

# ORE SOLUTIONS

NEWSLETTER OF CODES CENTRE FOR ORE DEPOSIT AND EARTH SCIENCES

> Summer 2018 No.32

## CODES: UNEARTHING NEW POSSIBILITIES

**CODES Director Professor David Cooke takes stock of 2018, which has turned out to be a standout year for CODES, and looks ahead at what's to come in 2019.**



**From strength to strength:** CODES staff and graduate students, including our Master of Economic Geology students, pictured in the CODES Rock Garden at UTAS, 31 October 2018. Our total number of staff and students is currently 129.

As 2018 draws to a close, CODES staff and students can reflect on a highly productive and successful year. We started several new major research initiatives (including AMIRA P1202, the Northwest Queensland exploration project, and Cerro Negro, Argentina), which led to the recruitment of new staff and students, and new research partnerships (with Monash University,

Universidad Austral de Chile and Mineral Mapping among others). Funding has been secured for the 4D geological modelling of the Cowal district project (Evolution Mining), which will commence shortly. An article on AMIRA P1202 appears later in this newsletter.

AMIRA P1153 was brought to a very successful conclusion in mid-2018, with a range of deliverables provided to the sponsor group via sponsors' research and field meetings. A total of seven PhD theses have been completed so far this year. Ten new PhD students joined or are about to join our existing cohort of students. The Master of Economic Geology program saw the largest ever number of new recruits join the program in 2018 (19 new students plus four lapsed students who have recommenced

their degrees). As part of that program, we presented three highly successful short courses, culminating in the very well-received three-day Garry Davidson Symposium (130 attendees), presented as part of the Ore Deposit Models and Exploration Strategies short course in 2018. The special issue of *Economic Geology* (January 2018) was another major highlight, with many articles written by CODES staff and students.

2018 was a challenging year with regards to teaching Earth Sciences at the University of Tasmania, due to the loss of three profile staff members in 2017. It is important to emphasise the fantastic job that our research staff have done in helping to ensure that Earth Sciences could deliver its full undergraduate degree in 2018.

Continued on p.2.

### IN THIS ISSUE

Honours: Class of 2018 .....	3
Garry Davidson Symposium report .....	11
AMIRA P1202 latest .....	13
Where are they now? Sarah Jones .....	15
Ores in Magmatic Arcs – Indonesia .....	20

## CODES CONTACTS

CODES DIRECTOR AND ARC INDUSTRIAL TRANSFORMATION RESEARCH HUB (TMVC) DIRECTOR

David Cooke  
Ph: +61 3 6226 7605  
d.cooke@utas.edu.au

### LEADERS, PROGRAM 1

Ore Deposits and Mineral Exploration  
Mike Baker and Lejun Zhang  
Ph: +61 3 6226 7210/7211  
Michael.Baker@utas.edu.au  
Lejun.Zhang@utas.edu.au

### LEADERS, PROGRAM 2

Geometallurgy, Geoenvironment and Mining  
Anita Parbhakar-Fox and Angela Escolme  
Ph: +61 3 6226 7142/2664  
Anita.Parbhakar@utas.edu.au  
Angela.Escolme@utas.edu.au

### LEADERS, PROGRAM 3

Sedimentation, Tectonics and Earth Evolution  
Shaun Barker and Jeff Steadman  
Ph: +61 3 6226 8337/5554  
Shaun.Barker@utas.edu.au  
Jeffrey.Steadman@utas.edu.au

### LEADERS, PROGRAM 4

Magmatic and Volcanic Processes  
Rebecca Carey and Dima Kamenetsky  
Ph: +61 3 6226 2987/7649  
Rebecca.Carey@utas.edu.au  
Dima.Kamenetsky@utas.edu.au

### LEADERS, PROGRAM 5

Analytical Research  
Leonid Danyushevsky and Sebastien Meffre  
Ph: +61 3 6226 2469/7207  
l.dan@utas.edu.au  
smeffre@utas.edu.au

### LEADERS, PROGRAM 6

Geophysics and Computational Geosciences  
Michael Roach and Matt Cracknell  
Ph: +61 3 6226 2474/2481  
Michael.Roach@utas.edu.au  
M.J.Cracknell@utas.edu.au

### PA TO THE DIRECTOR

Jane Higgins  
Ph: +61 3 6226 2472  
jane.higgins@utas.edu.au

CODES – Centre for Ore Deposit and Earth Sciences

University of Tasmania  
Private Bag 79, Hobart  
Tasmania, 7001 Australia  
Ph: +61 3 6226 2589  
Fax: +61 3 6226 2547  
utas.edu.au/codes

### CODES: UNEARTHING NEW POSSIBILITIES (continued)

Our profile staff numbers in Earth Sciences dipped to their lowest ever number in 2018, and the CODES research team rallied to help our profile staff to ensure that our undergraduate content was delivered in a highly engaging and effective fashion. They also helped enormously with Honours supervision – the fruits of that labour are profiled in this newsletter's review of the 2018 Honours candidates.

Looking forward to 2019, it is very pleasing to announce that the University

of Tasmania will be appointing two new profile staff members to Earth Sciences and CODES. These new appointments will help us to address our staffing shortfall and will grow our research and supervision capacity. Additional research appointments are being made, so that new staff will join us early in the new year. 2019 is the penultimate year of our Australian Research Council's Industrial Transformation Research Hub, and we look forward to the TMVC staff and students transferring its major outcomes to our industry partners. There are challenges ahead, but we look forward with optimism to the new opportunities on the horizon.

## LIVING ON THE EDGE IN THE RUSSIAN FAR EAST



PhD student Adam Abersteiner standing in the caldera of Ksudach Volcano (South Kamchatka) holding a piece of basalt-dacite.

Between August and October this year, PhD student Adam Abersteiner and Professor Dima Kamenetsky undertook extensive fieldwork in the far east of Russia. Adam was the successful recipient of the Max Banks Research Scholarship in Earth Sciences and a grant from the UTAS Conference & Research Travel Funding Scheme, which assisted in his travels abroad.

During this time in Russia, Adam and Dima explored remote areas of Kamchatka in conjunction with Russian researchers as part of a project to understand the complex active volcanism and subduction processes occurring in this area. This project aims to understand the origin of platinum-group elements and gold in sulfide melts from modern arc basalts. In addition, kimberlite research and sample collection was conducted in Siberia as part of a growing collaboration between UTAS and various Russian universities and geology institutes. And Adam even managed to master the Russian language while on this trip, as Dima will attest!

## HONOURS: CLASS OF 2018

**This year's crop of CODES Honours students has been a particularly large and diverse group, proving that an Honours degree in Earth Sciences is a popular choice for the smart-thinking geology student. Some of our mid-year graduates are already working in the industry while others, and those completing by the end of 2018, are keen to find placements. Here we introduce this year's cohort and their study interests.**

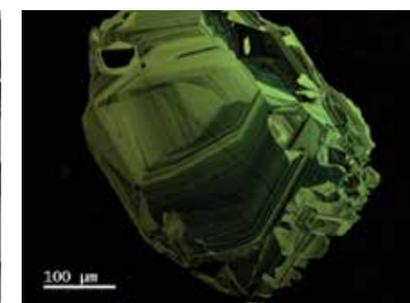
Through our Honours program in Earth Sciences at the University of Tasmania (UTAS), we aim to provide the best strategies to prepare our students for careers in industry or academia. The Honours degree in Earth Sciences is a composite course consisting of thesis-based research balanced with a literature review and four weeks of short courses that take place in Tasmania and Victoria. The Honours program has two intakes a year (February and July) and consists of 38 weeks of study, with graduations in December and August. The program is coordinated by Dr Martin Jutzeler.

This year has seen excellent results, with 19 students enrolled at some point during the year, which represent a large proportion of our graduate students. Most of the international students who graduate with a geology major from UTAS are keen to continue into Honours; three students from Malaysia and Indonesia will graduate this year. We also have

input from mainland students, with two representatives who graduated from QUT and Monash. Eight Honours students who had started mid-year in 2017 submitted their theses in April and graduated in August 2018. Their research projects were quite diverse, with five projects in economic geology, one in geophysics, one in marine geosciences, and one in environmental geochemistry. In February, nine students started Honours; seven of them carried out projects related to economic geology, and two related to geochemistry. Most of these students recently submitted their theses and will graduate this December. This year, we had two mid-year starter students, and their projects in economic geology and general geology will be completed by May 2019, with their graduation planned for August 2019; one part-time student will finish in late 2019. Our research projects are chiefly in Tasmania (nine) although several are based in other Australian states (seven),

in addition to one project based in offshore Tasmania, and one overseas in Inner Mongolia, China.

Many of our students are sponsored by industry and academia throughout their Honours year. We are most grateful to these sponsoring companies and organisations which include the TMVC Research Hub, Mineral Resources Tasmania, the CockerTwo Scholarship through the UTAS Foundation, the Australian Research Council, AusIMM, Copper Mines of Tasmania, Corona Minerals, CSIRO, Evolution Mining, Forest Practices, the Geological Survey of Western Australia, the Geological Survey of Victoria, the Geological Society of Australia, Heron Resources, the Institute of Mine Seismology, MMG, New South Resources, Newcrest Mining, Perilya, Signature Gold, and Venture Minerals. In addition, a proportion of the project work was supported by internal, university-based funding.



**Left:** Fatin Amni in a Copper Mines of Tasmania core shed at Queenstown examines drill core from Glen Lyell in the Mount Lyell district, researching advanced argillic alteration minerals (alunite and pyrophyllite). **Top right:** False-colour cathodoluminescence image of cassiterite from Renison Bell Tin Mine, western Tasmania, produced by Josh Denholm during his Honours work on the trace element chemistry of Tasmanian cassiterite. **Bottom right:** Ben Kowaluk outside an old farmhouse during his Honours fieldwork in Inner Mongolia, China.



#### 1 TOMAS ANDREWS

Current student, completing end 2018

**Supervisors:** Rob Scott, Stuart Bull

**Project title:** Use of pyrite trace element geochemistry as a vector towards Pb-Zn-Ag mineralization in northern Australian Proterozoic basins

Tom's Honours project was sponsored by MMG Exploration Pty Ltd. His study focussed on a laterally extensive sequence of anomalously pyritic, thinly bedded silty dolostones hosted in the early Mesoproterozoic Barney Creek Formation. The pyritic rocks (locally containing up to ~60% pyrite over 1m intervals) were intersected in drilling on MMG's Rosie Creek prospect in the northern Batten Fault Zone, ~100km north of the world-class McArthur River Zn-Pb sedex deposit. The lateral extent of the pyritic interval (or "pyrite envelope") at Rosie Creek has now been largely defined by MMG's drilling, and although the pyrite envelope locally includes anomalous concentrations of Zn and Pb, no ore grade accumulations of these metals have yet been identified. Tom's study involved initial sedimentological logging, facies analysis, sampling and interpretation of MMG multi-element geochemical data for a fence of five drill holes transecting the pyrite envelope. Subsequently, Tom investigated pyrite paragenesis and variations in pyrite trace element composition stratigraphically and laterally across the pyrite envelope. Tom's study has produced several important findings that have relevance to both mineral exploration in the district, and ongoing debate about the composition of the early Proterozoic ocean.



#### 2 HANNAH COUPER

Completed studies mid-2018

**Supervisors:** Angela Escolme, Ron Berry, David Cooke

**Project title:** Geology and geometallurgical characterisation of the high Au, low Cu material at West Dome, Telfer Cu-Au mine, WA

Hannah Couper came to CODES from the University of Queensland to complete her Honours on a project she developed herself with Newcrest Mining Ltd whilst doing vacation work at the Telfer Au mine in Western Australia. Hannah's project, 'Geology and geometallurgical characterisation of the high Au, low Cu material at West Dome, Telfer Cu-Au mine, WA', involved two weeks of fieldwork at Telfer and detailed analytical work back at UTAS. Her objectives were to characterise and describe the high Au, low Cu material from West Dome, determine the gold deportment, and critically review the suitability of current processing protocols for this material and aid the recognition of value-add opportunities. Hannah gave special attention to the variability in gold deportment by vein type and degree of weathering. Her results were well received by a technical team of Newcrest representatives, demonstrating the value of developing an Honours project whilst completing vacation work, and she graduated with First Class Honours.

*"I have really enjoyed this challenging year and have diversified my geological skills significantly. I am exceptionally grateful to the TMVC and Newcrest Mining Ltd for providing me with this opportunity."* – Hannah Couper



#### 3 HAMISH COWIE

Current student, completing mid-2019

**Supervisors:** Rob Scott, Jeff Steadman

**Project title:** Architecture of intrusion-related mineralisation at Ora Banda, Eastern Goldfields, WA

Hamish's Honours project, sponsored by Evolution Mining, is an investigation into the stratigraphy, structure, alteration and mineralisation history of a current gold prospect near Ora Banda in the Eastern Goldfields, 66km NW of Kalgoorlie. The Ora Banda area hosts several large gold deposits (e.g. Enterprise, Gimlet South, Slippery Gimlet) and displays widespread gold anomalism in near surface geochemical data (RAB and air core drilling) across a ~25km<sup>2</sup> area. The region of elevated gold appears to be spatially related to the Lone Hand Monzogranite (LHMG), which is interpreted to have intruded now steeply-dipping, NW-striking komatiite, high-Mg basalt and dolerite prior to deformation. Hamish will address the timing and character of gold mineralisation along a series of NE-trending fault/fracture zones, which appear to emanate from, and may have originally rooted into, the LHMG. Near surface multi-element geochemical data for the project area reveals a marked spatial partitioning of pathfinder elements, with higher temperature elements (Bi and W) elevated close to the LHMG, and lower temperature elements (Sb and As) concentrated 2–3km further to the west, at an originally higher level in the greenstone sequence. The present NE to SW lateral zonation of pathfinder elements across the project area resembles the vertical zonation of these same elements associated with some intrusion-related gold and low-sulfidation epithermal systems.

Hamish's study aims to determine whether gold mineralisation in this area occurred prior to regional deformation during emplacement of the LHMG (e.g. intrusion-related gold system), during later deformation (orogenic gold), or both.



#### 4 JOSH DENHOLM

Current student, completing end 2018

**Supervisors:** Sasha Stepanov, Wei Hong, Ralph Bottrill (MRT)

**Project title:** The trace element chemistry and U-Pb geochronology of Tasmanian cassiterite

Josh is a current Honours candidate, and is studying the trace element chemistry and U-Pb geochronology of Tasmanian cassiterite using LA-ICP-MS. He is supervised by Dr Sasha Stepanov and Dr Wei Hong from CODES, and Ralph Bottrill from Mineral Resources Tasmania. Josh is the recipient of the generous 2018 CockerTwo scholarship for Honours in Earth Sciences. Tasmania has a fantastic array of tin deposits, including Australia's largest and most productive tin deposit, Renison Bell. Josh's work is focussed on defining characteristic features of the trace element chemistry in cassiterite from different deposits in both northeastern and western Tasmania, as well as comparing the ages of Tasmanian granites to his new U-Pb cassiterite ages. He has also analysed alluvial cassiterite to assess how trace elements and dating might be used in provenance studies. This is the first time a regional study of cassiterite trace element chemistry has been attempted in Tasmania, and only the second time Tasmanian cassiterite has been dated using LA-ICP-MS.



#### 5 SARAH GILMOUR

Completed studies mid-2018

**Supervisors:** Anita Parbhakar-Fox, Nathan Fox, Paul Olin

**Project title:** Mineralogical and geochemical characterisation of historical slag: Evaluating environmental impacts and economic significance

Sarah Gilmour is a recent environmental geology Honours graduate who finished in mid-2018 and is now employed at GHD as a geochemist/geoscientist. Her supervisors during her Honours research were Dr Anita Parbhakar-Fox, Dr Nathan Fox and Dr Paul Olin. In Australia it's been reported that there are over 60,000 abandoned or historic mines, with approximately 215 legacy sites in Tasmania that generate acid and metalliferous drainage (AMD). These sites are both harmful to the surrounding environment and costly to remediate. Sarah's research looked at characterising two of these sites to evaluate their AMD potential and provided recommendations for remediation and/or reprocessing. To do this Sarah used a variety of techniques including static leach test work (paste pH, NAG pH, solution ICP-MS), XRD, LA-ICP-MS, reflected light microscopy, FE-SEM, pXRF, whole rock geochemical analysis (ICP-AES, ICP-MS, AAS) and elemental analysis (carbon-sulfur analysis). This resulted in detailed chemical and mineralogical profiles of the two sites which will be used in reprocessing/remediation decision making.



#### 6 STEWART JACKSON

Completed studies mid-2018

**Supervisors:** Martin Gal, Ernest Lotter (IMS)

**Project title:** Finite difference wavefield modelling for mining scale seismology

Stewart Jackson is a geophysics student from Tasmania specialising in earthquake seismology and with an interest in computational techniques.

With the support of the Institute of Mine Seismology (IMS), he produced a program to computationally model the propagation of seismic waves originating from earthquakes in mines, by utilising the finite difference method. The result is a program which, when given an input seismic source and model of rock mass in the region, will output synthetic ground motion readings at sensors in the region.

Seismic activity in mines can be potentially hazardous and, as such, needs to be monitored for safety; such monitoring provides ideal applications for the program. This program was tailor-made to tackle some of the problems that arise specifically in the setting of mine seismology – such as the relatively smaller scale, and higher contrasts in physical parameters than elsewhere.

The program is currently being used to develop new techniques to monitor tailings dams for stability.

Stewart is about to start a PhD at CODES working in Program 6; his PhD topic is 'Seismic characterisation of mine tailings dams'.



### 7 DARCY JAMES

Current student, completing mid-2019

**Supervisors:** Sebastien Meffre, Andrew McNeill (MRT), Ralph Bottrill (MRT)

**Project title:** What's under the Tasmania Basin?

After completing a Bachelor of Marine and Antarctic Science in July of this year, Darcy has now commenced his Bachelor of Science with Honours. Darcy's project is entitled "What's under the Tasmania Basin?" and is testing the "Tasmanian Orocline" hypothesis proposed by Dr Ross Cayley which postulates that the Mount Read Volcanics curve around from the west coast of Tasmania through to the area under Hobart. This project will analyse the rocks beneath the Tasmanian Basin, primarily in the lower midlands, adjacent to the Tamar Fracture System. The methods employed aim to date these rocks (U-Pb), characterise the chemistry (whole-rock geochemical analysis, Sm-Nd-Pb ± Lu-Hf in zircon), characterise mineralogy (SEM) and provenance crystals of interest (EMP). The data gathered will be used for comparisons with known ages, geochemical and mineralogical signatures of rocks in eastern and western Tasmania, and to inform the Paleozoic tectonic reconstructions. This work will be supervised by Associate Professor Sebastien Meffre with the aid of Mineral Resources Tasmania manager Dr Andrew McNeil and senior geologist Mr Ralph Bottrill (also from MRT). Darcy aims to complete his thesis by April 2019.



### 8 BEN KOWALUK

Current student, completing end 2018

**Supervisors:** Lejun Zhang, Mike Baker, David Cooke

**Project title:** Geology, genesis and geochemistry of the Hadamiao Porphyry Au ± Cu deposit, Inner Mongolia, China

The primary objective of Ben's research thesis is to develop a geological understanding of the Hadamiao Cu ± Au porphyry prospect in Inner Mongolia, China, with an emphasis on the evolution of hydrothermal fluids at the prospect.

Ben completed fieldwork in China in July this year, focussing on the collection of samples for their geology, alteration mineralogy and magmatic-hydrothermal transition textures. Hand sample observations, reflected light and transmitted light petrography, and SEM imaging were all used to help determine the paragenesis for the prospect.

Over the course of the year, Ben completed the first detailed documentation and synthesis of the geology, alteration and mineralisation of the Hadamiao gold porphyry system. This includes establishing the paragenesis for alteration and mineralisation at the prospect, characterising the breccias and veins associated with the Hadamiao porphyry and analysing key magmatic-hydrothermal transition textures to determine their relationship to alteration and mineralisation. He has also analysed key alteration minerals by ICP-MS to ascertain their suitability for fertility and vectoring studies.



### 9 BRIDIE LE'GALLAIS

Current student, completing end 2018

**Supervisors:** Leonid Danyushevsky, Grace Cummings (MRT), John Everard (MRT)

**Project title:** Olivine cumulates from the Whyte River Complex in western Tasmania

Bridie's Honours project is focussed on the Cambrian Whyte River mafic-ultramafic complex in the Waratah-Luina area in western Tasmania, a part of an ophiolite that was obducted onto proto-Tasmania's eastern passive margin at ~510 Ma during an arc-continent collision. The project was supervised by Leonid Danyushevsky from CODES and Grace Cummings and John Everard from Mineral Resources Tasmania. Using mineral chemistry determined by LA-ICP-MS and whole-rock trace element geochemistry, the project aims at assessing possible genetic links between the ultramafic cumulates of the Whyte River complex and tholeiitic lavas, and at constraining the geodynamic setting which led to the formation of the parental magmas. Magmas which formed the ultramafic cumulates were found to be strongly depleted in incompatible elements, unlike most of the modern subduction-related lavas.



### 10 RYAN McMANN

Completed studies mid-2018

**Supervisors:** Ray Cas (Monash), Paul Olin

**Project title:** A syn-depositional sill intrusive model for the Golden Mile Dolerite, Kalgoorlie, WA

The focus of Ryan's Honours project was to investigate the emplacement origin of the world famous Golden Mile Dolerite (GMD) in Kalgoorlie, Western Australia. Geologists have worked on this famous host to rich gold deposits for over 100 years. It has been commonly considered to have been emplaced as a post-lithification sill, although a few authors consider it to have been a very thick lava flow based on the presence of basalt clast breccias in the overlying Black Flag Beds (BFB). New drill core south of the Super Pit reveals that the GMD was emplaced as a syn-depositional sill, while the BFB were still unconsolidated. The breccias in question are peperite breccias formed when the hot intruding magma was chilled and quenched fragmented by the water-saturated sediments it was intruding, which goes to show that it is still possible to make new geological interpretations based on looking at geological relationships and rock textures and understanding volcanic processes!



### 11 FATIN AMNI MOHAMED AMIN

Current student, completing end 2018

**Supervisors:** Lejun Zhang, Evan Orovan

**Project title:** Advanced argillic alteration at Glen Lyell and Western Tharsis deposits, Mt Lyell district, western Tasmania

The Mount Lyell district is located within the middle Cambrian Mount Read Volcanic belt of western Tasmania and has more than 24 distinct Cu-Au-Ag orebodies that have been recognised in the area. Recent discoveries and studies show that there could be potential copper and gold mineralisation associated with advanced argillic alteration that is usually composed of quartz, alunite, pyrophyllite, dickite and kaolinite.

In the past year, Fatin has been carrying out detailed documentation of the mineralogy and textures of advanced argillic alteration and related mineralisation at Western Tharsis and Glen Lyell in the Mount Lyell district. Fatin has completed two field campaigns of sampling and mapping, collected 157 samples, and logged 5 drill holes. A series of analytical techniques, such as reflected light and transmitted light petrography, SEM imaging and short wavelength infra-red (SWIR) spectral analysis were employed during her studies. Consequently, high-sulfidation-style mineralisation has been recognised for the first time at Glen Lyell, and a comprehensive alteration and mineralisation paragenesis for Western Tharsis and Glen Lyell have been established. Fatin has also conducted LA-ICP-MS trace element analysis of key alteration minerals (e.g., alunite, rutile) which aims to vector to the heat source of the advanced argillic alteration and to add value to future exploration in the Mount Lyell district.



### 12 RHIANNAN MUNDANA

Completed studies mid-2018

**Supervisors:** Jo Whittaker (IMAS), Rebecca Carey, Sean Johnson

**Project title:** The geological evolution of the Cascade Seamount: Implications for understanding the opening of the Tasman Gateway

Rhiannan's Honours thesis focussed on the analysis of seafloor samples collected from the Cascade Seamount, East Tasman Plateau, to determine the geological history of the seamount that, in turn, informs us of the regional geological evolution. Rhiannan was part of the scientific crew aboard the RV *Investigator* voyage to the Cascade Seamount in 2016 before commencing her Honours in mid-2017 with the rock samples, sediment samples and bathymetric data collected from the voyage. The research incorporated a variety of analysis techniques, including Ar-Ar dating, whole-rock geochemistry, petrographic analysis, and a spatial analysis, to understand the formation and subsidence history of the Cascade Seamount and to elucidate the conflicting theories of the region's geological evolution.

## 2018 Honours students and their projects



- |   |                   |                       |    |                         |                     |
|---|-------------------|-----------------------|----|-------------------------|---------------------|
| 1 | TOMAS ANDREWS     | BORROLOOLA, NT        | 10 | RYAN McMANN             | KALGOORLIE, WA      |
| 2 | HANNAH COUPER     | TELFER DOME, WA       | 11 | FATIN AMNI MOHAMED AMIN | WESTERN TASMANIA    |
| 3 | HAMISH COWIE      | KALGOORLIE, WA        | 12 | RHIANNAN MUNDANA        | CASCADE SEAMOUNT    |
| 4 | JOSH DENHOLM      | NORTH-EAST TASMANIA   | 13 | XIN NI SEOW             | WESTERN TASMANIA    |
| 5 | SARAH GILMOUR     | WESTERN TASMANIA      | 14 | EMMET O'KEEFE           | WESTERN TASMANIA    |
| 6 | STEWART JACKSON   | WESTERN TASMANIA      | 15 | BEN RIDGERS             | NORTH-EAST TASMANIA |
| 7 | DARCY JAMES       | MIDLANDS, TASMANIA    | 16 | RIQUAN ROPLI            | JAMIESON, VIC       |
| 8 | BEN KOWALUK       | INNER MONGOLIA, CHINA | 17 | MARK SINFIELD           | BROKEN HILL, NSW    |
| 9 | BRIDIE LE'GALLAIS | NORTH-WEST TASMANIA   | 18 | MATTHEW VINCENT         | ROCKHAMPTON, QLD    |



**13 XIN NI SEOW**

Current student, completing end 2018

**Supervisors:** Mike Baker, Evan Orovan

**Project title:** Geology and genesis of the Prince Darwin prospect, western Tasmania

Xin Ni's research project focusses on studying the geology and genesis of the Prince Darwin prospect located in the Mount Read Volcanic belt (MRV) in western Tasmania. Western Tasmania is well-known for hosting world-class metal ore deposits and prospects containing copper, gold, silver, lead and zinc. Prince Darwin is one such prospect, with known occurrences of minerals hosting copper, gold and rare earth elements. Allanite is the main REE-bearing mineral in the Prince Darwin prospect. Xin Ni studied the evolutionary processes of the prospect (i.e., How did the minerals form? What was the order of their formation?) and determined the source of the rare earth element enrichment. She also evaluated the relationship of the Prince Darwin prospect to other metallogenic prospects along the MRV.



**14 EMMET O'KEEFE**

Current student, completing end 2018

**Supervisors:** Evan Orovan, Lejun Zhang

**Project title:** Genesis of the Trial Harbour skarn, western Tasmania

Emmet's Honours project involves the evaluation of a complex skarn system located at Trial Harbour, western Tasmania. His project was funded by the ARC Research Hub for Transforming the Mining Value Chain (TMVC) and supervised by Dr Evan Orovan, Dr Lejun Zhang and Professor David Cooke. Emmet received additional funding for fieldwork through a generous grant from Dr Tony Brown. Emmet's work focussed on detailed field relationships and he spent long hours conducting meticulous petrographic work. He unravelled a complicated skarn paragenesis that included early prograde anhydrous calcic and iron-magnesian skarn assemblages that were overprinted by several retrograde hydrous assemblages. Minor Zn-Pb mineralisation and an unusual association with Ni were paragenetically constrained. Through careful mineral mapping and U-Pb age determinations, Emmet was able to relate the complex and unusual skarn formation with the emplacement of the red Heemskirk granite into host rocks with variable provenances, including ultramafics, dolostones and wackes. Emmet displayed great character, enthusiasm and tenacity in the field, and was not deterred by poor weather, leech-infested forests or complicated geology – a rare breed.



**15 BEN RIDGERS**

Completed studies mid-2018

**Supervisors:** Sebastien Meffre, Ralph Bottrill (MRT), Jeff Steadman

**Project title:** Pb isotopic characterisation of ore deposits and prospects from NE Tasmania

Ben Ridgers studied the gold deposits hosted by Ordovician-Early Devonian turbidites in the Mathinna Supergroup in northeast Tasmania. He collected samples from drill core belonging to the Lefroy, Golconda, Alberton and Gladstone deposits analysing pyrite to determine the trace element chemistry, performing U-Pb analyses on hydrothermal minerals, and analysing Pb and S isotopes in pyrite and galena.

The study showed the pyrite is characterised by high As and Au cores and Ni-Co-As enriched rims similar to hydrothermal pyrite from other orogenic gold deposits found around the world. Pb isotope compositions for galena are generally slightly less radiogenic than expected for mineralisation of his age but similar to the early granodiorites in northeast Tasmania. Most of the monazite analysed were Devonian in age confirming an orogenic and/or granite-related origin for these deposits. S isotope analyses confirmed a magmatic source for the Golconda goldfield and revealed a likely magmatic sulfur source for the Chum Lode at Lefroy. S isotopic compositions at Alberton suggest a likely Devonian seawater source for the sulfur.



### 16 RIQUAN ROPLI

Completed studies mid-2018

**Supervisors:** Sebastien Meffre, Jeff Steadman, Rob Duncan (GSNSW)

**Project title:** Age and paragenesis of the Hill 800 prospect, Victoria

Riquan studied the Hill 800 prospect, a Au-Cu prospect located 145km east-north-east of Melbourne, Victoria. The study confirmed the Cambrian age of the host breccia showing that these formed in a proximal-to-emergent oceanic island arc volcano. U-Pb dating of hydrothermal apatite ( $498 \pm 12$  Ma) in pyrite and gold-rich samples showed that the deposit was formed close to the age of formation of the host rocks. However, the deposit was strongly affected by a number of later tectonic events which are recorded by the elongated monazite found in foliation ( $461 \pm 16$ ,  $408 \pm 6.7$  and  $344.6 \pm 8.6$  Ma). Pyrite imaging provided evidence of trace element migration in pyrite grains, strongly supporting the remobilisation of trace elements during deformation. Based on the results of his and previous studies, Riquan showed that the early mineralisation at Hill 800 formed as a hybrid with characteristics resembling both VHMS and Porphyry-Cu deposit. This early mineralisation was extensively modified during later deformation and metamorphism.



### 17 MARK SINFIELD

Completed studies mid-2018

**Supervisors:** Rob Scott, Tony Webster

**Project title:** Litho-structural control and origin of mineralisation at Carbonate Ridge – Broken Hill, NSW

Mark Sinfield's Honours study investigated the characteristics and stratigraphic position of base metal mineralised intercepts in deep drilling at Carbonate Ridge approximately 6km NE of Broken Hill. Mark studied drill core that was acquired in the 1970s, as part of brownfields exploration on the Northern Leases, searching for continuations to the Broken Hill main line of lode. At the time, base metal intercepts in two deep holes drilled at Carbonate Ridge were interpreted to be hosted in Freyers Metasediments, rather than the stratigraphically overlying Hores Gneiss, which hosts the Broken Hill orebody. Given the depth (>1km) and perceived unfavourable stratigraphic position of the Carbonate Ridge intercepts, little subsequent exploration or analysis of the prospect was undertaken. However, following the re-discovery/discovery and mining of the Potosi/Potosi extended ore body (hosted in Freyers Metasediments) and Silver Peak (hosted in Hores Gneiss) at the NE end of the main line of lode, there has been renewed interest in the previous mineralised intercepts at Carbonate Ridge.

Mark's study, which was sponsored by Perilya Limited, involved detailed logging, sampling, whole rock geochemistry, thin section petrography and SEM investigation of drill cores from the Carbonate Ridge area, as well as the study of comparative ore samples from the Potosi and Silver Peak deposits. His work confirmed earlier stratigraphic and structural interpretations for the Carbonate Ridge area, and highlighted the potential for further extensions to the Potosi orebody, in the area between the Potosi mine and Carbonate Ridge.



### 18 MATTHEW VINCENT

Current student, completing end 2018

**Supervisors:** Lejun Zhang, Mike Baker

**Project title:** The application of visible near infrared (vis-NIR) and short wavelength infrared (SWIR) spectral analysis in exploration for Mount Cassidy porphyry prospect, Rockhampton district, eastern Australia

The primary objective of Matthew's research project is to map the geology and alteration patterns at the Mount Cassidy porphyry prospect in the Rockhampton district, eastern Australia, from soil and rock samples to aid further mineral exploration.

Over the past year, Matthew completed fieldwork in April, focussing on mapping, and rock and soil sample collection. Hand sample description and a series of analytical techniques, such as reflected light and transmitted light petrography, SEM imaging, XRD analyses, visible near infrared (vis-NIR) and short wavelength infrared (SWIR) spectral analysis, have been employed during the study to enable detailed documentation of the alteration and mineralisation mineralogy and textures.

One of the main achievements of this project has been to explain how the effective integration of soil and rock samples, SWIR and vis-NIR data, along with regional soil geochemistry, multi-element whole-rock geochemistry, geophysics datasets and an understanding of regional geology can be used as an effective tool to rapidly define robust exploration targets in regions with poor outcrop. Matthew has also analysed key alteration minerals by LA-ICP-MS with the aim of providing vectors to the mineralisation centre.

## A TRIBUTE TO GARRY DAVIDSON



### Masters Program Co-ordinator Dr Rob Scott describes the recent Garry Davidson Symposium and related Masters short course that followed it.

This October, the biennial two-week Master of Economic Geology short course Ore Deposit Models and Exploration Strategies began with a very special event to commemorate the career contribution of our much-loved and highly respected colleague, Garry Davidson, who passed away in April 2017. Garry was remembered as a dedicated teacher and an innovative, insightful researcher who had an

insatiable curiosity and infectious passion for the earth sciences. In keeping with the objectives of the Masters short course, the Garry Davidson Symposium addressed the genesis of, and exploration for, the ore deposit types that Garry had devoted so much of his working life to characterising and understanding; namely IOCG, uranium, sediment-hosted Pb-Zn and copper, Broken Hill-type, volcanic-hosted massive sulfide and orogenic gold deposits. A total of 28 different speakers, including many of Garry's friends, colleagues, former students and collaborators, presented

talks at the symposium. It was a great success, and very well received by all 130 people who attended.

After the symposium, 28 Masters students and 18 other participants stayed on for the remaining nine days of the short course, presented by CODES staff and invited lecturers Professors Zhaoshan Chang and Noel White. Entire days were devoted to skarns, granite-related Sn-W deposits and Tasmanian ore deposits, porphyry Cu-Au-Mo deposits, high-sulfidation epithermal deposits and lithocaps, low- and intermediate-sulfidation epithermal deposits and Carlin-type gold deposits.

A highlight of the short course was a one-day fieldtrip to the Freycinet Peninsula led by David Cooke and Evan Orovan, during which participants examined spectacularly exposed features formed in the Devonian granites during the magmatic-hydrothermal transition. On the final day of the course, teaching staff handed over to the Masters students who, working in groups of three, presented a series of talks they had prepared on ore deposit types that had not previously been covered during the short course.



**Top:** The highly successful Garry Davidson Symposium (22–24 October), held at CODES, brought together many of Garry's friends, colleagues, former students and collaborators.

**Left:** David Cooke (centre) teaching Ore Deposit Models and Exploration Strategies Masters short course participants at Bluestone Bay, Freycinet, 27 October 2018.

## TAKING CENTRE STAGE



CODES PhD student Ayesha Ahmed in action at the inaugural Gordon Research Seminar on the Geochemistry of Mineral Deposits held during August in New Hampshire, USA.

**CODES staff and students played a pivotal role in both the Gordon Research Conference and the associated Gordon Research Seminar, both held recently in the USA. Ayesah Ahmed and Angela Escolme from CODES chaired the first ever Gordon Research Seminar for aspiring graduate students and post-docs.**

The inaugural Gordon Research Seminar (GRS) on the Geochemistry of Mineral Deposits was held on 4–5 August 2018 in the picturesque surroundings of Waterville Valley, New Hampshire, USA. Ayesha Ahmed, a PhD student at CODES, and Angela Escolme, a CODES postdoctoral researcher, were the seminar chairs. The event was a great success, and took place in the two days preceding the associated Gordon Research Conference (5–10 August), which was co-chaired by Professor David Cooke, Director of CODES.

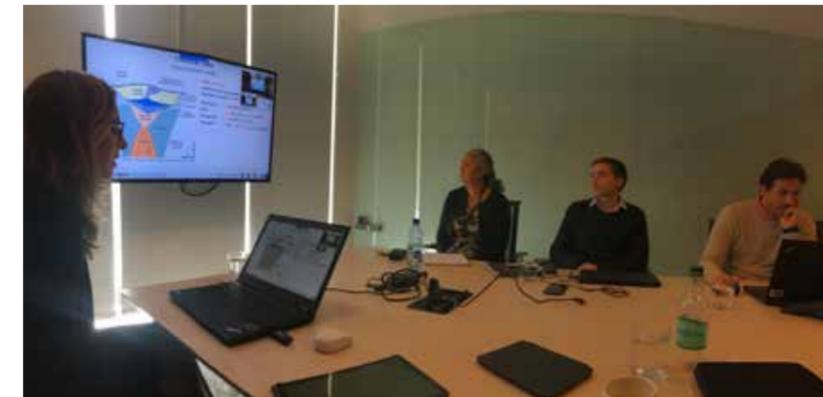
The GRS was attended by 57 people from 10 countries, and provided a unique forum for graduate students and early-career researchers to exchange new data and cutting-edge ideas with not only their peers, but industry and academic leaders. Former CODES graduate Dr Tim Ireland of First Quantum Minerals provided the opening keynote address, and probed the audience to consider how well geochemistry is currently being integrated into resource exploration. Over the course of two days, oral presentation and scientific poster topics covered by students and early-career researchers ranged from the formation of nanoparticle gold colloids in bonanza grade orogenic gold systems to the role of the subcontinental mantle lithosphere in ore-formation. At the end of the seminar, Dr Larry Meinert, editor of *Economic Geology*, provided a mentoring session on how to write a successful academic article.

The next Gordon Research Seminar will be held alongside the Gordon Research Conference on the Geochemistry of Mineral Deposits in 2020.



CODES Director Professor David Cooke (front row, centre), co-chair of the Gordon Research Conference on the Geochemistry of Mineral Deposits (6–10 August 2018), is flanked by co-chair Claire Chamberlain to his right and vice chair Sarah Gleeson to his left. They are pictured with the full complement of conference attendees at the conference venue, Waterville Valley, New Hampshire, USA. (Photo: courtesy of GRC.)

## AMIRA P1202: DIGGING DEEP TO DEVELOP COST-EFFECTIVE EXPLORATION PROGRAMS



Angela Escolme presenting on the AMIRA P1202 project to industry sponsors in Santiago, Chile, 2018.

**The AMIRA P1202 project, *Far-field and near-mine footprints – finding and defining the next generation of Tier 1 ore deposits*, commenced on 1 July 2018, following the successful completion of the AMIRA P1153 project in June 2018. The project is led by Professors David Cooke and Leonid Danyushevsky, Associate Professor Shaun Barker, Doctors Mike Baker, Lejun Zhang and Angela Escolme, and includes a team of researchers from CODES, Lakehead University, Monash University, Universidad Austral de Chile and Mineral Mapping.**

The P1202 project seeks to develop new tools that facilitate cost-effective exploration programs and resource assessments for porphyry, epithermal, skarn and other ore deposit types at the regional, district and near-mine scales. The project builds on fourteen years of cutting-edge research into the use of mineral chemistry for vectoring and fertility assessment. Researchers also seek to refine existing geochemical and geological tools for fertility assessment to enable explorers to assess whether tenements are likely to contain significant mineral resource and to ensure that deposits are discovered more quickly and at less cost.

The project has four research modules involving: green rocks (module 1), lithocaps (module 2), magmatic minerals (module 3), and the transition zone (module 4). The project currently has twelve sponsors of modules 1–3 (Anglo American, BHP, Boliden, Codelco, FMG, Freeport, Glencore, Merdeka, Newmont, Newcrest,

Rio Tinto and Teck), four of which also sponsor module 4 (BHP, FMG, Merdeka, and Newcrest). Module 4 is a new research initiative involving both near-mine exploration vectoring and geometallurgical assessments of the transition zone, where clay and mica alteration overprints early-formed potassic alteration. The research team are working closely with Corescan at Module 4 sites to optimise mineralogical characterisation of the transition zone for exploration, evaluation and mining. Kyle Eastman (CODES), Angela Rodriguez (Monash), Andrew Jedemman and Patrick Hamilton (Lakehead) and Camilla Arcos (Austral) joined Emily Smyk and Yi Sun as full-time students on the project during 2018, with several more students to join the team shortly.

A new area of research for P1202 will be a focus on the porphyry transition zone, where alteration overprints pose challenges to both explorers and miners. Researchers aim to develop new vectoring and fertility tools to assist exploration in complex and variably telescoped systems, tackling the challenges of grade additive versus grade destructive alteration. A major project theme is also the development of best practice workflows for deposit characterisation. The team will take novel approaches to integrate multiple datasets (including geochemistry and hyperspectral imagery) at multiple scales in order to extract deposit knowledge for geometallurgical applications.

Over the first four months of the project, the P1202 research team members have completed initial field campaigns at Yerington, Nevada; Christmas, Arizona; Laver and Aitik, Sweden; Tujuh Bukit, Indonesia; and Pemberton Hills and Mines Gaspé, Canada. Samples were also collected from greenstones of Vermont, USA. During this period industry workshops and planning meetings were held in the USA, Canada, Sweden, the UK, Indonesia, Australia and Chile. Further field campaigns will be conducted over the coming months.

The project will run until June 2021, and is still open for sponsorship – please contact Adele Seymon (AMIRA International) for further details: [adele.seymon@amirainternational.com](mailto:adele.seymon@amirainternational.com)



PhD student Kyle Eastman and Lejun Zhang (right) with two geologists from Merdeka Copper-Gold taking samples at the Tujuh Bukit porphyry deposit, Indonesia, during recent AMIRA P1202 fieldwork.

## VALE PROFESSOR PATRICK GERARD QUILTY AM (1939–2018)



Professor Pat Quilty will be greatly missed by the CODES family.

Associate Professor Ron Berry pays tribute to his friend and colleague Professor Pat Quilty, who passed away in August 2018.

Pat was born and grew up in country WA, and obtained his BSc (Hons) from the University of Western Australia in 1961. He came to the University of Tasmania (1962–1969) for a junior lecturer position and to produce a two-volume PhD (800 pages) on Tertiary Foraminifera. During this period, he had his first visit to Antarctica as a field palaeontologist with a party organised by the University of Wisconsin (1965/66). In 1968 he made a quick visit to Macquarie Island with Ric Varne and Dennis Gee, and they identified the island as a piece of Pliocene ocean crust. After Tasmania, Pat worked for six years

as an oil industry palaeontologist with the West Australian Petroleum Company (WAPET). This was followed by five years lecturing at Macquarie University. From 1981 to 1999, Pat was Chief Scientist for the Australian Antarctic Division and



Professor Pat Quilty at Mount Brice in Palmer Land, in his beloved Antarctica.

ANARE. This was a serious love affair with the geology of Antarctica and especially fossil whales and dolphins from the Vestfold Hills. He served as the Australian delegate to the Scientific Committee on Antarctic Research (SCAR) for many years, including a term as Vice President from 1994 to 1998.

Professor Quilty was awarded the US Antarctic Services Medal (1974), Royal Society of Tasmania Medal (1996), Membership of the Order of Australia (1997), Distinguished Alumnus of the University of Tasmania (1997) and Phillip Law Medal (2016). He had five fossil species named after him as well as the Quilty Nunataks, and Quilty Bay in the Larsemann Hills.

From 2000 to 2018, Pat spent his retirement as an Honorary Research Professor at the School of Earth Sciences, UTAS. He taught large blocks of paleontology to the undergraduates from 2000 until 2010 and supervised six PhD students. He convened the 17th Australian Geological Convention in Hobart (February 2004), and was an editor of the 2014 volume called *Geological Evolution of Tasmania*. During these retirement years he published 56 papers and was very active in outreach to the community. Mostly I remember him for his enthusiasm, for many animated discussions in the tearoom and for his willingness to always say “yes” when something needed doing. We miss him.

### WHERE ARE THEY NOW?

In the first of a series of regular interviews we take a look at how past CODES postgraduates are faring in the workplace... what they love about their work, and how they see the future shaping up in the geology space.

## PURE GEOLOGY IS WAY MORE FUN!

### SARAH JONES

Chief structural geologist at Gold Fields, based in Perth, WA

**PHD:** Geology and geochemistry of caprocks above VHMS deposits, Myra Falls, B.C. – completed November 2001

Sarah Jones, who gained her Masters from the University of Otago in 1995 and then her PhD from CODES nearly 20 years ago, has seen a lot of changes in the industry since she first began work at the Institute of Geological and Nuclear Sciences in New Zealand doing mapping.

Sarah has worked in her current role at Gold Fields, one of the world’s largest gold producers, for around two and half years. She describes herself as being “like an internal consultant”: “I go around helping out with structural geology issues at all of our sites; I do a lot of training and mentoring. But pretty much all of my job is pulling apart ore bodies and structural problems, trying to work out how they were formed”.

She is very clear that the thing she enjoys most about her work is the autonomy that she has to do geology: “I don’t have budgets, nobody answers to me, so I just get to do pure geology – it’s a purely technical role, which is awesome.”

Sarah has found that technical roles are always harder to get into, but credits her PhD from CODES as enabling her to get her subsequent role with the Geological Survey of Western Australia where she undertook regional mapping. “It was from there, and having written a couple of papers that were structurally oriented, that I started working as a consultant in 2006. I’ve been a consultant structural geologist ever since. I always wanted to be a structural geologist – I did my Masters in that and half of my [PhD] thesis was structural.”

Work practices have changed since the mid-1990s when she was out on the drilling rigs working at Darlot Gold Mine before doing her PhD: “You had

to provide your own clothes then and I used to go to St Vinnies and buy a whole lot of old clothes as no uniforms were provided.” When she began her PhD and was going underground in Canada she was virtually the only woman...but says there were always fewer women underground over there than here in Australia.

The high point of her working life happened only a few weeks ago when she was awarded the Geological Society of Australia’s A.B. Edwards Medal for the best economic geology paper in the Australian Journal of Earth Sciences for 2017 (<https://doi.org/10.1080/08120099.2017.1272492>). For Sarah, this medal was certainly worth its weight in gold.

Sarah sees the future of her line of geology as evolving gradually into one where much more work is carried out remotely, and notes that BHP already has some pits where no humans go into. “There are advantages but in some ways it worries me because we are getting further and further away from the actual rocks. We are losing our structural geology because that requires hands on rocks.” Yet, she says if she were to move back to her home country of New Zealand the advantage would be that she could work remotely by computer.

She has some words of wisdom for young geologists starting out on their

careers: “Right from the start identify what you really like doing – in geology there are so many different fields – and start doing it early. Don’t leave it for five years. Make it your passion and follow your gut instincts. If you look ahead at your boss and you don’t like what they’re doing, if you can see what their day is, it doesn’t get any better. Make those decisions early. If you want to follow a technical route – because it’s way more fun – you really have to push to follow that path.”

Sometimes Sarah has moved sideways and jumped ship at times to avoid the management roles because she’s wanted to stay in a technical role: “You get sucked in... they want to make you a boss...!”

As to life outside the workplace, Sarah emphasises that she likes a quiet life, walking her two dogs – and doing mosaics. She explains: “I used to collect china from the old goldfields when I was working on mapping – there were lots of bags of old china from the old tips and bottle dumps...my sister’s an artist and my father was an artist. I think that’s why I went into structural geology because it’s very visual. Most of the time during my working day I end up drawing cartoons!”



### CODES welcomes Chinese Government visitors

A Chinese governmental delegation of management and administrative staff from the Ministry of Natural Resources of China visited CODES on a fact-finding mission from 6–8 November. Tony Crawford, Leonid Danyushevsky, Ron Berry, Sebastien Meffre and Lejun Zhang from CODES met the delegation and gave talks on a variety of geology- and mining-related topics, with Lejun acting as interpreter.



### Farewell Martin Gal

Postdoctoral researcher in computational geophysics Martin Gal left CODES in November to work with the Institute of Mine Seismology based in Kingston, Tasmania.



Left: Chief Structural Geologist at Gold Fields, Sarah Jones. Right: Sarah examines drill core with Gold Fields colleague Exploration Geologist Darren Sparks.



Participants of the AMIRA P1153 Yerington field trip meeting: (L-R) Back row: Wolfram Schuh (Freeport), Debora Passos de Araujo (Rio Tinto), Richard Patterson (Rio Tinto), Mike Baker, Lejun Zhang, Radoslav Kehayov (Rio Tinto); Middle row: Ayesha Ahmed, Paul Agnew (Rio Tinto), Angela Afonso Rodrigues (Monash), Mario Valdez (MMG), Kyle Eastman, David Cooke, Ingemar Arellano (Freeport), Kyle Lewis (Freeport); Front: Tim Ireland (First Quantum) behind grass, Emily Smyk.

## INDUSTRY PARTNERSHIP PROGRAM

**Partner with CODES – the world leaders in minerals geoscience research and training – in 2019 to add value to your company’s research dollar.**

CODES’ collaborations with mining companies have increased substantially since our inception in 1989, during which time we have successfully built a team of world-class researchers with a wealth of knowledge and experience, and a focus on end-user driven outcomes.

Our improved package of partnership opportunities, introduced in 2017 and proving highly successful, has a variety of entry options that cater for the research and training needs of all levels of mining operations – from small to medium enterprises (SMEs) through to the major multinationals.

There are three basic options, starting at an affordable \$20k per annum for the Silver Level, and rising to \$40k and \$60k respectively for the Gold and Platinum Levels, with benefits increasing in accordance with the level of investment. In addition, partnership opportunities for SMEs can be discussed on a case-by-case basis.

Many organisations have gained great benefit from tapping into this resource, and see significant value in CODES’ ability to tailor research projects to meet their

individual requirements. Major benefits of an alliance with CODES include:

- Opportunities to focus research activities where they will have maximum impact for your organisation.
- Early-mover advantage when implementing research outcomes to enhance discovery potential and optimise existing reserves.
- One-on-one research projects tailored to company requirements.
- Access to world-class geoanalytical facilities.
- Facilitated engagement with our top geoscience graduates.
- Access to a comprehensive range of industry-focussed training courses – tailored to your requirements.

Download a copy of our Industry Partnership Program brochure at: <http://www.utas.edu.au/codes/about-us/industry-partnership-program>

or contact

Professor David Cooke  
+61 3 6226 7605 or  
D.Cooke@utas.edu.au

## CODES PHD COHORT INCREASES WITH NEW ARRIVALS

During the past five months a further five PhD students have joined CODES, bringing the total number of PhD students working with us to 47. These students continue to play a vital role in the operation of CODES by carrying out important research within our six programs and the TMVC.

PHD STUDENT	START DATE	PROGRAM	PROJECT TOPIC
 <b>Paulina Dobrowolska</b>	July 2018	Program 2 (CRC ORE), working with Mike Roach, Steve Walters and Ron Berry	‘Mineralogical and textural controls on grade-by-size fractionation in porphyry copper deposits’. Paulina has worked for geological public sector organisations in Spain and Ireland.
 <b>Kyle Eastman</b>	September 2018	TMVC, Module 4 research team, working with Angela Escolme and Lejun Zhang	‘Geological and geometallurgical characterisation of porphyry deposit alteration overprints’. Kyle recently completed a Masters at Montana Tech and brings to CODES significant experience in mineral identification, mapping and sampling.
 <b>Colin Jones</b>	November 2018	TMVC, working with Evan Orovan and David Cooke	‘An integrated study on the geology, geochronology and genesis of the Devonian granites of eastern Tasmania.’ This study will examine the relationships between compositional zoning, magma mingling, and the magmatic to hydrothermal transition.
 <b>Javier Merrill</b>	November 2018	TMVC (Module 4), and Programs 2 and 6, working with Anita Parbhakar-Fox, Angela Escolme, Michael Roach and Matt Cracknell	‘Identification and characterisation of geological domains for geometallurgical and geoenvironmental modelling’. Javier brings with him significant experience from CSIRO Chile in mining engineering, extractive metallurgy and geometallurgy.
 <b>Peter Berger</b>	November 2018	Program 1, working with Shaun Barker and David Cooke	‘Understanding and predicting hypogene and supergene footprints of Carlin-type gold deposits using a hydrochemical modelling approach’.

### New standout shirts for CODES students and staff

Staff and students from CODES will now be ‘highly visible’ whilst out and about doing their fieldwork in their new CODES branded, mine site-compliant work shirts! The cotton shirts, available in both ladies and men’s fit, have vents for hard geology in hot places, and are also personalised with an embroidered name. Look out for future mailouts if you’d like one yourself – very ‘on-trend’ in industry!



CODES PhD students (L-R) Shawn Hood, Ayesha Ahmed and Josh Phillips wearing the new custom-made CODES work shirts.



**Medal ceremony:** Medal recipient David Cooke attended the Haddon Forrester King Medal presentation with colleagues, friends and family. L-R: Ayesha Ahmed, Christopher Leslie, Ross Large, Helen Cooke, David Cooke, Emily Smyk, Angela Escolme, Joshua Phillips and Sebastien Meffre.

## HADDON FORRESTER KING MEDAL PRESENTATION

Professor David Cooke, Director of CODES, was presented with the Haddon Forrester King Medal in a ceremony at the Australian Academy of Science's Shine Dome in Canberra on 21 September 2018. The medal is awarded for life-long achievement and outstanding contribution to science. The event was attended by the Academy's Chief Executive Anna-Maria Arabia, the Director of International Programs and Awards Nancy Pritchard, family and friends of Haddon Forrester King, and other esteemed members of the Academy. Also in attendance were several staff and students from CODES, and other friends, colleagues and family members of David Cooke. The medal was presented by Emeritus Professor Jim Williams (Academy Secretary, Physical Sciences). Paul Agnew from Rio Tinto spoke on behalf of the minerals industry.

The evening's proceedings included a technical presentation by the awardee on "New advances in geochemical exploration—detecting the subtle, but giant, geochemical footprints of porphyry copper and gold deposits using mineral chemistry". As part of the award, David Cooke has also conducted a speaking tour of Australia, including presentations in Melbourne (July), Canberra (September and November), Perth, Darwin, Townsville, Parkes and Brisbane (November).



L-R: Academy Secretary, Physical Sciences, Emeritus Professor Jim Williams, with Professor David Cooke and Paul Agnew from Rio Tinto following the presentation.

## Jing on the red carpet!

CODES PhD candidate Jing Chen (fourth from left) pictured after receiving her prize for the best student talk on porphyry-skarn-epithermal deposits at the 14th National Conference on Mineral Resources of China, held in Shijiazhuang, Hebei Province, China, during October. Jing received 1,000 Chinese Yuan as her prize; she was also asked to give a keynote speech at the conference. She has recently submitted her PhD thesis, which was entitled 'The geology, mineralisation, alteration and structural evolution of Zijinshan ore field, Fujian Province, China'.



## From director to president...

Former CODES director Professor Bruce Gemmill is the 2018 President of the Society of Economic Geologists. At the SEG's annual conference in Keystone, Colorado, held in September, Bruce gave his Presidential Address entitled, 'Discovery to metals: minerals geoscience in our society'.

This presentation emphasised the need to incorporate minerals geoscience throughout the mining value chain and how important mineral resources are to our present society and into the future.

## OPEN DAY SUCCESS AGAIN!

Once again the UTAS Open Day in August proved a success with around 2,000 people visiting the Sandy Bay campus to check out what we do here. Earth Sciences and CODES staff played a big role in making the day one to remember, as you can see.



**Left:** Gold panning is always a hit at Open Day; here Adam Abersteiner and Dima Kamenetsky are showing visitors how to pan for gold.



**Right:** Rosie, our newest dinosaur addition, soaks up the attention from Open Day visitors.



The Earth Sciences/CODES T-Rex adored by fans!

## Dinosaurs galore

The 'Dinosaur Picnic' held jointly between the Royal Society of Tasmania and the Royal Tasmanian Botanical Gardens in November, featured the Earth Sciences/CODES celebrities, T-Rex and Utahraptor, and drew a huge crowd of around 5,000 people. Lesser known celebrity Emeritus Professor Ross Large led a dinosaur spotting walk and Dr Karin Orth led a walk through time. The event was part of a series leading up to the Dinosaur rEvolution exhibition, part of the celebrations for 175 years of the Royal Society of Tasmania.



WIMNet panellists (L-R): Kathy Ehrig, Shawn Hood, Margy Hawke and Penny Sinclair with moderator Hannah Couper (at podium).

## Women geologists come of age

The WIMNet event held at CODES on 24 October 2018 was highly successful with 55 people turning out to listen to the panel discussion. The panel was moderated by Hannah Couper (a former CODES Honours student). Panellists were Kathy Ehrig (BHP), Penny Sinclair (Vimy Resources), Margy Hawke (Hazina Geoscience) and Shawn Hood (TMVC PhD student). The event was sponsored by AusIMM, UTAS and the SEG Student Chapter. PhD student Ayesha Ahmed, who took the photo, said it was the best discussion she had ever been part of, and it ran way over time!

## MASTER OF ECONOMIC GEOLOGY SHORT COURSE ORES IN MAGMATIC ARCS – INDONESIA

8–19 MARCH 2019

(Pre-field trip workshop 4–6 March 2019 – optional for CODES Masters students)

Following the success of the Ores in Magmatic Arcs – Indonesia short course in 2017, CODES is again offering this highly popular two-week course for our Master of Economic Geology students and other interested industry participants.

With the growing importance of the western Pacific for exploration, mining and research, and revival of the mining and exploration industries, there is a need for relevant training on research and exploration skills in the magmatic arc environment. The only comprehensive training currently available is in the USA. To fill this gap in the western Pacific, and to address the differences in geological and environmental conditions in this region, we have designed our course on this important suite of deposits.

The course – which will visit Sumbawa, Lombok and East Java – has a strong focus on field observations and hands-on practical skills, supported by an understanding of theoretical aspects. The full spectrum of deposits in magmatic arc settings will be covered, thus addressing the need for familiarity with the diversity of mineralisation encountered in this setting. The course presenters have detailed familiarity with the deposits as both explorers and researchers, and are uniquely equipped to deliver the skills and insights needed by participants.

### COURSE PRESENTERS

**David Cooke:** Director of CODES, Director of the TMVC, and Professor of Geochemistry at CODES

**Adi Maryono:** Vice President of Exploration at J Resources, based in Indonesia, and a senior adjunct researcher at CODES

**Noel White:** a professor at Hefei University of Technology in China, and adjunct professor at CODES and at James Cook University, who has worked in industry for over 40 years

**Lejun Zhang:** Research Fellow at CODES, specialising in the application of alteration mineral chemistry

**Rachel Harrison:** an independent consultant exploration geologist, based for the past decade in Indonesia and who recently completed a PhD at CODES

**Iryanto Rompo:** a field-based geologist with more than seven years' experience exploring in the lithocap environment on the island of Lombok, Indonesia

- The pre-field workshop, which is optional for CODES Masters students, will be held at Gadjah Mada University, Yogyakarta, Indonesia.
- The field-based short course will require students to arrive in Lombok, Indonesia, on Thursday 7 March, with the course beginning the following day.

A detailed flyer covering the itinerary, costs and payment options will be available very soon on the CODES website: [www.utas.edu.au/codes](http://www.utas.edu.au/codes)

**For further information, please email:**

Dr Robert Scott,

Masters Program Co-ordinator:

[Robert.Scott@utas.edu.au](mailto:Robert.Scott@utas.edu.au)

OR

Dr Lejun Zhang:

[Lejun.Zhang@utas.edu.au](mailto:Lejun.Zhang@utas.edu.au)

