ore solutions 2

UNIVERSITY OF TASMANIA

Newsletter of the Centre for Ore Deposit Research at the University of Tasmania

This Issue: May 1998

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new research opportunities

# Advisory Board and Science Planning Panel meetings set new research directions

During March our annual planning and advisory board meetings were held to determine the way forward for our research programs.

Feedback from these meetings has been extremely important for our planning process. The message we are getting from industry is that although times are tough, there are still research funds available for top-quality projects that have direct relevance to mineral exploration.

Three of our major AMIRA research projects will be completed this year, and a considerable effort is being made by staff and postgraduate students to ensure that the final research reports are completed on schedule.

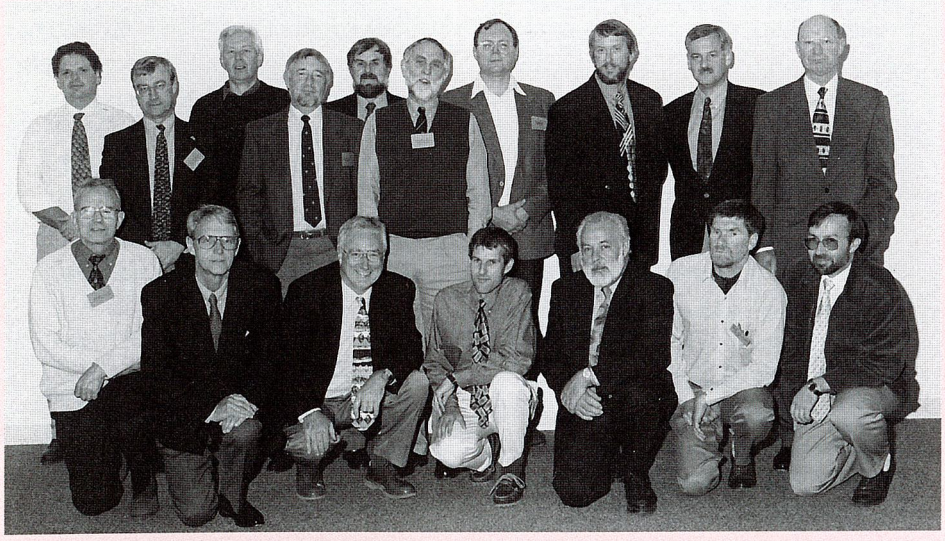
A range of potential new projects is also currently under discussion with industry sponsors, AMIRA, AGSO and CSIRO to maintain our strategic research thrust. Potential new projects are:

- porphyry copper-gold systems (David Cooke and John Walshe from CSIRO).
- a multi-disciplinary approach to sedimentary copper deposits (Peter McGoldrick).
- application of chemical modelling for the exploration geologist (David Cooke).
- comparative studies of globally significant VHMS deposits (Bruce Gemmell).
- low-cost, precise lead-isotope studies using high-resolution ICPMS (Peter McGoldrick)

More information is in the 'News' section on page 2.

Please contact myself or our project leaders listed above if you require more information about these proposals.

Ross Large
Director



**Science Planning Panel**
*Back row: Rick Valenta (MIM), David Borton (Acacia), Tony Crawford (CODES), Kerry O'Sullivan (Rio Tinto), John Hammond (Normandy), David Groves (UWA), Tom Weis (Normandy), Gary McArthur (Aberfoyle), David Wallace (Aberfoyle), David Denham (AGSO). Front row: Eugen Stumpfl (IGS), Gus Bravo (GCM), Ross Large (CODES), Scott Halley (RGC), Tony Brown (MRT), Wil Godsall (CMT), Paul Roberts (Pasminco).*

# From the Editor

Reaction to the first edition of **ore solutions** has been wonderful. It has proven to be an important tool in promoting discussion on new research projects as well as issues in geological research. It has also become a valuable information resource: most of us here find that it takes permanent residence on our desks and a second print run has literally run out of the door.

In this second edition, we provide information on a range of new research projects, and we introduce two comprehensive new publications: the 1997 Annual Report and the companion volume Research Compendium 1997-1998.

Both documents bring together detailed information about CODES and we believe we are establishing a high standard of communication with all our stakeholders about the breadth of our research and expertise.

We also provide an outline of the Australian Student Mineral Venture, an AusIMM initiative to bring young people into contact with the range of careers available in the mining and minerals industry.

The flyer announces the 'Basins, Fluids & Ores' symposium at CODES during the short course 'Ore Deposit Studies & Exploration Models', 15-26 June 1998. Places are filling fast so get in quick with your registration.

On the back cover you'll find an expanded contacts list to keep communication flowing.

Thanks to everyone who felt inspired to pass on their comments and let's have more of them to help keep **ore solutions** a vibrant and relevant publication. OS

# News

## New CODES reports

### Annual Report 1997

The report comprehensively documents our research activities under the Special Research Centre structure and records progress towards our goal to develop a centre in the top rank of international research centres specialising in ore deposit geology.

It features detailed reporting under each of our five research programs and provides a useful all-in-one summary of our operation.

### Research Compendium 1997-1998

The Research Compendium provides an up-to-date summary of all currently active research programs and projects.

It includes core research activities funded by our Special Research Centre grant from the Australian Research Council (ARC) as well as non-core activities funded by other grants from industry, the Australian Minerals Industry Research Association, the Australian Geological Survey Organisation, Mineral Resources Tasmania and other grants from the ARC.

Invitations are open to any organisation to contact either Ross Large or one of our team leaders to discuss potential participation in these activities.

Copies of both reports are available from:
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## Name change

The Department of Geology is now called the School of Earth Sciences as part of a university-wide series of name changes.

## MRT, University share honours

Mineral Resources Tasmania and the School of Earth Sciences recently struck an agreement to share the Honours supervision load. Honours enrolments have risen to an all-time high of 27 in 1998, and this shared arrangement will provide useful collaboration.

## Winning poster

PhD student Peter Winefield won the award for best student poster at the '9th International Symposium on Water/Rock Interaction' in New Zealand in March/April. Its title: 'Evidence of Proterozoic primary $CaCO_3$ precipitation from the McArthur Group of northern Australia'.

## Low-cost lead isotope breakthrough

Recent work by CODES PhD student Zongshou Yu and Ashley Townsend from the University's Central Science Laboratory has demonstrated that solution ICPMS (inductively coupled mass spectrometry) can measure lead isotope ratios with a precision similar to that obtained by conventional TIMS (thermal ionisation mass spectrometry).

The work means that it is now more cost-effective to use lead isotope surveys to search for new mineral deposits.

Using the CSL's Finnigan Element high-resolution ICPMS, Zongshou

and Ashley measured the isotope ratios for galena and polymetallic sulfide samples from western Tasmania and Broken Hill. Results were in excellent agreement with those measured elsewhere by TIMS.

Unlike TIMS, measurements of lead isotopes by ICPMS requires minimum sample preparation and sample analysis is rapid, resulting in much cheaper analyses. Multi-element geochemical analyses by ICPMS can be obtained at the same time as isotopic analysis.

Further work has confirmed the technique's viability for samples with as little as a few 10s ppm lead. The results are soon to be published in the *Journal of Applied Analytical Spectroscopy*.

For more information, contact:
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Email: P.McGoldrick@utas.edu.au

# MRT, AGSO conference on TASGO data

Mineral Resources Tasmania and the Australian Geological Survey Organisation launched results of the TASGO project on 14-15 May 1998 at a conference in Hobart.

TASGO is a joint project between MRT and AGSO to use high-technology studies to determine the character of Tasmania's geological structures at depth and to test models for key structures.

For more details contact:
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TASGO Coordinator, AGSO
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# New research opportunities

**Motivated and enthusiastic geologists are invited to join the CODES team on a range of exciting new projects. The requirement for entry is first-class Honours or upper second-class Honours with industry experience. Scholarships of $20,000 pa with relocation expenses up to $1,000 are available.**

## MSc: Mt Muro, Indonesia

This project will investigate the mineralisation and alteration of the Kerikil and Serujan lode systems.

This two-year Master of Science project is a collaborative study with Aurora Gold geologists to examine the drill core, surface geology and computer database at Mt Muro to: 1) characterise the geologic and structural setting of the veins and wallrock mineralisation; 2) define the character and geochemistry of the hydrothermal alteration; 3) document lithological, structural, geochemical and fluid controls of the mineralisation; 4) propose an ore genesis model.

Closing date 22 May 1998. Project to commence July 1998.
Contact Bruce Gemmell on: (03) 6226 2893.

## PhD: Myra Falls, Canada

The project will investigate the geology and geochemistry of the exhalite-like 'cap rocks' associated with the Myra Falls VHMS deposits.

This three-year project is a collaborative study with Boliden-Westmin to examine the drill core, surface geology and computer database at Myra Falls to: 1) characterise the geologic and structural setting of the cap rocks and their depositional environment; 2) describe the mineralogy, textures, paragenesis and metal zoning in these cap rocks to classify them as either true exhalites or as alterations of pre-existing sediments-volcanics; 3) determine the geochemical characteristics (trace elements, stable istotopes) and signature of the cap rocks; 4) propose a genetic model; 5) develop useful criteria for local exploration.

Closing date 22 May 1998. Project to commence July 1998.
Contact Bruce Gemmell on: (03) 6226 2893.

## PhD: Gawler Range, South Australia

This project aims to define the volcanic facies architecture of the Gawler Range Volcanics, identifying volcanic centres and clarifying eruption and emplacement processes of large-volume, extensive felsic volcanic sheets such as the Yardea Dacite. It will involve field-based physical volcanology including mapping, logging sections, petrology and textural studies, with limited geochemistry.

The project will be partly funded by an ARC Large Grant and by Mines and Energy South Australia. It includes a scholarship plus support for field and laboratory work and the possibility of additional company support.

Project to commence immediately.
Contact Jocelyn McPhie on: (03) 6226 2892.

## PhD: Induced polarisation in sulfide rocks

This project involves a detailed experimental investigation of the mechanism of induced polarisation in sulfide rocks, focussing on applying newly-developed imaging techniques to study the IP effect at mesoscopic/microscopic scale.

It will be funded from an industry-collaborative project and includes a scholarship plus support for field and laboratory work. Closing date 12 June 1998. Project to commence as soon as possible after this date. Contact Mike Roach on: (03) 6226 2474. OS

# Getting behind tomorrow's leaders

The Australian Student Mineral Venture is an AusIMM Education Endowment Fund initiative to bring high school students into contact with the realities of careers in the minerals industry. It began with a three-year pilot program in 1996 and will continue for a second term between 1999-2001.

Results from 1996-1998 participant surveys indicate that the scheme is achieving a significant impact on student views of the mining industry. In many cases, negative impressions are being dispelled and a greater respect is being generated for the considerable efforts towards good corporate citizenship and environmental affairs by Australia's industry.

Existing sponsors have indicated that the biggest value in their participation is access to data on the students who go on to university and ultimately enter the industry. While it is early days for this sort of information, AusIMM is working towards a database of all ASMV participants.

In the South East Region, our consortium (comprising the Centre for Ore Deposit Research, the School of Earth Sciences and the Tasmanian Minerals Council with support from Hobart College as well as Mineral Resources Tasmania) will conduct the program in its second term.

Tasmania is ideally suited for the Summer School because it provides a compact natural laboratory to investigate the spectrum of activities associated

*continued on page 5*

# Research **Profile**

## Advances in research at the Carpentaria Zinc Belt

**from Peter McGoldrick**

The Carpentaria Zinc Belt of northwest Queensland and the Northern Territory hosts several world-class stratiform sediment-hosted ('SEDEX') zinc-lead-silver deposits. New discoveries, notably Century and George Fisher, have ensured that the region will be Australia's main zinc producer into the next century.

However, all known deposits in the region, with the possible exception of George Fisher, crop out at the surface. New strategies are needed to find other 'blind' or shallowly-buried deposits and differing ideas over the years about ore genesis in this environment have highlighted the need for high-quality scientific research to underpin new exploration strategies.

Much of the Carpentaria Zinc Belt region was mapped at 1:100 000 scale in the late 70s and early 80s by the Australian Geological Survey Organisation and state geological surveys. Research on specific deposits during this time was largely done in-house or as individual postgraduate thesis studies. More recently, work at the Australian Geodynamics Cooperative Research Centre elucidated the early geological history of the Mount Isa Inlier, and other research, often company sponsored, continues in a number of areas.

By the early 1990s, despite a long history of research into SEDEX deposits worldwide, there was no consensus as to their origin. Genetic models developed from Canadian and European deposits did not easily account for all the features of the northern Australian deposits and many Australian researchers believed our deposits formed (during diagenesis) at some depth in the sediment subsurface from metal-bearing fluids infiltrating through the sediments. Exhalation (the EX in SEDEX) was not a pre-requisite for ore formation.

This was the background to the establishment of a major project established in 1992 at CODES as a three-year project and was subsequently extended for a further three years. It is now a major component of the Centre's research under its 'Ores in Continental Rift Basins' program. Funding comes from the Australian Research Council and the Australian Mineral Industry Research Association. Eight Australian companies, three Canadian companies and AGSO also sponsor the project.

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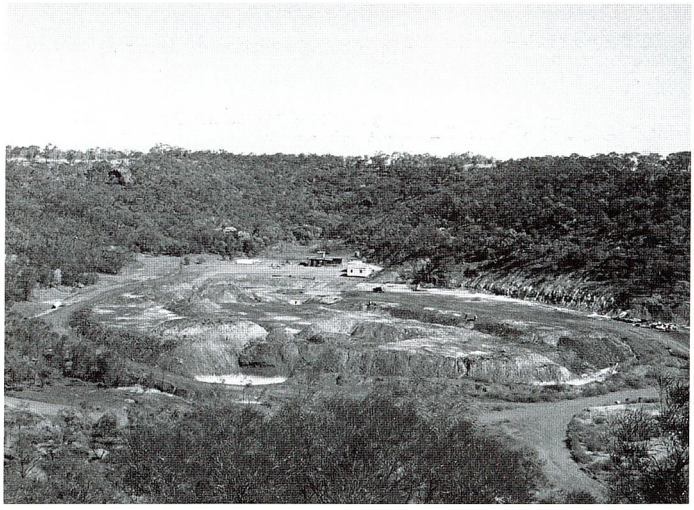

*Lady Loretta mine site, northwest Queensland*

The research approach was designed to have less emphasis on deposit-specific studies but, rather, to take a step back and examine the northern Australian deposits in the context of the structural, tectonic and sedimentological evolution of the basins in which they are found.

A second important area for research, with direct practical use in day-to-day exploration, has been to document primary lithogeochemical halos associated with the Carpentaria Zinc Belt deposits and to use these to develop vectors to hidden mineralisation.

Thirdly, computer thermodynamic modelling has been used to test the viability of a wide range of possible ore fluids and sulfide depositing reactions.

While not initially a primary goal of the research, work at the Lady Loretta and HYC deposits has yielded important new insights into the genesis of these deposits.

For the Lady Loretta mineralisation, a new model has been developed in which the ores are thought to have formed when cool, oxidised, saline base metal-bearing fluids mixed with stagnant pore and bottom waters in a shallow, restricted water body.

## getting behind tomorrow's leaders

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*The 1998 Australian Student Mineral Venture team at Tasmania's spectacular Cradle Mountain.*

In contrast, work on the giant HYC deposit supports the earlier deep water exhalative model for the mineralisation. These ores formed in the deepest part of a large water body. Ore textures suggest a layer-by-layer paragenesis for mineralisation in which individual ore lenses are the product of thousands of separate 'pulses' of metal-bearing fluid that exhaled onto the basin floor as bottom-hugging currents.

Setting aside arguments about ore genesis, explorationists can utilise empirical ore deposit models like these in the search for new deposits. Results from the Centre's research have been used to develop and refine an exploration model based on the Carpentaria Zinc Belt deposits that is applicable to the search for new deposits in the McArthur and Mt Isa Basins and other continental rift basins in Australia and overseas. OS

*This article is based on Peter's presentation to the Silver-Lead-Zinc Symposium in Brisbane in March.*

The program cannot continue to exist at its high standard without support from the minerals industry, both for reality-based information as well as financial support. Aberfoyle–Hellyer Division, Pasminco (Rosebery Mine and Hobart Smelter) and Placer Pacific are currently major industry sponsors of the South East Region.

The sponsorship program offers companies an excellent opportunity to reach young people with positive messages about the minerals industry and career opportunities. Major sponsors providing a significant donation will have their company logo in all media coverage and advertising as well as on coaches, day packs, stationery and clothing. Also, sponsors are invited to send staff along on the program.

New initiatives for 1999-2001 include activities to increase awareness of the program, such as:

- a wider spread of regional media coverage.
- new activities in the careers guidance industry.
- connections with existing youth-oriented activities.

Student applications close 31 May 1998 and sponsor opportunities are available throughout the year.

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### ARC/AMIRA Project P384/P384A: Sediment-hosted base metal deposits

**Industry sponsors**

Aberfoyle, BHP, Cominco, Inco, MIM, Noranda, Normandy, North, Pancontinental, Pasminco, RGC.

**Collaborators**

Australian Geological Survey Organisation, Northern Territory Geological Survey, University of Melbourne.

**Research team 1992-1998**

**Leaders:** Dr Peter McGoldrick, Professor Ross Large and Dr Stuart Bull.
**Researchers:** Dr David Cooke, David Selley*, Dr Garry Davidson, Dr Richard Keele, Dr Rob Scott, Dr David Leaman.
**PhD students:** Mark Duffet, John Dunster*, Jamie Rogers* and Peter Winefield.
* graduated students

# In Circulation

## 1998 student intake

### PhD

**Owen Hatton**, with support from BHP World Minerals. Owen's project is part-funded by an ARC Australian Postgraduate Award-Industry grant and an ARC Strategic Partnership with Industry: Research and Training (SPIRT) grant. His thesis is 'Basin configuration, volcanology/ sedimentology and pre-deformational alteration of the Toole Creek volcanics, Mt Isa Inlier'.

**Oliver Holm**, with support from Goldstream. Oliver is a Tasmanian Government Mining Scholarship holder. His thesis is 'The geology and mineralisation of the Arthur metamorphic complex'.

**Vanessa Lickfold**, with support from North. Vanessa is a School of Science & Technology Scholarship holder. Her thesis is 'Intrusive history and volatile evolution in the Goonumbla porphyry Cu-Au district'.

**Richard Squire**, who is a School of Science & Technology Scholarship holder. His thesis is 'Geological and metallogenic evolution of the southern Molong volcanic belt, NSW'.

**Daryl Clark**, with support from Aberfoyle Resources. His thesis is 'Geology and genesis of primary copper mineralisation, Gunpowder deposit, Qld'.

### Master of Economic Geology

**Mitchell Bland**, with support from Newcrest.

**Paul Cromie**, with support from BHP World Minerals.

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**Dr Udi Hartono**, Research Fellow from the Ministry of Mines & Energy, Geological Research & Development Centre (Indonesia) visited for three weeks over December and January to use the XRF and to discuss potential collaboration with CODES.

**Dr Rod Allen**, a consultant based in Norway, visited during February to work in Program 3 and gave a seminar titled 'Unravelling the structure, stratigraphy and genesis of the multiply-deformed 1.9 Ga Renstrom volcanic-hosted Zn-Pb-Cu-Au deposit, Sweden'.

**Carsten Muenker** from the International University of Göttingen (Germany) is visiting for three months to work with Tony Crawford and has given a seminar titled 'The Devil River Volcanics: a Cambrian Mt Read Volcanics correlate in the South Island of New Zealand?'.

**Prof Eugen Stumpfl** from the Mining University, Leoben (Austria) visited during March to discuss collaborative research and gave a seminar title 'Rampura-Aguchia, India's largest Zn-Pb-Ag deposit'.

**Dr Jeff Alt** from the University of Michigan (USA) visited during March-April to work with Garry Davidson and gave a seminar titled 'Sulfur in serpentinised oceanic peridotites: serpentinisation processes and sulfate reduction'.

**Dr Edwin Roedder** from Harvard University, Cambridge (USA) visited during March-April to work with Khin Zaw and gave a workshop on fluid and melt inclusions. Sessions included fluid inclusions in MVT deposits, in sedimentary environments and in mantle materials as well as a session on Thomas Gold deep methane controversy and the significance of $CO_2$ and melt inclusions in ultramafic xenoliths.

**Christian Schardt**, Masters student at the Institut fur Mineralogie, Tu Bergakademe, Frieberg (Germany) visited to discuss collaborative research in Program 5.

**Anna-Maria Lima** from the University of Naples (Italy) plans to visit during July/August.

**Prof Stephen Self** from the University of Hawaii is visiting for collaboration with Jocelyn McPhie and gave a seminar titled 'Long basaltic lava flows, fissure eruptions and potential atmospheric impact'.

**Prof Grant Garven** from Johns Hopkins University (USA) is visiting on sabbatical leave and gave a seminar titled 'Hydrogeology and crustal heat flow, Hawaiian islands'.

**Dr Ian Cartwright** from Monash University (Australia) visited during May to discuss collaborative research and gave a seminar titled 'Regional-scale oxygen isotope resetting at Broken Hill, NSW: its relationship to base metal mineralisation and hydrothermal fluid flow systems'.

### International linkages

- the University of The Philippines (Diliman) in association with the University of British Columbia's Mineral Deposit Research Unit (Canada).
- the Institut fur Mineralogie, Tu Bergakademe, Frieberg, (Germany).
- the University of Ljubljana, (Slovenia). OS

# University of Tasmania SEG Student Chapter

### King Island Excursion and visit by Professor Malcolm Walter

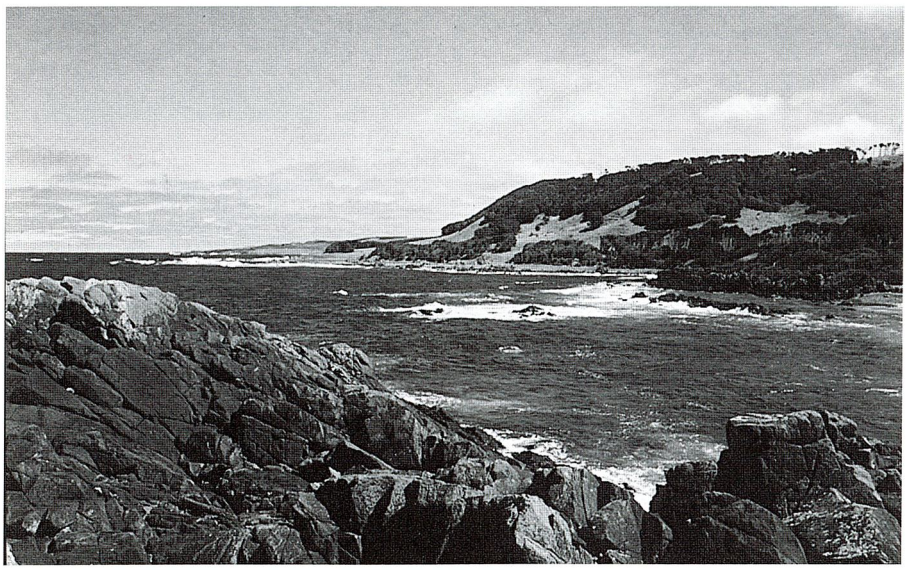
In February 1998, the University of Tasmania Society of Economic Geologists Student Chapter, CODES and the Geological Society of Australia (Tasmania Branch) played host to eminent Australian Proterozoic microbiologist Malcolm Walter, Adjunct Professor at Macquarie University and consultant to the NASA 'Life on Mars' project.

Professor Walter presented a well-attended public lecture on the progress achieved in finding evidence of the former existence of life on Mars.

On subsequent days he presented some thought-provoking talks and discussions on relationships between microbial life and the formation of ore bodies. Malcolm also kindly allocated time to individual CODES staff and postgraduates to discuss likely microbial applications to their economic geology projects.

The Student Chapter also ran a four-day geological excursion to King Island in March. The excursion party of 17 people included professional geologists and geology students from the Universities of Tasmania, South Australia, Stockholm, Göttingen and Lulea, plus Adelaide and Macquarie Universities as well as Mineral Resources Tasmania.

King Island was chosen for the excursion because of its relative isolation, lying midway between the Australian mainland and Tasmania, and because of its historical and economic significance. It is rarely visited by geologists, yet boasts some of the most diverse and exceptional geology in southeastern Australia. Supracrustal rocks range in age from middle Proterozoic to early Cambrian and include pristine siliciclastic, dolomitic and basaltic volcanic rocks on the east coast, and high-grade (partly anatectic) metasedimentary and mylonitic rocks on the west coast. These have been intruded by late Proterozoic and Devonian granites, the latter associated with a world-class scheelite-garnet skarn deposit.



*City of Melbourne Bay, King Island showing exposures of pre- Cambrian dolomite and basalt.*

It is apparent that the local and regional geological framework of King Island is problematic, and its economic potential is still untested.

We hope that discussion and interest from the field trip will initiate collaborative research on King Island between university and government researchers in Adelaide and Tasmania.

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## 1998 student intake

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### Master of Expl. Geoscience

**Pamela Italiano**, with support from Mining Project Investors.

**Simon Woffenden**, with support from Western Mining. Simon has transferred from the Master of Economic Geology course.

### Honours students

David Atchison
Nicole Cashion
Timothy Chalke
Paul Davidson
David Dedenczuk
Marinka Dellar
Mark Edwards
Robert Findlay
Ashley Grifiths
Mandy Hillier
Racquel Kolkert
Rochelle Macdonald
Andre Mueller
Nicholas O'Donohue
Adrian Penney
Matthew Ramsden
Michael Skirka
Sophie Smith
David Stacey
Kris Taylor

### Mid 1998 Start

Mark Davidson
Matthew Gray OS

CODES SRC
Centre for Ore Deposit Research

## Contributions

Contributions welcome but not guaranteed to run. Send to:
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# Short course dates for 1998

**ore deposit studies & exploration models**
**15-26 June 1998. Leaders: CODES and international experts**
Covers all the major classes of ore deposits: volcanogenic massive sulfides, sediment-hosted Pb-Zn-Cu, carbonate-hosted Pb-Zn, Broken Hill type, Proterozoic Cu-Au, Sn-W, porphyry Cu, epithermal Au-Ag, Archean Au, Ni and PGE deposits. Features of the deposits relating to their genesis and exploration will be discussed and exploration models will be presented.

**Features the international symposium: Basins, fluids & ores**
**15-19 June 1998. Co-sponsored by the SEG Student Chapter**
Day 1, Monday 15: Australian sediment-hosted Zn-Pb deposits
Day 2, Tuesday 16: North American sediment-hosted Zn-Pb deposits
Day 3, Wednesday 17: Mississippi Valley and Irish Style Zn-Pb deposits
Day 4, Thursday 18: Hydrology and geochemistry of fluids in basins
Day 5, Friday 19: Broken Hill Type deposits

**tectonics, structure & ore deposits**
**2-14 November 1998. Leaders: Dr Ron Berry and Assoc Prof Tony Crawford**
Deals with tectonic and structural controls on ore deposits and includes field trips to northeastern and western Tasmania. Sessions examine structural techniques and the broad tectonic setting and magmatism associated with ore deposits. The course emphasises applications of structural techniques to geological problems in exploration and mining geology and explores the relationship between modern tectonics, structure and ore deposits.

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