

Congo project reaches successful climax



Dr Rob Scott (centre, with backpack) unravelling the structural history of the Lumwana copper deposit for local geologists.

The final sponsors' meeting held in the Democratic Republic of Congo and Zambia during October marked the climax of the successful P3.L3 project, entitled *Origin and Setting of Congolese-type Copper Deposits*.

Attended by over 100 participants, the program was one of the largest geological conventions ever to be held in central Africa. During a week-long series of technical and field-based events,

delegates heard that over its four-year time span the project had achieved its primary objectives of: a) developing holistic models for the structural, sedimentological, and hydrological evolution of the Katangan Basin; and, b) developing pragmatic exploration tools for sediment-hosted Cu ores, applicable in central Africa and similar geological environments worldwide.

One of the project's major successes was the resolution of macro-scale basin architecture, which has made a significant contribution to the understanding of the

geology of the Central African Copperbelt. Other outcomes include the discovery of rare earth patterns that show great potential to be developed into highly effective exploration tools

The Technicalities

To achieve this success, the research team applied a multidisciplinary approach, integrating regional isopach mapping, balanced cross-section construction, gravity modelling, zircon provenance analysis, sequence stratigraphic methods, and thermo-barometric modelling
continued page 2

in this issue:

Smithsonian collaboration	4	Conclusive evidence for hot mantle theory	8
GeM ^{III} set to expand	6	Three new professors	13
Vital analysis at Australian Synchrotron	7		

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from page 1

of metamorphic assemblages. The results demonstrate that gross extensional architecture of the basin was maintained throughout Lufilian inversion, and that modification via high magnitude thrusting during orogenic episodes was considerably less pronounced than previously thought – at least within the principal ore-bearing parts of the basin. Two tectono-stratigraphic entities were originally separated by a thick sequence of rift-maximum salt, the latter now withdrawn or dissolved. During later stages of accommodation development, the basin became ubiquitously decoupled at the level of salt, leading to accumulation of upper stratigraphic levels within a compartmentalised array of sub-basins. Much of the complex deformation that characterises the classical ore horizons and, to a lesser extent, the upper basin fill, resulted from this syn-extensional halokinesis.

The team examined the hydrological evolution of this basin framework using a highly sophisticated numerical fluid flow modelling approach that, for the first time, employed fully-coupled sediment compaction, fluid density contrast, and thermal fluid driving forces. They demonstrated a two-fold basin hydrology, comprising:

- Macro-scale convection of residual evaporitic brines, involving lower syn-rift strata and underlying basement rocks – which were both potential contributors to the metal content of the fluid.
- Episodic release or expulsion of metal-bearing brines through lateral terminations of, and/or punctuations in, the evaporitic horizons that coincide vertically with the tapering edges of the underlying syn-rift basin.

The models raise the intriguing prospect that stratiform and/or fault-controlled mineralisation could have formed at different times and various stratigraphic levels around the periphery of the Katangan Basin.



Dr Dave Selley addresses the packed audience at the final meeting.

Constraints on ore fluid composition were determined via chlorine / bromine analysis of fluid inclusions contained in sulphide phases from several Congolese and Zambian ores. Despite the diverse structural and lithostratigraphic nature of the ores examined, a common ore fluid type was indicated involving a highly evolved (evaporated) seawater-

derived brine. The extremely dense and highly saline character of this fluid type is thought to have contributed to its interaction with large volumes of potential metal source rocks, as well as its metal scavenging capacity.

Preparation of papers for publication will take place during the next six months.

Project Background

The Democratic Republic of Congo (DRC) has held a fascination for geologists since the early days of European settlement. It contains a rich diversity of minerals including copper, cobalt, uranium, nickel, selenium, lead, zinc, germanium, and arsenic. Copper and cobalt have been exploited in the greatest volumes over the years, with the country's southern province of Katanga producing nearly 500,000 tonnes of copper per annum at its peak, before two major wars ravaged the country between 1996 and 2003. Since the wars, the DRC produces only a fraction of this output.

However, high commodity prices and a return to relative peace and political stability have seen something of a revival of the minerals industry in recent years, with most major international copper producers having an exploration presence.

This renaissance provided an environment conducive to the birth of this ARC-AMIRA research project in 2004. The core research team involved members from CODES and the Colorado School of Mines. However, additional collaborations, each fundamental to the success of the project, included the US Geological Survey, and central Africa-focused companies Gecamines, Anvil Mining, Equinox Minerals, George Forrest International, Teal Mining and Nikanor. Some of the many advantages of these collaborations were effective knowledge transfer, and the research team's access to world-class datasets, both at the regional and deposit-scale levels.

The research team was also able to use, and build upon, the knowledge base established from a recently completed three-year study of the contiguous, yet geologically distinct, Cu ores of the Zambian Copperbelt.

Gosowong

the El Dorado of South East Asia

***Inset:** from left to right: Steven Micklethwaite (post-doctoral Research Fellow), Deddy Barata (plant metallurgist), Lindsey Clark (PhD student) and Daud Silitonga (Master of Economic Geology student) on top of the plant thickening tank at the Gosowong mine, Halmahera Island, Indonesia.*



CODES, together with industry partner Newcrest Mining, has launched a three-year project to characterise the Gosowong goldfield epithermal and porphyry systems on Halmahera Island, Indonesia, by integrating structural, geochemical and geochronological approaches. The main resources in the goldfield are the Gosowong, Toguraci and Kencana epithermal deposits.

The research team consists of Professor Bruce Gemmell (leader), Dr Steve Micklethwaite (Research Fellow), Lindsey Clark (PhD student), and Daud Silitonga (Master of Economic Geology student).

"We are very excited to be conducting collaborative research with Newcrest in the Gosowong district. This is an emerging world-class goldfield with substantial potential for the discovery of additional epithermal resources and possibly porphyry Cu-Au deposits as well", says team leader Bruce Gemmell.

Just back from his first field season at the site, Dr Steve Micklethwaite says, "Gosowong is an incredibly exciting site. The ore bodies are truly spectacular by any standards. For instance, at most sites around the world ore grades that average

10 grams per tonne (g/t) are considered excellent. At this goldfield, the average is 40 g/t, with occasional grades at well over 1000 g/t.

The project builds on the successful AMIRA P588 project, which included Gosowong as one of its key sites. The site was also in the news in recent years when the research results of a former CODES Master of Economic Geology student, Dan Olberg helped lead to the discovery of the Kencana gold deposit.

The Gosowong goldfield is located on the north arm of the island of Halmahera in the Maluku province of eastern Indonesia. Host rocks consist of Miocene shallow marine, intermediate-basic volcanic and volcanoclastic rocks. Gold mineralization is hosted within multiphase epithermal quartz-adularia and quartz-chlorite fissure veins, breccias, and stockwork veining. Weakly mineralised Cu-Au, porphyritic intrusions occur throughout the district.

The main goal of the project is to develop vectors to sites of further resource discovery. In the process, the team will determine the structural controls that localise epithermal gold mineralization, characterise the types and styles of epithermal and porphyry mineralisation and alteration, and determine the ages of the mineralisation and alteration.

"One of the most fascinating aspects of the project is that, although the goldfield formed over a million years ago, the processes that formed it may be still

active now. This becomes obvious as you approach Halmahera by air and you get a bird's eye view of volcanoes that are smoking or erupting. Once on the ground, you can get a close up view of hot springs and bubbling mud pools that burn the native rainforest. Even when you are indoors you are reminded of the turmoil outside. For instance, during our last visit the buildings we were in were shaken by a magnitude 7.3 earthquake," says Dr Micklethwaite.

Team member Lindsey Clark, from the University of London is undertaking a PhD project to characterise the geological and structural setting of the deposit, define alteration zonation, and describe the ore and gangue mineralogy, assemblages, textures and zonation. She will also determine the geochemical characteristics and signature of the alteration and ore, and propose an ore genesis model for the deposit. Lindsey completed her first field season in late September.

Daud Silitonga, a Newcrest employee at Gosowong, will characterise the Bora porphyry Cu-Au prospect and Damar epithermal deposit through detailed geological and geochemical investigation. This project will be part of Daud's Master of Economic Geology course at CODES. Daud is collecting field data for his project as part of his work on site.

Smithsonian collaboration

CODES has linked with the Smithsonian Institution, the world's largest museum complex and research organisation, for two significant areas of volcanology research involving felsic magmas. The team consists of Dr Richard Fiske from the Smithsonian Institution and Professor Jocelyn McPhie, Martin Jutzeler (PhD student) and Dr Sharon Allen (ARC Research Fellow) from CODES.

The first area of collaboration tackles a quantitative approach to seafloor explosive eruptions and their products, incorporating experiments conducted in laboratories in the Smithsonian using samples recovered from seafloor volcanoes in the Izu-Bonin arc south of

Japan. Results were published in *Earth and Planetary Science Letters* (Allen et al. 2008).

The second project involves field-based research on subaqueous pyroclastic successions in Japan and Washington State, USA. Dr Fiske's pioneering work in this area is now being refined in the light of three decades of seafloor exploration and sampling. Martin Jutzeler has completed fieldwork at two key locations and preliminary results indicate that substantial revisions of established models for the behaviour of subaqueous explosive eruption columns are required. Martin presented his findings at the International Association of Volcanology and Chemistry of the Earth's Interior's conference in Iceland in August.

The Smithsonian

Formed in 1846, the Smithsonian Institution is the world's largest museum complex and research organization, composed of 19 museums and nine research centres. Last year, the institution had 30 million visitors to its museums and travelling exhibitions. It has an incredible 136 million items in its collection.

PhD student, Martin Jutzeler (left), with Richard Fiske from the Smithsonian Institution working at Mount Rainier, Washington State, USA.



New project – New Zealand

Magmas, metals and volatiles in the Taupo Volcanic Zone

A new project has been launched in the Taupo Volcanic Zone in New Zealand involving Research Fellow, Emily Johnson, and Professors Dima Kamenetsky and Jocelyn McPhie.

Their approach uses melt inclusions in quartz crystals in which original volatile and metal species and abundances can be determined. The Taupo Volcanic Zone is one of the largest and most productive modern felsic volcanic provinces, and one in which links between volcanism, tectonics and geothermal processes are well established. Quartz phenocrysts in pumice generated by explosive eruptions provide the best data because the inclusions are rapidly quenched. Therefore, melt inclusions are typically glassy and can be analysed without re-heating. There are numerous well-preserved quartz-bearing volcanic formations available for study in the Taupo Volcanic Zone.



The research is part of a larger project that is examining the volatile and metal budgets of felsic magmas. During the course of the project the team will use a range of micro-analytical techniques and equipment available at CODES' UTAS Hub and its collaborating nodes and institutions.

CODES Research Fellow Emily Johnson, gathering rhyolitic pyroclastic deposits from Okataina caldera in the Taupo Volcanic Zone.

Olympic gold... uranium & copper



A new collaborative research project has commenced at Olympic Dam in South Australia, involving CODES and BHP Billiton researchers.

The Olympic Dam ore body, which is being mined by BHP Billiton, is the world's largest uranium deposit, fourth largest copper deposit, and fifth largest gold deposit. The ore is deeply buried below a cover sequence of sedimentary formations, and exposures are limited to underground development and drill core intersections.

The Olympic Dam multi-mineral ore body is the world's fourth largest remaining copper deposit, fifth largest gold deposit and the largest uranium deposit.

The team comprises Professors Jocelyn McPhie, Dima Kamenetsky and new Research Fellow Isabelle Chambefort from CODES, plus Kathy Ehrig (Principal Geometallurgist) and Nick Green (Senior Geologist) from BHP Billiton. Team expertise spans igneous petrology and geochemistry, hydrothermal systems, volcanology, ore mineralogy and alteration.

This collaboration is based on CODES' volcanology and melt-inclusion research profile in the Gawler Range Volcanics, the host succession to the Olympic Dam deposit, and BHP Billiton's commitment to improving current understanding of one of the largest and most spectacular deposits on the planet.

Geometallurgy research set to expand

Plans are well advanced for an extension to the AMIRA P843 GeM^{III} (Geometallurgical Mapping and Mine Modelling) project that will extend the life of this highly successful initiative for a further four years, starting from July 2009. The scope of the research is still being defined in close consultation with industry partners, but it is expected that the project will expand into the areas of blasting, environmental characterisation and hydrometallurgy.

The AMIRA P843A extension, will develop and validate outcomes from the current initiative and seek to extend its already impressive list of collaborators, which include 19 industry sponsors with total funding of \$8.5 million over the life of the project to date. The major partner in the project is the Julius Kruttschnitt Mineral Research Centre at The University of Queensland (UQ), a world leader in mineral

processing research. Other institutions involved are the WH Bryan Mining Geology Research Centre at UQ, which aims to be a world leader in mining geostatistics, operations research and optimisation in mine design and planning; and the CSIRO Exploration and Mining HyLogger group, a world leader in automated spectral reflectance logging. In total, GeM^{III} supports a team of over 30 researchers across the four institutions and is the largest AMIRA project ever undertaken by CODES.

The five research modules being developed for AMIRA P843A are:

- Geometallurgical modelling of environmental indices
- Geometallurgical blasting indices
- Deterministic comminution modelling
- Texture-based liberation and recovery modelling
- Development of geometallurgical leaching indices

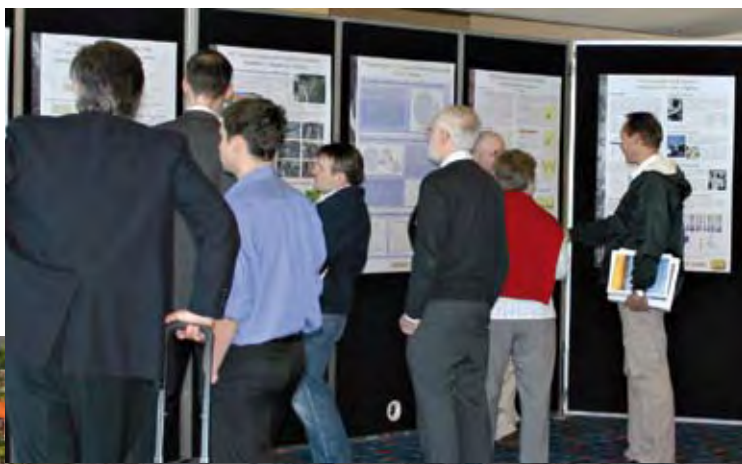
GeM^{III}, the centrepiece of the Recovery Program, has already delivered a range of hardware and software-based tools and methodologies for improved geometallurgical mapping and modelling with direct relevance to routine applications in the minerals industry. As the research matures, a wide variety of deliverables with potential for rapid technology transfer are emerging. These are linked to case studies from six world-class base and precious metal operations in North America and Australia.

An extension of the project will enhance the reputation of the CODES Centre of Excellence in Ore Deposits for providing the world's most significant, and largest, university-based integrated geometallurgical research capabilities.

For further information, contact Professor Steve Walters – steve.walters@utas.edu.au

***Inset:** delegates view the poster presentation.*

***Over 80 delegates** attended the eighth AMIRA P843 sponsor meeting, held over three days at Wrest Point, Hobart.*



Vital analysis at Australian Synchrotron

CODES and UTAS researchers have been granted time at the Australian Synchrotron in Victoria to conduct invaluable analytical work. This is the first time since the state-of-the-art Synchrotron opened its doors in July 2007 that UTAS personnel have gained highly-prized access to its exceptional facilities.

During October, Professor Leonid Danyushevsky and PhD student Fiona Best from CODES, together with Dr Thomas Rodemann from the UTAS Central Science Laboratory, were allocated 96 hours on the Infrared Beam Line to conduct Fourier Transform Infrared (FTIR) spectroscopy measurements of volatile species, water and carbon dioxide in melt inclusions in olivine phenocrysts from a wide range of mantle-derived magma types.

FTIR is a non-destructive analysis technique that provides information about the chemical bonding or molecular structure of materials, whether organic or inorganic. The advantage of using the synchrotron light source is that it allows measurements with a very narrow beam, – five microns in



PhD student, Fiona Best (seated), discusses a melt inclusion sample with Dr Ljiljana Puskar from the Australian Synchrotron.

diameter, which is critical for the precise analysis of microscopic melt inclusions. This also provides a unique opportunity for mapping the distribution of H₂O and CO₂ inside the melt inclusions, an application which is not available on other instrumentation. Furthermore, it enables researchers to identify which volatile species are present in the fluid bubbles inside the melt inclusions, and whether the concentrations of H₂O and CO₂ in the

melt inclusion glasses are affected by the presence of the fluid bubbles.

The team successfully analysed 70 melt inclusion samples during their allocated time. They will use the data they collected to ascertain crystallisation pressures of primitive mantle-derived magmas, and quantitatively assess the extent of degassing during magma crystallisation and the effect it has on the concentrations of metals in the silicate melt.



CODES at PACRIM

CODES had a strong presence at the three-day PACRIM Congress held on the Gold Coast in late November. The congress focused on the importance of the Pacific Rim for the global minerals industry and brought together the latest advances in fundamental research, regional surveys by government agencies and industry developments.

CODES personnel attend the booth at PACRIM. Left to right: Dr Clara Wilkinson, Prof. Bruce Gemmell and Dr Zhaoshan Chang.

Conclusive evidence for hot mantle theory

A team that includes Professor Leonid Danyushevsky has made a major breakthrough to provide conclusive evidence that komatiite is formed through melting a very hot mantle.

For years, geologists have argued about the genesis of this igneous suite of Archaean rocks formed more than 2500 million years ago. One side supported the 'wet melting' theory, which hypothesised that the rocks formed at mantle temperatures only slightly higher than what they are today and contained a substantial amount of water. The second camp asserted that komatiite was formed at temperatures as much as 500°C higher than the current mantle temperatures.

Professor Danyushevsky says that the first step on the road to this breakthrough was

made in the late '80s when new komatiite lava flows, with inclusions of the original melt preserved in the crystals, were discovered in Zimbabwe. Up to that date, the scarcity of quality samples had been a major hindrance to research. Nevertheless, it was only in 2008 that these samples could be utilised to their full potential.

The catalyst for the breakthrough was the development of a technique using synchrotron X-ray technology by Professor Hugh O'Neill from ANU and Dr Andrew Berry, Imperial College, London. The new technique enabled them to examine the oxidation state of the melt inclusions, which proved pivotal in confirming the hot mantle theory. They confirmed that the low water content (~0.3 wt%), measured in those inclusions by Danyushevsky, was almost certainly the original water content, because the level of oxidation is similar to that of today's mantle at approximately 10%. These findings

provided conclusive evidence that discounted 'wet melting' as a viable theory.

The team says that the discovery could have wider implications by helping geologists to determine the rate at which the Earth's interior has been cooling, how the forces affecting the Earth's crust have changed over time, and the heating produced by radioactive decay. Amongst other benefits, this new analytical technique is expected to make a significant contribution to the quest to better understand ore forming processes – and subsequently find new ore bodies.

The team's findings were published in *Nature* – Volume 455/16, October 2008.

An olivine fragment (~500 microns long) from Belingwe komatiite that contains several melt inclusions of different sizes.



Visitors to CODES



The Head of Exploration and Mining for Anglo American, Owen Bavington, visited CODES in September. During his visit, he gave a presentation on Anglo American's operations and discussed projects with various postgraduate and Honours students. Owen is pictured with Carla Vincent, who is the recipient of the Anglo American sponsored scholarship in applied geochemistry.



Dr Stuart Simmons, SEG Regional Vice President Lecturer visited CODES in November. Dr Simmons, who is an epithermal expert, gave a fascinating lecture entitled: The Origin, Flux and Fate of Gold and Related Trace Metals in Active Hydrothermal Systems.

Strengthening our links with Vietnam

The project titled *Tectonic and Metallogenic Evolution of Northwest Vietnam* is now well underway and beginning to deliver on one of its main goals: "To strengthen scientific co-operation between Australia and Vietnam."

The initiative is led by Associate Professor, Khin Zaw, who earlier this year achieved funding for the project under the Federal Government's Australian Leadership Awards. Khin Zaw was successful in achieving \$35 000 support for the initiative, which covers almost 80% of the costs for the \$45 000 project.

The main scientific aims are to obtain a better understanding of the thermotectonic evolution of central and north-western Vietnam and enhance knowledge of the role it played in the mineralisation of the wider South East Asia region. This will greatly assist exploration targeting in the region and enhance the prospects of the discovery of economically viable ore deposits.

Khin Zaw is working closely with Dr Tran Hai Thanh from the Department of Geology and Mining at Hanoi University, Vietnam. Dr Thanh visited CODES in December, partly to assist in important laboratory work involving geochemical, isotopic and LA ICP-MS U-Pb zircon age dating, using samples collected from fieldwork carried out in Vietnam in March and September, 2008.

An added benefit of the initiative is that it has created practical training opportunities for students in both countries, with the project forming the basis for one PhD and two MSc theses. Participants comprise three Australian and three Vietnamese students and staff. The project is scheduled to conclude in March 2009 and it is hoped that further outcomes will include publication in a number of ISI listed journals.



Assoc. Professor Khin Zaw (right) with visitor Dr Tran Hai Thanh from Hanoi University. Dr Thanh is an expert in structural geology and tectonics.

Hot topics in Iceland

The premier international organisation for volcanologists—the International Association for Volcanology and Chemistry of the Earth's Interior (IAVCEI)—held its eagerly awaited General Assembly in Reykavik, Iceland, in August.

The event was attended by a number of CODES personnel, whose participation in the proceedings included the presentation of a series of papers covering current volcanological research underway at CODES.

PhD students were well represented, with papers presented by Jacqueline Blackwell on sector collapse on Lihir Island, PNG; Sarah Gordee on cryptodomes in a submarine arc succession, Japan; and Martin Jutzeler on a new view of pyroclastic facies from submarine explosive eruptions.

In addition, papers were delivered by Research Fellow, Emily Johnson on degassing of monogenetic volcanoes,

Dima Kamenetsky on a new interpretation of the origin of diamond-bearing kimberlite pipes, and Jocelyn McPhie on the dynamics of neptunian eruptions from subaqueous volcanoes. Immediately following the conference, Professor McPhie also conducted a session on subaqueous explosive eruptions, which was part of a short course on advances in explosive volcanism organised by the IAVCEI Commission on Explosive Volcanism.

During the intra-conference break, these presenters joined up with CODES PhD graduates Caze Rosa* and Kate Bull* to climb one of the island's most famous landmarks – Hekla volcano, situated west of the island's Eastern Volcanic Zone. The volcano is noted for eruptions fed by magma of intermediate composition (transitional mugearite and icelandite), which is unique in Iceland. It is also famous for powerful explosive eruptions, with 18 recorded plinian or subplinian events that covered much of eastern Iceland and part of northern Europe with ash; the most recent eruption occurred in 2000.

Another of Iceland's many geological attractions featured in the conference was Askja volcano, on the Northern Volcanic Zone. Although the volcano is currently dormant, Askja has had numerous historic and pre-historic eruptions, the most notable of which was in 1875. This event involved a series of very powerful explosive eruptions fed by exceptionally hot rhyolitic magma and led to the formation of a 3.5 km-diameter caldera. Tephra fallout destroyed agriculture over a large area, resulting in widespread hardship and famine and causing approximately 20% of the population to emigrate. Rebecca Carey conducted a field workshop on the volcano, which covered the near-vent pyroclastic deposits of this major eruption. Rebecca is a former UTAS Honours graduate who is now completing her PhD on the Askja 1875 eruption at the University of Hawaii.

*Caze Rosa is now with the Geological and Mining Institute in Lisbon and Kate Bull has joined the Alaska Volcano Observatory.

Former UTAS Honours graduate, Rebecca Carey (left), leads a field workshop on Askja volcano.



Short course, full house



Inset: Dr David Selley delivers his presentation on the geology and geochemistry of the Central African Copperbelt.



The full house signs went up well in advance of CODES latest short course entitled *Ore Deposit Models and Exploration Strategies*. During an intensive program, participants took part in a review of the theoretical models of the geology and genesis of a wide range of deposit types, including porphyry Cu-Mo-Au, Broken Hill-type, SEDEX, VHMS, sediment-hosted copper and intrusive related nickel.

A total of 12 CODES researchers conducted a mix of practical and lecture sessions on a range of topics relating to the genesis of ore deposits, with exploration models presented for each style. Course participants received informative overviews of cutting-edge

genetic models, understanding of alteration systems, the structural environment, and the mineralised system architecture.

The theory was complemented by practical, team-based exercises that provided a lab-scale view of each deposit style. Students examined suites of rock types from type-deposits of the class, placed them in their geological context by using geological, geophysical and geochemical data, and then developed exploration strategies based on their observations.

The course culminated with a series of presentations conducted by the students in which they each provided a 10-minute overview on a major deposit style and its exploration models. To add even more variety to the scope of the course, the types of deposit discussed were outside the topics covered previously.

The course leader and Masters Coordinator, Dr Tony Webster, was particularly impressed with the standard of participants, which was supported by the fact that there were three high distinctions, 16 distinctions and four credits awarded.

The course is part of the Minerals Geoscience Masters Program. The next stop is South America in March for the much-anticipated Ore Deposits of South America short course, run by Professor David Cooke.

Symposium with an edge



Honorary Research Associate, Patrick Quilty, being interviewed by ABC Radio's Robyn Williams aboard the vessel taking delegates to Moorilla Estate.

A successful *Exploration on the Edge* symposium was held at CODES from the 27th–29th of October, attracting over 60 delegates from around Australia and overseas.

The event was opened by UTAS Vice-Chancellor, Professor Daryl Le Grew and the Director of CODES, Professor Ross Large. Speakers included representatives from industry, the Tasmanian State Government, CODES and other research institutions.



Lorraine Torckler, from Newmont Mining, New Zealand, was one of many high-profile speakers at the symposium.

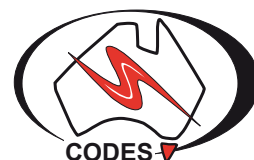
The theme of the symposium was the nature of the margins of mineralised systems and how to recognise when you might be on their distal fringes. Six key deposit types were discussed, including epithermal and orogenic gold, IOCGs, Iron, Mt Isa Copper and sediment-hosted copper deposits. Presenters highlighted the contrasting scale of physical and chemical footprints of these and other important ore deposits, and outlined the current state of ore deposit models, emphasizing the expression of these systems from deposit to district-scale.

A number of social events were run in conjunction with the symposium, including a gala dinner at Moorilla Estate where well-known ABC science journalist and broadcaster, Robyn Williams, was the guest speaker.

Congratulations to the symposium convenors Tony Webster and Anthony Harris, plus the rest of the team, on a highly successful event.

Calling all alumni and friends of CODES to a special symposium

CODES The First 20 Years



3–6 December 2009

This year marks CODES' 20th anniversary.

As part of our activities to celebrate this landmark event, we are holding a special symposium entitled *CODES – The First 20 Years*. People are invited who have played a role in our success over this period, including current and past students, staff and friends. This will provide a great opportunity to catch up with old acquaintances and colleagues and to join us in a celebration of the key milestones along our journey.

This would not be a CODES symposium if it simply looked back and did not cover topics at the forefront of our profession. This event will be no different. The program is in the planning stages at the moment, but be assured that we will be inviting a high calibre of speakers to present on topics at the cutting edge of developments. And we will not be forgetting the social side of things, with a number of recreational events being planned for participants and their partners.

For further information please visit: www.codes.utas.edu.au/20yrs

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



Moving up



Congratulations to our three new professors (from left) Dima Kamenetsky, Leonid Danyushevsky and David Cooke.

Inset: Mike Roach, seen here with a visiting student, has received a well-earned promotion to the position of Senior Lecturer.



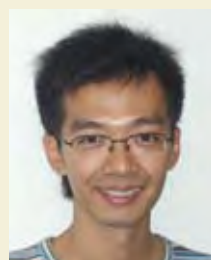
Moving in



Research Fellow, **Dr Clara Wilkinson** will be working with Prof. David Cook and Prof. Dima Kamenetsky on the development of fluid and melt inclusion analysis by laser ablation and PIXE techniques, and its application to metal transport in magmatic-hydrothermal systems.



Hesham El Kaliouby has joined CODES from the National Research Centre, Egypt. Hesham will be working on EM methods in the GeM^{III} and GLODISC projects.



LAI Chun Kit (aka Kit) has joined our PhD group and will be working with Tony Crawford and Sebastien Meffre.



Fardin Mousivand from Iran is visiting CODES for approximately six months, working with Mike Solomon.



Professor Yuling Xie from the University of Science and Technology in Beijing is visiting CODES for six months. Yuling is working with David Cooke on carbonatite magma and fluid evolution.



Jamie Wilkinson is a visiting Research Professor from Imperial College, London, who will be working on the P765a porphyry-epithermal project and the development and application of LA-ICPMS, PIXE and transition metal isotope techniques.

Hard Rock Cafe

a look at the lighter side of CODES

Students find their touch



CODES' staff and students enjoying the sun and bit of touch footy is a regular sight on the 'oval' at lunchtimes.

Killer gives no second chance



A temporary truce is called as the Killers Canucks and Second Chance mingle and pose for the camera.

The Killer Canucks showed no mercy to their hapless victims, Second Chance, beating them 9 goals to 4 in one of a series of fiercely contested ice hockey matches arranged by the SEG Student Chapter recently.

Geomentallurgy

The mysterious case of the missing dollar

On a field trip, 3 geologists share a room in a cheap hostel. They pay \$30 to the manager and go to their room. The manager suddenly remembers that the rate is \$25 and gives \$5 to his assistant to return to the guests. On the way to the room, the assistant reasons that \$5 would be difficult to share among 3 people, so he pockets \$2 and gives \$1 to each guest. Now each geologist paid \$10 and got \$1 back. So they paid \$9 each, totalling \$27. The assistant has \$2, totalling \$29. *Where is the missing \$1?*

Email entries to: steve.calladine@utas.edu.au by Friday, May 1. Open to all readers. The winner receives a CODES windcheater vest.

Solution to the Previous Puzzle

The answer was 2. Split the 9 samples into 3 equal sets. Place a set on either side of the scales, leaving 1 aside. If the scales balance, the heavier sample is in the set that has been put aside. If one side of the

scales goes down, the heavier sample is in that set. Either way, you have narrowed the search to 1 set. Repeat the process, now placing 1 sample from the remaining set on either side of the scales. Using the same logic as in the first weighing, you have found the answer in 2.

Congratulations go to Mark Duffett who won a bottle of Bream Creek Pinot Noir.



This photo just missed the last issue: from left, Emily Johnson, Jacqui Halpin and Fiona Best enjoying festivities at the annual Geology Dinner, held at the Royal Yacht Club in Hobart.

Outreach

a look at our involvement in the community



Young hearts, old rocks

Deputy Director, Bruce Gemmell, visited Forest Pre-school in Sydney where he talked to a class of four and five-year olds about 'volcanoes and rocks.' Bruce captivated his young audience by dressing in working clothes that included a helmet, safety glasses and a reflective jacket. He also introduced them to a geologist's typical toolkit, including a hand lens and rock hammer. The entertaining talk ended with the children donning safety helmets and entering a 'cave' where they found glowing, fluorescent minerals. To cap off a memorable day, each budding geologist was given a sample collection of opal, agate and quartz crystals.



Spreading the message

This visit from Cosgrove High School is one of a series of Outreach initiatives aimed at promoting the earth sciences to the wider community. In the main photo Isabella (Izzy) vonLichtan can be seen spreading the message to students.

Inset: Isabelle Chambeft listens intently to questions from a student and teacher.



Ore Deposit Models for Mineral Exploration Workshop

presented by CODES

The highly successful Ore Deposit Models for Minerals Workshop is on again. Please note that places are limited to just 20 people – so it is first come, first served. Don't be disappointed.

Venue: School of Earth Sciences, University of Melbourne

Date: Monday April 20 to Friday April 24

Program: Day 1 Sedimentary Zinc & Sedimentary Copper deposits – Peter McGoldrick
Day 2 Volcanic-hosted Massive Sulfides & Modern Seafloor Deposits – Bruce Gemmell
Day 3 Epithermal gold deposits – David Cooke, Bruce Gemmell; Porphyry copper-gold deposits – David Cooke
Day 4 Carlin-type gold deposits – Robert Scott; Magmatic nickel sulfides – Jeff Foster
Day 5 Iron-oxide copper-gold deposits – Garry Davidson

Course Content: The course provides an introduction to the key features of several major classes of economically important mineral deposits and a synopsis of the latest genetic and exploration models. Each deposit style is discussed in terms of geological and tectonic framework, mineralisation, alteration, genetic models and exploration criteria. Lectures covering each deposit type are complemented by exploration exercises or practical classes examining sample sets of typical ores and host rocks. The course can be taken over the full five days, or any two days may be selected.

Cost: 5 days (course code ODM) – \$660, 2 days (course code ODZ) – \$330

Further Information and Enrolment: Enrolments are through the Victorian Institute of Earth and Planetary Sciences (VIEPS).

For online enrolment, please visit their website at: www.vieps.org.au/index.htm

For further information, contact Peter McGoldrick at CODES – (03) 6226 7209



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