

ore solutions

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



Positive outcomes from Rosebery to Gosowong ... to Canberra



Well-known science communicator and entertainer Adam Spencer makes a point to forum panel members (from left) Bruce Gemmell and Ross Large (CODES), Stephen Simpson (University of Sydney) and Matthew England (University of New South Wales).

There is no doubt that both CODES Director Ross Large and Deputy Director Bruce Gemmell are seasoned presenters. However, on 18 June in Canberra, they had their communications skills tested to the limit when they were provided with a presentation task with a difference. The inaugural Graeme Clark Forum in Canberra was an ARC initiative to showcase research outcomes to the wider community. The audience comprised a diverse mix of people from a variety of backgrounds, including politicians, public servants, business leaders, financiers and the media.

Submissions for the forum were requested from researchers from ARC Centres, including early-career researchers and Federation Fellows. These high-quality submissions were then assessed by a panel of ARC executive directors against a stringent set of selection criteria. At the end of this rigorous adjudication process, a select number of people were asked to present at the forum and contribute articles for a coffee table book, which was

produced to complement the event. It is a testament to the high calibre of work carried out by CODES that both of its submissions gained sought-after spots in the tight, one-day program.

The forum focussed on the broader benefits of research to the community at large, rather than the usual emphasis on the fundamentals of research. The essence of the motivation behind the forum was

... page 2

IN THIS ISSUE

A teaming success – Director's review of CODES	3	Mike Solomon honoured	7
New project proposal	5	GLODISC	8–9
		Dima shines bright	12
		and more ...	





Positive outcomes from Rosebery to Gosowong ... to Canberra *... from page 1*

summed up by ARC Executive Director, David Falvey:

"I recall when I was a younger researcher that my mother asked me what I did. With great care and devotion, I explained about searching out new knowledge, peer review, papers in prestigious journals and invitations to lecture, but to no avail. 'Okay', she said, 'but what do you really do?' Mum didn't particularly care about the stuff we generally take as the ultimate and sacred product of research innovation. She just wanted to know what use it was to anyone!

"That was more difficult to explain, but I think a clear and publicly comprehensible answer is vital if the research community is to justify its very credible contribution to our society in terms that 'real' people understand."

Bruce Gemmell chose the research project on Halmahera Island, Indonesia, that led to the discovery of a rich gold deposit worth \$2.7 billion at today's rates – a discovery that had widespread benefits, or 'outputs', for a wide range of stakeholders in Indonesia and further afield.

For his portion of the presentation, Ross Large chose a research project at the Rosebery zinc mine on Tasmania's west coast. This successful project, which involved an investigation into the characterisation of alteration halos, helped in the discovery of a \$358-million ore lens that secured the long-term viability of the operation.

Positive outcomes all round, but did Ross and Bruce meet the challenge within the time constraint, which was set at only ten minutes in total for both presentations? You bet they did. They gave a short and succinct summary of both projects in a total of just 9 minutes 50 seconds – they know this because the MC gave a special commendation for their concise performance at the end of proceedings!

Maybe next time you think either Ross or Bruce is being a little too long-winded you can say to them: "Just give me your Canberra version."



▶ **Halmahera Island, Indonesia**, where CODES research led to the discovery of a rich gold deposit worth \$2.7 billion.

The research work carried out at the **Rosebery Mine** on Tasmania's west coast helped in the discovery of a \$358-million ore lens that secured the long-term viability of the operation. ▶



A teaming success

As the third anniversary of CODES status as the ARC Centre of Excellence in Ore Deposits approaches, Director Ross Large reflects on what has been achieved and looks forward to challenges that lie ahead.

In some ways, it is hard to believe that it is nearly three years since CODES became an ARC Centre of Excellence. On the other hand, when I look at what we have achieved, I find it remarkable that the period has not been longer.

In this relatively short time, we have delivered over 360 research reports to our industry sponsors, produced 104 SCI journals, and presented 25 short courses. CODES is now the leading AMIRA International research provider in geoscience and we have consolidated our position as the leading academic group to publish in *Economic Geology*, the top international journal in our field. In addition, our graduate research program has continued to grow, despite fierce competition for human resources as a result of the mining boom. We currently have 53 research students, with new arrivals joining our ranks on a regular basis.

On the technical front, our holistic approach to fundamental and applied research has continued to pay dividends, with major advancements being achieved in all five programs. Just a few highlights include significant analytical developments via the LA-ICPMS facility, groundbreaking melt inclusion research into subduction-related magma geochemistry, the development of the 'explorer's toolbox' for porphyry and epithermal districts, and the completion of the pioneering three-year project into controls on the formation and sulfide trace-element signatures of sediment-hosted gold deposits. There is also the highly successful GeM^{III} ARC-AMIRA project that includes 18 international mining companies and is now the world's largest multidisciplinary geometallurgy research program.

As the demand for mineral resources continues to grow and many existing deposits become increasingly difficult and expensive to find and to extract, so the importance of our research becomes all the more evident — not just for the mining industry, but for the general economic health of countries around the world.



Teamwork has been a key factor in CODES success.

This is an exciting stage in our development. While we have evolved to meet the challenges to date, there is no doubt that we will need to continue this development in order to capitalise on the exciting opportunities that lie ahead. Over the next few years we will need to continue to invest in equipment, infrastructure and human resources. And our collaborations and synergies with our industry partners and other research institutions will continue to play a key role. However, the single most important ingredient for our future success will be just the same as it's been in the past — our teamwork. Not surprisingly, three-quarters of our projects are team-based, but that does not tell the full story. It is not just the fact that our projects are team-based that gives us an edge, it is more the manner in which our teams interact

"While we have evolved to meet the challenges to date, there is no doubt that we will need to continue this development in order to capitalise on the exciting opportunities that lie ahead."

that makes the difference. It is the three Cs — co-operation, camaraderie and collaboration. I thank all the members of the CODES team, past and present, who have contributed to this winning formula, which now stands us in good stead for the exciting challenges that lie ahead.

Short course in for the long run



A mix of local and international delegates attended this year's popular Brownfields Exploration Masters short course.

Over a two-week period in June, CODES presented another highly successful Brownfields Exploration Masters short course to students from around the world. The program, led by Tony Webster, comprised six comprehensive modules, plus a workshop and exercises encompassing empirical brownfield datasets. The course is offered as part of the National Geoscience Masters Program, which is widely regarded as the world's most comprehensive Masters degree in mineral exploration and mining geology.

"One of CODES key strengths is our close collaboration with the world's leading mining companies, which enables us to develop a range of services closely aligned to the needs of the industry. For instance, this course has been developed to align with a prevalent trend within the industry to explore data-rich environments in close proximity to existing mining operations," says Director of CODES, Ross Large.

During the course, students had the opportunity to gain valuable knowledge

in the very latest technologies associated with geophysics, geochemistry and 3D visualisation.

"It is an increasingly popular course. Part of its success is due to the fact that the students have the opportunity to use real data from world-class mineralised districts. Another success factor is the quality of the teaching staff, which are drawn from within CODES and complemented by top presenters from industry and other academic institutions," says Large.

Highlights of the program included developments in the integration of 3D modelling, plus examples of brownfields successes from around the world. A popular aspect of the course is the way the content has been structured to comprise an interesting blend of lectures and laboratory activities.

Tony was ably supported by fellow presenters Peter McGoldrick, Michael Roach, Andrew McNeill and Steve Walters from CODES, plus Simon Gatehouse (University of NSW), Vic Wall (Taylor-Wall & Associates), Tim Callaghan (Allegiance Metals), David Green (Mineral

"One of CODES key strengths is our close collaboration with the world's leading mining companies, which enables us to develop a range of services closely aligned to the needs of the industry."

Resources Tasmania), Angela Lorrigan (Zinifex) and Travis Murphy (Eastern Australia Base Metals).

Course administrator Izzy von Lichten reports that places were fully booked well in advance of the start date and expects more 'fully booked' signs when the course makes a welcome return in 2010.

New project builds on success

Technology breakthroughs, pioneered by CODES laboratories, have revolutionised the approach to exploration models for gold deposits, leading to a proposal for an exciting new project in gold-deposit modelling.

The proposed initiative, which builds on the highly successful CODES-AMIRA project P923, aims to develop innovative gold-deposit models for exploration in sedimentary, mixed volcanic-sedimentary and greenstone terrains, including Carlin and orogenic-style gold deposits.

"Project P923 radically changed our thinking on exploration models for gold deposits through its innovative approach of combining geochronology, sedimentology, sediment geochemistry, pyrite textures, pyrite composition, laser Pb and S isotopes on pyrite to develop

preliminary models for selected Au-As deposits. This new project will enhance these methodologies, and develop new technologies that will be applied to a number of major global provinces, selected in consultation with potential sponsors," says project leader, Ross Large.

The Breakthroughs

The CODES technology breakthroughs that made the project possible are in the application of LA-ICPMS to rocks and ores, and include:

- multi-element laser trace analysis to fingerprint different pyrite generations in a province and ore system
- 2D and 3D laser mapping of invisible gold and other trace elements throughout the paragenesis of ores and altered rocks

- laser Pb and S isotope analysis on various sulfide minerals in ores and host rocks
- a new technique for rapid, very low-level gold and PGE analysis on rocks, minerals, organic matter and matrix material
- comprehensive gold mineralogy analysis to determine the nature and siting of gold in ores and rocks; refractory gold, invisible gold, free gold, gold tellurides, gold-PGE minerals, and gold-bearing organics, etc.

Project Framework

The project framework will involve four integrated themes in four selected gold provinces:

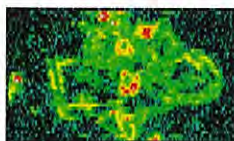
Theme 1: Gold background, sources and halos.

Theme 2: Timing of gold events (single or multi-stage).

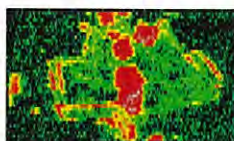
Theme 3: Pyrite chemistry and gold mineralogy.

Theme 4: The role of organic-bearing shales.

Research will concentrate on five global gold provinces, selected in consultation with the major sponsors. Provinces suggested for discussion are the Carlin district, Central Asia, Victoria, Yilgarn, Patterson, Tanami, Otago, Brasilia and the Urals.



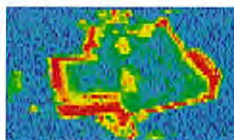
Co59



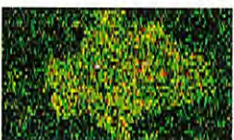
Ni60



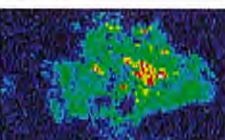
Pyrite



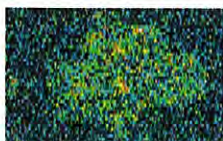
As75



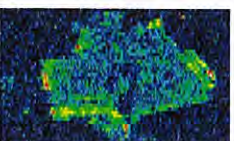
Se77



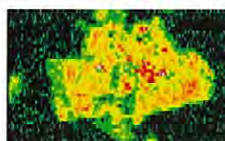
Ag107



Te125



Au197



Bi209

Composite pyrite with Au-As rim from Bendigo.

The Project Team

Project leader Ross Large has a strong track record of delivery on industry-funded research projects and is ably supported by a project team with a wealth of knowledge and experience. Team members are: Robert Scott (structure and geochemistry), Stuart Bull (sedimentology, basin analysis), Garry Davidson (pyrite fingerprinting), David Selley (province structure), Leonid Danyushevsky (LA-ICPMS leader), Sebastien Meffre (geochronology), Lyudmyla Kosiy and Grant Garven (fluid-flow modelling), plus Helen Thomas (geochemistry). To complement this talented mix, the team plans collaborations with a number of recognised international researchers.

The Outcomes

The project will provide the following deliverables in a progressive manner over the four years of research funding:

- ore deposit models and gold exploration criteria for each selected province
- a database of low-level gold, PGE and trace elements for the major rock types in each province
- criteria to distinguish source rocks and trap rocks in each province
- identification of favourable trap structures and favourable lithologies in each province
- a database and software package to enable pyrite chemical fingerprinting of the various mineralising events in each province
- a preliminary gold mineralogy model to help in the prediction of mineral processing characteristics of the major ore types in each province.

Potential Sponsors

CODES is seeking expressions of interest from potential sponsors for this exciting new project. Sponsorships are available at two levels:

Major Sponsor – \$50,000 per year

Eight sponsorships available. This level enables sponsors to select the provinces and provide a case-study site.

Junior Sponsor – \$20,000 per year

Sponsors may nominate two provinces for which they will receive all research results from the project.

For further information, including a project proposal, contact Ross Large on +61 3 6226 2472 /ross.large@utas.edu.au

Mining Tassie's potential

With mineral exploration in the state continuing to rise, there was a particularly strong interest in this year's Exploration Group Forum held at Country Club Tasmania in Launceston.

The annual forum, organised by the Tasmanian Minerals Council in conjunction with Mineral Resources Tasmania, was attended by leading figures associated with the industry in both the private and public sectors. Each year, the group meets to share key developments and discuss the opportunities and challenges that lie ahead for the sector in the short, medium and long term.

Key trends to emerge from the forum included how Tasmania's mineral exports have surged over the past three to four years, underpinning a strong performance from the state in international markets. It was highlighted that, as a consequence of this increase in activity, the profile of the industry has been raised and there will be a corresponding increase in scrutiny in a range of areas.

CODES was ably represented at the forum by Ross Large and Jeff Foster. Ross was a member of a high-level panel that led discussions focussed on minerals exploration, surviving risk, and aversion



Ross Large (left) participates in a lively debate during the Exploration Group Forum held at Country Club Tasmania in Launceston in May. Other panel members are Lindsay Newnham, Harry Stacpoole and David Moore.

in the markets. Jeff gave a comprehensive presentation covering the activities of CODES, including the five key programs – Location, Formation, Discovery, Recovery and Technology; plus new developments, both local and overseas. Items of local interest included the research into the geology, geochemistry

and genesis of the Avebury Ni deposit led by Jeff and ex-CODES student Tim Callaghan, who is now Chief Geologist at Allegiance Mining; plus the pilot study into ambient noise seismic tomography in the Coal River Valley, led by Anya Reading.

Bon voyage Bonyadi



There was a typically warm CODES send-off for Zahra Bonyadi (3rd from right) on 29 July. Zahra was heading back to Iran the next day after spending six months working on Iranian IOCG deposits research with Garry Davidson (standing to Zahra's right).

Mike Solomon receives highest accolade



Professor Michael Solomon (right) receiving the Penrose Medal from Professor David Groves at the Australian Earth Sciences Convention in Perth.



One of CODES most liked and respected team members, Professor Michael Solomon, received the Society of Economic Geologists' highest accolade at a special ceremony at the Australian Earth Sciences Convention in Perth on 23 July.

Mike was presented with the Penrose Medal by Professor David Groves from the University of Western Australia, who commented on Mike's many accomplishments, including his pioneering work with volcanic-hosted massive sulfide (VHMS) deposits.

"Mike's first research on the Mt Lyell copper deposit and other base-metal deposits on the then isolated west coast of Tasmania led to many seminal

publications on VHMS systems, with the Mount Read Volcanic Arc becoming infamous in the VHMS world," said Professor Groves.

One of these seminal publications, produced with John Walshe, was the groundbreaking work 'The formation of massive sulfide deposits on the seafloor', which was published in *Economic Geology* in 1979. Despite a great deal of scepticism at the time, this paper correctly predicted 'black smokers' on the seafloor long before they were discovered in deep sea dives.

Professor Solomon has always been one to push the boundaries. He stimulated the first papers on the evolution of ore deposits in terms of the plate-tectonic evolution of the Tasman Orogenic Zone

in 1972, and the book *The Geology and Origin of Australia's Mineral Deposits* (co-authored with David Groves) published in 1994, is still by far the best overview of those deposits and their setting almost 15 years after it was first published.

"He put the University of Tasmania on the economic geology map, and was essentially the non-biological father of CODES, which under the guidance of Ross Large has become one of the top research centres on the planet," said Professor Groves.

After six decades of outstanding achievement all we can say is may CODES and the world of geology be blessed with the wisdom of Solomon for many years to come.

Mike Solomon A LIFETIME OF ACHIEVEMENTS

Professorial Research Fellow, Mike Solomon MSc, PhD (Tasmania), DSc (London) – started his career in geology as an Assistant Geologist with the South Australian Geological Survey, then moved to the Mount Lyell Mining and Railway Company, before joining the Rio Tinto Mining Company. His academic career started in 1959 at UTAS, where he became Reader in Economic Geology. He joined the Australian Bureau of Mineral Resources (later renamed Australian Geological Survey Organisation, now Geoscience Australia) in 1983 and spent the next decade as Senior Principal Research Scientist, before 'retiring' to join CODES.

In 1969, he became a Royal Society Fellow at Imperial College, London. He was Visiting Professor at the Massachusetts Institute of Technology in 1981 and was a Leverhulme Visiting Fellow at the University of Durham in 1996. In addition to receiving the Penrose Medal this year, Mike received the prestigious Heemskirk Medal in 1979 and the Stillwell Award in 1987.

GLODISC

– a world of discovery –

A series of state-of-the-art, industry-friendly software packages with potential commercial applications is just one of the many exciting outcomes of a groundbreaking initiative named GLODISC – a composite abbreviation of ‘global discovery’. The project, headed by Jeff Foster, will form a key part of the Discovery Program over the next three years as it integrates key aspects of geology, geophysics and geochemistry with technology.

The first of the initiative’s three key modules is *geophysics*, which covers a number of research areas including petrophysics, constrained inversion, 3D EM and integrated deposit models.

“The geophysics module will continue to refine and develop mathematical models to improve the 3D inversion of transient electromagnetic data, which will incorporate elements of field testing on four selected deposits, accompanied by the acquisition of down hole and hand specimen-based petrophysical data. In all cases, forward and inverse models will be compared with known geology.

“During the past 10 years, geophysical interpretation has moved from idealised geometrical bodies floating in air to fully three-dimensional models. The principal conceptual driver of this change has been the growing recognition of the importance of integrated interpretation in developing an Earth model consistent with all available information,” says Jeff Foster.

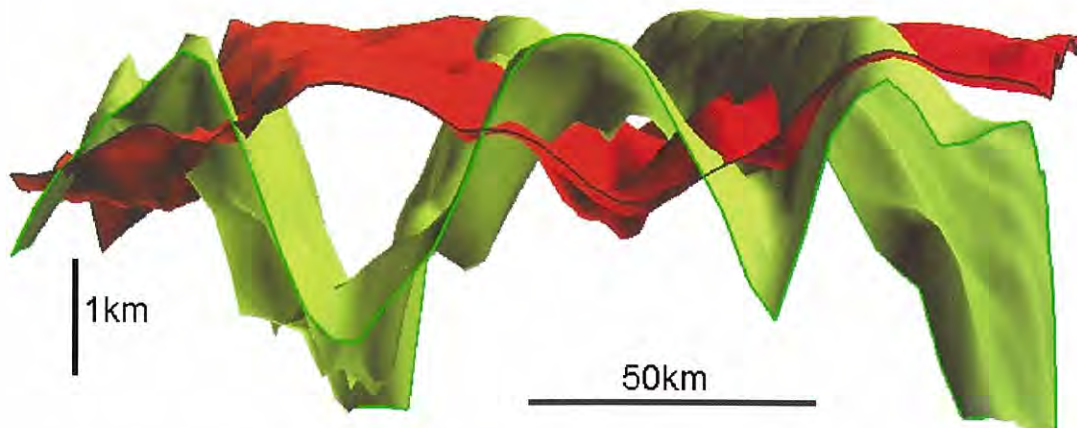
One of the main aims of the GLODISC initiative is to ensure the results of the program are transferred to industry in a form that enables them to be used easily and routinely.

The importance of geological constraints during inversion of gravity data is illustrated below. The graphic shows the result of depth-to-basement (geometry) inversion over the Boulia 1:250,000 map sheet in Queensland.

The inferred basement topography ‘flips’ when a modest amount of geological information is brought to bear.

The expanded role of constrained 3D inversion techniques will have a significant impact on both brownfield and greenfield target definition. In addition, advances in the integration of different data types within the inversion framework will allow a number of properties to be considered at the same time. Therefore, combined constrained inversion, coupled with advances in 3D classification, will allow explorers to directly identify targets that have combined response characteristics, removing ambiguity and aiding target prioritisation.

Another major component of the geophysics module is the use of ambient seismic energy techniques (ASET) to enable structures beneath the surface to be mapped in 3D. This approach relies on correlating ambient signals between two seismic stations operating simultaneously and not, as in traditional seismic methods, on a focused explosive or naturally occurring seismic event.



Perspective view of inferred basement surface, comparing the results after constrained (red) and unconstrained (green) geometry inversion.

The **geochemistry** module of GLODISC builds on modern research data and the substantial world-class mineralogical and geochemical datasets built up by CODES researchers over the past 20 years.

The first component of the program will 'redevelop' a range of tectonic discrimination diagrams that have essentially remained unchanged since the late Seventies. These tectonic discrimination functions will be substantially expanded and include a range of Archean and Proterozoic terranes that exhibit different levels of erosion and metamorphic grades. A gap analysis will identify key missing information and a series of sampling programs will be developed to acquire new data that will be used to further improve discrimination functions, ultimately leading to the development of a variety of tectonic-terrane fingerprinting tools.

The second component builds on CODES world-class deposit knowledge base, which will be used to construct geologically constrained geochemical deposit templates and fertility indices for

BHT, sedex, VHMS, IOCG, porphyry-Cu, sediment-hosted Cu, sediment-hosted Au and magmatic Cu-Ni $\pm$ PGE systems. These ore deposit templates will allow explorers to directly compare and contrast exploration data with real deposits in 2D and 3D. This component, when combined with the tectonic-terrane fingerprinting tools, will be essential in recognising new opportunities in 'new terranes' and missed opportunities in 'old terranes'.

The final component of the geochemistry module will seek to develop a new approach to pattern/anomaly recognition from complex multi-variable geochemical datasets. This new approach, based around 'inverse theory,' will be tested against conventional levelling techniques.

One of the major aims of the GLODISC initiative is to ensure the results of the program are transferred to industry in a

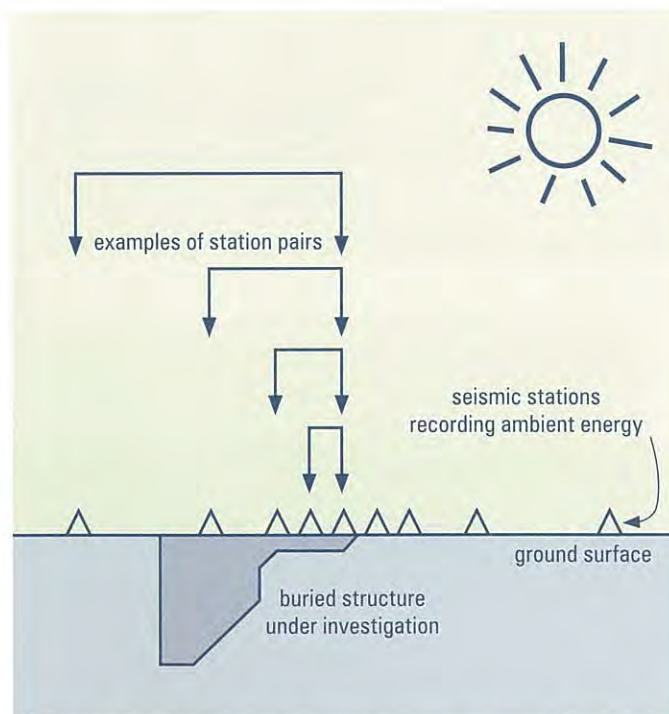
form that enables them to be used easily and routinely. The primary method of knowledge transfer will be through the development of three industry-friendly software packages built by expert programmers sourced through industry-related service providers.

These software packages will be developed in the third module – **targeting technology**. The outcomes from the Geophysics and Geochemistry modules will be brought together in two stand-alone packages capable of feeding into a third integrated target generation package. This package will be an advanced target generation system built around the process of probabilistic, scale-independent data coring. Initial versions will be tested in 2D before advancing to a 3D system that will introduce multi-variable classification techniques for both geochemical and geophysical data.

Combined constrained inversion coupled with advances in 3D classification will allow explorers to directly identify targets that have combined response characteristics, removing ambiguity and aiding target prioritisation.



GLODISC may have wider applications in the study of coal-bearing sedimentary basins, plus large layered igneous bodies such as South Africa's platinum-rich Bushveld Complex (shown above) and the Sudbury Igneous Complex in Canada.



Schematic showing deployment of passive seismic instruments recording ambient seismic energy.

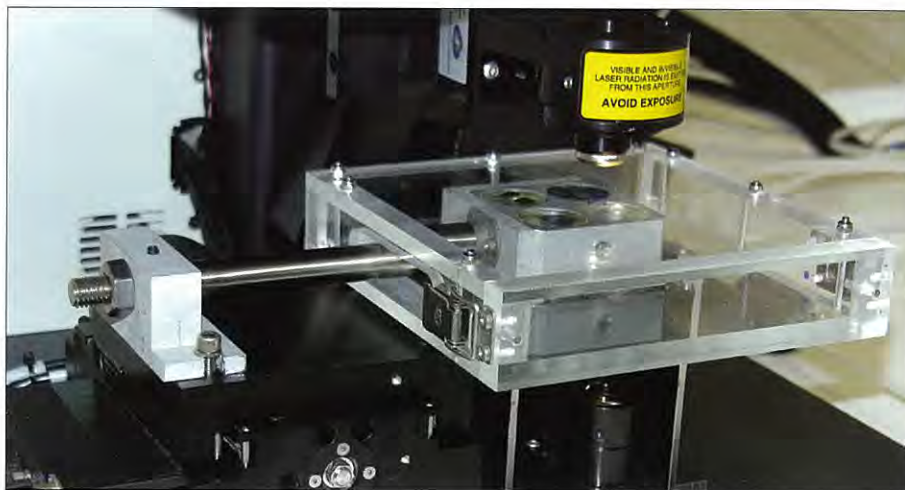
For further information,
contact Jeff Foster: jeffrey.foster@utas.edu.au

Fast cell sells fast

A new laser ablation cell being developed at CODES will deliver faster response times and washout, higher signal strength, and enhanced stability of the signal intensity throughout the cell.

Program Leader, Leonid Danyushevsky, says "As we push the boundaries of laser ablation techniques to achieve increasingly precise measurements of fluid and melt inclusions, low level Au and PGE, age dating and imaging, it has become increasingly important to get optimised ablation cell configurations that provide the maximum possible yield of ablated material into the mass-spectrometer. And this new cell meets these objectives."

The cell currently in use was designed by Leonid some six years ago and, although



The new laser ablation cell being developed at CODES.

it has served us extremely well over the years, it is no match for the performance of the new cell.

"Once the cell is fully developed, we hope to make the design widely available to other institutions with orders already on the books to make a chamber for Geoscience Australia," says Leonid.

The other members of the development team are Sebastien Meffre and Sarah Gilbert, who are working in collaboration with Laurin Technic in Canberra.

A prototype is nearing completion in the UTAS Central Science Laboratory and will be ready for testing by the time *Ore Solutions* goes to print in September.

Excursion to world's largest Au-rich Porphyry deposit

The CODES Student Chapter of the Society of Economic Geologists is organising a field excursion to the epithermal and porphyry Au-Cu deposits of Indonesia.

Mine visits include Pongor (West Java); Batu Hijau (Indonesia), the world-class giant porphyry Au-Cu deposit; and Grasberg (Irian Jaya), the world's largest Au-rich porphyry deposit. This excursion also presents an excellent opportunity to visit spectacular active volcanic areas including Krakatau (Indonesia) and the Bedugul geothermal project (central Bali).

The field excursion is intended to run for 7 to 10 days from mid- to late January 2009, under the field guidance of Bruce Gemmell. The Chapter would like to invite members of industry to participate in this excellent opportunity to see some of the world's finest magmatic-related ore deposits. For further details, please contact the SEG Student Chapter President Jacqueline Blackwell (leslieb@utas.edu.au) or Bronto Sutopo (bsutopo@utas.edu.au).



Indonesia's world-class Batu Hijau giant porphyry Au-Cu deposit.

Strong presence at AESC

CODES had a strong presence at the Australian Earth Sciences Convention (AESC) held at the Perth Convention and Exhibition Centre from 20–24 July.

Speakers included Ross Large, Mike Solomon, Jeff Foster and Abhisit Salam. In addition, CODES had a stand in the exhibition hall and a number of delegates attended the various sessions at the convention.



Abhisit Salam and Steve Calladine on the CODES stand at AESC 2008 in Perth.

A first for CODES students



PhD students Anita Parbhakar and Nic Jansen became the first students from CODES to receive a prestigious *Graduate Student Research Fellowship Award*, valued at \$12,500 and \$15,000 respectively, from the SEG Foundation.

Other notable successes for our students were:

Hugh E. McKinstry Student Research Award

Abhisit Salam, \$5000 grant. PhD: An integrated geochemical and metallogenic study of the Chatree area, Thailand.

Newmont Student Research Grant

Jacqueline Blackwell, \$3000 grant. PhD: Ages of host-rock stratigraphy and hydrothermally cemented breccia, Ladolam gold mine, PNG.

SEG Canada Foundation Awards

Jacqueline Blackwell, \$2000 grant. PhD: Ages of host-rock stratigraphy and hydrothermally-cemented breccia, Ladolam gold mine, PNG. **Heidi Pass**, \$3000 grant. PhD: Carbonate and sulfide zone patterns in alkalic porphyry and epithermal mineral systems.



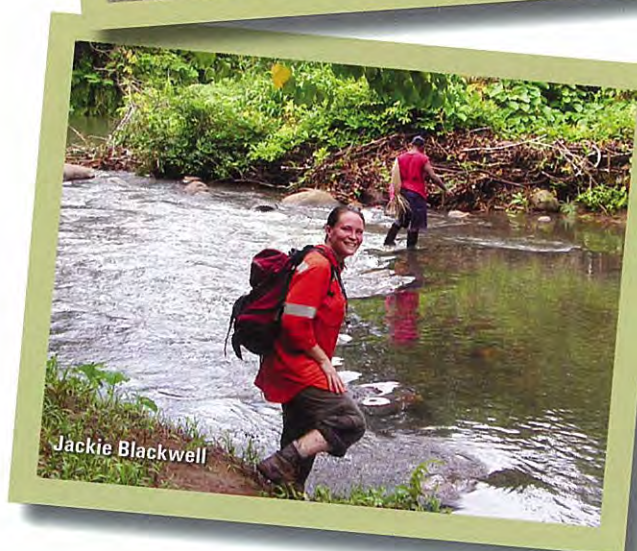
Abhisit Salam (right)



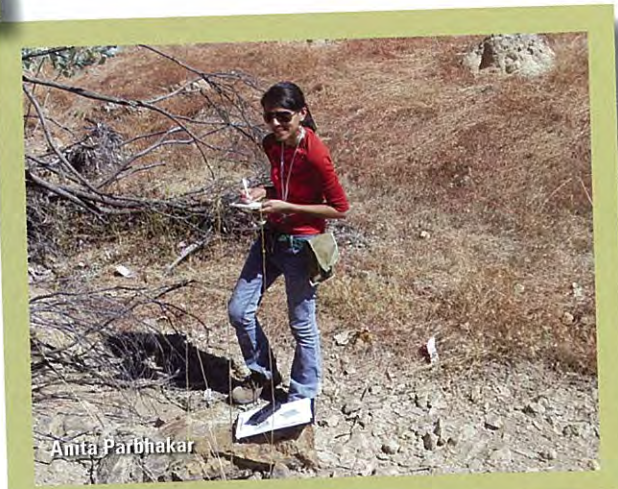
Heidi Pass



Nic Jansen



Jackie Blackwell



Anita Parbhakar

Advisory board considers CODES growing pains

The CODES Advisory Board met on 5 June, and one of the key points on the agenda was the need for more space for CODES.

With a number of new research staff joining in the past few years, and eight more on their way in the coming months, CODES is fast reaching breaking point in terms of office accommodation. In many ways, the centre is a victim of its own success. As the scope of the centre's work has broadened, there has been a corresponding increase in the number of research projects undertaken.

The Advisory Board discusses a range of issues of strategic importance to CODES.



As a consequence, the need for research staff has also increased.

The Advisory Board heard from Director, Ross Large, about a number of avenues being pursued to find an answer

to the problem. And while we cannot report that a solution is imminent, we can say that the problem is being thoroughly investigated as a matter of priority. In the meantime, dare we say 'watch this space'.

New imaging technique for CODES

A new imaging technique has been developed at the CODES LA-ICPMS analytical facility that is revolutionising the way that geologists analyse sulfide and silicate minerals. The technique, which generates images reflecting major and trace-element distribution within rocks and minerals, shows the distribution of as many as 18 elements within an area of up to 2 mm wide in a polished mount.

The process runs automatically after just 30 minutes of user input at the start of the analysis; and images are produced within minutes of completion – thanks to a computer program written by former CODES Senior Technical Officer, Chris Hollitt. The new technique, which provides valuable efficiency benefits for researchers, is now routinely applied to the analysis of sulfide and silicate minerals within CODES.

Dima shines bright

Congratulations to Dima Kamenetsky who has received the prestigious Dean's Award for Research Excellence to the value of \$7500.

This accolade marks another milestone in an exceptional career. Dima, who is an ARC Professorial Research Fellow, received his BSc (Hons) from the Moscow State University in 1983, and PhD from the Vernadsky Institute of

Geochemistry and Analytical Chemistry (Russian Academy of Sciences) in 1991. In 2003, the Alexander von Humboldt Foundation (Germany) awarded Dima the prestigious Friedrich Wilhelm Bessel Research Award.

In the past five years, Dima has published a prodigious 37 refereed journal articles, including seven in the *Science* and *Nature* publications.



Dima with Program 1 Team leader, Tony Crawford (left) and Director, Ross Large (right) after receiving his cheque.

SPM outgrows venue

This year's Science Planning Meeting (SPM) on 4 June had a remarkable 50% increase in attendance, which resulted in the venue being changed from its usual spot in the CODES Conference Room to the Geology/Geography Lecture Theatre, which seats up to 150 people. In addition to numerous members of the CODES team, over 70 local, national and international guests attended the event, which showcased the progress and plans for the Centre, with a focus on the five core research programs.

Highlights of this year's event included the exciting new GLODISC project, a proposal for new gold deposit models to stimulate exploration, Super GeM – the world's largest multi-disciplinary geometallurgy research program, and the new alkalic IOCG project.

National and international speakers included Jim Mortensen (University of British Columbia); Janet Hergt (University of Melbourne); Steve Cox (Australia National University) and Chris Ryan (CSIRO).

Survey reveals a winning formula

A survey conducted amongst external attendees at the SPM revealed some interesting results. Respondents showed a very positive response to a question regarding the value of the meeting, with over 95% choosing the top categories of 'Very Valuable' and 'Valuable.' There was also a healthy interest in all the projects, but top by a narrow margin was the Super GeM project.

The survey allowed respondents to remain anonymous and was completed by approximately two-thirds of external attendees.



L-R: Geoff Green (Mineral Resources Tasmania), Leonid Danyushevsky (CODES), John Dow (AusIMM), and Ross Large, Bruce Gemmell and Tony Crawford (CODES) listen attentively to the proceedings.



Anthony Harris presents on alkalic IOCG.



Program 3 Leader, Jeff Foster presents GLODISC to a large audience at the highly successful Science Planning Meeting in June.



Hard Rock Café

a look at the lighter side of CODES



More than a tea party

Canada Day on 1 July and American Independence Day on 4 July were reasons aplenty for our resourceful PhD students to organise joint celebrations on Saturday, 5 July.

Held at Patrick Sack's 'Canadian Embassy' in Sandy Bay, the event was open to all comers – young, the not so young, general staff, students, husbands, wives, children etc., etc. – even those pesky Brits were welcome to attend.

Ample food and beverage, good company, plenty of Tassie winter sunshine and the enticing aroma of the barbie wafting through the air – sounds like a good day to celebrate your freedom.



Graduates from the school of hard rocks show how to have a good time.

Students get the needle

No, this is not a joke ...' was part of the opening line of PhD student Natalee Bonnici's email calling all closet knitters, cross-stitchers, scrapbookers, etc. to the first CODES Craft Night on 10 July.

Natalee may have feared that in these days of Facebook and iPods the old, traditional crafts were fast going the way of the Tasmanian tiger. However, any fears proved to be unfounded as an enthusiastic crowd of crafters gathered in the CODES tea room. Crafts on display included nailbinding – a craft dating back to medieval times – plus more familiar skills such as knitting, quilting and hand-sewing.

It may not have been a joke, but it seems that at least a few were in stitches.



CODES personnel and associates find a crafty way to socialise.

GEOMENTALLURGY – new puzzle to boggle the mind and exercise the brain cells

And once they have been exercised, you may get the chance to kill a few of them off. That is if you are lucky enough to win our prize of a bottle of premium-quality Bream Creek Pinot Noir. We have decided to give you a fairly easy task to get things started.

A question of balance

A geologist has nine drill samples of quartz. All are exactly the same size and identical in appearance. However, one contains barites intergrown with quartz – which makes it very slightly heavier than the other eight. Using only a standard, old-fashioned set of balance scales, what is the least number of times the geologist would have to weigh the samples to be 100% sure which is the sample containing barite. Luck should play no part in the answer, which must include a brief description of the process followed.



All entries to be emailed to the editor (steve.calladine@utas.edu.au).

With the exception of the editor, the competition is open to everyone – including readers on our external mailing list. Entries close on Friday, 17 October 2008. Names of entrants supplying the correct answer (assuming there is more than one) will be placed in a miner's helmet and the winner will be drawn on Monday, 20 October.

MOVING IN

Isabelle Chambefort is a Research Fellow who is working with Jocelyn McPhie and Vadim Kamenetsky on the Olympic Dam deposit, South Australia.

Nilar Hlaing is Ross Large's PA.

PhD candidate **Kirill Bychkov** is working on AMIRA project P962 on modelling of crystallisation of large layered intrusions

Postgraduate **Fiona Best** will be working with Leonid Danyushevsky on the behaviour of metals during magma fractionation in subduction zones.

PhD student **Lindsey Clark** has already headed off for a two-month stint in Indonesia, where she is working on the Gosowong project with Bruce Gemmell.

Nic Jansen, from Nova Scotia, will be supervised by Bruce Gemmell, Dave Cooke and Zhaoshan Chang on his PhD project based on the Ixhuatan deposit, southern Mexico.

Shaun Inglis has joined CODES as a Research Technician.

Research Fellow **Helen Thomas** will be working with Ross Large and Stuart Bull on sediment-hosted gold.

Zen Miles has joined the IT team as computer support assistant.

Steve Calladine has been appointed Communications Manager, which includes being editor of *Ore Solutions*.

Terrie Sawyer has taken up the role of Technical Officer in the LA-ICPMS facility.

David Hutchinson has joined Jeff Foster's Program 3 team as a Research Fellow working on Tweefontein Sector, which is on the Platreef in South Africa.

Huayong Chen is a Research Fellow working with Dave Cooke and the P765A team on epithermal porphyry systems.

Research Fellow **Emily Johnson** has joined us from the University of Oregon to work on felsic magmas on Program 1 with Jocelyn McPhie, Sharon Allen and Dima Kamenetsky.

Steve Micklethwaite is working with Bruce Gemmell on the Gosowong epithermal deposit, Indonesia, to constrain the structure, tectonics and processes that enhanced permeability and controlled fluid migration in this system. Steve was previously with ANU.

Jamie Laird has been appointed as a CODES/CSIRO Postdoctoral Fellow to work on the applications of the CSIRO nuclear microprobe (PIXE) to geological problems. Jamie is based in Melbourne.

Welcome back to **Michael Baker** who graduated (PhD) from CODES in 2007 and will be working as a Research Fellow with Dave Cooke on project P765A.

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Australian Government
Australian Research Council

Ore Solutions banner: Supergene Cu oxides (asunite and malachite). Nifty sediment-hosted Cu deposit, Great Sandy Desert, WA.

Exploration On The Edge



A THREE-DAY SYMPOSIUM

Effective exploration of alteration systems requires detailed knowledge of the physical and chemical footprint to ore. This year's CODES Ore Deposit Models and Exploration Strategies Short Course will commence with a three-day symposium that will outline the geological model of several important deposit styles, emphasising the expression of these systems, and the challenges faced in their exploration and resource location. Exploration on the Edge will bring together industry professionals and research academics actively exploring aspects of economically important ore systems covering the complete commodity spectrum (Au, Fe-Cu-Au±U and Cu). We seek to emphasise ore-forming processes and to trace these processes through to the peripheral parts of each hydrothermal system. Real-world case studies will highlight exploration success in subtle and often complex alteration haloes.

new discovery requires new knowledge of altered rock



Ore systems with contrasting alteration footprints, from the relatively restricted systems to kilometre-scale, will be discussed.

Au: Gosowong, Lihir, Cerro Vanguardia, Pajingo, St Ives, Sukhoi Log, Waihi

Fe-Cu-Au±U: Hamersley (Tom Price), Mary Kathleen, Ernest Henry

Cu: Mount Isa, Central African Copper Belt, Western Succession

• SPEAKERS INCLUDE

Scott Halley (Consultant), Matthew Briggs (Goldfields), Richard Morris (CSIRO), Lorraine Torckler (Newmont), Geoff Derrick (Consultant), Tim Baker (Sovereign Metals), Vic Wall (Consultant), Frank Bierlein (Afmeco Mining & Exploration); from CODES Ross Large, Bruce Gemmell, David Selley, Peter McGoldrick, Steve Walters, Jeff Foster, Garry Davidson ...and more

27–29 OCTOBER 2008

COST: \$1800

ARC Centre of Excellence in Ore Deposits
UNIVERSITY OF TASMANIA
Hobart, Tasmania



Registration forms available online
www.codes.utas.edu.au