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Newsletter of the Centre for Ore Deposit Research, an ARC Special Research Centre at the University of Tasmania

CODES - Global Collaboration



Dave Cooke, Peter Hollings and James Cannell explaining the geology of the Chilean Andes during the recent AMIRA P511 meeting in Chile.

The first half of 2001 has seen teams of CODES researchers travelling across the globe to field meetings for AMIRA projects in Chile, New Zealand and Zambia. Despite ongoing changes in the minerals industry, our record of collaborative research remains strong.

CODES currently has projects operating in 17 countries worldwide, in collaboration with approximately 60 mining and exploration companies and a similar number of universities and government institutions.

In addition to our international collaborations, CODES is also active in a number of Australian projects involving a range of mineral exploration companies. The final meeting of the NSW Ordovician porphyry copper SPIRT project, in collaboration with the Geological Survey of NSW, was held in Orange (NSW) in April, and proved to be a very successful research event. The six participating companies were presented with results of the research on the tectonic and structural evolution, geochemistry, alteration and facies architecture of the Ordovician volcanic and plutonic belts hosting the Parkes and Cadia porphyry copper deposits. Following expiry of the 18-month confidentiality period, it is hoped that the results of this project will appear as a thematic issue of the *Australian Journal of Earth Sciences* in late 2002 or 2003.

CODES Global Research ... page 2

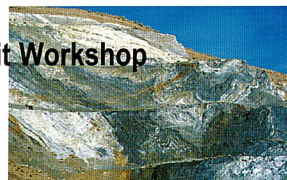
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Ore deposits of South America
5–16 November 2001
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Giant Ore Deposit Workshop
17–19 June 2002
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Focus on Research

AMIRA P511: Giant porphyry Cu field trip and sponsors meeting



Gypsum deposit near Portillo, Los Andes, Chile

From 5-12 March, an eight-day field meeting was held in central and northern Chile for sponsors of AMIRA project P511 (Giant Ore Deposit Systems). This meeting was run jointly by CODES and CSIRO, with important industry contributions from Codelco and Collahuasi mine and exploration geologists. Over forty geologists participated in all or part of the field trip, which included presentations on research results for the first two years of the copper module of P511, along with mine visits to El Teniente, Rio Blanco, Chuquicamata and

Collahuasi, and regional traverses in central and northern Chile. The trip proceeded without a hitch, despite floods, rain, lightning storms and thick fog in the 'so-called' driest desert in the world — the Atacama desert! The research team is extremely grateful for the presentations, logistical assistance and access provided by mine staff at El Teniente, Rio Blanco, Chuquicamata and Collahuasi, and to Codelco Exploration. Participating sponsors are also thanked for providing 4WD vehicles, without which the trip could not have proceeded.

AMIRA P588 Sponsors meeting: A geothermal odyssey

The third progress meeting, chaired by AMIRA's Alan Goode, of AMIRA P588: Epithermal Au-Ag Deposits: Geological, Geochemical and Isotopic Vectors to Target Major Deposits, was held in early June in steamy, frosty Rotorua - the land of the long grey fog. Our team of nine researchers from CODES and the Geothermal Institute at the University of Auckland, led by Bruce Gemmell and Stuart Simmons, met with twelve representatives from eight industry sponsor companies (AngloGold, Aurora Gold, Cerro Vanguardia S.A., Delta Gold, Homestake Gold, Lihir, Newcrest and Normandy) in the colonial splendour of the Princes Gate Hotel to present and discuss the current research in P588.

The first day involved presentations on research progress from five case studies being undertaken at Cerro Vanguardia, Argentina (Robina Sharpe and Rob Scott), Lihir Island, Papua New Guinea (Wally Herrmann, Greg Cater), Mt Muro, Indonesia (Andrew Wurst) and Gosowong, Indonesia (Bruce Gemmell and Dan Olberg). On the following three

days, Stuart (Foggy) Simmons led the group on stimulating visits to the active geothermal areas at Waiotapu, Waimangu and Orakeikorako, a recent (January, 2001) eruption crater in a park at Rotorua, an inactive epithermal gold prospect at Ohakuri, and to the Martha Hill epithermal gold mine at Waihi.

The geothermal systems are the upper parts of actively forming neutral-chloride type epithermal mineral deposits. They provided unparalleled opportunities for our mineral explorers and researchers to "experience" the processes of ore formation.

Enthusiastic and lively discussions were highlights of the field meeting. Despite the hectic schedule, all participants thoroughly enjoyed the fine geothermal activity and debates that continued in the luxury of steamy hot pools and into the long nights around tables of fine victuals. The third P588 meeting was a memorable success due to strong feedback and interaction between researchers and sponsors. The organisational and scientific



*Back Row (L-R): Bill Hoskins (Normandy Exploration), Anthony Truelove (Delta Gold Ltd), Cesar Riveros (Cerro Vanguardia S.A.)
Middle Row: Bruce Gemmell (CODES), Dan Olberg (Newcrest Mining Ltd), Jocelyn McPhie (CODES), Greg Cater (UAuckland), Nigel Radford (Normandy Exploration), Wally Herrmann (CODES), Andrew Rowell (AngloGold Ltd), Mick Clifford (AngloGold Australasia Ltd), Stuart Simmons (UAuckland)
Front: Mike Blake (CODES), Kylie Braund (Newcrest Mining Ltd), Viviana Scavuzzo (Cerro Vanguardia S.A.), Robina Sharpe (CODES), Andrew Wurst (CODES), Rob Scott (CODES), Nick Green (Normandy Exploration).
Absent: Alan Goode (AMIRA)*

efforts of many people in the lead up to, and during the meeting, were greatly appreciated. The project, now halfway to completion, is well on track and looks set to produce results that will significantly enhance the understanding and discovery rate of epithermal precious metal deposits.

AMIRA P544: Proterozoic sediment-hosted copper deposits

The Zambian Copperbelt is one of the truly great copper mineralised provinces in the world, producing some 24 million tonnes of metal between 1930 and 1987. Recent privatisation of the formerly state-owned and operated deposits has led to an upsurge of activity in the Copperbelt, and presented an opportunity for new geological research. Last year CODES and the Colorado School of Mines began a collaborative research project in Zambia funded through AMIRA and the ARC. This project, AMIRA P544, is called 'Proterozoic sediment-hosted copper deposits'.

The second sponsors meeting for AMIRA P544 was held in Zambia in early June, with more than 30 representatives from 11 of the sponsor companies attending. Most remained for a further four days of mine visits and core displays. Mines visited included Nkana, Mufulira, Nchanga, Konkola, Chambishi and

Chibuluma and drill-core came from the new Konkola North deposit and from 'stratigraphic' holes in the Chambishi Basin. The mine visits and logistics for our meeting were organised by Mike Porter as part of the Australian Mineral Foundation's 'Africa 2001' trip, and his efforts are most appreciated.

Because of the large numbers involved, it was not possible for everyone to visit each mine, so the party was split into three groups. Each group was charged with the daily task of summarising what they thought were key observations, questions and exploration implications of the day's activities. These summaries formed the basis for a brainstorming session led by Murray Hitzman (CSM) on the final afternoon. As a result, sponsors and researchers now have a much better idea of the key questions that need answering in order to understand the origin of Zambia's copper deposits.



David Burrowes (INCO) and Rob Scott (CODES) examine a fold in the ore shale, Chambishi Open Pit.



Preparing to go underground at Mufulira.

CODES Bookshop

The following CODES publications are currently available. To order any CODES publications please contact Nilar.Hlaing@utas.edu.au, or download an order form from our website: www.geol.utas.edu.au/codes

	Cost \$AUD
Earth, Universe, Cosmos	\$45.00
New Developments in Broken Hill-Type Deposits	\$25.00
Basins, Fluids and Zn-Pb Ores	\$40.00
Volcanic Textures	\$75.00
Volcanic Environments and Massive Sulfide Deposits	\$45.00
The Geology and Origin of Australia's Mineral Deposits	\$150.00

Volcanology and Geochemistry PhD Bonanza

The last few months have seen the completion of several volcanology and geochemistry PhD theses by students in Program 1 (Tectonics, Magmas and Fluids) and Program 2 (Volcanology).

Steven Hunns submitted his thesis on the volcanic setting and origin of the Mount Chalmers massive sulfide deposit in the Berserker beds, Queensland. Steve is presently living in Germany. *Cathryn Gifkins* finished her thesis on the facies architecture and

alteration in part of the Mount Read Volcanics, western Tasmania. Cathryn's thesis has been accepted and she is now undertaking post-doctoral research at CODES. *Kirstie Simpson's* thesis on the regional volcanic architecture of the Mount Windsor Volcanics, Queensland, was submitted in February. Kirstie has a post-doctoral position with the Seismic Research Unit of the University of the West Indies and is working on St Kitts in the Caribbean. *Alison Raos* completed her thesis on the volcanic

geology and geochemistry of Efate Island in Vanuatu. Ali undertook a detailed study of submarine pumice breccia generated by a major dacitic explosive eruption. She is currently working for Esso Australia, based in Melbourne. *Rick Squire's* thesis on the southern Molong Belt in central western NSW was submitted in May. Rick examined the Ordovician volcanic and intrusive units that are important in the formation of rich Cu-Au porphyry deposits in the region.

Education News

New PhD students

Several PhD students have recently joined CODES, studying a variety of projects.

Nicki Pollington is currently undertaking fieldwork in Zambia, working with AMIRA P544 under the supervision of Peter McGoldrick. Nicki completed Honours at CODES in 1996, and has since worked in exploration in Cyprus and most recently in Uganda.

Mawson Croaker will also start work with AMIRA P544 in August. He is currently working in the Pilbara with BHP Iron, but will move to Zambia shortly to begin fieldwork. Mawson completed a Masters degree at the University of Natal following his Honours degree at Queensland University of Technology.

Wallace MacKay is working on the Australian aspect of P544, examining the depositional environment of the Callanna Group, Adelaide Fold Belt in South Australia. Prior to joining CODES, Wallace worked for a number of years in Ghana and Zambia, before moving to the Northern Territory with Rio Tinto Exploration, looking at sediment-hosted copper in the Amadeus Basin.



Nicki Pollington



Wallace MacKay



Mawson Croaker

Russell Fulton has commenced work with Bruce Gemmell on the Greens Creek project in Alaska after completing his Master of Economic Geology degree on alteration at the Hellyer VHMS deposit.

Steve Lewis has started work with Garry Davidson on a new project, Hydrothermal processes of Macquarie Island ocean crust in a modern tectonic context.

Welcome back, Ben Jones

Ben Jones is a very lucky geologist. The CODES PhD student fell while rock climbing on Mt Wellington in January, and suffered head injuries, putting him in a month-long coma. Doctors were unsure if he would fully recover.

CODES is now very pleased to announce that Ben is making a full recovery, and has returned to his PhD studies with Ross Large, after only 6 months recuperating at home in Canberra.

Ben would like to thank everyone for their emails and support during his period of recovery.





CODES SRC

Giant Ore Deposit Workshop

17-19 June 2002

Tasmania



The next international Giant Ore Deposits workshop will be held in June 2002, as part of the CODES Ore Deposit Models & Exploration Strategies shortcourse. This 3-day workshop will be held at the Centre for Ore Deposit Research, University of Tasmania from June 17th to 19th, 2002. Twelve internationally recognised speakers will present academic and industry perspectives on a variety of giant ore deposits: porphyry Cu, Fe-Oxide Cu-Au, sediment-hosted Pb-Zn, Carlin Au, Ni-PGE deposits and Witwatersrand Au. As part of the Ore Deposit and Exploration Strategies shortcourse, this workshop will be attractive to both industry geologists and students studying under the National Masters in Economic Geology.

Specifically, the speakers will address the following issues for each ore deposit type:

- Characteristics of the giant ore deposits
- Anatomy of a giant ore deposit discovery
- Exploration strategies for future discoveries

The provisional program is listed below. Bookings and enquiries regarding the workshop or shortcourse should be directed to Andrew Tunks on phone 03 6226 2819 or email: Andrew.Tunks@utas.edu.au.

Day 1 – Monday 17 June

Porphyry Deposits

- Introduction & giant porphyry systems - Alan Clarke (Queens University)
- Case history of discovery - Collahuasi - Richard Moore (Falconbridge)
- Exploration strategies forum

Fe-Oxide Cu-Au Deposits

- Giant Fe-oxide systems - Douglas Haynes (BHP)
- Case history of discovery
- Exploration strategies forum

Workshop Cost

\$A400 per day

\$A1000 for three days

- 20% *early bird discount* by booking prior to 3 March 2002
- CODES Sponsors discounts also apply
- 50% discount for students

Day 2 – Tuesday 18 June

Sedex & BHT Deposits

- Giant sediment-hosted Pb-Zn systems – Ross Large (CODES)
- Case history of discovery
- Exploration strategies forum

Carlin Au Deposits

- Giant Carlin Au systems – Tommy Thompson (Mackay School of Mines)
- Case history of discovery – Betze-Post Keith Bettles (Barrack Goldstrike Inc.)
- Exploration strategies forum



Two day Post Conference Field Trip to western Tasmania's giant VHMS and Sn-replacement deposits. Limited places, so book early.

Cost: \$350, including meals and accommodation

Day 3 – Wednesday 19 June

Nickel-PGE Deposits

- Giant nickel-PGE systems – Tony Naldrett (University of Toronto)
- Case history of discovery
- Exploration strategies forum

Witwatersrand Au Deposits

- Witwatersrand Au systems
- Exploration within Witwatersrand – Nick Fox (Anglo Gold)
- Exploration strategies forum



**MINERALS
COUNCIL**
OF AUSTRALIA

This course is offered as part of the National Masters Program in Mineral Exploration and Mining Geology, which is funded by the Minerals Council of Australia, DEETYA, and the host institutions (UTas, JCU, UWA)

For more information concerning the National Masters Program, go to <http://www.geol.utas.edu.au/codes/>

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Issue 10

Research Profile



Greg Ebsworth has recently commenced a PhD at CODES SRC focussing on regional stratigraphic correlations in the Mt Read Volcanics (MRV). The main issue to

be addressed is whether the various VHMS deposits in the MRV occur at several stratigraphic positions, or at one horizon – euphemistically described by some in the mineral exploration industry as the ‘Holy Host’.

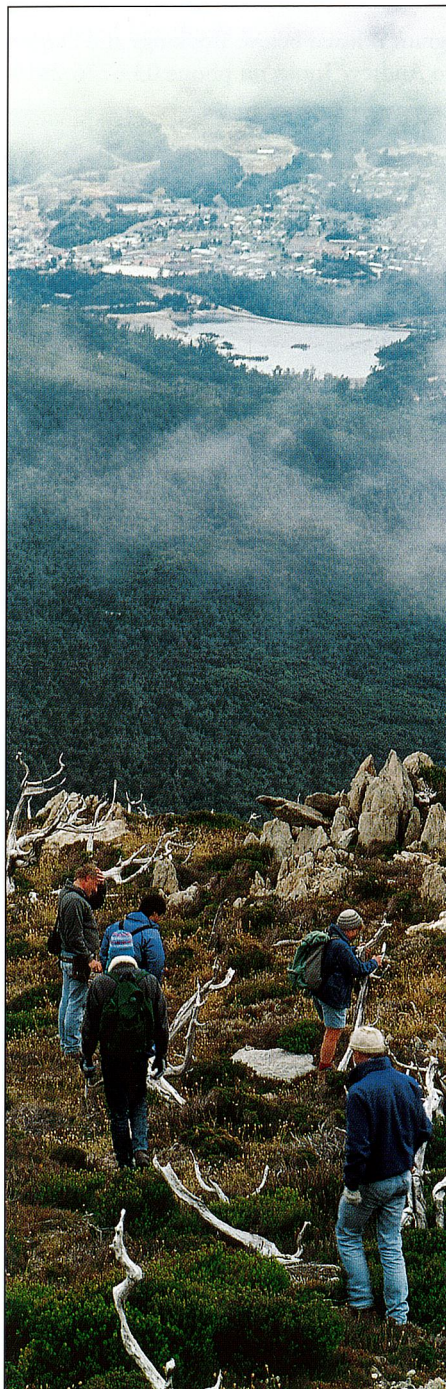
Volcanological and geochemical studies are being carried out to characterise the sequences overlying known arc deposits in the MRV. The sequences have been interpreted to contain syn-eruptive depositional units related to large-volume explosive volcanic eruptions. They appear to have come from a subaerial to shallow, active marine volcanic terrane. Syn-eruptive units of this type are likely to have been rapidly emplaced and may be widely distributed. These features make them potentially useful as stratigraphic markers (McPhie and Allen, 1992; White and McPhie, 1996).

Of particular interest are andesitic crystal-rich sandstones in the lower part of the Tyndall Group (White & McPhie, 1996). These contain a significant component of ferro-magnesian minerals including titanomagnetite, and form distinctive magnetic units. Previous research, company mapping and initial field work indicate that the magnetic sandstones are widely distributed throughout the MRV, occurring from just south of Queenstown to near Ulverstone.

Geochemistry of the crystal-rich sandstones and other volcanic rocks will be investigated using both whole-rock analysis and microprobe or LA-ICPMS analysis of ferromagnesian minerals. In addition to being a tool for stratigraphic correlation, the geochemical studies will seek to improve understanding of the

Is there a ‘Holy Host’ for Massive Sulfides in the Mt Read Volcanics?

by Greg Ebsworth



primary magmatic affinities of volcanic rocks in the upper part of the MRV, and their tectonic setting. The LA-ICPMS facilities at CODES may also be used to produce new U-Pb in zircon isotopic ages for the MRV.

A successful outcome of this PhD research will be invaluable for the Tasmanian mining industry. If all the major massive sulfide deposits do occur at the same stratigraphic position, and if that position can be accurately mapped using a combination of volcanic facies analysis, litho-geochemistry and geophysics, then there will be a new focus for mineral exploration along the full length of the MRV.

Greg is being supervised by Associate Professors Jocelyn McPhie and Tony Crawford, and Professor Ross Large. He is supported by an Australian Post-graduate Award and by research funds from the Tasmanian Government Scholarship scheme.

References

- McPhie, J. and Allen, R.L. (1992) Facies Architecture of Mineralized Submarine Volcanic Sequences: Cambrian Mount Read Volcanics, Western Tasmania. *Economic Geology* 87: 587-596.
- White, M.J. and McPhie, J. (1996) Stratigraphy and palaeovolcanology of the Cambrian Tyndall Group, Mt Read Volcanics, western Tasmania. *Australian Journal of Earth Sciences* 43: 147-159.

Exploring Mt Read, looking north towards Rosebery

SEG heads to Eastern Europe



Each year the CODES SEG Student Chapter organises a major field trip to an ore deposit region. The trip is significantly subsidised by the Society of Economic Geologists (USA) as part of their commitment to student economic geologists around the world.

After previous successful trips to King Island and the Lachlan Fold Belt (Cadia, Ridgeway, Lewis Ponds and Browns Creek deposits) in New South Wales, the Chapter was urged to consider an overseas trip. After much planning, the SEG student chapter organised the 2001 trip to ore deposits in Bulgaria, Greece and Turkey.



Natalia Jivkova, Dr Popov, Dr Strashimir Strashimirov, Andrew Wurst and Andrew Stewart visiting the mineral museum at the St Ivan Rilski University of Mining and Geology, Sofia.

Starting in Sofia on 3 August, a variety of mineral deposits were visited, including LS and HS sulfidation epithermals, porphyry, skarn and VMS deposit types. Although CODES has a strong interest in modern and ancient volcanic arc and back arc settings, this interest has been largely confined to the Pacific Rim. SEG student members have now seen these systems as they occur in Eastern Europe. While in Bulgaria, they met with the SEG student chapter in Sofia, as well as collaborated with academic and industry geologists. Professor Kamen Bogdanov from Sofia University was the tour guide on the Bulgarian leg of the trip to the world-class deposits of Kremikovtzi, Chelopech, Assarel, Madan and Michalkovo.

Leaving Bulgaria, the trip moved to Greece and Turkey, where Olympias, Stratoni and Skouries from TVX, Perama Hill and Ovacek from Normandy, and Sappes from Danae were visited. The trip finished in Istanbul on 17 August.

Several SEG students presented papers at the GSA-SEG conference in Krakow, Poland (August 27-29) following the field trip.



Evgueni Pliovshev, Andrew Stewart, Neil Martin, Tim Ireland, Andrew Wurst and Daryl Clarke — Kremikovtzi giant iron ore deposit, Bulgaria

Big, bold reds best?

The CODES wine tasting group meets every couple of months to blind taste a variety of wines, and test their skills in identification.

Ross recently introduced a series of "big, bold reds" to the group, with the challenge being to determine both the region and variety of each of the six wines. Most people had no trouble distinguishing the three Shiraz wines from the three Cabernet sauvignon, but determining the Coonawarra wines from the McLaren Vale proved to be more difficult. Ross asked the group to rank the wines in order of preference, before revealing the labels, and surprisingly, the McLaren Vale wines came out in front of those from more prestigious Coonawarra region.

The final twist came when it was revealed that a Tasmanian Cabernet sauvignon had been sneaked into the blind tasting. This wine was ranked second in order of preference by the group, demonstrating that Tasmania can, in fact, produce big bold reds!



In Circulation

2001 – A Hydrothermal Odyssey, 17-19 May 2001, Townsville

CODES staff and students made a number of oral and poster presentations at this international conference. A full session of the conference was devoted to the results of our research in sediment-hosted Zn-Pb-Ag deposits of northern Australia. Stuart Bull commenced the session with a keynote address on the implications of tectono-sedimentary settings for genetic and exploration models for northern Australian Proterozoic sediment-hosted Zn-Pb-Ag deposits. This was followed by papers from David Selley, Grant Garven, Ross Large and Peter McGoldrick. The full list of presentations is given below.

Congratulations must go to **Christian Schardt** who received the student prize for one of the best posters at the conference.

Bull, S.W. Implications of tectono-sedimentary setting for genetic and exploration models for northern Australian Proterozoic sediment-hosted Zn-Pb-Ag deposits.

Selley, D., Winefield, P., Bull, S.W. & Scott, R.J. Fault pattern and geometry of sub-basins active during deposition of the host sequence to the McArthur River orebody, southern McArthur Basin, Northern Territory.

Yang, J., Large, R.R. & Bull, S.W. Numerical simulation of transient hydrothermal fluid migration associated with the formation of mineral deposits in the McArthur Basin.

Large, R.R., Bull, S.W., McGoldrick, P.J. & Foden, J. Isotopic evidence for the development of an extensive warm brine pool related to the McArthur River Zn-Pb-Ag deposit, northern Australia.

McGoldrick, P.J. & Norman, M. Textural and trace element variations in pyrite from the Lady Loretta deposit:

hydrogenous, hydrothermal, microbial?

Davidson, G. & Davis, B. Structural and geochemical constraints on the emplacement of the oxide Cu-Au Monakoff deposit.

Gemmell, B. Genesis of the footwall and hangingwall alteration associated with the Hellyer VHMS Deposit, Tasmania, Australia.

Harper, B. & Wilson, A.J. Alteration and mineralisation at the Cadia Ridgeway porphyry Au-Cu deposit, NSW and comparisons to alkaline porphyry systems in the Lachlan Fold Belt.

Kamenetsky, V.S. Composition of high-temperature precursors to hydrothermal fluids: Insights from magmatic inclusions in glasses and phenocrysts.

Norman M., Clark D., Solomon M., McGoldrick P., Davidson G. & Large R.R. Trace element compositions of sulfides by laser ablation ICP-MS: applications to ore deposit research and mineral exploration.

Schardt, C., Yang, J. & Large, R.R. Heat and fluid flow modelling of the Panorama volcanic-hosted massive sulfide district, Western Australia.

Solomon, M. More evidence that brine pools are the depositories for major Palaeozoic VHMS deposits.

Tasmanian Minerals Briefing, *Australian Journal of Mining*, May 2001

Large, R.R.. Research and innovation for the Tasmanian minerals industry.

Geological Association of Canada annual meeting, St. John's, Newfoundland, Canada, 28-30 May, 2001

Norman, M. & Garcia, M. Mineral -melt distribution coefficients for pyroxene, plagioclase, and olivine in Kilauea tholeiitic lavas determined by laser ablation ICPMS.

Clark, D., Gemmell, J. B., Norman, M. & Hespe, T. Textural and geochemical distinction between supergene and hypogene copper sulfide phases, at the Mammoth deposit, Queensland, Australia.

Invited presenter at the Mineralogical Association of Canada Short Course, 26-27 May 2001, St. John's Newfoundland, Canada.

Norman, M.D. Applications of laser ablation ICP-MS to the trace element geochemistry of basaltic magmas and mantle evolution. In: Principles and applications of laser ablation ICP-mass spectrometry in the earth sciences.

Victorian Chamber of Mines Exploration Workshop, 27 July, 2001, University of Ballarat

Crawford, A.J.C. Tasmanian view of the western Lachlan foldbelt.

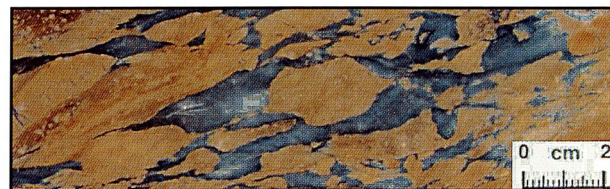
GSA-SEG conference, 27-29 August 2001, Krakow, Poland

Clarke, D., Gemmell, J.B., Norman, M., & Hespe, A.M. Textural and geochemical distinction between supergene and hypogene Cu sulfide phases of the Mammoth copper deposit, Queensland, Australia.

Large, R., Bull, S. & Foden, J. C, O and Sr isotopic halos related to the giant McArthur River stratiform Zn-Pb-Ag deposit, northern Australia.

Volcanic Alteration:

A New CODES Publication in Progress



Polyphase carbonate and feldspar alteration in flow banded rhyolite breccia, Central Volcanic Complex, Mount Read Volcanics, western Tasmania.

Following the success of *Volcanic Textures*, published in 1993, CODES has begun work on a new book on alteration in ancient submarine volcanic successions. Provisionally titled, *Volcanic Alteration: a guide to the alteration of ancient submarine volcanic successions*, the book is a culmination of years of research into VHMS deposits, volcanic facies analysis and alteration studies. It will incorporate many of the outcomes of AMIRA project P439 (Studies of VHMS-related alteration: geochemical and mineralogical vectors to ore), and provides an introduction to the processes of alteration in submarine volcanic successions with emphasis on hydrothermal alteration associated with VHMS deposits.

Volcanic Alteration introduces the common processes responsible for alteration in submarine volcanic successions (see figure) and provides examples of alteration facies, assemblages and compositional changes associated with these processes. While not a definitive atlas of all possible alteration facies that occur in the submarine volcanic environment, it will equip the geologist with the methods to describe and interpret alteration using field, petrographic and chemical observations. Short case studies are presented for both regional alteration styles and hydrothermal alteration associated with a variety of VHMS deposits including Rosebery, Hellyer, Henty, Thalanga and others. The case studies incorporate data sheets used to present the mineralogical, textural, photomicrographic and compositional

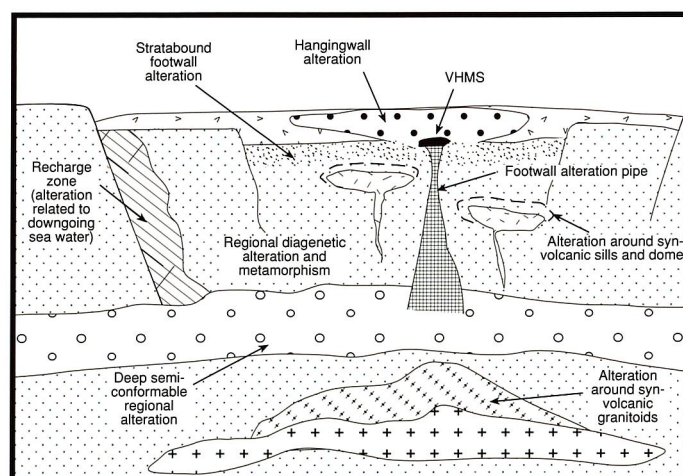
characteristics of each of the main alteration facies. A critical aspect of these case studies is the multi-disciplinary approach combining volcanic facies analysis, alteration mineralogy, textures, intensity, and alteration geochemistry (including whole rock, mineral chemistry and stable isotopes) to constrain the features of different alteration styles.

The authors have extensive experience in detailed volcanic facies analysis, and alteration styles. Principal author, Cathryn Gifkins has a background in detailed volcanic facies analysis, regional alteration styles, especially diagenetic alteration and compaction in glassy volcanic rocks, and an unparalleled understanding of the mineralogical, textural and compositional changes that occur during alteration of a submarine volcanic succession.

CODES researcher, Wally Herrmann, was a principal researcher on AMIRA P439 and co-editor of the special issue of *Economic Geology* on 'Alteration associated with the spectrum of volcanic-hosted massive sulfide deposits, and its exploration significance'.

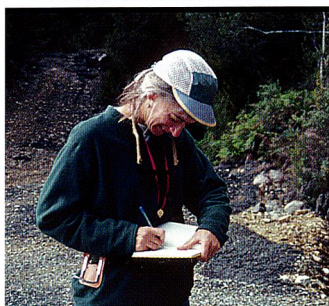
Ross Large, Director of CODES, has a comprehensive knowledge of VHMS deposits worldwide and has actively promoted and developed the application of geochemical techniques to mineral exploration. This innovative approach has recently produced the Alteration Boxplot, an alternative way to relate alteration intensity, mineralogy and geochemistry.

The authors expect that *Volcanic Alteration* will be on sale in mid 2002.



The distribution of different alteration styles in a schematic volcanic succession (after Gemmell and Herrmann, 2001).

Visitors



Associate Professor Nancy Riggs from Northern Arizona University visited CODES for a month from mid-April. She is collaborating with Jocelyn McPhie on volcanological research that includes investigation of contrasts between submarine and subaerial felsic domes and the emplacement processes of extensive felsic lavas. Her visit included field-work in

the Mount Read Volcanics, western Tasmania, and in the Gawler Range Volcanics, South Australia. Professor Riggs presented a paper on the Triassic history of the North American cordillera at the April meeting of the Tasmanian Branch of the Geological Society of Australia. She also addressed a joint meeting of Program 1 (Tectonics, Magmas and Fluids) and Program 2 (Volcanology), describing results of recent research on an extensive field of Tertiary latitic domes in northern Arizona.

Dr Carlos Inverno, from the Instituto Geologico e Mineiro, Lisbon, and a doctoral graduate from the Colorado School of Mines, will be working in CODES until August. He is completing a study with Mike

Solomon into the origin of the Feitais (Aljustrel) orebody in the Portuguese section of the Iberian Pyrite Belt. Although previously mined, Eurozinc Ltd has over the last few years outlined a substantial tonnage of relatively highgrade massive sphalerite ore, and a small tonnage of stockwork copper ore; feasibility studies are currently underway. This project is one of several studies at CODES into the origin of the unusual pyritic ores of the Iberian Pyrite Belt. Mike Solomon is assisting Fernando Tornos of the Instituto Tecnológico Geominero de Espana with a genetic study of the Tharsis deposit, and also Orlando Gaspar, previously of the Instituto Geológico Minero, Porto, with a review of the mineralogy of the Neves Corvo Sn-Cu ores. Tornos, Gaspar and Inverno are joint authors with Mike Solomon of the thesis that many of the Iberian deposit were precipitated in brine pools, thereby explaining much of their unusual mineral content, and their generally low Pb and Zn grades.

Professor Dick Price, Dean of Science at University of Waikato in New Zealand, and an igneous petrologist-geochemist by trade, is visiting the School of Earth Sciences and CODES for a month of his study leave. He is writing up several papers on NZ volcanism, especially Taranaki (Mt Egmont), and is completing a paper with Tony Crawford on the Pentecost ophiolite in Vanuatu.

CODES Staff Changes

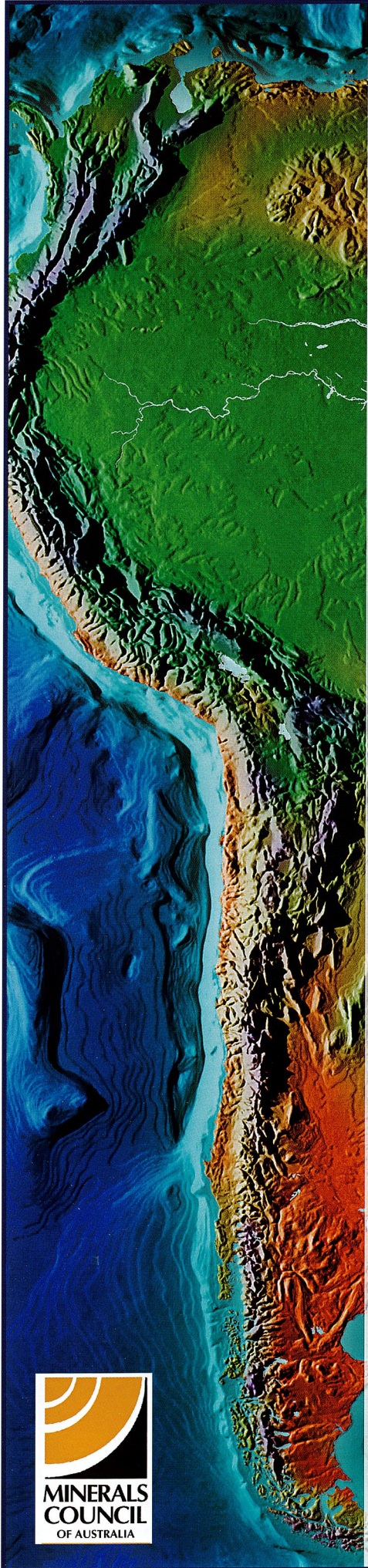
Several changes are taking place in CODES as new staff arrive, and other staff leave.

Peter Hollings has accepted an Assistant Professorship in the Department of Geology at Lakehead University (Thunder Bay, Ontario), and he and his wife, Jill Taylor-Hollings, headed home to Canada in early August to prepare for a busy teaching schedule. Jill has been acting Administrative Assistant in CODES, and will return to her work as an archeologist, also at Lakehead University.

Jessica Tyler has officially resigned from her position as Public Relations Officer, to spend more time with her daughter and pursue other career interests. **Michaela Patel**, who has been acting in the position, will also be leaving in October to move to Melbourne. A new Public Relations Officer will be appointed in the near future.

Andrew Tunks has joined the CODES staff as the new Minerals Council of Australia lecturer. Andrew will be responsible for coordinating the Masters program, and will lead the 'Ore Deposits

of South America' field trip in November. He comes to CODES from Ghana, where he was the Exploration Manager for Obosso Goldfields Ltd, part of the Ranger Minerals group. Prior to this, he worked in Western Australia as Senior Geologist with Haliden Resources and with North Ltd. His interests include structural geology with a particular focus on the controls of mineralisation, and exploration techniques.



Ore Deposits of South America

5-16 November 2001

Leaders: Andrew Tunks & David Cooke
Centre for Ore Deposit Research

Featuring

- The world's largest underground copper mine
- The world's largest open pit
- Cu-Mo porphyry deposits
- Fe-Oxide Cu-Au deposits
- High-sulfidation epithermal Au
- Regional geology, structure & tectonics
- Exploration techniques

Mine Visits include:

- El Teniente
- Rio Blanco
- Chuquibambilla
- Mantos Blancos
- La Coipa
- Candelaria
- Mantos Verde
- Mina Ivan

Important travel dates

- Arrive Santiago, Monday 5 November
- Fly Santiago-Calama, Lan Chile flight LA158, 20.00 hrs Thursday 8 November
- Fly Copiapo-Santiago, Lan Chile flight LA117, 17.25 hrs, Friday 16 November
- Depart Santiago, evening Friday 16 November

Individuals are required to book their own flights (both international & domestic) - book early to obtain the cheapest fares. Internal Chile flights with Lan Chile can be included in a Qantas round the world airfare (Lan Chile is a One World partner).

Limited places available, so book early! Early payment of the registration fee is required to guarantee your place

Registration Cost (excluding airtickets)*

- Masters students enrolled at G3 institutions:
\$A3500 (\$2000 for unit, plus \$1500 field costs)
- All other participants:
\$A4500

* Includes course fee and all ground costs - accommodation, car hire, field guide, fuel & meals.

Contact

For enquiries concerning the field trip or the National Masters Program, contact Andrew Tunks, Andrew.Tunks@utas.edu.au, or David Cooke, d.cooke@utas.edu.au

This fieldtrip is offered as part of the National Masters Program in Mineral Exploration and Mining Geology, which is funded by the Minerals Council of Australia, DEETYA, and the host institutions (UTas, JCU, UWA)

For more information concerning the National Masters Program, go to:
www.geol.utas.edu.au/codes/



Upcoming Short Courses

Ore Deposits of South America

6–18 November 2001

Leader: Andrew Tunks

See page 5 for details

Volcanic Processes, Products & Successions Shortcourse: Modern & Ancient Systems

18–24 November 2001

Lead by Ray Cas (Monash University), Jocelyn McPhie (CODES) and Steve Beresford (Monash University), the course will include lectures on the latest concepts in volcanology, and two outstanding field days at the Late Devonian Boyd Volcanic Complex.

Contact: Ray Cas, ph: 03 9905 4897, email:

rcas@mail.earth.monash.edu.au

Ore Deposit Models and Exploration Strategies

17–28 June 2002

Leader: David Cooke

See page 4 for details.

Volcanology Short Course

November 2002

Leader: Jocelyn McPhie

A two-part field course on volcanology and mineralisation in volcanic terrains for geologists interested in a review of current approaches to mapping, facies analysis and mineralisation in ancient and modern volcanic successions. Includes field geology in New Zealand and western Tasmania.

CODES Corporate Sponsors

GOLD Sponsor: BHP-Billiton

SILVER Sponsors: Goldfields Exploration, Homestake Gold of Australia, MIM Exploration, AngloAmerican, Newcrest Mining, Rio Tinto, Pasminco Exploration, Western Metals, WMC

There are many benefits of becoming a corporate sponsor of CODES

- Association with, and first call on, a world-class research team in ore deposit science
- Fee reductions on our regular industry short courses
- Access to scholarships for staff undertaking a Masters in Economic Geology or Masters in Exploration Geoscience
- Membership of the CODES Science Planning Panel

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Fun in the field



Who said geologists never have fun? CODES PhD student Andrew Davies found a new use for his conference poster after the Gold in 2000 conference at Lake Tahoe, USA.