took up a short-term research position (April to August) working within the TMVC. He has now left to work at the University of Helsinki.

## Promotions and new roles

**Dr Rebecca Carey** has received a promotion to become an Associate Professor.

**Dr Lejun Zhang** has received a promotion and is now a Senior Lecturer.

**Dr Martin Jutzeler** is now a Senior Research Fellow on the Cowal ARC Linkage project (previously a Lecturer in volcanology).



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

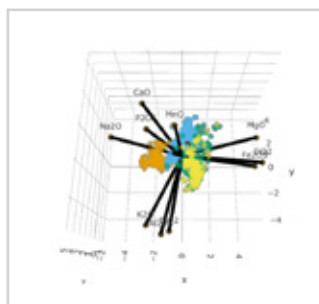
The past few months have seen some extraordinary efforts by our staff and students as they adapted to the COVID-19 crisis. Our Master of Economic Geology short course in June 2020 (Ore Deposit Models and Exploration Strategies) was migrated to full online delivery mode due to COVID-19 and surpassed all of our expectations, with >220 participants from 20 countries, 17 universities and institutes, 23 mining and exploration companies and three geological surveys. This was the largest and most diverse cohort of participants for any short course we have offered in the past three decades and has provided a template for online delivery in the MEconGeol program that will extend well beyond COVID-19. The next two shortcourses in 2020 (Brownfields and Geodata Analytics) will also be fully online and our staff are working hard to ensure they will also be highly effective and engaging learning experiences.

Our research teams have been delivering online workshops to our industry partners that have significantly enhanced our industry engagement, allowing us to connect with industry geologists in far-flung locations, enhancing our industry impact and engagement. Challenges continue to arise, but our team has been adapting swiftly in order to minimise disruptions and to find alternative pathways to ensure that our research and training activities suffer minimal disruptions.

With regards to the program of Masters short courses in 2021, we are currently reviewing our planned schedule, with the view to moving the field-based courses to late in 2021 in recognition of the challenges created by border closures and a ban on international travel. We will be announcing a revised schedule of short courses in the next month via our website and social media, so please stay tuned for more developments. 2020 is likely to present more challenges for us all before the year's end, but hopefully the lessons learned over the past few months will stand us all in good stead as we continue to adapt to a challenging year.

Kind regards  
Dave

For further information about short courses,  
please email: [CODES.info@utas.edu.au](mailto:CODES.info@utas.edu.au)  
OR Master of Economic Geology Program Co-ordinator,  
Dr Robert Scott: [Robert.Scott@utas.edu.au](mailto:Robert.Scott@utas.edu.au)  
For all other CODES contacts, see page 2.



## UPCOMING MASTER OF ECONOMIC GEOLOGY SHORT COURSES

### GEODATA ANALYTICS

**5 OCTOBER–18 DECEMBER (WITH BREAKS)**

COURSE LEADERS: MATTHEW CRACKNELL, SHAUN BARKER

The Geodata Analytics course 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. Students will gain skills in rigorous and repeatable methods for extracting and visualising meaningful information from geochemical, geophysical and geological information. Case study examples of applications in mineral exploration; ore extraction and processing; and waste management will be provided. The communication of resultant models to aid interpretation and facilitate decision making, to both geoscientists and non-geoscientists, is an important aspect of computer-assisted analysis of data and will be covered using a range of delivery modes. (See further details on pages 1–2.)

### EXPLORATION IN BROWNFIELD TERRAINS

**19–30 OCTOBER 2020**

COURSE LEADERS: JONATHAN CLOUTIER, ROBERT SCOTT

The compilation and analysis of large datasets that are common in areas of significant previous exploration can present a challenge for any geologist. This fully online-based short course looks at exploration strategies in areas close to existing mine sites, where abundant, but commonly under-utilised, data is typically available. The short course gives participants first-hand experience in the use of cutting-edge technologies in geochemistry, hyperspectral mineral analysis and 3D visualisation for mineral exploration in data-rich environments. The short course is presented by expert teaching staff from CODES and leading minerals industry professionals using real data from world-class mineralised districts. A more detailed program with information about presenters, costs and payment options will be available soon from the CODES website: [www.utas.edu.au/codes](http://www.utas.edu.au/codes) (and see page 22 for further details).