

Ore solutions



Newsletter of CODES, the ARC Centre of Excellence in Ore Deposits at the University of Tasmania

Targeted mine site research: New directions for collaborative CODES research



Site of the future Cadia East open pit. Over 18 million ounces of gold is contained within this deposit



View of the current Cadia Hill open pit



Exploration drilling in the CVO

The Cadia Valley district in central NSW is the focus of an exciting new research collaboration between CODES and industry partner Newcrest Mining Limited. Over the next four years CODES researchers will work closely with industry geologists to develop a better understanding of the rocks that host the ore bodies in the district and the processes that led to their formation. This information will facilitate the discovery of similar ore bodies in Australia and the rest of the world. Newcrest's Cadia Valley Operations (CVO) is the largest producer of copper and gold in NSW, and one of Australia's largest gold producers. The combined in situ resource of the Cadia Valley district is approximately 28 million ounces of gold and 3.8 Mt of copper.

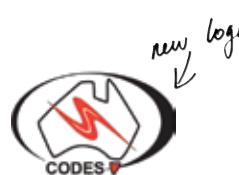
The CODES team is led by David Cooke and Ron Berry. Anthony Harris (CODES Research Fellow) will attempt to unravel the district-scale architecture and evolution of porphyry ore deposits in the Cadia Valley district, investigating aspects of structural and economic geology, volcanology, geochronology, and geochemistry. His work will benefit from the unprecedented level of access he will have to data and to the geology throughout the valley. Ana Liezl Cuison's PhD project aims to better constrain fundamental controls on porphyry emplacement at the Ridgeway mine and establish usable exploration criteria. Another PhD project will begin later this year and will document the spatial distribution of alteration-mineralisation assemblages throughout Cadia East. Other Honours and Masters research will focus on aspects of the district's geology. The studies include collaborative research projects with MDRU at the University of British Columbia.

The team has begun targeted deposit-scale research into characterisation of the Ridgeway and Ridgeway Deeps deposits. More district-scale research has included the reconstruction of the volcanic architecture. On-going research seeks to better constrain the geometry of the rocks hosting the porphyry ore deposits. Research outcomes will directly assist current exploration activities at CVO. This project has benefited from the enthusiastic support of John Holliday, Dean Fredricksen and numerous other mine and exploration geologists at Newcrest Mining Limited.

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MOVING IN ...

Ruben Chan



Ruben joined us as Database and Website Manager at the beginning of June 2006. He graduated from UTAS with a BComp in 2003 and gained employment developing web-based database applications for private industry. Ruben is currently developing a data repository at CODES in conjunction with Leonid

Danushhevsky to provide researchers with data management tools.

Paul Davidson



CODES Research Fellow, Paul Davidson, is further investigating a number of problems that emerged from his recent PhD project on the metal and volatile budgets of felsic magmas. The research involves a melt inclusion study of rhyolitic lavas from Okataina in the Taupo Volcanic Zone, in the North Island of New Zealand, and is part of Project F1.3 on felsic magmas and their roles in formation of a variety of hydrothermal ore deposits. This project brings together CODES petrologists, hydrothermal geochemists, melt inclusion specialists and volcanologists. Paul is one of a growing number of CODES researchers making use of the special information available from melt inclusions. In this project, he will shed light not only on the character of metal-bearing aqueous fluids, but also on the interplay between volatile evolution and eruption styles.

Mark Duffett



Mark Duffett has (re-)joined CODES as a Research Fellow in regional geophysics and tectonics. In addition to some geophysics teaching, he will be working on geophysical interpretation and modelling aspects of projects in mineralised regions of Tasmania, mainland Australia and Africa. Since completing his PhD at CODES, Mark has been at Charles Darwin University in Darwin (three years) and most recently with the Northern Territory Geological Survey in Alice Springs (five years).

Grant Garven



Professor Grant Garven, a hydrogeologist from Johns Hopkins University has returned to spend his three-month summer break at CODES, during which time he will write some papers and contribute to an ongoing collaboration on sedimentary-hosted ores with Ross Large and Stuart Bull. Grant has been collaborating and visiting CODES since 1998. At Johns Hopkins, he employs former CODES student Dr Christian Schardt, who is modelling submarine hydrothermal flow systems in the Red Sea Rift, a modern analogue for SEDEX type ores in ancient rift basins.

Anisa Gofrany



Anisa (PA to the Director) is with us until the end of 2006, while Katrina Keep is on maternity leave.

Julie Hunt



Julie Hunt moved from the Yukon Geological Survey to join CODES as a postdoctoral fellow at the beginning of May. She is carrying out research for the Geometallurgical Mapping and Mine Modelling (GeM^{III}) project which is examining the interface between ore petrology and mineral beneficiation. This program will include a focus on how to better document the physical and chemical characterisation of ore bodies with an aim to optimising mine planning and performance.

Dan Matthews



During his five-month stay as a Visiting Research Fellow at CODES, Dan was working with Bruce Gemmell on a pilot study of the shale and pyrite geochemistry throughout the Que River Shale above the Hellyer VHMS deposit (Tasmania). The aim of this project is to develop vectors to sites of hydrothermal discharge and VHMS mineralisation for use by explorationists. This project is being undertaken with Mark Hannington (University of Ottawa) and Jan Peter (Geological Survey of Canada).

Andrew McNeill



Andrew McNeill joined us in early May as a Senior Research Fellow. He moved from his former position as Senior Exploration Geologist, Rosebery, to take up this position, which will keep him busy for the next three years. Andrew's research will follow on from his PhD work, using melt inclusions to work out the origin of magmatic nickel deposits and develop models to be used for exploration. He will also work on Tasmanian projects, including investigating aspects of the Rosebery VHMS deposits to help with exploration in the area.

Taofa Zhou



Professor Zhou is from the Hefei University of Technology, China. He is visiting CODES until the end of 2006, working with Dave Cooke on skarns, porphyries, and other types of hydrothermal deposits.

Welcome to new students

Since our last newsletter was produced, CODES has welcomed the following new PhD and Honours students.

HONOURS STUDENTS

Dan MacIntyre: The Hollway Prospect; stratigraphy, regional correlations, alteration and mineralisation (western Tasmania)

Wijnand van Eijndthoven: Unravelling the southern extent and history of the Cambrian Rosebery Fault, western Tasmania

Richard Mazurek: GIS application to landslip prediction around major montane roadage infrastructure

Dave Finn: Late stage mineralised faults in the Cadia district: their geological and exploration significance

Alexandra Lintner: Aspects of the Henty gold deposit, Mount Read Volcanics, western Tasmania

Lachlan Brown: Geophysical investigation of tailings system integrity, Mount Lyell mine, Tasmania

PhD STUDENTS

Jacqueline Blackwell: Characteristics and origins of breccias in an alkalic epithermal gold deposit: Ladolam, Lihir Island, Papua New Guinea



Natalee Bonnici

Textural and process mineralogical characterisation of Cu-Au systems (GEM^{III})



Leizl Cuson

Geology and genesis of the Ridgeway porphyry Au-Cu deposit, NSW

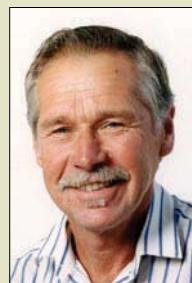


Quang Sang Dinh

Geochronology and geological evolution of the Khontum massif, Vietnam

MOVING ON ...

*'And I somehow rather fancy that I'd like to change with Clancy,
Like to take a turn at droving where the seasons come and go,
While he faced the round eternal of the cashbook and the journal -
But I doubt he'd suit the office, Clancy, of The Overflow.'*

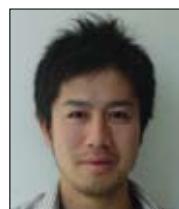


Wally Herrmann has left us with this evocative fragment, and ventured back out into the wild, suddenly wide, world of mineral exploration. For almost nine years he hath toiled at CODES in mineral exploration-related and industry-linked research projects covering a wide range of ore deposit types including VHMS, porphyry copper-gold, epithermal gold-silver and Archean lode-gold, under at least three of the five CODES programs. His fear of long-service leave, and the thrill of mysterious exploration challenges, outweighs his sadness at parting. He plans to fill-in the next few months, of short Tasmanian days, geologically contracting in some warmer northern location. Then he intends to take the summer off with Danielle, to re-habilitate their derelict house and gardens at Forth in NW Tasmania and, no doubt, to do a bit of fly-fishing, bush walking and forest research. Beyond that, their destiny is unforeseen and unknown, in the hands of providence, as it is for us all.



Abhisit Salam

Integrated geochemical and metallogenetic study of the Chatree area, Phetchabun Province, Central Thailand



Takayuki Manaka

Epithermal low-sulphidation system at Ban Houyxai and LCT deposits, Laos PDR



Heidi Pass

Chemical and mineralogical zonation patterns in alkalic mineral systems – Implications for ore genesis and mineral exploration



Patrick Sack

Geology and geochemistry of the Footwall Phyllite, Greens Creek VHMS deposit, Alaska: Implications for ore genesis and exploration

AMIRA P843 GeM^{III} project forges ahead with new logging technology

The AMIRA P843 GeM^{III} project (Geometallurgical Mapping and Mine Modelling) involves unprecedented collaboration between world-class geological, mineral processing and mine optimisation research groups at CODES, the Julius Kruttschnitt Mineral Research Centre (JKMRC) at the University of Queensland, and the WH Bryan Mining Geology Research Centre (BRC) also at the University of Queensland.

As reported in previous newsletters, AMIRA P843 GeM is a major new cross-discipline research project designed to define and integrate the fundamental relationships between geological characterisation of metalliferous mineral deposits and their quantified impact on mineral processing and recovery. The four-year project has received over AU\$6 million in cash funding support from 13 of the world's largest resource companies and federal funding through the CODES ARC Centre of Excellence, and currently involves a collaborative team of over 20 researchers.

A key aspect of the project is the use of technology drivers to facilitate geometallurgical integration. Over \$1.3 million has been invested to date in new equipment to support P843 in addition to the significant testing and analytical facilities already available. One area clearly identified by industry as requiring technology investment is core logging, particularly during feasibility assessment. Current largely visual-based core logging can be subjective, is experienced-based and often suffers from poor QA/QC compared to many other minesite data types. Producing more quantified, systematic and reproducible core-scale data that can be directly correlated with attributes related to processing performance is a prime objective of the AMIRA P843 GeM^{III} project.

To address this challenge the GeM^{III} project has recently acquired an automated multi-sensor core logger (MSCL) manufactured by GEOTEK in England. The MSCL is designed to automatically log drill core feed using a linear array of mainly petrophysical sensors. This is a logical but novel derivative of down-hole logging whereby instead of placing a probe in the rock, the rock is brought to the probe. Unlike typical off-hole and cross-hole exploration applications, the MSCL approach is focussed on defining core-scale attributes that can be correlated with assays and physical testing from the same core material. An emphasis on core logging also allows use of the extensive archived core libraries available at most mine sites, which can often be related to historical processing performance data.

GEOTEK has an oceanography background, with over 80 MSCL logging systems used around the world primarily for ocean drilling (ODP) research, climatology (ice core) and petroleum applications. Although based on mature technology

this is the first system that will be used in the metalliferous mining industry. This requires significant adaptation and development of modified operating protocols. The GeM^{III} MSCL logger is housed in a fully containerised facility and is currently undertaking its first site deployment at Newcrest's Cadia Valley Operation in New South Wales.

The current sensor configuration includes contact and non-contact magnetic susceptibility, non-contact resistivity, gamma attenuation derived density, p-wave velocity and a new dual camera high-resolution imaging system. Petrophysical attributes are being used to calculate derived parameters of direct processing significance (e.g. p-wave velocity and density as a function of strength), or as a suite of proxies for comparative physical change mapping linked to processing domain definition. A major program of new sensor development for the MSCL is also underway, with significant progress already made on core-scale hardness testing. Given the significant logistical requirements of providing a linear core feed, the mantra is to log once, collect many. Sampling spacing and use of individual sensors or sensor arrays are user-defined features likely to be customised for individual deposit styles.

The dual-camera system provides a novel imaging approach that digitally 'unrolls' a 200° view of whole core allowing semi-automated image analysis and rapid orientation of planar features such as joints and fractures, mainly for geotechnical applications. The high-resolution images (40 micron) are also being used to develop 'machine vision' approaches for comparative classification of lithologies and textural types.

Associate Professor Steve Walters, who is leading the AMIRA P843 GeM^{III} project, reports that the new MSCL is a key enabling technology that can radically change the current industry approach to systematic core logging of ore deposits. 'We see the MSCL as providing continuous core-scale context for all our subsequent sampling and physical testing for more quantified processing attributes', says Steve, 'the key is integration of these inputs across all the research activities within GeM.'

There is also obvious potential for the application of MSCL outputs in more regional exploration. The high-quality petrophysical data can be used to construct and constrain geophysical inversion models becoming widely used in exploration, particularly under cover. Negotiations are underway with state geological surveys to periodically base the logger at selected core libraries to provide this crucial information.

For more information contact Steve Walters <stevew@utas.edu.au>.



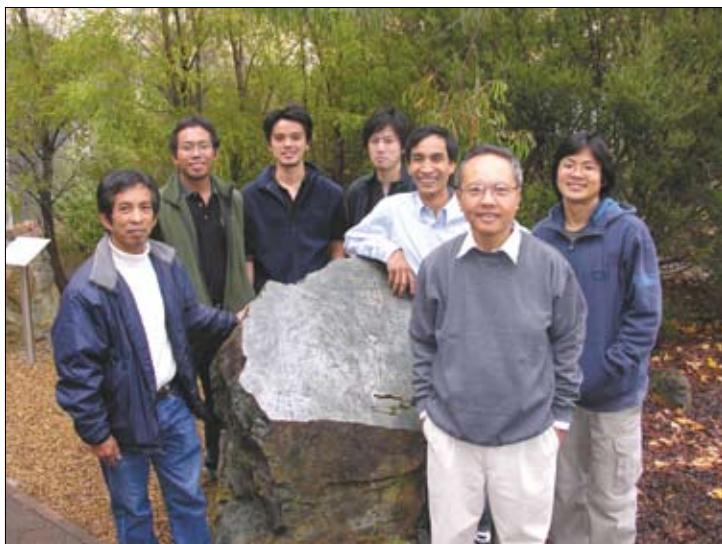
Close-up of dual camera imaging system also showing typical resolution for a piece of half core on left.



Peter Høj and his team visit CODES. During a recent institutional visit, members of the ARC Executive were given an update on CODES activities: (L to R) Steve Walters (CODES); Dr Mandy Thomas, ARC Executive Director Humanities and Creative Arts; Ross Large (CODES); Professor Erich Weigold, former ARC Executive Director Physics, Chemistry and Geoscience [now Pro Vice-Chancellor (Research), La Trobe University]; Bruce Gemmell (CODES); ARC Chief Executive Officer Professor Peter Høj; Ms Mary Burton, ARC Director Program Management; Ms Penny Knox, ARC Director Strategic Management; Jocelyn McPhie (CODES); David Cooke (CODES) and Dima Kamenetsky (CODES).

Team Asia and Team Canada take on CODES

The SE Asian and Canadian students at CODES light-heartedly refer to themselves as Team Asia and Team Canada. Both teams are pictured here with 'coaches' Khin Zaw and Bruce Gemmell.



Team Asia (L to R): Abhisit Salam, Bronto Sutopo, Teera Kamvong, Takayuki



Team Canada (L to R): Julie Hunt, Bruce Gemmell, Heidi Pass, Cari Deyell, and Patrick Sack and Dan Matthews (both seated)

Unravelling the hydrothermal history of Macquarie Island ocean crust by integrating magnetic and field-based observations: a task for a Queenslander stranded in the Southern Ocean

STOP PRESS: “We currently have berths for two scientists to winter on Macquarie Island, logically supported by the Australian Antarctic Division, leaving on voyage 5, 17 March 2006, and returning approximately one year later. These berths are meant to support a PhD or MSc student and a second unpaid field support person. However, two students working together would also be feasible, including one in a completely different discipline (for instance, Antarctic biology, etc.). One working alone, but securing help from the main base staff, is also feasible. We need to have definite commitments for these berths by 30 January 2006.”

Paul Ferguson answered this advertisement in *The Australian Geologist* in January of this year, and now finds himself in the sub-Antarctic, surrounded by fierce winds and uplifted ocean floor, undertaking Masters level fieldwork. The island environment, though beautiful and exhilarating, can be very harsh, often with high winds, and high wind chill factors, with snow and ice common in the winter months. Paul is working in a small close-knit community of wintering scientists and Australian Antarctic Division support staff. They are able to help out as companions in more remote spots when their other duties permit. All of the fieldwork is done on foot, carrying a heavy pack. There is a main base, but most fieldwork is being undertaken from satellite field huts scattered around the coast. Access to some areas in the far south is restricted by wildlife permits, but the winter timing of his fieldwork allows Paul to enter many of these areas.

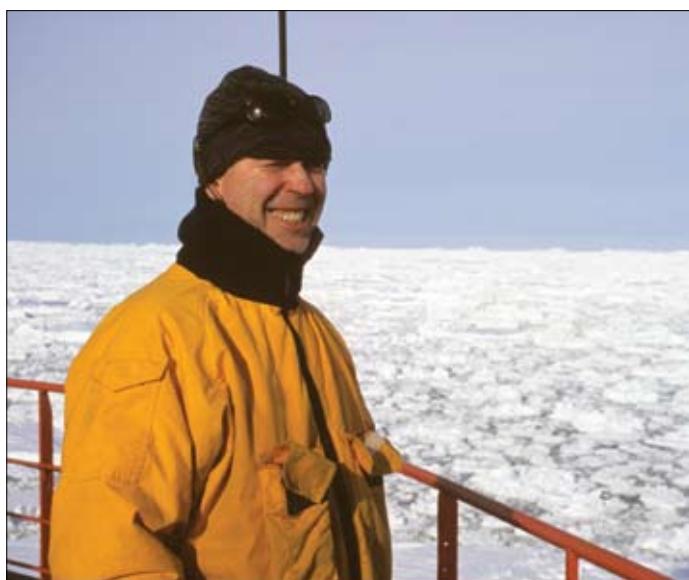
The project itself is a follow-up to a detailed ground magnetic survey that was undertaken in 2004–05 by Bronwyn Kimber and Andy Wakefield, with preliminary work by Kate Godber, under the supervision of Garry Davidson and Michael Roach (both tucked up nice and warm in Hobart). This survey revealed many new and interesting features about Macquarie Island’s geology that need to be better understood, with the potential for some exciting new insights into Earth processes. An offshore airborne magnetic survey was undertaken in collaboration with the USGS (Carol Finn) and Duke University (Jeff Karson) during the 2006 April resupply. Through the superb logistical support of AAD and contractor Helicopter Resources, this survey (under the supervision of the indefatigable Bronwyn and offside Emma Watt) collected 18 hours of new data from up to 20 km away from the island. These data will be integrated with the ground magnetic data to place the island magnetics in a wider perspective.

The main aim of Paul’s project is to ground truth the geological information stored in the magnetics data, particularly focussing on the interpretation of magnetic lows. Our previous work has showed substantial magnetic depletion coinciding with NW hydrothermally altered faults, but how extensive is this type of response through the ocean crust? Does the magnetic data contain an integrated record of magnetite-destructive fluid interaction? Steve Lewis’ recently completed PhD thesis (January

2006) on the origin of hydrothermal products (sulfides, quartz, metals) in faults on the island provides another excellent starting point for further work.

If you would like to learn more about this subject, Paul would be glad to hear from you on the island <rockdoctor@ozemail.com.au>.

Garry can supply details about the wider project <Garry.Davidson@utas.edu.au>.



Paul Ferguson enjoys the light sea air en route to Macquarie Island, V5



Katrina Keep, June Pongratz and friend at the CODES booth —

AusIMM student chapter

Third-year geology students were sponsored by CODES to attend the AusIMM New Leaders Conference in Kalgoorlie in April this year.

Laura Frankcombe, president of the UTAS AusIMM Student Chapter, said, 'The New Leaders Conference was a great success. It provided us with knowledge on how to plan for the future of our careers, presented various options available in the form of graduate programs, and described new technologies that are being implemented and their relevant success. It also provided insight into other professions in the minerals industry, such as geotechnical engineering, mining engineering and metallurgy.'

Ian Woolward was another of the UTAS students who attended the conference and he described some of the highlights: 'Approximately 200 delegates attended the conference. These comprised students of mining engineering, metallurgy and geology, and employees from the mining industry. The theme of the conference was "Riding the boom: the mineral industry into tomorrow". Talk topics were divided into two categories: technical topics of recent and projected advances in mining industry related technology, and personal and career development issues.'

Mine visits to the St Ives Gold Mine and the Super Pit were organised for the students and, for many, this was their first exposure to mining operations. Throughout the two-day conference students were encouraged to network at every opportunity. Ian said, 'The repeated process of introducing



AusIMM New Leaders: L to R back row – Shanara Smith, Jodi Fox, Ian Woolward, Jim Yaxley, Kent Wighton, Chris Booth Alyce Brownlie, Richard Taylor, Laura Frankcombe, John Ateny; front – Cameron Hamilton, Meg Humphries

ourselves, shaking hands, and exchanging information was both good practice in itself and productive; among the exchange of business cards was one firm job offer (albeit not for geology) and the forging of some excellent contacts.'

'CODES sponsorship was gratefully appreciated and everyone came away from the conference with greater knowledge and confidence about the industry', said Laura.

GEOINDO Conference

Dr Khin Zaw spent time with past and present CODES geologists from Thailand when he attended the International Conference on Geology, Geotechnology and Mineral Resources of Indochina (GEOINDO 2005) and chaired the Mineral Resource Section. The conference ran from 28–30 November 2005 and aimed to update the regional geologists, geotechnologists and engineers on recent findings in geology, engineering geology, and other related fields. Conference themes included Geology and Mineral Resources, Geotechnical Engineering and Geomechanics, Petroleum and Energy Resources, Groundwater Resources, Geophysics and Environmental Geology, Tectonics and Earthquake, and Geohazards.

A highlight of Zaw's trip was the opportunity to create links and initiate further collaborative research into the Shan-Thai Terrane with geologists and researchers from SE Asia. Zaw said, 'The SE Asian region has attracted great interest from international mining and exploration companies. The region is emerging as one of the major exploration challenges remaining in the world.'



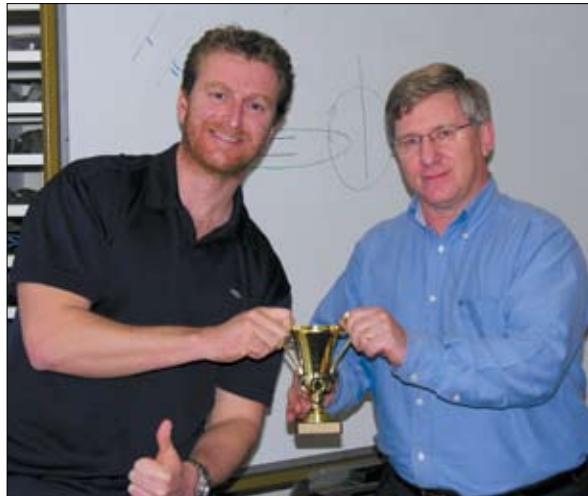
The Thailand connection: Past and present Thai geologists from CODES and SES with Khin Zaw at International Conference on Geology, Geotechnology and Mineral Resources of Indochina (GEOINDO 2005), Khon Kaen, Thailand. From left to right, Phisit Limtrakun (Lecturer, Chiang Mai University, UTAS/SES PhD 2003), Pol Chaodumrong (Director, Department of Mineral Resources, Bangkok, UTAS/SES PhD 1992), Khin Zaw, Weerapan Srichan (SES PhD student) and Teera Kanvong (CODES PhD student)

Brownfields Exploration

CODES Masters course ‘Brownfields Exploration’ has been developed to cover a wide range of topics and exploration strategies designed to facilitate exploration in the data-rich environments close to mining operations.

A new feature of the course was two sessions led by eminent industry speakers. In the first session, two contrasting philosophies of brownfields exploration were presented by Ed Eshuys (St Barbara Limited) and Greg Hall (Barrick). The second session featured successful case studies of brownfields exploration: the Goldcorp Challenge by Vic Wall (Taylor Wall and Associates), the Sepon in Laos by Stuart Smith (Oxiana), Rosebery by Andrew McNeill (Zinifex), and Pajingo, Indonesia, by Craig Miller (Newmont).

A two-day data compilation and targeting exercise based on 3D integration of open-file data from 50 years of exploration in the Mount Read Volcanic Belt of western Tasmania was the culmination of this year’s course. Students selected which datasets they felt most relevant and planned a limited drilling



Steve Walters (right) presenting the mighty CODES West Coast Challenge ‘gold’ cup to Colin Carter of Copper Mines of Tasmania

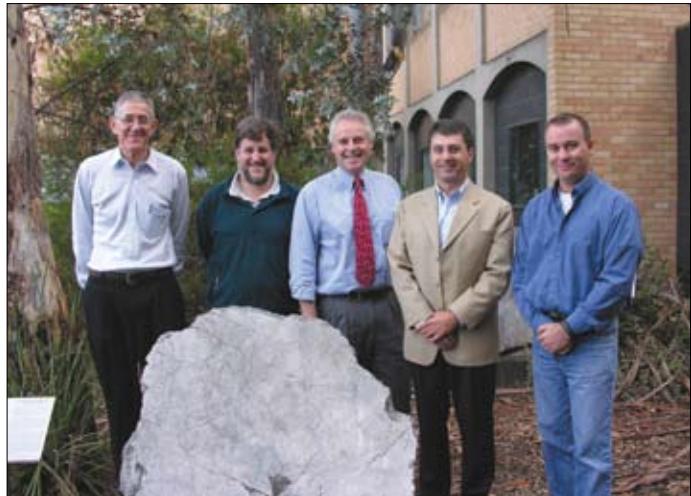
program to test for VHMS-style mineralisation in the Que River–Hellyer area. The large amount of available historical data, use of geophysical inversion models for detailed magnetics and gravity, and ability to visualise and integrate the data in 3D using FracSIS software, presented a genuine challenge. Students were then required to prepare a Powerpoint® presentation and present their exploration programs to a panel of judges.

The winner of the ‘West Coast Challenge’ was Colin Carter from Copper Mines of Tasmania (see photo below).

CODES acknowledges Intec for permission to use data from Hellyer, software support provided by Fractal Technologies and Leapfrog, and use of data compilations from the Tasmanian 3D Geological Model produced by Mineral Resources Tasmania.

Many thanks to GoldCorp for making the entire mine and exploration database of the Red Lake Mine available for the students to use in exercises.

The Brownfields Exploration course will be run again in 2008.



Presenters at the recent Brownfields short course (L to R): Vic Wall (Taylor Wall and Associates), Andrew McNeill (Zinifex), Bruce Gemmell,

Visiting Russian scientists

Last summer CODES hosted several visiting scientists from the Russian Federation, all of whom welcomed the opportunity to escape a Russian winter that was one of the coldest on record.

Professor Valery Maslennikov, from the Institute of Mineralogy of the Ural Branch of the Russian Academy of Sciences, was the first Visiting Fellow at our new Centre of Excellence. He arrived in mid-November to spend six months conducting research on the geochemistry of sulphide minerals from a variety of ore deposit types, including active black smokers, ancient black smokers, VHMS deposits and sedimentary-hosted gold deposits. Valery’s project, in cooperation with Ross Large and Rob Scott, was largely based on use of the CODES LA-ICPMS facility.

Associate Professor Pavel Plechov, from the Moscow State University, visited CODES for three months from November

to January. His research interests include the geochemistry and petrology of modern subduction-related magmatism. While at CODES, Pavel cooperated with CODES researchers from the Location Program involved in project F1.2: Modern volcanism in the SW Pacific. The main purpose of his visit was to continue cooperation with Leonid Danyushevsky on the modelling of magmatic processes. A new version of the modelling software *Petrolog* was developed during Pavel’s visit.

Professor Alexei Ariskin, from the Vernadsky Institute of Geochemistry, Russian Academy of Sciences, visited CODES in January for three weeks. Alexei specialises in modelling the crystallisation of mafic magmas, and intrusives in particular, and is involved in the development of a new CODES project aimed at studies of magmatic nickel deposits.

Four weddings ...

Wedding bells have been ringing around CODES. The surprise wedding of the year was that of Kate Bull (PhD 2006) and Terry Honeysett (dentist extraordinaire), who were married in Fairbanks, Alaska, last December. A beautiful southern Tasmanian summer's day was the setting for the wedding of Ben Jones (PhD student) and Heather McCallum at Peppermint Bay in January. Andrew Wurst (PhD 2004) and Cari Deyell (Postdoctoral Research Fellow) were married on Heron Island in Queensland in February. To complete the quartet, in March, Cathryn Gifkins (PhD 2001 and Graduate Research Fellow) and Michael Buchanan (M.Econ.Geol. 2002) were married in Castlemaine, Victoria. After a short honeymoon in Tasmania they returned to Vancouver, Canada.



Cari and Andrew



Heather and Ben



Cathryn and Michael



Kate and Terry

Altered Volcanic Rocks

A guide to description and interpretation

Cathryn Gifkins, Walter Herrmann and Ross Large

A follow-up to the highly successful "Volcanic Textures"

Altered volcanic rocks is designed to be a practical guide for systematically describing and interpreting altered volcanic rocks, and determining their significance in terms of mineral deposit prospectivity. It discusses the processes and products of the common alteration styles in submarine volcanic settings, including diagenetic alteration, burial metamorphism, hydrothermal alteration and mineralisation, and intrusion-related alteration. It takes a multi-disciplinary approach combining alteration mineralogy, textures and intensity with lithogeochemistry to constrain the characteristics of different alteration styles. To emphasize the ore deposit context, the book includes a major chapter that uses innovative illustrated data sheets to describe the main alteration facies or zones associated with a variety of volcanic-hosted massive sulfide (VHMS) deposits. The final chapter describes and presents examples of how altered rocks and their characteristics may be applied to exploration for volcanic-hosted deposits.

The book contains 275 pages: 127 figures and 66 full-page alteration data sheets, which include 274 colour photographs that illustrate the textural and mineralogical characteristics of different alteration intensities, facies and styles.

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(plus postage and packing)

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"Volcanic Textures" AND
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ZINC BIG



Century

During the last twelve months, Peter McGoldrick from CODES has had the opportunity to visit the world's two biggest zinc mines, the Zinifex Century mine in tropical northwest Queensland and the Teck Cominco Red Dog operation in the Alaskan arctic.

Red Dog mine is the world's largest producer of zinc concentrate with more than 3 million tonnes of ore milled in 2005 in order to produce nearly 550,000 tonnes zinc in concentrate. Century is a close second, mining approximately 5 million tonnes of ore each year which, in 2003, yielded 520,000 tonnes of zinc in concentrate (information from company web sites).

Although, the geographical setting of the two deposits could not be more different, there are many geological similarities that allow both deposits to be grouped into the family of sediment-hosted base metal deposits. These deposits form from large hydrothermal systems that operate from time to time during the life of sedimentary basins. Although a contentious point with

some Australian geologists, many of these deposits probably formed at, or near, the sediment-water interface, and hence are termed SEDEX (sedimentary-exhalative) by many people. Importantly, the enormous size of some of these Zn deposits implies that large volumes of spent ore fluid would ultimately end up in the ocean during formation of the ores.

The fate of these spent ore fluids, their effect on local and ocean-scale water column chemistry and how this might influence the scale and nature of halos to SEDEX deposits is the focus of a CODES Program 1 research project . The research will use sulfur isotope measurements made on trace amounts of sulfate found in most carbonate-bearing sedimentary rocks to develop seawater sulfur isotope curves for northern Australian Proterozoic sequences that host zinc ores. The work is a collaboration between Peter McGoldrick and Prof. Tim Lyons from University of California-Riverside. For more information contact Peter McGoldrick <p.mcgoldrick@utas.edu.au>.



Red Dog

A NEW CHAPTER FOR THE SEG AT UTAS

After a sluggish start, leadership of the SEG student chapter at UTAS has settled down. Joint presidents Tim and Heidi are ready to go, Tim having recovered from field work, and Heidi having finally made it back from the hairdresser. The executive decided that the year was too busy already to organise a field trip, and so initiated a series of social and professional events to compensate. This includes a series of half-day workshops on elements of economic geology geared towards exploration, and a series of social outings.

The first of the workshops was presented by Dr Neville Alley, Executive Director of diversified explorer Monax Mining Ltd. Neville took us through some statistics about uranium supply and demand – such as that the Chinese government has reportedly determined to double their nuclear energy production by 2020. To achieve this they'll have to build two new nuclear power plants each year between now and then. In general, uranium production has been falling worldwide and demand has been increasing, and the time is nigh for Australia – host to more than 35 per cent of the world's uranium reserves – to make up its mind. Up there with water resource management, it's another 'debate we had to have'.

Rollfront-style mineralisation – formed when oxidised, uraniferous groundwaters react with reduced sedimentary lithologies in their host aquifers – are a notoriously difficult exploration target, but parts of western South Australia have all the ingredients. Participants in this workshop were asked to use the SA government's online geological database to define an area of exploration potential, taking into account the corporate, social, and environmental aspects of how that exploration might unfold.

More recently, Mitch Mihalynuk and Jim Logan of the British Columbia (Canada) Geological Survey dropped in to discuss their pet projects: the tectonic evolution and porphyry metallogeny of the western Canadian cordillera. Mitch produced line after line of convincing evidence for an almost unbelievable oroclinal accretion history for the prospective accreted terranes of BC, and Jim elaborated on the unusual petrogenesis of the highly unusual magmatic rocks associated with the BC porphyry systems.

In August we'll be welcoming Trevor Ireland, Managing Director of Australasia Gold Ltd, to take us through some of the economic considerations surrounding exploration and corporate strategies that underpin our profession.

Our next event is a brewery tour and beer tasting at Hobart's Cascade Brewery on Friday 21 July. Other events are advertised around the department, so keep an eye out. Drop me an email and get involved: <tireland@utas.edu.au>. **Tim Ireland**

Ore Deposit Models and Exploration Strategies

12–24 November 2006

Ore Deposit Models and Exploration Strategies is an up-to-date synopsis of ore-deposit types and their characteristics. Important features which relate to their genesis and exploration will be discussed and exploration models will be presented for each style. Deposit styles covered include VHMS, Broken Hill type, Proterozoic Cu-Au, porphyry Cu-Mo-Au, orogenic gold, sediment hosted massive sulfides, epithermal Au-Ag, sedimentary Zn and Cu, and magmatic Ni. Course Leaders are Australian and international experts on each deposit style.

PROGRAM

DAYS 1–3

• ORES IN SEDIMENTS WORKSHOP – for details see back page of this newsletter, and *register at* <www.codes.utas.edu.au>

DAY 4

Sediment-hosted Zn-Pb-Ag deposits: Peter McGoldrick, Stuart Bull, Ross Large

DAY 5

Volcanic-hosted massive sulfide deposits (Ross Large, Bruce Gemmell)

DAY 6

Broken Hill-type deposits (Steve Walters, Garry Davidson, Ross Large)

Week 2: 20–24 November

DAY 7

Fe-oxide Cu-Au deposits (Garry Davidson, Murray Hitzman, Julie Hunt)

DAY 8

Orogenic Au deposits (to be advised)

DAY 9

Magmatic Ni-sulfides (to be advised)

DAY 10

Porphyry and skarn deposits (Noel White, David Cooke, Anthony Harris, Zhaoshan Chang)

DAY 11

Epithermal Au deposits (Noel White, Bruce Gemmell, David Cooke)

COST

Days 1–3: Ores in Sediments Workshop

early bird registration	\$1350*	(students \$800)**
after 1 October 2006	\$1500	(students \$1000)

REGISTRATION AND PAYMENT MUST BE MADE VIA CODES WEBSITE

Days 4–11: Ore Deposit Models and Exploration Strategies shortcourse

Days 4–11 inclusive	\$3000
Individual days	\$400 per day

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Ores in Sediments: New Directions, New Developments

A workshop for researchers and explorers

12–14 November 2006

CODES, ARC Centre of Excellence in Ore Deposits
to be held at Wrest Point Convention Centre, Hobart, Australia

This year's CODES Ore Deposit Models and Exploration Strategies Masters Short Course will commence with a three-day symposium that will cover processes involved in ore-formation in sedimentary basins and present exciting new ideas about the origin of several important styles of basin-hosted deposits.

The symposium is open to all, and will address fundamental questions such as what causes local enrichment of metals in sedimentary basins, whether different metals get concentrated at different times during basin evolution, or is there a continuum of processes operating during basin evolution? Key deposits and mineralised areas will be described. How understanding processes can help develop practical exploration guidelines will be emphasised.

The following deposit types will be discussed:

- U deposits (Australian and Canadian examples)
- Cu (the African Copperbelt)
- Zn-Pb (Australia, Canada and China)
- Au (Carlin and Sukhoi Log)
- Ni-Mo-PGE (carbonaceous shales from China and Canada)

Speakers include: Kurt Kyser (Queens University), Ron Matthews (Cameco), Paul Polito (Anglo American Exploration-Australia), Murray Hitzman (Colorado School of Mines), David Rickard (University of Cardiff), Poul Emsbo (USGS), Ray Coveney (UMKC), David Selley, Ross Large, Stuart Bull, Rob Scott, Peter McGoldrick (CODES).

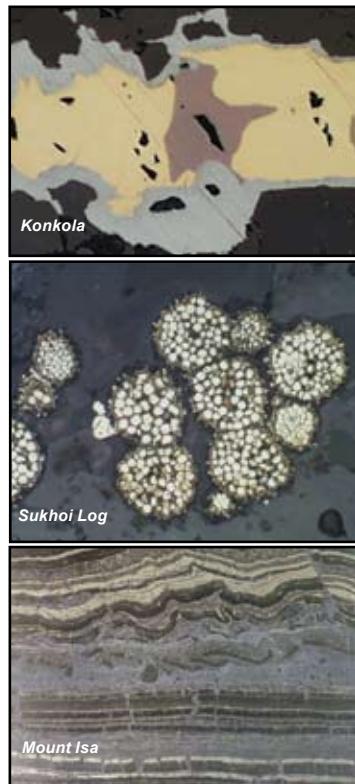
The meeting will commence with a general paper describing ore-forming processes in sedimentary basins (Kyser), and conclude with an overview and synthesis (Hitzman). All presentations will be by invited speakers, and ample time will be set aside for discussion.

Registration fee: Early bird registration \$1350* (students \$800)
after 1 October 2006 \$1500 (students \$1000)

* includes GST

For more information contact: PMcGoldrick@utas.edu.au

Registration: www.codes.utas.edu.au



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Australian Government
Australian Research Council

Ore Solutions banner: Multi-generational low-sulfidation epithermal veining, Favona Au-Ag deposit, Waibi district, New Zealand



It's not all science at CODES — Alexei Ariskin, from the Russian Academy of Sciences, took time out while in Australia to perfect his cover drive

another Pongratz Production 2006